



Sector Analysis and Strategic Plan at National and EU level

English summary + National analysis

Deliverable 2.2

WP2. Supporting local supply bioenergy chains

uP_running

Take-off for sustainable supply of woody biomass from agrarian
pruning and plantation removal

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TERMS AND ABBREVIATIONS

AP	'uP_running' agrarian partner (agrarian association or cluster)
APPR	Agricultural pruning and plantation removal
CAP	Common Agricultural Policy
CCS	Carbon Capture and Storage
CHP	Combined Heat & Power
COP	Conference of the Parties
DHC	District Heating and Cooling
ESCO	Energy Service Company
ESD	Effort Sharing Decision
ETS	Emission Trading System
GDP	Gross Domestic Product
GHG	Greenhouse Gases
IED	Industrial Emissions Directive, 2010/75/EU
INDCs	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
LCE	Low-Carbon Energy. Within "Horizon 2020" the pillar: "Societal Challenges" also including "Secure, Clean and Efficient Energy".
LCE	Low Carbon Economy
LCFS	Low-Carbon Fuel Standard
MP	Member State
MS	Member State within the European Union
NREAP	National Renewable Energy Action Plan
PM	Particulate Matter
PPA	Power Purchase Agreement
RED	Renewable Energy Directive
RES	Renewable Energy Sources
RHC	Renewable Heat and Cooling
SO	Strategy deployed in the "Action plan" consisting in employing strengths in order to profit by opportunities (" <i>attack strategy</i> ").
ST	Strategy deployed in the "Action plan" consisting in employing strengths in order to avoid or reduce external threats (" <i>defence strategy</i> ").
SWOT	SWOT analysis is an evaluation process that identifies an organization's strengths, weaknesses, opportunities and threats. In this document, SWOT analysis was applied to the APPR sector.
TP	'uP_running' technical partner (university or other research and technology centre)
UNFCCC	United Nation Framework Convention on Climate Change
WO	Strategy deployed in the "Action plan" seeking to alleviate the effect of weaknesses by taking advantage of opportunities (" <i>reorientation strategy</i> ").
WP	Work Package: a group of related tasks within a project (often thought of as sub-projects within a larger project).
WT	Strategy deployed in the "Action plan" that alleviate weaknesses and seek to reduce the impact of threats (" <i>serviving strategy</i> ").

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EXECUTIVE SUMMARY

This deliverable presents an overall analysis at European scale about the policy strategies in favour of the bioenergy sector, with emphasis on the APPR kind of feedstock (i.e. agricultural pruning and plantation removal) used as renewable energy source. A general framework of reference was worked out considering visions, missions, targets and goals, as well as policy measures and instruments fitted to boost the setting up of new energy value chains and strengthen the bioenergy sector. Then, the outcomes of each single *National APPR Sector Analysis and Strategic Plan* resulting from the activities developed in seven European Countries are reported in the annexes.

In this document a comparison between the visions, missions, objectives and actions captured from outside and from inside the bioenergy sector, respectively, was carried out. Two different but complementary perspectives were therefore outlined, both useful in order to join a common strategy of sector development.

The general picture of the biomass/APPR and bioenergy sector and a clear vision about its developing conditions is offered by merging and combining the information gained from a higher level of scale (the European one) with the knowledge learned at a lower scale (i.e. the regional and national one).

Outside the sector, the perspective expressed by policy makers and representatives of policy institutions was considered through their formal and public statements and documents. These institutions and policy leaders are acting on the sector through legislation, regulations, and decisions assumed at policy level, defined according to a set of general principles and considering their own understanding about issues to be faced and aims to be pursued.

Inside the sector, farmers and farmer organizations, agro-food cooperatives and consortia, agro-service companies, professionals in agriculture and business consultants, logistics, machinery and energy firms, builders and dealers of energy facilities and biomass plants, biomass consumers and final industrial bioenergy users, have expressed ideas and opinions on the sector needs and the policy instruments to be implemented. This coherent set of believes allow the building up of a unitary strategy, suggesting the path to be follow in promoting the sector development. The sector stakeholders have been consulted (through interviews and focus groups) in order to acquire a deep understanding on the long-term sector development and the role the sector is going to play with respect to the main societal challenges (energy, climate change, sustainability in resource uses, economic growth and social promotion).

In order to fulfil the terms of the Paris Agreement taken in COP21 in 2015 and avoid the most catastrophic climate impact scenarios, the energy sector must be fully decarbonised. Today, considering the energy sector, the main policy issues should be those ensuring a sharp but orderly transition away from fossil fuels. Holding global average temperature rise well below 2°C, not to mention a much safer limit of 1.5°C, requires nothing short of the complete decarbonisation of the energy sector.

The economic, social and environmental issues conveyed by the biomass/bioenergy sector are in favour of, and in agreement with this global policy target. According to stakeholder's opinions, the

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future energy mix will be mostly represented by renewables and the contribution of bioenergy could be significant considering the multiple and diversified forms of energy carriers is offered, for households, large buildings, district heating, heat & cooling for industrial applications as well as agro-food processing.

Of course, stakeholders offer a stronger emphasis to the local/regional dimension of biomass supply, the consequent territorial value attributed to the bioenergy productive sector and the resulting market and, finally, the socio-economic relevance credited to rural development as compared to an indiscriminate and not well-qualified industrial growth. Regional conditions should be the main determinants in addressing the strategy to be implemented in supporting the biomass/bioenergy sector take-off or reinforcement.

A sustainable use of biomass resources, with particular reference to fruit-tree residues, may be the unifying vision in fostering the regional economic development. If based on local supplied biomass residues, regional bioenergy value chains could allow significant savings in fossil energy and a drastic reduction in atmospheric emissions (effectively contributing to “decarbonisation”). By supporting the energy self-consumption and relieving the energy dependency of some agro-food and industrial activities, the risks and costs of energy supply would be significantly reduced. Through diversifying and expanding the productive activities, a solid and stable business would also be encouraged. It can be said that rural development is the new and unprecedented dimension added to the so-called “energy-climate-sustainability” nexus.

The aforementioned arguments represent very good reasons to promote and disseminate this vision and should establish an effective platform to appeal for a new policy, clearly determined to proceed towards the implementation of these concepts.

According to stakeholders, bioenergy is part of a general ecological shift our societies are implementing. The sustainable energy use of biomass generates several positive effects, optimally framed in the process of ecological revitalisation to be performed at local / regional scale. A large variety of bioenergy value chains and business models are available, each according to specific territorial characteristics, exhibiting the full achievement of favourable environmental and ecological standards. A close and worthy integration can be established between agriculture and industrial processing, alongside the food sector, through non-food biomass as source of biological feedstock and energy carriers and a wide range of industrial energy uses are also possible. Bioenergy projects rooted in the regional fabric are promoting a community oriented, self-reliance, and self-sustaining models of rural development, thus contributing in performing a local socio-economic acceleration based, firstly, on a well-balanced biomass supply, carefully exploiting without harnessing the actual available land and biomass resources. They represent an effective leverage of productive diversification in the agricultural sector, allowing an alternative source of farm income, reinforcing farming activities in marginal rural areas, generating added value from non-conventional productions. Therefore, bioenergy value chains can be recognized as a fundamental component of the multi-functional asset of agriculture, and the production of renewable energy from biomass one of the features, among many others, of a self-centred and multidimensional rural development

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When considering the kind of biomass we are specifically interested in (i.e. APPR), the advantages offered by the biological and renewable nature of this feedstock further highlight the positive characteristics and the thorough sustainability of the bioenergy value chains that can be planned and implemented starting from these residual biomasses. Biomass from pruning residues contributes to the "decarbonisation" of the energy system, do not compete with food crops, lessens the energy dependence of the agricultural sector, are a flywheel for rural development, enhance the farm productive diversification and favour an income integration, allow to overcome the bad practice of pruning burning directly in the field and in open-air conditions.

Having remarked the role bioenergy from APPR can usefully play in the forthcoming years in promoting the energy sector development as well as in the parallel sectors of agriculture and industry, specific policy recommendations can be addressed and summarized as following.

Ambitious targets in GHG savings and bioenergy contribution to the renewable energy mix should be set, while a long-term policy framework for bioenergy should be established, thus increasing investor confidence and allow for sustainable bioenergy production. In parallel, the phasing out from inefficient fossil fuel subsidies should be assured, progressively expanding a carbon tax and introducing appropriate accounting in CO2 pricing schemes. Moreover, new investments in fossil fuel infrastructure should be prevented. An integrated strategy in mobilizing biomass for energy from residues and by-products should be further implemented, applying sustainability governance frameworks based on GHG performance. A strong technological development in bioenergy is ensuring significant benefits over fossil fuels, favouring those technologies offering the deepest decarbonisation for the least cost. Financial support (e.g. through grants and loan guarantees) should be provided to those investments addressing the highest risks related to commercial-scale, through appropriate and dedicated financial mechanisms and instruments for low-carbon bioenergy systems, thus facilitating technological development and market deployment. A convenient public support, although temporarily, can consolidate the economic affordability of biomass use and the economic return along the value chain. Unnecessary administrative barriers to bioenergy deployment should be identified and removed, consistently with sustainability objectives. National and regional roadmaps, strategies and sustainability regimes for bioenergy should be prepared and implemented all over the European countries. Capacity building should be enhanced in promoting, planning, designing and implementing new bioenergy value chains according to sustainable criteria and affordable conditions. The integration of renewables with biomass, energy efficiency, emission standards, fuel flexibility and multi-fuel energy units, district heating, industrial and residential heating are specific fields of intervention. Strong connections among different strategic plans in bioenergy, bioeconomy, and circular economy can be very effective in promoting a deep transition to a new socio-ecological system.

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1 INTRODUCTION

'uP_running' is a H2020 project, performed under the call LCE-14-2015 "Low-Carbon Energy" [1]. The present document is a formal and public deliverable (D2.2) of the project itself, the second outcome after the release of the first deliverable (D2.1), both pertaining supporting actions and strategies to favour and boost the bioenergy sector development. As it will be better explained further on, the two deliverables are strictly linked one another, although independent and standing-alone documents.

"Biomass" and "bioenergy" are, in general terms, the wide references of the project, although 'uP_running' is specifically focused on one particular kind of biomass as energy feedstock, the one we have point out with the acronym APPR.

APPR stands for 'agrarian pruning and plantation removal'. Residual wood biomass obtained from pruning operations and from the trees removed at the end of the plantation lifespan, in both specialised plantations and orchards, optionally useful in renewable energy generation, especially heat and power.

The specific objective of this deliverable is to report the outcomes about the *National APPR Sector Analysis* and the *Strategic Plan* resulting from the activities developed in seven European Countries, together with an overall analysis at European scale, the latter as a comprehensive outcome performed at a higher hierarchical level.

The general picture of the Biomass/APPR and Bioenergy sector and a clear vision about its developing conditions can be offered by merging and combining the information gained at this higher level of scale (the European one) with the knowledge learned at a lower scale (i.e. the regional and national one).

Consequently, effective and decisive strategic tools and policy measures can be properly suggested in the frame of the European policy with respect to strategic issues such as energy, environment, research and innovation, rural development, and so on.

The 'uP_running' project foresees and includes actions needed to foster the development of the bioenergy sector. Ensure its sustainability and increase the share of bioenergy in the final energy consumption are correlated targets [2].

Carry out actions in favour of the bioenergy sector means promoting the setting up and strengthening of *local bioenergy supply chains*, on condition that the highest environmental criteria and quality standards are met. This means that more bioenergy should be generated in the EU.

The starting step of the 'uP_running' project is that, despite considerable amounts of biomass in the form of tree crop residues (APPR) are currently available in EU (principally in Mediterranean countries), these biomass resources are largely underused or not properly valorised. A substantial immobility is characterizing this potential energy sector, and the key actors of these possible value chains need to be strongly encouraged to start new businesses and setting up innovative biomass-to-energy initiatives.

Both technical and non-technical barriers to the production and use of bioenergy are constraining the biomass APPR sector and should be overcome. For its part, the 'uP_running' project is mostly addressing non-technical barriers.

Considering the present document, some specific objectives have been targeted:

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- Soliciting the involvement of stakeholders within the Biomass/APPR sector at every scale (regional, national and European).
- Promoting the circulation of knowledge, awareness, ideas, proposals, also developing a common vision and a mission among the same stakeholders.
- Performing a sector analysis, thus gaining a precise understanding about the opportunities and constraints of the Biomass/APPR sector.
- Working out an action plan to deploy effective implementation initiatives promoting the take-off of new biomass/bioenergy value chains and a stable and sound APPR sector.
- Scaling-up the analysis, from the regional to the national, and finally at the EU level, assessing the sector operating conditions and outlining actions and measures needed to reinforce the APPR sector.
- Arranging a strategic policy plan to assure a correct development of the APPR biomass sector.
- Offering policy recommendations, strategic guidelines for the sectors development.

“uP_running” should be considered a “seeding” initiatives, to be reinforced (“fertilized”) inside the regions and countries of application, and to be exported (“disseminated”) in other areas and vastly replicated at EU level.

A sound and clear understanding of the conditions currently prevailing in the bioenergy/APPR sector is warmly advisable before putting in place a set of actions aimed at reinforcing the sector itself. Once these conditions have been sufficiently explained, strong reasons are on hand to identify tools aimed at increasing the awareness on the sector potential development, boosting its capacity to impact significantly in the EU areas, supporting the creation of new supply chains, new businesses, new jobs, and promoting well-targeted dissemination activities.

The immediate objective, however, was to recognize the deep reasons why, still in the majority of the European countries, the sector take off is far from what it would be expected. Correspondingly, barriers having the greatest impact were detected, together with the highest obstacles hindering the sector development. Anyhow, the poor development of the APPR sector provides a great chance to work out a detailed and effective programme implementing tools, actions, and initiatives enabling the best conditions for a prompt and solid growth, while taking into account regional, national and European external barriers.

A detailed analysis at local/regional level concerning the operating conditions currently governing the bioenergy sector based on the APPR kind of feedstock was performed already in our previous deliverable (D2.1). With this second deliverable (D2.2) the objective is carrying out a “Sector Analysis” and preparing a “Strategic Plan” at national and EU level. Drivers and constraints of the sector (to be further divided into strengths and opportunities, as well as weaknesses and threats, respectively) were carefully detected in order to have a deep understanding about the sector status and its development prospects.

The representative organisations or the key actors involved in the analysis were, this time, at a higher hierarchical scale than before. The national and EU level rather than the local and regional one were taken into account.

This analysis should support national and EU policy in promoting the bioenergy/APPR sector and its development. The results reported in this document (D2.2) are made of the contribution from each



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national project team, mainly stressing on a “strategic” view about the core and relevant goals to be prioritised, thus assuring a sound bioenergy/APPR sector development, effectively contributing to the “decarbonisation” path and to the EU targets on renewables.

It is worth to note that while at regional level a plan of “*Actions*” was conceived, differently, at national and EU level the plan follows a “*Strategic*” approach. It means that in this latter case the perspective is different, necessarily broader, comprehensive, and forward-looking, i.e. more involved into issues related to “*policy*” and “*governance*” rather than strictly related to a sectoral or corporate dimensions.

As a further outcome, a draft of policy recommendations was prepared, thus outlining policy measures best tailored to specific countries and EU as a whole. The right instruments to overcome barriers and promote the advancement of the bioenergy sector are identified and R&D strategies and policy measures needed to support biomass technologies development are also suggested.

About the structure of this document, some indications are presented below, thus allowing a better orientation in reading it.

After the general introduction presented in this *Section 1* that considered the main objectives and issues the document is focused on, some comments and clarifications about the approach followed in performing the analysis will be provided in *Section 2*. The particular viewpoints associated to the analyses performed at the two contrasting hierarchical levels will be provided, the national as compared to the European one.

Section 3 will address the visions about the bioenergy sector, specifically considering both the vision “from above” and the vision “from within” the sector. The former is assuming the point of view of the EU policy makers in charge of proposing and launching regulation tools and policy instruments (according to a *top-down* attitude). Conversely, the latter is conveying the perspective of those stakeholders that belong to the biomass/ bioenergy sector and are operating inside the sector itself, trying to develop their economic activities notwithstanding difficulties or barriers (we can define this as a *bottom-up* attitude).

The positions taken by “policy makers” and the decisions they assume are particularly affected by external sector conditions (the broad urging scenario). These conditions can be both positive (drivers) and negative (barriers) and could be schematically identified by the two terms of the SWOT analysis, i.e. “threats” and “opportunities”, respectively.

Differently, stakeholders operating inside the bioenergy sector are mostly influenced by internal conditions, again both positive (drivers) and negative (barriers), that according to the SWOT terminology are defined as “strengths” and “weaknesses”, respectively.

Considering a *top-down approach*, in other words applying a typical policy perspective, policy strategies towards a stronger Bioenergy sector will be discussed in *Section 4*. Measures and instruments regulating and promoting the bioenergy sector will be reported in *Section 5*. This kind of outlook can be properly considered as a “*Strategic Plan*”.

When a *bottom-up approach* is adopted and a typical sector analysis perspective is applied, a set of priority actions is identified directly from stakeholders involved in the sector. These proposed



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actions is reported in *Section 6*, they are supposed to be appropriate in boosting the bioenergy sector by soliciting the direct interventions of the actors operating inside the sector. This kind of outlook can be properly considered as an “*Action Plan*”.

Section 7 corresponds to the conclusions, useful to reconstruct, very briefly, the whole document and the main conceptual traits that should be considered as “lessons learned” and main recommendations.

At the end of each chapter, useful notes and bibliographical references are reported. Sometimes, more detailed comments or information tools to deepen the subjects are also suggested.

Finally, *annexes* include the results of the sector analysis and the strategic plans developed in the seven partnering EU Countries. For each country, the attached documents were written both in English and in the corresponding national language.

Notes and References

- [1] Horizon 2020, LCE-14-2015. Market uptake of existing and emerging sustainable bioenergy. “*Market uptake of existing and emerging sustainable bioenergy*” is the Horizon 2020 public call identified with the acronym LCE “Low-Carbon Energy”, within the ‘*Secure, Clean and Efficient Energy*’ challenge.

Available at:

<https://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/lce-04-2014.html>.

- [2] Consult: EU, 2013. Renewable Energy Progress Report, COM(2013)175 and, more recently: EU, 2017. Renewable Energy Progress Report, COM(2017) 57.

2 SELECTING THE ANALYTICAL FRAMEWORK

Strategy without action is a daydream; action without strategy is a nightmare.

(Japanese proverb ^[1])

The National sector analysis was carried out by each national project team (both DCs and OCs), while the sector analysis at EU level was completed by partner UFG.

The EU analysis was implemented not only by collecting and organizing each single national contribution, but also carrying out a specific survey of documents, position statements, policy reports, and strategic informative prepared by the EU Commission, governmental agencies, and non-governmental organizations within EU or outside it. This large literature survey allowed gaining a deep insight on the international and EU conditions pertaining the renewable energy system, also including the bioenergy sector; possibly particular references to the APPR biomass feedstock were detected and commented.

Although the applied methodological approach was quite similar, when comparing the *Regional*, the *National* and the *European* scale of survey, the major difference was that the representative organisations or the key actors involved in the analysis (i.e. the so called “stakeholders”) are placed at different hierarchical levels. This level was clearly higher at EU level, and lower when considering the national or the regional dimension of the analysis.

It should be considered the following hierarchical levels:

- Level 1: single stakeholder;
- Level 2: stakeholders’ network at local level;
- Level 3: representatives of national stakeholders’ organizations (clusters of networks);
- Level 4: representatives of large EU organizations (such as governmental agencies and non-governmental associations).

At a higher level of hierarchy, as compared to the lower one, new properties are “emerging” from the analysed sector; these properties are not necessarily related to the lower level but are the resulting effect of new relationships. We need to capture these new relationships and do not return on previous analyses, already accomplished in the first year of project and reported in the previous deliverable (D2.1).

The analysis, this time, was performed at national and EU level of scale; for this reason, it interacted with the system elements placed at level 3 and 4 of the organizational structure reported before. Therefore, it was necessary identifying the corresponding actors (stakeholders) playing at these levels, as well as the forces (drivers and barriers) influencing the sector status and its development specifically at these higher levels of organization. The sector analysis should be performed with respect to the proper level of hierarchy within the sector organization, thus interacting with the specific actors playing a role at this particular level.

Having defined the hierarchical structure characterizing the system under examination, another relevant decision to be taken when approaching a planning process could be how to proceed in the analysis; in other words, if it is better to apply the analysis starting from the “top” of the hierarchy and proceeding downwards or, conversely, starting from the bottom and proceed upwards ^[6]. Again, it depends on the aim of the analysis and, accordingly, with the information in our hands.

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A *bottom-up approach* is related to a process progressing from lower to higher units; in other words, it is an approach that works up to the highest conceptual level, piecing together the basic elements to give rise to the complex system. The work planning proceeds from level 1, to level 2, and finally to level 3. These elements are progressively linked together, forming larger subsystems, which in turn are linked until a complete top-level system is formed.

Conversely, a *top-down approach* is related to a process progressing from a broader, more general frame to lower subunits; in other words, is an approach that begins at the highest conceptual level and works down considering lower hierarchical levels. It is essentially the breaking down of a system (in our case the hierarchical organization of the sector) to gain insight into its compositional sub-systems. In a top-down approach an overview of the system is formulated, then specifying every level subsystems. The work planning proceeds from level 4, to level 3, and finally the level 2.

In performing the *regional analysis*, a bottom-up planning approach was applied. Single stakeholders and the local stakeholder networks (level 1 and level 2) provided the basic understanding about the organization of the sector at regional level. This, indeed, was the approach followed in preparing the first deliverable (D2.1).

The *national analysis* presented in this deliverable (D2.2) was conceived as the continuation of the same bottom-up approach, although pushed at a higher hierarchical level (i.e. from level 2 to level 3). The sector analysis was performed by each project country team by involving representatives of national organizations and private or public national institutions.

The reverse approach was adopted in performing the *European analysis*, and a top-down planning perspective was applied. The contributions from representatives of large and influential EU organizations (governmental agencies and non-governmental associations) as well as representatives of international organizations were collected, interpreted and discussed (i.e. moving from level 4 to level 3).

The main features and characters of the Bioenergy/APPR sector (as identified by the sector analysis) were initially assigned to two different categories: “*barriers*” (or “*constraints*”), and “*driving forces*”, respectively. The former are recognized as negative factors affecting the sector, while the latter are considered positively influencing the sector growth and development. Later on, according to the conventional SWOT structure, it was straightforward proceed in splitting the “*barriers*” into internal (“*weaknesses*”) and external factors (“*threats*”). Similarly, “*driving forces*” were also divided into internal (“*strengths*”) and external factors (“*opportunities*”). The construction of the SWOT analysis was the consequent outcome.

The usual definition of the four factors comparing in the SWOT analysis is the following:

- **Strengths:** factors, internal to the sector, that are positive at present; characteristics of the sector that give it an advantage; you should maintain or increase them, build on them, and use them as leverage.
- **Weaknesses:** factors, internal to the sector, that are negative at present; characteristics of the sector that place it at disadvantage conditions; you should remedy, change or stop them;

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- **Opportunities:** factors, external to the sector, that could be positive for the future; factors in the environment that the sector could exploit to its advantage; you should prioritize or capture them, build on them and optimize them.
- **Threats:** factors, external to the sector, that could be negative for the future; factors in the environment that could cause trouble for the sector; you should manage or mitigate them or even counteract them.

The SWOT analysis is often used as part of a strategic planning process. Four basic strategies can be identified by applying a paired combination of an “internal” together with an “external” SWOT factor. By the pairwise combination of internal and external factors, the following strategic alternatives might be obtained:

- **SO Strategies** i.e. strategies employing strengths in order to profit by opportunities. These are *max-max* type strategies, in the sense that they combine both the most favourable elements in building a strategy. SO strategies use strengths and powerful elements in order to make it benefit from external opportunities and could be considered an “aggressive” approach (*attacking strategy*).
- **WO Strategies** i.e. strategies seeking to alleviate the effect of weaknesses by taking advantage of opportunities. These are strategies of the *min-max* type because they combine inside weaknesses with external opportunities. The strategy attempts to use opportunities in order to eliminate or alleviate weaknesses (*reorientation or adjust strategy*).
- **ST Strategies** i.e. strategies that employ strengths in order to prevent or minimize threats. They are strategies of the *max-min* type, in the sense that they use the strengths in order to avoid or reduce external threats (*defence strategy*).
- **WT Strategies** i.e. strategies that alleviate weaknesses and seek to reduce the impact of threats. They are *min-min* type strategies seeking to minimize weaknesses if external threats can be avoided (*surviving strategy*).

Each country team performed its *National Sector Analysis* according to this kind of strategic planning methodology, strictly connected to a SWOT analytical procedure. The documents annexed to this deliverable and prepared by each of the seven countries clearly show how this approach was applied. The resulting output is an “*Action Plan*” that identifies, for each country, the main measures and activities to be activated in targeting well-defined aims or objectives considered of strategic relevance. In this respect, *Section 5* tried to summarize in a unique framework all the contributions expressed by each *National Sector Analysis*, defining a common set of objectives and specific fields of action.

Differently, *Section 4* is entirely devoted to the analysis performed at European level, according to the so-defined top-down approach. Accordingly, only external conditions can be considered at this level; therefore, when applying the SWOT procedure, just “opportunities” and “threats” (i.e. external factors) were taken into account. The resulting output, in this case, is a “*Strategic Plan*” targeting more general and comprehensive aims about the sector development and considering a much wider international framework affecting the sector from above.

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Notes and References

[1] Japanese proverb, as quoted in Civilization's Quotations: Life's Ideal (2002) by Richard Alan Krieger, p. 280.

For those interested in a deeper understanding of the methodological terminology, some references are listed below.

The difference between “strategy” and “action” is addressed in several websites, below a short selection:

- <https://www.linkedin.com/pulse/20141016135759-81156671-strategy-vs-action-plan-vs-process-do-you-know-the-difference/>;
- <https://www.quora.com/Whats-the-difference-between-a-strategic-plan-and-an-action-plan>
- <https://cmoe.com/a-plan-versus-a-strategy-is-there-a-difference/>
- <http://www.differencebetween.com/difference-between-action-plan-and-vs-strategy/>

The difference between “vision” and “mission” is addressed in several websites, below a short selection:

- <http://www.differencebetween.com/difference-between-vision-and-vs-mission/>
- <https://www.clearvoice.com/blog/difference-between-mission-vision-statement-examples/>
- <http://www.glennsmithcoaching.com/mission-vs-vision-whats-difference/>
- <https://www.shrm.org/resourcesandtools/tools-and-samples/hr-qa/pages/isthereadifferencebetweenacompany%E2%80%99smission,visionandvaluestatements.aspx>

The difference between “aim” and “objective” is addressed in several websites, below a short selection:

- <http://www.differencebetween.com/difference-between-aims-and-objectives/>
- <https://patthomson.net/2014/06/09/aims-and-objectives-whats-the-difference/>
- <http://www.differencebetween.net/language/difference-between-aims-and-objectives/>
- <https://learn.solent.ac.uk/mod/book/view.php?id=116233&chapterid=15294>

Concerning the definition of “bottom-up” and “top-down” approach, the following were the consulted websites:

- https://en.wikipedia.org/wiki/Top-down_and_bottom-up_design
- <https://www.thefreedictionary.com/bottom-up>
- <https://www.thefreedictionary.com/top-down>

3 THE BIOENERGY VISIONS COMPARED

*“Good leaders have vision and inspire others to create their own.
Great leaders share vision and inspire others to turn vision into reality.”
(Roy T. Bennett, The Light in the Heart)*

An unusual comparison was performed in this section, putting side by side the contents of two possible or apparently contrasting visions. The vision captured from outside the sector and the vision seized from inside the sector are faced each other and their possible mismatch or agreement was detected.

→ *Outside the sector*, the vision expressed by policy makers and policy institutions was considered through their formal and public statements and documents. Those institutions and policy leaders are acting on the sector through legislation, regulations, and decisions assumed at policy level, defined according to a set of general principles and considering their own understanding about the main issues to be urgently faced and the most relevant aims to be pursued.

→ *Inside the sector*, farmers and farmer organizations, agro-food cooperatives and consortia, agro-service companies, professionals in agriculture and business consultants, logistics, machinery and energy firms, builders and dealers of energy facilities and biomass plants, biomass consumers and final industrial bioenergy users, have expressed their ideas and opinions allowing the building up of a unitary vision. More in general, the sector stakeholders have been consulted in order to acquire a deep understanding about their vision on the long-term sector development and the role the sector is going to play with respect to the main societal challenges.

While the vision “from above” was captured by an extensive literature survey (reported in the reference list at the end of this section), the vision “from within” was clearly appreciated by directly meeting stakeholders through regional and national workshops (both in the form of “focus group” or “forum”) and by interviewing some relevant representatives of the APPR sector.

The questions to be solved now are the following: are the two visions similar? Are they expressing the same overall aims? Are there significant differences in the perception of the fundamental sector characteristics? Is there agreement about the potential role the sector can play in answering to the main social challenges?

Comparing the two visions (assumed from outside and inside the sector, respectively) means, unavoidably, to rise the following two reciprocal questions:

- What should the sector stakeholders know about energy policy strategies and related issues that policy-makers should talk about?

But the reverse question is also relevant:

- What should policy-makers know about the bioenergy sector and related sectors that the sector stakeholders should talk about?

Comparing the two visions means suggesting their fine-tuning and promoting a comprehensive and reconciling dimension, useful in targeting a better sector development.

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3.1 The energy, climate and sustainability nexus

A momentous ‘trilemma’ is seriously affecting the planet. Three main planetary problems cannot be postponed any longer and must be taken into serious consideration immediately. They are strictly connected one another to form a recursive “cause and effect” feedback, thus requiring a concerted set of actions and prompt responses. In facing these serious threats affecting the planet, it is necessary to harmonize and properly match the three sides of the overall problem, i.e. food, energy and environment (*Figure 3.1*).

- Food:** food resources are at risk of prominent scarcity due to demographic pressure (thus producing a progressively higher food demand) coupled with unsustainable human management (causing a progressively lower food supply). Soil degradation, water constraints, climatic disorder, polluting use of agro-chemicals, biodiversity ‘erosion’, are connected features of the same problem.
- Energy:** the availability of fossil fuels is dramatically decreasing and these resources are going to be exhausted in a short period. Moreover, the strong dependence on energy consumption, the structural connection between energy use and the rate of economic growth, the instability and insecurity of ordinary fossil supplies, and the worrying geopolitical scenario in many areas of the globe where fossils are still available, represent connected features of the same problems.
- Environment:** unsustainable human management of natural resources and the profound alteration of large environmental compartments (such as air, water and soil) due to degradation and pollution caused by human activities is affecting the ecological stability at planetary scale. On this respect, *climate change* is the most alarming problem. The unremitting increase in the concentration of atmospheric greenhouse gases (GHGs) and the consequent effect of a progressive global warming is producing drastic ecological alteration, able to interfere radically with the human economy and even in the survival of entire populations.

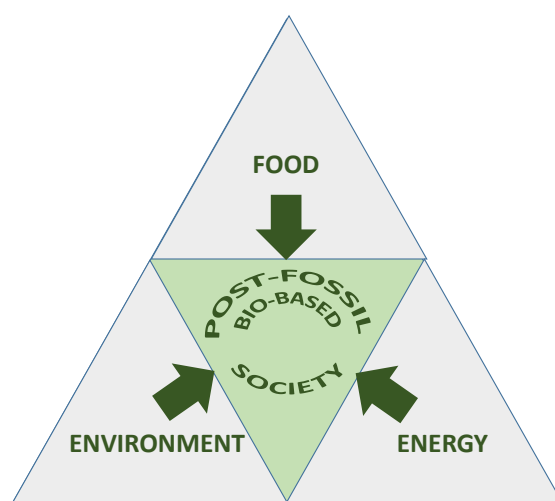


Figure 3.1: The three interconnected problems acting at planetary level and the transition to a “post-fossil”, “bio-based” society as the only strategy to find a solution.

What kind of problem should be the most worrying or dangerous is both difficult to say and irrelevant, as they are totally interlinked and, therefore, they need a unique and comprehensive strategy to be (hopefully) overcome.

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A responsible climate policy would simultaneously improve the energy supply security and the environment protection. The strategy that was proposed (since the beginning of 1970s'), at both European and world level, is a decisive and irreversible reorientation of our economy towards a "post-fossil" era (considering the legacy of the past), or a "bio-based" economy (as for the prospecting future). This means that a "transition" to this new economic model should be not only encouraged, but also rapidly undertaken with great resolution.

Economy includes every kind of human activity on the planet, from agriculture to industry, from production to consumption, from 'cradle to grave' (as it is usually told), from local to global, because the future of humankind itself is the price we are going to pay.

This "transition" path is an exit strategy (the so-called "decarbonisation") together with the deployment of a new strategy based on very different economic, cultural and technological paradigms. Therefore, this "transition" should have a large policy momentum, as well as should be able to outreach general awareness and involve a participated commitment from everybody.

Considering the biomass/bioenergy sector, the following message should be of primeval importance:

<< In a world seeking solutions to its energy, environmental, and food challenges, society cannot afford to miss out on the global greenhouse-gas emission reductions and the local environmental and societal benefits when biofuels are done right. However, society also cannot accept the undesirable impacts of biofuels done wrong >> [1].

3.2 The vision from above (policy drivers of bioenergy)

A great and radical perspective change (or "shift") took place in these last years. While in previous decades climate change was seen either as a distant threat or a purely environmental issue, it is now clear that the impacts of climate change have become a tremendous "threat multiplier" [2].

The unique and exclusive fact about managing climate change risk, as well as its wide and profound planetary effects, is that it is able to drive aggressive changes in the Earth's life support systems that are vital for the planet. These threats on natural systems and on human societies as well are irreversible, at least considering a time span relevant to humankind [3].

The ultimate goal, but the first priority, is stabilizing the GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Moreover, such a level should be achieved within a timeframe sufficient to allow the ecosystems adaptation to climate change, to ensure that food production is not threatened and to enable economic development to proceed sustainably [4]. Unfortunately, today, we know already that in consequence of climate change the economic development is going to be altered, but we ought to prevent or mitigate (and, at the same time, to adapt to) those large scale perturbations able to shock our economy.

Managing climate risk and the consequent global energy transition are today the new critical issues to Europe's security, and must be the pivotal problem running throughout the EU policy.



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Climate change is the ultimate “threat multiplier”, more challenging than other global issues because it is a race against time. Climate risk, indeed, threatens core European interests; efforts to ensure security and prosperity inside and outside the European borders could be jeopardised by uncontrolled climate change ^[2].

Despite the success in Paris COP21, governments need to plan and manage a broad range of climate-related impacts and threats. The emission reductions pledged by countries, known as the *Intended Nationally Determined Contributions* (INDCs), still put the world on course for an increased average temperature of up to 3.7°C to 2100.

The aforementioned perspective shift has placed great emphasis on climate change, but also highlighted the progressive decrease in importance of other issues, previously considered of the uppermost relevance. On this respect, ensuring reliable access to and affordable supply of fossil fuels is a clear example. Structural changes in energy demand and new energy technologies made the EU less exposed to conventional energy security risks than in the past. Today, the security issue is much less in the supply of fossil energy and much more in getting rid of fossils. Of course, this is still a trend, but well established by this time, and a clear manifestation of the current “transition”.

Moreover, Europe is still exposed to a serious security threat and great uncertainty, and must adopt a strategy that should be resilient to all eventualities, including worst-case scenarios. The foundation of European security cannot be built simply on the hope that agreed commitments will be delivered on time to avoid dangerous climate impacts, or that worst-case scenarios will not materialise. This means that EU institutions and Member States need a new approach to climate risk, which seeks to both reduce the probability of a bad outcome and manage the potential severity of its consequences ^[2].

Thanks to politics put in place decades ago and with a good degree of foresight, a strong increase in renewables and energy efficiency is driving a steep decline in fossil fuels consumption across Europe. However, the stakes have to become much higher!

Today, considering the energy sector, the main policy issues should be those ensuring a sharp but orderly transition away from fossil fuels. Therefore, the goal should be “100 % renewables”

In order to fulfil the terms of the Paris Agreement taken in COP21 and avoid the most catastrophic climate impact scenarios, the energy sector must be decarbonised. Holding global average temperature rise well below 2°C, not to mention a much safer limit of 1.5°C, requires nothing short of the complete decarbonisation of the energy sector ^[4]. The call for a 100 % renewable energy future is gaining widespread support. It is a clear and simple concept, expressing perfectly the ambition signalled by countries in signing of the 2015 landmark Paris Agreement.

Renewable energy technologies are coming of age, and are increasingly cost-competitive with respect to conventional fuels. Given their vast global potential, they are becoming increasingly dominant. They are no longer the “alternative” energy sources of the 1970s; conversely, they are the mainstream technologies of the 21st century. Nonetheless, uncertainties about the pathway towards this future remain ^[4].

Climate change reconciliation thus represents the emerging and predominant pillar among the fundamental visions developed at planetary level, although several other connected visions are



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eligible as guiding the world policy. *Table 3.1* summaries what are considered the relevant visions currently shaping the policy trends at international level targeting a “post-fossil” era.

Table 3.1: *Several visions inspiring policies at European scale and addressing the main economic, environmental and social challenges.*

A climate vision	A climate-reconciled planet that succeeded in reducing greenhouse gas emissions into the atmosphere and consequently arrested the global warming effect within a threshold compatible with ecosystems preservation.
A post-fossil vision	A world entirely relying on renewable energy resources.
A bio-based vision	A world economy centred on the sustainable production and conversion of biomass into a wide range of food, feed, health, fibre, added-value goods and industrial products, also including energy.
A bioenergy vision	Bioenergy (energy obtained from biomass) still a relevant component of the world renewable energy portfolio.
A sustainability vision	Sustaining economy, environment, and community for future generations. It involves the “triple bottom line,” of People, Planet, and Profit. According to the United Nations sustainable development goals: “We can be the first generation to end extreme poverty, the most determined generation in history to end injustice and inequality, and the last generation to be threatened by climate change”.
A secure energy vision	A stable and secure energy supply due to a diffused, distributed and large-scale deployment of improved renewable technologies that are environmentally sound and socially acceptable. The lack of dependence from fossil fuels is the reason of an unprecedented peaceful world arrangement.

The European Commission has set a long-term goal to develop a competitive, resource efficient and low carbon economy by 2050 ^[5]. The “green economy” concept was incorporated into the general framework at different levels of EU policy ^[6]. Green economy is fully on the track of sustainability, thus targeting to improve human well-being and social equity, while significantly reducing environmental risks, polluting emissions, ecological scarcities and valuing ecosystem services. The concept of low-carbon economy (LCE) or decarbonised economy is strictly connected to sustainability and specifically refers to an economy based on technologies having a minimal output of greenhouse gas (GHG) emissions into the atmosphere.

In the frame of the wider concept of green economy, the bio-based vision is mostly centred on the use of renewable raw materials coming from organic sources. In addition to the environmental



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emphasis assigned to the concept of green economy, bioeconomy (or bio-based economy) focuses on the new economic growth opportunities of both traditional sectors (such as agriculture, food, fishery, forestry, pulp and paper industries, etc.) and emerging biotechnological sectors, as well as bioenergy^[7]. Of course, environmental concerns (such as resource scarcity) and societal challenges (such as climate change) are at the core of the solutions setting up by bioeconomy.

According to the European Commission's bioeconomy interpretation, it covers "the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy"^[7].

At international level, the report "The Bioeconomy to 2030: Designing a Policy Agenda"^[8] was the result of a foresight project that examined long-term futures. At European level, after a long lasting debate, the process concluded with the approval of the EU bioeconomy strategy^[7], accompanied by a Commission staff working document^[9] providing background information and a detailed action plan^[10]. This strategy is embedded in the overall strategy "Europe 2020"^[11].

In order to set a framework for bioeconomy development, the European Commission has put forward the EU strategy for building a sustainable bio-based economy as an opportunity to address several challenges, such as food security, natural resource scarcity, fossil resource dependence, and climate change. Therefore, this policy model brings together several stand-alone, but clearly embedded, policy issues (e.g. energy, agriculture, industry, research and development, environment, etc.) as an attempt to provide an integrated response to several broad challenges^[6].

Within this framework, bioeconomy is considered a focus on solving global challenges and, considering Europe, expectations of economic growth together with an enhanced international competitiveness are still of high relevance and closely linked to the aim of playing a leading role in technology development, but are now combined with promises of improved sustainability^[10].

The sustainable development scenario reflects an integrated focus on the three dimensions of sustainable development (People, Planet, and Profit, respectively), as well as an explicit integration of (dynamic) planetary limits to ecosystems capacity. The transition to sustainable development involves concerted actions in a range of sectors. There are many interdependencies, synergies and trade-offs across sectors, affecting policy solutions to be tailored accordingly.

3.3 The vision from within (sector drivers of bioenergy)

A comprehensive array of stakeholders at regional and national level expressed strong conviction about the role biomass / bioenergy can have in the future energy mix (*Table 3.2*).

These positions were assumed in the course of meetings, consultations and interviews with a wide range of regional and national stakeholder's representatives.

According to stakeholder's opinions, the future energy mix will be mostly represented by renewables and the contribution of bioenergy could be significant considering the multiple and diversified forms of energy carriers is offered, for households, large buildings, district heating, heat & cooling for industrial applications as well as agro-food processing.

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In general terms, the economic, social and environmental issues conveyed by the biomass / bioenergy sector (that is to say, proceeding in a bottom-up direction) are in favour of, and in agreement with the visions previously highlighted by considering the global policy framework and reported in *Section 3.2*.

Of course, largely different is the emphasis assigned to the local / regional dimension of biomass supply, the consequent territorial value attributed to the bioenergy productive sector and the resulting market and, finally, the socio-economic relevance credited to rural development as compared to an indiscriminate and not well-qualified industrial growth. Regional conditions should be the main determinants in addressing the strategy to be implemented in supporting the biomass / bioenergy sector take-off or reinforcement.

A sustainable use of biomass resources, with particular reference to fruit-tree residues, may be the unifying vision in fostering the regional economic development. If based on local supplied biomass residues, regional bioenergy value chains could allow significant savings in fossil energy and a drastic reduction in atmospheric emissions (effectively contributing to the “decarbonisation” mission). By supporting the energy self-consumption and relieving the energy dependency of some agro-food and industrial activities, the risks and costs of energy supply would be significantly reduced. Through diversifying and expanding the productive activities, a solid and stable business would also be encouraged.

The aforementioned arguments, to be further discussed and deepened in the continuation of this chapter, represent very good reasons to promote and disseminate this vision and should establish an effective platform to appeal for a new policy, clearly determined to proceed towards the implementation of these concepts. *Table 3.2* gives an effective summary of the main pillars the bioenergy vision is based on.

Table 3.2: *Visions inspiring the stakeholders of the biomass / bioenergy sector in order to set a wide and comprehensive framework of the sector development.*

An ecological shift in society	Bioenergy is part of a general ecological shift our societies are implementing (from the side of both productive structures and consumption models). This pertains to several relevant features, the recovery and recycling of residues and waste, energy saving and efficiency, renewable sources, high natural forms of agriculture, farming respecting the quality of soil and food, new agricultural services offered to protect the environment, technological innovation in a sustainable key, are all essential and complementary elements that must be jointly targeted.

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Biomass is a useful renewable energy source	The sustainable energy use of biomass generates several positive effects, optimally framed in the process of ecological revitalisation to be performed at local / regional scale. In order to cope with climate change, in particular, we must quickly adopt all possible and effective solutions. Among these solutions, a large variety of bioenergy value chains and business models are available, each according to specific territorial characteristics, exhibiting the full achievement of favourable environmental and ecological standards, so that local communities can recognize biomass economic potential, environmental value and social utility.
New forms of agro-industrial integration	A close and worthy link is established between agricultural activity and industrial processing. This integration should not be exclusively restricted to the agro-food sector, but also expanded to include non-food biomass as source of biological feedstock and energy carriers. Apart energy (heat and power), a wide range of industrial uses are also possible in place of products obtained from fossil fuels.
The territorial value of bioenergy	Bioenergy value chains are connected and included within the territorial milieu, offering new opportunities and services, in a complementary relationship with pre-existing agricultural activities. They represent an effective leverage of productive diversification in the agricultural sector, allowing an alternative source of farm income, reinforcing farming activities in marginal rural areas, generating added value from non-conventional productions.
Self-sustained local development	These bioenergy projects, being rooted in the regional fabric, are promoting a community oriented, self-reliance, and self-sustaining models of development, thus contributing in performing a local socio-economic acceleration based, firstly, on a well-balanced biomass supply, carefully exploiting without harnessing the actual available land and biomass resources.

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An open and multi-functional approach	If the local dimension of bioenergy value chains is confirmed, the sector development can be achieved without detrimental effects on other agricultural activities (e.g. by subtracting arable land, resources and investments to the food sector), or jeopardizing the environmental quality. Local bioenergy projects are not invasive, and they can be harmonized with pre-existing activities, specifically considering territorial constraints and drivers. At the same time, a plurality of broader objectives can be met thanks to well-tailored bioenergy projects: sustainable agro-forestry management; energy use of waste, residues and by-products; diversified agricultural systems; increase of agricultural income; soil protection from hydrogeological instability; finely tuned rural development processes; employment and new business settlement. Therefore, bioenergy value chains can be recognized as a fundamental component of the multi-functional asset of agriculture, and the production of renewable energy from biomass one of the features, among many others, of a self-centred and multidimensional rural development.
A new energy quality	Having agreed that expanding the availability of renewable energy and displacing fossil fuels is extremely useful and necessary, this cannot be done indiscriminately or arbitrarily. Therefore, the energy value obtained from biomass cannot be expressed, simplistically, by the quantity of renewable energy produced, but rather by the effective improvement in the quality of life, in terms of a complex and comprehensive set of indicators. The way in which renewable energy from agro-forestry is produced is much more decisive than the amount of its production.

When considering, in more detail, the kind of biomass we are specifically interested in (i.e. the APPR biomass), the advantages offered by the biological and renewable nature of this feedstock further highlight the positive characteristics and the thorough sustainability of the bioenergy value chains that can be planned and implemented starting from these residual biomasses.

The following set of drivers connected to the APPR bioenergy value chains and reported in *Table 3.3*, are valuable in remarking the potential benefits that can be attributed to bioenergy models “done right” ^[1]. The threats and dangers frequently ascribed to bioenergy are, in these cases, largely overcome. On this respect, pruning is one of the best biomass candidate just considering its residual origin.

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Table 3.3: Several visions inspiring the stakeholders of the biomass / bioenergy sector in order to set the wide and comprehensive framework of sector development.

Biomass from pruning residues ...	
... contributes to the "decarbonisation" of the energy system	The energy use of pruning can contribute (especially in some regions) to replace and minimize the consumption of fossil fuels and to reduce the emissions of greenhouse gases responsible for global climate change.
... do not compete with food crops	Since pruning is a residual kind of biomass (i.e. not obtained as main product, but as by-product) its use as energy carrier does not threaten food production, nor it subtracts agricultural land from ordinary food crops. It represents a totally new and supplemental resource, still underutilized.
... lessens the energy dependence of the agricultural sector	The energy use of pruning significantly decrease the energy dependence of the farms from which this kind of biomass is obtained (energy self-supply) and can greatly contribute to the energy supply in favour of agro-food or agro-industrial processing activities in the rural areas where the farm itself is operating.
... are a flywheel for rural development	Bioenergy models focused on the use of pruning and locally structured within the regional rural areas can boost local economic development, acting as a positive driver to leverage experiences of agro-industrial integration, mainly tuned from the side of agriculture rather than industry.
... enhance the farm productive diversification and favour an income integration	The energy use of biomass from pruning contributes to diversify the farm production and significantly decreases the costs resulting from the pruning management as waste, often simply considered a useless hindrance to be readily disposed.
... allow to overcome the bad practice of pruning burning directly in the field and in open-air conditions	The burning of residues, performed freely in the open field, must be considered a technically obsolete practice, not only unnecessary, but also harmful considering agronomic purposes. Moreover, this conventional practice is highly damaging because of indiscriminate pollutant emissions into the atmosphere. Pruning can usefully be addressed to the generation of energy or, alternatively, be retained at the soil surface or integrated into the top-soil, thus acting as a soil conditioner and contributing to the build-up of soil organic matter (just in case no risks of parasitic attacks are present).

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3.4 Rural development should be the added nexus

Comparing the two sets of visions about energy and climate change (the one from above and the one from within the sector, respectively) close relationships, similar inspirations and parallel long-term aims can be remarked, although taken from opposite perspectives and showing different highlights.

If the previous comment is true, it should be observed that the “vision from within” is expressing the position that the local dimension of well-applied renewable energies projects (and specifically bioenergy value chains) can greatly support rural development.

It can be affirmed that *rural development* is the new and unprecedented dimension added to the so-called energy-climate-sustainability nexus.

Figure 3.2 visually explains this further nexus integration.

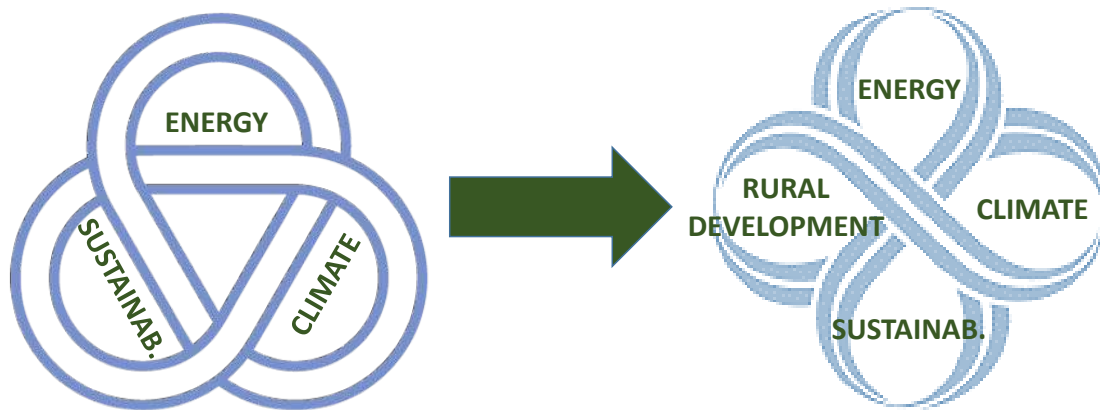


Figure 3.2: Comparing the vision from above with the vision from within, a fourth dimension should be added to the traditional nexus, the one related to rural development.

As suggested by this additional component on the overall vision, renewable energy, and bioenergy particularly, should be associated with rural development and properly implemented to provide specific benefits to rural areas, and promote their social and economic improvement.

Therefore, rural development should be considered the “missing link” in bioenergy evolution when the strategic view on bioenergy development is designed according to a top-down approach. Conversely, it is regarded as the fundamental pillar of all the development strategy when conceived from within the sector, i.e. taking into account the beliefs and opinions directly expressed by stakeholders.

This implies targeting a “paradigm shift” also including rural development. In particular, bioenergy should not be considered a standalone sector within regional rural economies. Potential backward and forward linkages with rural industries (forestry, food-processing, manufacturing) should be developed through an integrated approach to bioenergy development. Collective actions should be stimulated through intermediate institutions active in rural communities, and policy makers should

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aim at involving a larger number of stakeholders in policy interventions to promote sustainable development and improve local support ^[12].

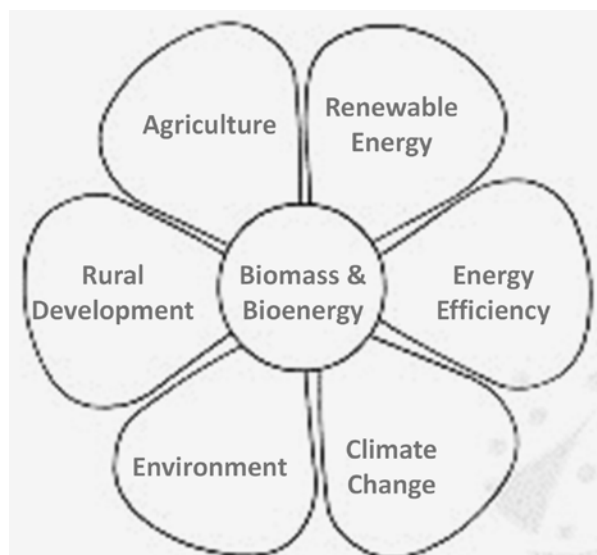


Figure 3.3: The wide range of challenging dimensions that the biomass/bioenergy sector is influencing through the display an integrated and systemic territorial strategy.

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4 POLICY STRATEGIES TOWARDS A STRONGER BIOENERGY SECTOR

"Problems cannot be solved at the same level of thinking that created them."

(Albert Einstein)

In order to proceed in a strategic analysis, a top-down approach was applied; the focus was addressed in performing an overview of the existing strategies, trying to define the conceptual pillars of these strategies and the possible connections with other policy instruments.

Taking into account that in a top-down procedure the external conditions are those considered as affecting the sector, the most relevant “opportunities” and “threats” associated to the selected strategies were identified.

This in-depth overview was performed through an extensive literature review and a detailed internet enquiry for several documents. Information were obtained by collecting and reading some influential documents produced by governmental and non-governmental institutions acting at international levels. More specifically, statements, position papers and planning documents were taken into account. The complete list of documents considered in the analysis is available in the references section at the end of this chapter. Extensive sentences and extracts from these documents have been reported in order to testify directly the positions taken and the guidelines informing the political and governmental actions. On this respect, specific relevance was attributed to those institutions and organizations operating at European scale.

Policy displayed at international level (also considering the EU policy in the frame of the UN scenario), and the consequent governance targets, decisions and rules, should be considered as the complex outcome of the interactions emerging among international institutions, such as EU Commission, intergovernmental agencies and organizations and stakeholder associations operating at international and EU level, according to *Figure 4.1*.

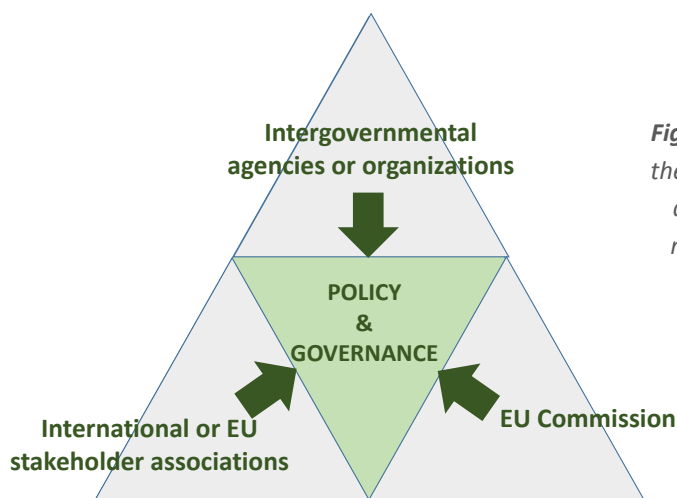


Figure 4.1: Policy in the world scenario is the resulting outcome of the interactions among influential governmental and non-governmental organizations and institutions.

Starting from an all-compassing strategic scenario, the analysis progressively converged to more specific problems concerning energy, renewable sources, bioenergy and finally that kind of energy feedstock consisting of solid wood biomass (to which APPR could be ascribed).

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Clearly, a “descending” approach was applied in order to get a deeper understanding about the external conditioning factors and their influential effects on the bioenergy/APPR sector.

4.1 European pillars of the strategy on climate change

As stated already in *Chapter 3*, climate change is the leading issue influencing and affecting the energy policy at EU level as perceived by several intergovernmental and sectorial international institutions. In this respect, the energy sector is the first and most involved economic and industrial sector to be called into question. Around two-thirds of GHG emissions stem from energy production and use, which puts the energy sector at the core of efforts to combat climate change. The energy sector needs a total overhaul, with a transformation from fossil-based to zero-carbon energy production by the second half of this century. This transformation to a sustainable energy system with high shares of renewables would meet climate goals and pay for itself ^[1].

The decarbonization path should have a double set of targets, one from the side of *energy demand*, the other from the side of *energy supply*.

On the one hand, reducing the total amount of energy consumed and, therefore, significantly increase the amount of energy saved is mandatory. This also means to improve systemically the current level of energy efficiency at the global scale and decoupling energy use from economic growth (GDP increase). Of course, assumptions relating to energy demand are important for planning future energy supply.

On the other hand, the energy supply should eliminate fossil energy sources. Undoubtedly, the major benefit of using renewable energy sources is the climate. The substitution of fossil fuels and the consequent reduction in GHG emissions are significant and should greatly increase in the following years, aiming at the full accomplishment of a 100% renewable target.

Contrasting figures still characterize this transition phase, and positive side by side with negative features are evident in the current global energy system.

The new energy economy is today at the heart of Europe’s economic and energy security. Fossil fuel consumption has declined by 20% since 2010 while over € 400 billion have been invested in clean energy across Europe. Renewables are cutting annual demand for fossil fuels equivalent to the annual fossil fuels consumption of France, putting any new fossil fuels infrastructure at risk of becoming stranded ^[2].

Despite the growing opportunity, Europe is losing ground and, within the EU 28, the CO₂ emissions increased the first time in 2015 from several years ^[2]. This is an alarming fact and in full contradiction with climate targets established. Moreover, Europe is no longer the global engine for clean energy investment. China is investing more than twice as much in clean energy as in EU, in both absolute terms and per capita, with plans to deploy 3.5 times more wind power and 6 times more solar by 2020 ^[3]. Differently, global trade in clean technology needs to become the core of EU energy strategy.

Apart from Europe, the big concern is that the world is on track to miss the goals set forth in the Paris Agreement, with nearly 1°C of global average temperature rise already witnessed since the



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pre-industrial era ^[4]. To stay within the agreed Paris Agreement boundaries, the world can only afford 0.6°C to 1.1°C of additional average warming ^[5]. Current country pledges, or nationally determined contributions (NDCs), could initiate an emission decline in the coming years, but they are not sufficient to reach climate goals ^[1]. Therefore, efforts must be significantly strengthened.

The three main dimensions identified in combating climate change from the side of the energy sector (*Figure 4.2*) are the following:

- energy feasibility and affordability;
- energy environmental sustainability;
- energy social and economic benefits.

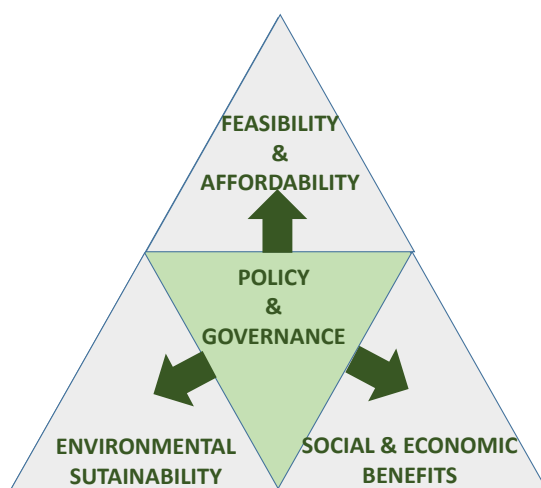


Figure 4.2: European policy on climate change is the resulting outcome of the interactions among three main pillars: feasibility and affordability; environmental sustainability; social and economic benefits.

In *Table 4.1* the main opportunities and threats of the EU energy strategy are reported considering, one by one, the previously identified dimensions to which policy and governance are requested to give urgent answer. To this goal, the same pillars represented in *Figure 4.2* have been taken into consideration.

Table 4.1: Selected external drivers (opportunities) and barriers (threats) mostly influencing the energy strategies as detected by intergovernmental organizations and sectorial international institutions.

EU POLICY & GOVERNANCE ON CLIMATE CHANGE	
OPPORTUNITIES	THREATS
Transition to a low carbon, climate resilient, sustainable development is an imperative to manage the risks associated with climate change ^[6]. Technologies, know how, experience, capital, potential and positive examples are available as on no other continent. With a successful	Climate change poses a severe threat to future sustainable development unless anthropogenic effects and development models that drive greenhouse gas (GHG) emissions are reconciled ^[6]. As it stands, the world is on track to miss the goals set forth in the Paris Agreement.

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climate policy, Europe could urge other continents to follow the European example ^[7]. Bioeconomy as a possible driver. The emerging bio-based economy, producing a broad range of products from biomass to replace those derived from conventional fossil raw materials, adds a further dimension to the determination of the optimal deployment of bioenergy ^[8].	Current country pledges, or nationally determined contributions (NDCs), could initiate an emission decline in the coming years, but they are not sufficient to reach climate goals ^[1]. Policy agreement are difficult and time-consuming, but meanwhile GHG emissions are still increasing and global warming worsening.

FEASABILITY & AFFORDABILITY	
OPPORTUNITIES	THREATS
The energy transition is technically and economically feasible; it would meet climate goals, and pay for itself, fuelling economic growth and creating new employment ^[1]. Bioenergy is the only renewable source that can replace fossil fuels in all energy markets – in the production of heat, electricity, and fuels for transport ^[9-10]. Biomass is a versatile energy source. In contrast to other energy sources, biomass can be converted into solid, liquid and gaseous fuels. Moreover, bioenergy can be used for heating homes, electrifying communities, industrial consumptions, and fuelling the transport sector ^[9]. The sustainable potential of biomass coming from the EU is by far under-used (it comprises residues and by-products from agriculture, forestry, organic waste, energy crops from marginal land, etc.).	The domestic (intra EU) production of fossil fuels is dwindling. The declining production of fossil fuels in Europe increases the dependency on imports and endangers the security of supply ^[2]. Bioenergy deployment and investments are not growing quickly enough. Therefore, a widespread increase in the production and use of sustainable bioenergy is urgently needed. An increasing use of biomass as feedstock for the production of energy, chemicals and materials can emphasise competitive relationships among these supplying sources and hamper to get sustainable conditions on biomass use ^[9].

ENVIRONMENTAL SUSTAINABILITY	
OPPORTUNITIES	THREATS
Sustainable bioenergy is an indispensable component of the necessary portfolio of low carbon measures.	The expanded bioenergy must be based on sustainable practices to ensure unequivocal carbon savings and to avoid any other

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A sustainable bioenergy can provide wider environmental benefits by replacing fossil energy sources. Bioenergy value chains are (mostly and generally) energy efficient and able to obtain significant GHG savings. Therefore, sustainable produced biomass is, basically, a carbon neutral energy source. Scaling up sustainably bioenergy is possible, given smart agricultural practices, better use of rural and urban waste, research and innovations, and proper policies.	detrimental environmental, social or economic impacts. Bioenergy development is connected with the growing demand for food, feed and fibre to meet the needs of an increasing world population ^[8]. The potential competition for land and feedstock with other biomass uses must be carefully managed. GHG emissions are generated all along the supply chain of biomass (due to harvesting, transport, processing and other activities) thus a life cycle assessment (LCA) should be carefully applied to avoid misleading assumptions about sustainability.

SOCIAL AND ECONOMIC BENEFITS	
OPPORTUNITIES	THREATS
A sustainable bioenergy can provide wider social and economic benefits by creating jobs and by promoting regional development ^[11]. By accelerating the sustainable supply and use of biomass, the economic impacts will be optimised resulting in more cost-competitive bioenergy and a stronger energy market ^[8]. Biomass for energy offers various benefits: it supplies the markets for heat, electricity and transport fuels; it creates new jobs in the construction and operation of bioenergy plants; it allows the productive use of land not needed for food supply; it improves energy security ^[7].	Social acceptance is recognized as an important issue shaping the widespread implementation of renewable energy technologies and the achievement of energy policy targets. While there are ambitious targets to increase the share of renewable energy in the different EU Member States, it is increasingly recognized that social acceptance may form a factor constraining the expansion of their implementation and use. The lack of energy infrastructures could represent an obstacle while poor infrastructure could slowing the economic development prospected by a fast development of renewables.

Considering the affordability and reliability of the transforming energy system, considerable importance also have the relationships established among the contributions made by renewable sources and the energy forms that are prevalently used. In this respect, it seems that the power sector is winning the race to a renewable energy future. Wind power is now among the cheapest

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new power plant technologies, and solar photovoltaic (PV) systems have achieved grid parity in many countries^[12]. However, achieving 100% renewable energy systems will require a mix of many different technologies to cover the full range of needs, and technologies such as biomass, geothermal and hydro have largely been overshadowed by rapid growth of wind and solar. A debate amongst the multiple sectors and stakeholders of the power market about how to stimulate the growth of all renewable power generation technologies is therefore required to determine the best applications to achieve resilient power systems^[12].

The strategic role of energy for heating and cooling should be largely reconsidered and strongly reinforced; in this respect, solid biomass is the most fitting energy sources. Energy for heating currently represents over 40% of total final energy demand – a greater share than the entire power sector. However, heating does not feature as high on the agenda in energy debates. Policies for the heating sector – with regard to both demand and supply – are required. Industrial process heat is universally needed, unlike heating of homes and offices, which are highly dependent on climate conditions^[12]. Heating and cooling technologies can help integrate more variable solar and wind power in a number of different ways. Therefore, a broad discussion should be welcome in defining the best options, as well as the best energy mix, also given the long time needed for installing the necessary infrastructures^[12].

Technological feasibility and affordability is another important issue when considering the energy system and its development. In order to find the most efficient and sustainable energy supply system, a dedicated technology assessment is relevant. Identifying the technologies offering the best solutions and benefits for a specific application is a relevant task. Even more relevant assessing the technological development trends of the same technology and its “learning curve” in the near future, as well as its potential market penetration. If an interesting technology is currently too much expensive, a farsighted strategy should bring down its current costs expecting its best economic performance in the near future. We can consider the solar photovoltaics as a clear example: 30 years ago it was by far the most expensive power generation technology, but early on it had been identified as having one of the highest technical potentials^[12]. As a result, specific support projects were initiated focusing on technology advancement and expansion of market volumes, which led to the expansion of production capacities. Costs decreased by an order of magnitude, and solar photovoltaics are now amongst the cheapest options for power generation^[12].

Undoubtedly, bioeconomy is a strong potential candidate to drive the fossil-free transition and, therefore, to boost the development of the bioenergy sector. What should be strongly remarked are the positive effects that bioeconomy could exert on sustainability, if the right conditions are created and appropriate measures are taken. Therefore, sustainability is recognized as a strong and valuable guiding principle in the accomplishment of a new energy system and a new model of social and economic development. Particularly considering the several problems raised in defining the biomass potential availability and the sustainable extraction rates of these biological resources, some additional guiding principles have been set to support the general concept of sustainability, with specific reference to the following^[13]:

- Priority for food;

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- Prevention of land use conflicts;
- Priority for residual and waste biomass;
- Cascading and coupled use of biomass;
- Consideration of ecological and socio-economic impacts.

Among the most relevant sustainability problems to be faced in the frame of defining new energy strategies, primary production of biomass takes a prominent place, thus including the sustainable use of natural resources (such as soil, water, nutrients, genetic resources and biodiversity) as well as sustainable agricultural technologies and agricultural production systems ^[13].

The substitution of fossil fuels and the consequent reduction of GHG emissions are generally significant when considering bioenergy systems. Although the process of harvesting, transportation and energy conversion of biomass might include some fossil inputs, the overall life cycle benefits of the supply chains are largely better than using fossil fuels in most cases ^[9]. If we consider the environmental assessment, there have been various studies on the criteria of net energy and emissions of bioenergy. The final climate benefit depends on various factors – water requirement, fertiliser use, human labour, grid electricity consumption and transportation fuel used etc. Whichever pathway is chosen, it is important to perform life cycle analysis exploring the social, environmental and economic benefits of each pathway ^[9].

Biological resources (also including residues, by-products, side streams, and waste) assure the circularity of material flows and the lowest environmental impacts of every conversion processes. A true circular economy should be established. Potential competitive uses of biomass (food, feed, fuel, fiber, etc.) and land use change issues should be carefully managed and reconciled by implementing stringent sustainability criteria.

The multi-faceted socio-economic benefits of renewable energy have been gaining prominence as a key consideration for decision makers ^[14]. The economy-wide impacts of the energy transition (employment, income generation, welfare improvements, greater social inclusiveness, gender balance and local industrial development) are becoming clearer. In addition to the climate and environmental aspects of deploying renewable energy, maximising the social benefits is essential to ensure a fair, timely and economically efficient transition. A well-planned transition spreads the benefits of renewable energy broadly and enhances its overall acceptance in local communities and across societies ^[14]. Therefore, renewable energy provides climate-safe solutions that also support a wide range of socio-economic benefits. Considering that employment is essential for wage generation and thus for the well-being of individuals and their families, the creation and retention of jobs is of critical importance. The employment generated goes far beyond direct jobs in the renewable energy sector and indirect jobs in the supply chain should be taken into account, also encompassing the so-called induced jobs in the wider economy ^[14]. Moreover, some skill sets in the fossil-fuel industries are transferable and adaptable to the renewable energy sector. As the energy transition accelerates, the growth in renewable energy employment appears to become stronger. New job creation in renewables and energy efficiency would more than offset the job losses in the conventional energy sector.

A number of countries have pursued policies to localise at least portions of the renewable energy value chain and thus to boost the domestic share of employment generation. Local policies typically



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require that a specified portion of a renewable energy project be sourced from domestic suppliers. Localisation of the value chain is, to some extent, a precondition of generating community benefits, thus ensuring that a certain percentage of revenue streams flows to the involved region ^[14].

Differently, national policy goals and industry interests principally drive large-scale renewable energy projects, which do not always accord with the specific needs of local communities. This frequently generate social discontent and unacceptance about the project, considered exogenous and a sort of “foreign” exploiting investment rather than an opportunity of development. To maximise socio-economic development opportunities and transformational change, policies and projects need to draw as much as possible on the local workforce, offer skills training programmes, and promote gender fairness and equality ^[14].

4.2 The European strategic framework for energy

“We can only see a short distance ahead, but we can see plenty there that needs to be done.”
(Alan Turing, Computing machinery and intelligence)

At European scale, key policy areas that will help achieving energy and climate goals include a large and multi-faceted set of targets.

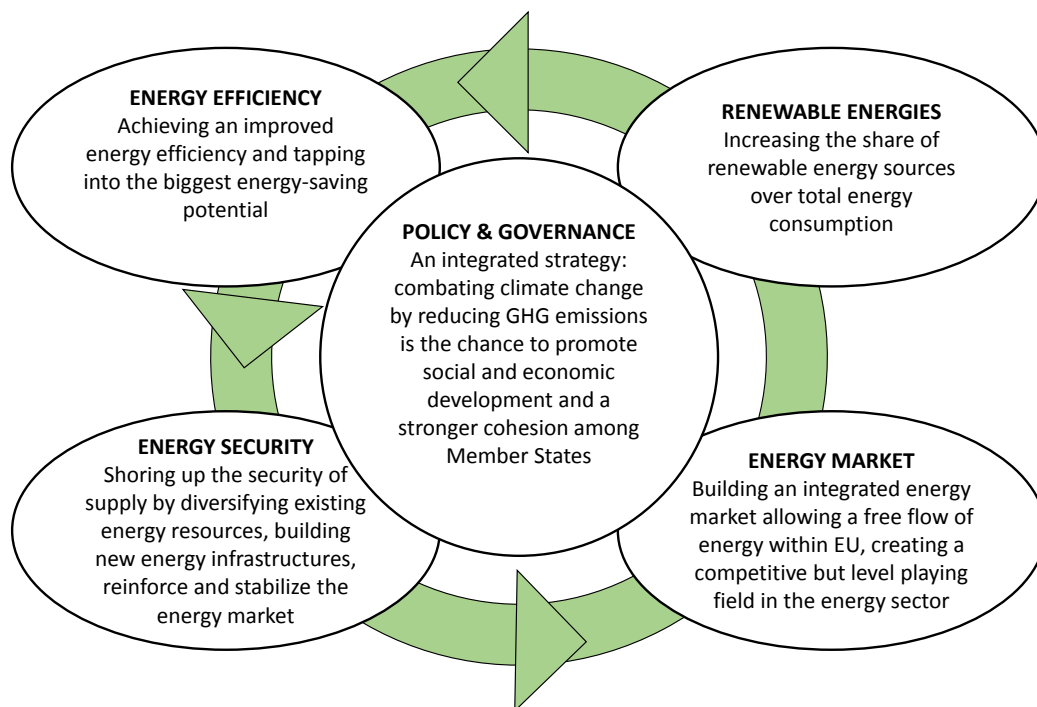


Figure 4.3: European energy policy according to the most relevant strategic aims setting up by the EU Commission over the last two decades.

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The following is a comprehensive list.

- Ensuring *secure, affordable and clean energy* for EU citizens and businesses by allowing a *free flow of energy* across national borders within the EU, through the lowering of greenhouse gas emissions, pollution, and fossil fuel dependence, bringing *new technologies and renewed infrastructure* to cut household bills, create jobs and boost growth.
- A European *energy security strategy* that presents short and long-term measures to shore up the EU's security of energy supply, ensuring the reliable provision of energy whenever and wherever it is needed.
- European energy infrastructures, new pipelines and power lines to develop EU-wide networks for gas and electricity. Common rules designed to increase competition between suppliers and to promote consumer choice.
- A *resilient and integrated energy market* across the EU (the internal energy market), ensuring that energy providers operate in a competitive environment allowing affordable prices for homes, businesses, and industries.
- Boosting the EU's domestic production of energy, including the *development of renewable energy sources*.
- Promoting *energy efficiency* and applying measure to save energy and displace fossil energy sources.
- *Safety across the EU's energy sectors* with strict rules on issues such as the disposal of nuclear waste and the operation of offshore oil and gas platforms.

In *Table 4.2* the main opportunities and threats of the EU energy strategy are reported considering, one by one, the previously identified dimensions to which policy and governance are requested to give urgent answer. To this goal, the same pillars represented in *Figure 4.3* have been taken into consideration.

Table 4.2: Selected external drivers (opportunities) and barriers (threats) mostly influencing the energy strategy defined within the EU policy.

EU POLICY & GOVERNANCE	
OPPORTUNITIES	THREATS
At EU level, an ambitious commitment is in place to reduce greenhouse gas emissions in line with the 2050 roadmaps.	The continued use of fossil fuels in Europe is causing global warming and pollution. Energy related emissions account for almost 80% of the EU's total greenhouse gas emissions.
EU should become a global leader in the deployment of renewable energy. A policy trying to comply with the climate targets would allow Europe to achieve this goal ^[7] .	EU dependence on energy imports is a particularly pressing issue, with the EU currently importing over half its energy.
Europe has a specific responsibility to lead the way into a fossil free society. Without European leadership, no other continent will take the lead to implement COP 21 targets in	The existing EU energy strategy is currently unlikely to achieve all the 2030 targets, and it is wholly inadequate to the longer-term challenges (commitment to the

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time and the race against uncontrolled global warming will be lost globally ^[7]. Building on the momentum behind the development of renewables with a policy based on a more cost-efficient approach that reinforces the European dimension and has further integration of the internal energy market and undistorted competition ^[15]. EU leading the way towards a smarter and cleaner energy for all, to implement the Paris agreement, fuel economic growth, spur investment and technological leadership, create new employment opportunities and enhance citizen's welfare ^[16].	decarbonisation path with a target for the EU and other industrialised countries of 80 to 95% cuts in emissions by 2050). The EU targets defined in the 2030 perspective do not comply any longer with the outcome of COP 21. The share of renewables has to be much higher by 2030 and the reduction of emissions stronger.

ENERGY EFFICIENCY	
OPPORTUNITIES	THREATS
Improved energy efficiency means energy savings: it makes an essential contribution to all of the major objectives of EU climate and energy policies; it improves competitiveness, security of supply, sustainability, and the transition to a low carbon economy ^[15].	In some sectors, such as industry and passenger vehicles, the improvements observed in recent years will have to continue, while in sectors such as housing, other transport modes, and electrical equipment there will be a need for a significant acceleration of current efforts to tap the significant unexploited potential ^[15]. Almost half of the EU's buildings have individual boilers installed before 1992, with efficiency of 60% or less. 22% of individual gas boilers, 34% of direct electric heaters, 47% of oil boilers and 58% of coal boilers are older than their technical lifetime ^[17].

ENERGY SECURITY	
OPPORTUNITIES	THREATS
Improving energy security, while delivering a low-carbon and competitive energy system, through common action, integrated markets, import diversification, sustainable development of indigenous energy sources,	Structural changes in energy supply are forcing European economies to choose among energy products and infrastructures ^[18]. Old and conventional infrastructures could be no more fitted to a changed and improved



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investment in the necessary infrastructure, end-use energy savings and supporting research and innovation ^[15]. Diversify existing energy resources, replace equipment and cater for challenging and changing energy requirements ^[18].	energy systems fed by different energy sources.

ENERGY MARKET	
OPPORTUNITIES	THREATS
The EU is the level at which energy policy should be deployed and a common energy market should develop. Energy is the market sector where the greatest economic efficiencies can be made on a pan-European scale. The EU must consolidate its competitiveness in the energy technology markets ^[18]. Rebalance energy actions in favour of a demand-driven policy, empowering consumers and decoupling economic growth from energy use ^[18]. Create market conditions that stimulate investments on renewables, on higher energy savings and on low carbon technologies, to exploit a wide range of centralised and distributed renewable energy as well as key technologies ^[18]. A competitive and integrated internal energy market provides the necessary environment and cost signals for the achievement of energy policy objectives in a cost-efficient manner ^[15]. The EU must remain an attractive market for companies at a time of increasing competition on energy resources worldwide. The new European energy strategy must support an integrated industrial approach ^[15]. By putting a price on CO2 emissions, the EU Emissions Trading Scheme has provided an	Without a well-functioning European energy market, the costs for consumers will increase and Europe's competitiveness is at risk. Different national support schemes need to be rationalised to become more coherent with the internal market, more cost-effective and provide greater legal certainty for investors ^[15]. Increasing amounts of electricity generated from wind and solar have also exerted downward pressure on wholesale prices, particularly in regions with high shares of these renewable energy sources, while also contributing to higher prices in the retail market as the costs of support schemes are passed on to consumers ^[15]. Subsidies for mature energy technologies, including those for renewable energy, should be phased out entirely in the 2020-2030 timeframe. Subsidies for new and immature technologies with significant potential to contribute cost-effectively to renewable energy volumes would still be allowed ^[15]. Still significant public supports for oil, coal and other carbon-intensive fuels continues to distort the energy market, creates economic inefficiency and inhibits investment in the clean energy transition and innovation ^[16]. EU should removing inefficient fossil fuel subsidies in line with international

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incentive to use low carbon fuels and to invest in energy efficiency. Public procurement rules should insist on efficiency conditions to increase energy savings and spread innovative solutions, notably in buildings and transport ^[18]. The potential of market-based and other policy instruments, including taxation, to enhance energy efficiency should be fully exploited ^[18].	commitments under G7 and G20 and in the Paris Agreement. Fragmented markets not only undermine security of supply, they also limit the benefits which energy market competition can bring. The internal energy market is still fragmented; it did not achieve its potential for transparency, accessibility and choice ^[18]. The security of internal energy supplies is undermined by delays in investments and technological progress ^[18]. In recent years, the energy price gap between the EU and many major economic partners has increased. This risk is particularly high for industries that have a high share of energy costs and which are exposed to international competition ^[15].

RENEWABLE ENERGY	
OPPORTUNITIES	THREATS
Renewable energy must continue to play a fundamental role in the transition towards a more competitive, secure and sustainable energy system. This transition will not be possible without significantly higher shares of renewable energy ^[15]. To the extent that renewables are generated within the EU, they can also reduce the EU's trade deficit in energy commodities, its exposure to supply disruption and to volatile prices of fossil fuels ^[15]. Renewables have the potential to drive growth in innovative technologies, create jobs in emerging sectors and reduce air pollution ^[15]. Growth in renewable energy should be driven by the most innovative technologies that deliver substantial greenhouse gas savings.	The rapid deployment of renewable energy already poses challenges for the electricity system in particular, which needs to adapt to increasingly decentralised and variable production (solar and wind) ^[15]. Most renewables development in the EU is driven by national support schemes, which on the one hand can address national and regional specificities but at the same time can hinder market integration and reduce cost-efficiency ^[15]. Unlike in the current framework, the EU 2030 target would not be translated into national targets via EU legislation, thus leaving greater flexibility for Member States to meet their greenhouse gas reduction targets in the most cost-effective manner in accordance with their specific circumstances, energy mixes and capacities to produce renewable energy ^[15].

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Shortly after the release of the first IPCC summary report, in 1990, the European Council discussed about climate change and, in the same year, preparing the upcoming UNFCCC negotiations, it was agreed to stabilise the GHG emissions in Europe at 1990 levels by 2000 ^[19]. However, specific preventing emission policies and measures were not specified. In this early process of climate policy development three main areas of climate policy were identified, still present today: reducing GHGs, promoting renewable energy sources (RES) and improving energy efficiency (EE).

At the climate summit in Kyoto, in December of 1997, the industrialised countries agreed on a set of quantitative GHG emission targets, with the European Community committing to 8% reductions during the period 2008-2012 (compared to 1990 levels).

The development of an EU energy policy started with the Green Paper “*A European Strategy for Sustainable, Competitive, and Secure Energy*” following the request of the European Council to develop a long-term and coherent energy policy ^[20].

In 2007, as a means of stimulating the UN negotiations on targets for the period after 2012 (post-Kyoto or Kyoto II agreement), EU agreed on a set of targets on GHG emissions, renewable energies and energy efficiency, respectively. The integrated energy and climate change package (2007) includes the energy and climate goals: *Energy policy for Europe* ^[21] and *Limiting global climate change to 2°C the way ahead for 2020 and beyond* ^[22].

The goals are as follows:

- A reduction of greenhouse gas emissions by at least 20% in comparison to 1990 levels;
- A 20 % share of renewable energies in final energy consumption (as well as a 10% target for renewable fuels);
- 20 % of savings on the EU final energy consumption.

To implement the new targets, the European Commission introduced the “*Climate and Energy Package*” in 2008. This package consists of the following main regulatory instruments:

- a reviewed Directive on emissions trading (ETS Directive) with a single EU-wide cap;
- the Effort-Sharing Decision (ESD) introducing national reduction targets for non-ETS sectors of all MS;
- the Renewable Energy Directive (RED) laying down national targets for use in electricity, heating/cooling and transport;
- the Fuel Quality Directive and CO2 emission performance standards for cars;
- a Directive on carbon capture and storage (CCS Directive).

The EU emissions trading system (ETS) is the EU's key tool for cutting greenhouse gas emissions from large-scale facilities in the power and industry sectors, as well as the aviation sector. The ETS covers around 45% of the EU's greenhouse gas emissions. In 2020, the emission target for these sectors is 21% lower than in 2005.

Concerning the sectors not in the ETS (such as housing, agriculture, waste, transport but excluding aviation), accounting for some 55% of total EU emissions, EU countries have taken on binding annual targets for cutting emissions (compared to 2005) under the “Effort-sharing decision”. The targets, this time, differ according to the national wealth of each MS (from a 20% cut for the richest

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countries to a maximum 20% increase for the least wealthy). The Commission monitors the progress every year, with each country required to report its emissions.

The Renewable Energy Directive (RED) ^[23] on the promotion of renewable energy sources translated into legally binding frameworks the energy targets for 2020: the share of renewable energy of 20% in final energy consumption and 10% renewable energy in the transport sector (EU, 2009a). Fuel Quality Directive (FQD) ^[24] set a target of 6% GHG reduction in the fuel used in transport in 2020. The RED and FQD include criteria for sustainable biofuel production and procedure for verifying that these criteria are met. The RED also includes a set of provisions to facilitate the development of renewable energies, such as legal requirement for the MS to prepare the National Renewable Energy Action Plan (NREAPs) with detailed roadmaps to reach the RES targets and measures taken to reach these targets and develop energy infrastructure. Bioenergy is expected to provide almost 60% of the renewable energy in 2020.

In 2010, each EU Member States have submitted to the European Commission (Art. 4 of Directive 2009/28/EC) a National Renewable Energy Action Plan (NREAP). Every two years, each Member State has to submit a progress report on the developments in renewable energy sources compared with the interim targets fixed in the NREAP. The plan covers individual renewable energy targets for electricity, heating and cooling; the planned mix of different renewables technologies; policy measures to achieve national targets; national policies to develop biomass resources; and other features. NREAP is a fundamental document to be analysed under the spotlight of a new document each Member State should prepare ^[25]. The National Plans for Energy and Climate (2020-2030) must be ready, as a draft, by the 1st Jan 2018. During 2018, a review will be prepared, and the 1st Jan 2019 a final version will be reported to the EC. The plans will enter into force on the 1st Jan 2020.

The *Energy 2020 – a strategy for competitive, sustainable, and secure energy* ^[18], defines the energy priorities and sets the actions of an energy strategy until 2020. The Energy 2020 strategy identifies five energy priorities: reduce energy consumption; build internal market and develop infrastructures; extend technological leadership; ensure secure, safe and affordable energy; and reinforce external dimension. The objective of this strategy are part of the “*Europe 2020 strategy for smart, sustainable, and inclusive growth*” and into its flagship initiative “*Resource Efficient Europe*” with the specific goal to support the development of innovative, new, low-carbon technologies, through the *Strategic Technology Plan (SET-Plan)* ^[26]. Considering the critical issue of financing innovation in the energy sector, the Union is ramping up investment in energy and climate related research and development ^[15]. Under Horizon 2020, the Union research and innovation programme, close to € 6 billion are dedicated to energy efficiency and to secure, clean and low carbon technologies, as well as to smart cities and communities. Increased funds will also be available for financial instruments, public private partnerships and SME projects.

The Energy Roadmap 2050 ^[27] investigated possible pathways for a transition towards a decarbonisation of the energy system, while ensuring energy security and competitiveness, and the impacts, challenges, and opportunities for modernizing the energy system. A number of energy scenarios to achieve 80% reduction in GHG emissions and about 85% reduction of energy-related CO₂ emission have been examined. According to the decarbonisation scenario of the Energy



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Roadmap 2050, it needs to achieve significant reductions in GHG emissions already in 2030 (57-65%) and to reach near-complete decarbonisation by 2050 (96-99%). RES are the key in any decarbonisation strategy. The share of renewable energy in transport is expected to increase to 19-20% in 2030 and to 62-73% in 2050. Bioenergy is expected to have an important role within the long-term goal to become a competitive, low-carbon economy.

The Communication on *Policy framework for climate and energy in the period from 2020 to 2030* ^[15] has put forward an integrated policy framework for the period beyond 2020 and up to 2030 to drive progress towards a low-carbon economy. It aims to build a competitive energy system that increases the security of energy supply, reduces energy dependence, and creates new opportunities for growth and jobs. The targets proposed for 2030 include 40% reduction of GHG emissions compared with 1990 levels, and a share of renewable energy of at least 27% in the final energy consumption.

European Parliament Pushes for More Ambitious Renewable Energy Targets

Most recently (January 2018), the European Parliament voted on the Renewable Energy Directive (RED II) and proposed a 35 % binding target for the share of renewable energy at EU level.

The European Parliament voted to strengthen the EU's sustainable energy objectives. The parliament states that sustainable energy must have a 35 % share in the energy mix by 2030. With this the target has been substantially increased; in 2016 it still voted for a share of 27 %.

Energy efficiency in the European Union must also increase by 35 percent, the European Parliament decided. In the transport sector, the share of renewable energy (and fuel) must cover 12 percent of the total by 2030.

Jose Blanco Lopez, the European Parliament's renewable energy rapporteur, says of the raised objectives: "The European Commission was initially too timid in its objectives. If Europe wants to comply with the Paris Climate Agreement and wants to take a leading role in the global energy transition, then we need to do more. These new goals reflect that intention."

To achieve these objectives for the entire European Union, Member States are asked to draw up their own national objectives, which are then monitored. These national plans must be submitted before 1 January 2019. Members of the European Parliament are now discussing with EU ministers to make the new objectives binding.

As part of its Clean Energy Package, the European Commission (EC) presented the amended Renewable Energy Directive (RED II) in November 2016. The Council (government ministers of the member states) formed its stance for RED II last December 2017, while the European Parliament (EP) approved its version on 17 January 2018. In general, the EP approved the amendments proposed by its Committee of Industry, Research, and Energy last November 2017.

The share of renewable energy sources (RES) in the total energy consumption is still an issue under debate and object of difficult discussions among the parties. The Council accepted the EC's proposal for a Union binding target of at least 27%, while the EP would like to see a Union binding target of at least 35% RES share to be accompanied by national targets. The European Union will decide on its 2030 clean energy goals later this year.



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4.3 The strategic role of biomass and bioenergy

As biomass is distributed worldwide, one of the advantages of biomass utilisation for energy is that almost every country can utilise their own biomass resources. On the other hand, the energy density of biomass is lower than that of fossil fuels. Although biomass pre-treatment processes have been developed technically, proper collection and transportation are still required for an efficient biomass utilisation. Seasonal/annual fluctuation in biomass supply, due to its biological nature and environmental diversity from place to place, is another important characteristic. Taken together, these indicate that securing good quality feedstock at affordable prices over a plant's lifetime is crucial for biomass power projects ^[28].

The increasing use of bioenergy leads to better coordination between farmers, landowners and the bioenergy industries, thus promoting a better agro-industrial integration. The increasing revenues lead to local economic development. The use of agricultural residues like straw and pruning, generates extra revenue streams for farmers. Integration of the supply of residues with bioenergy installations can lead to providing reliable electricity to rural communities. This will also reduce the dependence on expensive and polluting fossil fuels. Therefore, development of bioenergy also supports rural development, increase farmer income and mitigate energy poverty ^[9].

The multi-dimensional role of biomass is one of its unique characteristics. It is currently utilised for food, feed, fibre and energy supply, all using the same land for its production. It also supports different types of ecological services, including biodiversity, GHG emission reductions and landscape improvement. Bioenergy utilisation can dynamically change those relationships and produce either positive or negative impacts, both locally or globally ^[28].

Anyway, energy from biomass will be a major energy source still in the future and the solution is to favour the transfer of best practices in effective management of forests and agricultural land. The increasing use of forest and agricultural residues, along with improvements in the biomass supply chain and improved bioenergy equipment, are very important targets ^[9]. On this respect, one of the main challenge related to bioenergy is the management and optimisation of potential benefits and trade-offs, such as GHG savings, biodiversity, employment opportunities and energy/food security. A comprehensive approach which covers all the sustainability issues from their economic, environmental and social perspectives is probably still needed, although many initiatives on sustainability guidelines, criteria and indicators (together with several proposed certification schemes) are ongoing through collaboration among governments, research centres, private sectors and civil society ^[28].

In *Table 4.3* the main opportunities and threats related to biomass and bioenergy strategy in the framework of the EU strategy are reported.

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Table 4.3: Selected external drivers (opportunities) and barriers (threats) mostly influencing the biomass and bioenergy strategy defined within the EU policy.

BIOMASS & BIOENERGY	
OPPORTUNITIES	THREATS
Bioenergy represents a large proportion of our renewable energy mix, and will continue in the future. It brings employment and economic development in rural areas, replaces fossil fuels and contributes to energy security. An improved biomass policy maximises the resource efficient use of biomass in order to deliver robust and verifiable greenhouse gas savings and to allow for fair competition between the various uses of biomass resources. Potential great synergies can be established between the circular economy and various biomass uses, particularly given the fact that wood can be used for a range of products with higher added value than just energy. Biomass addressed to heating and cooling can contribute significantly in achieving the decarbonisation objectives; especially buildings must be decarbonized, but the same is true for industry. Biomass energy sources can make heating and cooling an efficient and sustainable priority for the Energy Union. Some industries generate heat as a by-product. A relevant fraction of this energy could be reused within plants, or sold to heat buildings nearby. District heating offers flexibility to the energy system by integrating renewable electricity,	There is a high risk of failing to achieve long-term climate goals without effectively considering the contribution of bioenergy. A slower-than-expected growth in bioenergy for heat and power generation was observed in last years. Demonstration and commercialization of bioenergy technologies are progressing at a much slower rates than originally foreseen. Although the heating and cooling sector is moving to clean low carbon energy, 75% of the fuel it uses still comes from fossil fuels (nearly half from gas). Sustainable use of land, sustainable management of forests, addressing indirect land use effects are still questioned issues. Concerns may rise if the level of biomass use continues to increase. Ensuring climate benefits in the long term will require in particular limiting additional pressure on forests. Indiscriminately supporting all technological solutions and generative models could be both ineffective and particularly expensive. Only efficient biomass to energy conversions should receive public support. A large amount of energy (heat or cold) is lost by leakage from buildings of low quality. Two thirds of the EU's buildings were built when energy efficiency requirements were non-existent. The potential of heating and cooling to contribute to the overall renewables target is still underused. Similarly, the economic

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geothermal and solar thermal energy, biomass, waste heat and municipal waste. Synergies between waste-to-energy processes and district heating/cooling could provide a secure, renewable, and in some cases, more affordable energy in displacing fossil fuels. Cogeneration of heat and power (CHP) can produce significant energy and CO₂ savings compared with separate generation of heat and power.	potential of cogeneration is not being exploited. Complying with both electricity and heat supply regulations is still complex. Smaller units face grid connection and grid access barriers, such as slow processes for granting permits and high charges. These regulatory and administrative barriers have not been fully addressed by Member States yet. The Commission warns about the negative impact on air quality from the use of coal (lignite) or solid biomass. In some parts of Europe, up to three quarters of outdoor fine particulate matter pollution is attributable to household heating with solid fuels (including coal and biomass).

Apart from various environmental benefits, the use of bioenergy has relevant socio economic benefits as well. The increased use of bioenergy could generate more jobs, provide added income to farmers and strengthen the local economies ^[9]. The socio-economic impacts of bioenergy are as locally specific as the potential applications of the available technologies. This flexibility and local specific adaptability are relevant features of the bioenergy value chains.

Bioenergy is a local technology with one or more intermediate processing stages prior to the energy final use. This can encourage the development of complementary industries beyond the farming and bioenergy plant operations. Bioenergy development could require large-scale semi-automated farming and the plants are not particularly labour intensive, therefore the sector requires skilled workers but not large numbers of workers ^[9]. Other kinds of bioenergy business models could be different, or exactly the opposite, and promote smaller energy plants and a largely distributed labour. In this latter case, the jobs can be seen as “local”, thus strengthening the regional economies, creating additional income and jobs in farming and forestry. After all, the jobs can be both “large scale” and “small scale”, but like all jobs in farming and forestry they will be spread over large areas ^[9].

Solid biomass currently used for heat and power in the EU is mainly local or regional, and based on side-streams from the forest industry. Heating and cooling are produced locally in markets that are fragmented. Some trade of biomass products does occur at regional level, but there is also increasing evidence of international trade of biomass. Bioenergy, in the past, was largely considered as a local commodity with local use of resources and consumption mainly occurring domestically. Even though large share of biomass is still traditional in a sense, bioenergy trade is becoming important. The trade of pellets and biofuels is enabling the transfer from regions with high biomass

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potential (USA, Canada, Russia) to regions with high renewable energy targets like the EU. The pellet trade, for example, will continue to grow rapidly in the near future ^[9].

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5 POLICY MEASURES AND INSTRUMENTS TO PROMOTE BIOENERGY

An appropriate policy and regulatory environment is needed to support the expansion of bioenergy, even for technology that are considered mature ^[1].

This section reports policy measures and instruments specifically considering a set of concerted and coherent interventions on the biomass / bioenergy sector in order to expand its “*carrying capacity*”. Borrowing the concept from biology, the carrying capacity is the maximum population size of a species that the environment can sustain, given the environmental resources; in other words, it is the environment's maximal load. Out of metaphor, considering the bioenergy sector in its socio-economic milieu, to enlarge the “*carrying capacity*” means to give the sector more developing chances (*opportunities*), and take under control all possible constraints (*threats*). This means seizing the opportunities to grow while minimizing or overcoming threats. Considering that both opportunities and threats are external factors (see *Section 2*), a top-down procedure should be applied, according to a typical directive policy strategy, trying to interpret at the best the real needs of the sector.

To enhance the role of biomass in the energy sector an effective policy mix is needed rather than a single stand-alone policy or individual policy measures. To accelerate bioenergy penetration within the energy sector, appropriate policies, international and national targets, market design and regulatory frameworks need to be put in place. These can level the playing field for bioenergy, for example by removing measures that favour fossil fuels, or recognising the benefits from the reduction in GHG emissions, and removing unnecessary regulatory barriers. Policy frameworks can also provide a low-risk investment climate, ensuring market access and predictable revenue streams that can facilitate lower-cost finance ^[1]. Policy measures, economic and financial interventions, the legal framework to be applied, and the market regulations to be promoted are complex decisions and should be properly defined according to a general framework that considers all possible reciprocal influences (*Figure 4.4*). A list of possible measures and instruments to promote bioenergy retrieved through an in-depth literature survey is reported in *Table 5.1*.

Table 5.1: List of the selected policy measures that should be implemented.

1	Setting ambitious bioenergy targets
2	National bioenergy strategies and roadmaps
3	Fostering biomass mobilization and securing its supply
4	Biomass sustainable supply and use
5	Supporting industrial leadership and technological development
6	Research and development in the biomass / bioenergy sector
7	Favouring profitable and stable investments in the bioenergy sector
8	Simplifying and harmonizing administrative procedures
9	Promoting an intelligent and flexible financial support
10	Phasing out from fossil subsidies and carbon pricing through taxation
11	Targeting effective technologies, value chains and business models
12	Quality standardisation of solid biofuels
13	Eco-design and retrofitting technologies

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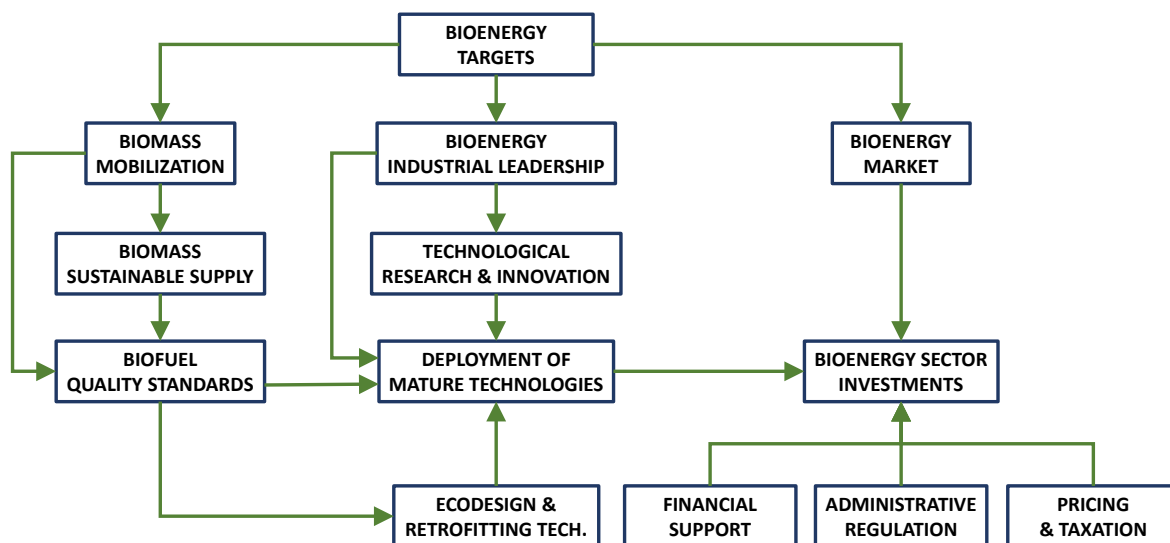


Figure 4.4: Cascading effects of policy strategies applied to the biomass / bioenergy sector.

5.1 Setting ambitious bioenergy targets

EU and UN targets on GHG reduction, energy efficiency and energy from renewable sources should be strictly observed and, if possible, the highest effort should be made to further reinforce those targets. Having regard to the numerous factors that may affect the global energy scenario, the strategy to be applied should be highly ambitious, surely effective, while unpredictable perturbations should be timely buffered.

If ambitious renewable energy targets are fixed in a short term, biomass and bioenergy will surely have to play a decisive role. By 2020, technically reliable, environmentally friendly and economically attractive renewable solutions should be available for almost each type of final consumers as alternative to fossil-based systems ^[2]. By 2050, the energy needs will have radically shifted towards increased electricity and reduced heat demand, due to higher energy efficiency, better insulation and lower energy consumption in residential buildings and tertiary sector. Notwithstanding this trend, bioenergy will still play a key role in all energy markets. In this respect, bioenergy should be intelligently coupled with other RES technologies (such as solar thermal or geothermal) to generate further advantages ^[2].

Considering the residential heating & cooling sector, by 2030 bioenergy technology should fully replace heating oil in the existing building stock, while in 2050, apart the full replacement of fossil energy for space heating, no biomass combustion installation should be without cogeneration (thus obtaining a significant share of electricity and cooling) ^[2].

Considering the industrial sector, together with District H&C, by 2020 the target should be to increase significantly the bioenergy contribution in large-scale systems by developing multi-fuel units with high efficiency rates. By 2030, biomass residues and wastes should be used routinely as fuel with no serious technical problems in industrial units characterized by enhanced efficiency and

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increased operability ^[2]. The 2050 scenario should be the prevalent and almost complete use of biomass in place of fossil fuels in industrial process heat at highest temperatures (which cannot be supplied by other renewable sources). Sustainable and economically competitive biomass potential will be valorised, implying any type of biomass, in both industrial thermal applications and district H&C. In other words, biomass will certainly play a key role in decarbonizing high temperature process heat ^[2].

5.2 National bioenergy strategies and roadmaps

National and regional bioenergy strategies should be considered essential instruments to put into force thoroughly, according to precise targets and a roadmap, well-fitted instruments, defining the main milestones in the decarbonisation path. Accurate but simple indicators should be applied in monitoring the progress of the strategy, while the set of instruments to be implemented should be clearly defined and periodically updated ^[2].

Such a bioenergy strategy can mobilize the necessary stakeholders to identify specific opportunities based on the available resources, together with constraints and barriers, or issues to be agreed on, such as sustainability of biomass supply, research needs in the energy sector, enabling technologies to be considered, and so on. The preparation of the strategy could be a very complex undertaking, requiring close coordination between a number of different government and regulatory bodies and engaging a wide range of stakeholders. In this regard, the “uP_running” project provided a full set of experiences (“focus group”, “forum”, “policy workshop”, “expert consultation”, etc.) and documents (D2.1, D2.2 and the forthcoming D2.3) specifically centred on this issue.

5.3 Fostering biomass mobilization and securing its supply

The need for increased quantities of sustainable biomass production for energy (also considering materials and chemicals) requires an integrated approach to biomass production in forestry, agriculture, waste and residue streams ^[3]. If bioenergy should play a key role in the decarbonisation of the energy system, this will require an impressive increase in the supply of biomass feedstock as compared to today. This is challenging but still within the range of global estimates of long term potential ^[1].

The increased need for bioenergy requires a proactive policy to develop the European potential of biomass for energy. Such a policy should include, for instance, incentives to a better use of waste, crop residues and by products from agriculture and forestry ^[4]. In particular, the feedstock range of bioenergy supply chains can be broadened significantly through the mobilisation of alternative biomass feedstock resources, such as forest and agricultural residues and also wastes. There is substantial potential to utilise currently unexploited local biomass sources; for example agricultural residues can be used ^[5], while wastes and residues together can provide around two-thirds of the required biomass feedstock ^[1].

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With biomass supply set to increase significantly by 2020, a sustainable, innovative and cost-efficient advanced biomass feedstock supply will bring reductions in supply costs and a decrease in production costs ^[5].

5.4 Biomass sustainable supply and use

Sustaining an increased flux of biomass supply could lead to a worsening in the environmental burdens and to a higher competition between the use of biomass resources for food, feed, materials, chemicals, and energy. Effective policies and clear regulations should come into force in order to assure the sustainable supply and use of biomass.

Unless bioenergy is not able to assure actual GHG emission savings, compatible environmental impacts and positive social outcomes, there is no reason to gain and to maintain political support for the measures promoting bioenergy growth at sufficient scale ^[1]. Clear and consistent ecological, social and economic advantages should results from the use of biomass addressed to bioenergy production and use. Only with a strong and convincing scientific and technical background, and by properly identifying options and conditions of sustainable biomass energy use, is possible to call for supporting policy measures and financial instruments to promote bioenergy.

In this respect, a long and exhausting struggle for the recognition of the bioenergy beneficial effects (on a national, European and international scale) is still going on, combating conflicting visions, convictions and interests.

Strengthening of current efforts to deliver a clear legislative framework regarding sustainability requirements for biomass use will need a tangible progress towards regulatory consensus as we approach 2020 ^[5]. The ongoing debate about the reform of the Renewable Energy Directive (the so called RED II) is a clear example of the difficulties to reach an overall agreement on very complex issues all related to the need to seriously taking into account the environmental risks that may result from an indiscriminate biomass exploitation.

Detailed considerations on the most relevant sustainability issues have been carried out at several representative levels, both at UN and EU scale, and through the activities of technical and expert committees, as well as governmental and non-governmental initiatives. Several proposals together with sets of sustainability criteria and indicators were produced to define a general agreed framework and search for a wider consensus. Currently is quite clear what are the main issues entailed in the broad and frequently fuzzy term of “sustainability”, too often adopted without a precise awareness about its specific meaning.

ISO 13065: 2015 (Sustainability criteria for bioenergy) gives a practical framework for considering the three “pillars” of sustainability, the environmental, social and economic aspects to facilitate the evaluation and the compatibility of bioenergy production and products, supply chains and applications (ISO, 2015).

These indicators highlight potential negative impacts from bioenergy, but can also emphasise significant potential positive outcomes associated to bioenergy when undertaken according to best practices and accurate deployment criteria. In summary, there are risks, of course, but also a lot of opportunities in biomass use. We do not be afraid in increasing biomass mobilization for energy



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use, for several reason. First because several biomass types or categories are still not used or considerably under-used and their availability is large. Second, because there are technical and ecological criteria to be applied assuring that biomass exploitation to supply value chains and business models can be performed appropriately, without damaging the environment and accordingly to its carrying capacity. Third, properly defined regulations should represents a safeguard in order to discriminate bioenergy done wright from bioenergy done wrong, clearly and severely prohibiting an incorrect biomass appropriation. International agreement, as well as EU legislations, is therefore of primary interest.

All the understanding acquired on concepts related to biomass-to-energy systems and connected with sustainability should be embodied in policies, regulations, certification systems and good practices, further complemented by an adequate enforcement system that ensure best practice is delivered in reality ^[1].

A number of comprehensive regulatory packages have been put in place to take into account issues relating to life-cycle GHG assessment, direct and indirect land use change, ecological resource use (such as soil organic matter, water, biodiversity) , etc. i.e. the broad range of potential sustainability concerns. Usually, these regulations are linked to policies that mandate or financially incentivise bioenergy projects or uses on condition that sustainability those criteria are met.

It could be worth to mention that also industry-led certification schemes are available today. They are aimed at assuring the sustainable supply and use of biomass at a project level, while demonstrating compliance with sustainability best practices and with the appropriate legislation. Of course, the companies that decide to implement the certification scheme into the management of their biomass value chain apply these certification schemes on voluntary base ^[1].

However, these schemes needs to be reinforced by provisions at national and regional level, thus ensuring that the project- and the product-level schemes meet minimum standards ^[1].

In order to avoid competitions in biomass uses, the fractional and cascading use of biomass should be preferred as the first option. In most cases, the energy use of just a fraction of biomass feedstock is a complementary opportunity in the use of other products; this latter is the principal product, while the former being a by-product. Examples include the use of crop residues and pruning as solid fuel for heating or/and power generation. Bioenergy from residues, indeed, can improve the economics and the carbon benefits of the agriculture primary products, helping to maintain existing industries and strengthening the overall economic feasibility of new projects ^[1]. This is why bioenergy strategies should be strictly linked with policies of rural development.

5.5 Supporting industrial leadership and technological development

EU is a global leader in biomass technologies and provides a wide range of high quality biomass harvesting technologies, conversion installations with high efficiency, controlled and clean combustion, and automated operation for domestic, commercial and industrial uses. To date, technically reliable, sustainable and economically attractive bioenergy solutions and business models already exist. Solid biomass can provide heat at temperatures above 250°C, at a competitive

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cost compared to fossil fuel alternatives. In the coming years, these solutions will continue to improve, but also new solutions should be available.

Anyway, the growth of bioenergy will need to rely on a mix of technologies. Therefore, meeting the long-term potential of bioenergy will also depend on a number of novel technologies that are not yet fully mature and commercialised (such as small-scale biomass gasification and pyrolysis). To reach the commercialisation of these technologies will require specific policies to support their initial development and subsequent deployment. These include obligations or mandate for deployment of sustainable novel fuels, appropriate and dedicated financial mechanisms, and instruments to facilitate technological development and subsequent market deployment, such as loan guarantees.

5.6 Research and development in the biomass / bioenergy sector

Enhanced support for research, development and demonstration (RD&D) aimed at expanding technology options and reducing costs. Through a permanent commitment in innovation the European biomass industry keeps improving the quality of the products introduced in the market. To give an example, the most performant EU biomass small-scale boilers and stoves can today reach 90% energy efficiency with very low emission levels (NO_x, SO_x and particulate matters). Europe is also a world-leading manufacturer in large-scale combustion technologies, e.g. fluidised bed combustion technology and large scale CHP plants ^[5].

In order to maintain this industrial leadership and sustain a continuous technological update, funding in research and development should be addressed to private and public projects; moreover, programmes of innovation transfer into business should be promoted through dedicated initiatives. Both long-term and short-term research and innovation should be properly tuned in order to smooth an unremitting path to technological deployment. Special funding instruments dedicated to industrial research in partnership with public entities are essential instruments to sustain a competitive business environment.

5.7 Favouring profitable and stable investments in the bioenergy sector

The best way to mobilise private finance is to ensure an attractive investment profitability and create a long-term stable regulatory conditions in order to boost investor confidence ^[5]. A long-term and stable regulatory framework provides certainty about the market conditions; this should be assured for a properly extended period (15-20 years), sufficient to justify investments in a series of business projects ^[1]. A predictable policy framework largely encourages investments. Indeed, without a consistent, clear, easy to be applied regulation, the level of entrepreneurial risk is increased, return of investment is threatened or delayed, competitiveness with alternative investments drastically reduced.

There is nothing more conditioning than waiting a long time before a new legislative framework or a new regulatory body is approved, meanwhile being afraid of the possibility of a resizing in the public support to the sector. Even if the feared threats are not confirmed subsequently, an “investor

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escape” from the sector is observed only having suggested these possibilities. At this point, the chance that entrepreneurs may reconsider their investment options are further reduced.

Risks in the biomass/bioenergy sector are generally perceived to be higher than in other sectors. There is a need to address lack of knowledge by improving data flows and the understanding of sustainable energy investments by banks, financial institutions, investors etc. Favouring the establishing of networks between finance, industry and technology providers could be a recommended measure, as well as fostering training for banking and insurance company agents related to biomass technologies to support the development of appropriate financing products. It would also be beneficial to develop a pipeline of flagship projects and models of innovative financing solutions to gain investor confidence and enable standardisation and aggregation ^[5].

Of course, bioenergy producers should have access to the relevant markets, e.g. they should be able to legally produce and sell electricity and to have access to the grid under reasonable conditions ^[1]. In other words, market liberalization must be effective and any kind of possible “shaded” monopoly should not hamper the free form of dispatching and selling the produced energy.

Considering the need to reduce the investment risk and attract new bioenergy projects, appropriate and sufficiently compensating mechanisms to reward low-carbon energy production should be in force (such as long-term PPAs or off-take agreements), thus providing adequate revenue visibility to attract finance at competitive terms ^[1]. Stringent but stable sustainability governance rules should be defined, pivoted on proven and globally accepted good bioenergy practices and policy instruments. Moreover, transparent and appropriate environmental safeguards (such as emission standards) are needed, together with appropriate regulations and standards on biomass / biofuel / bioenergy quality and characteristics ^[1]. Last, but not least, the benefits of bioenergy should be recognized in terms of social, economic and environmental positive outcomes. All these issues will be discussed below in more details.

5.8 Simplifying and harmonizing administrative procedures

The administrative procedures, with particular reference to the permitting operations to setting up a biomass-to- energy plant, should be easier and simpler and, therefore, much faster in the time needed to their accomplishment. Unfortunately, permission requirements can be different from region to region (in the same country), and from country to country (within EU). A proper understanding about the reasons behind these differences is urgently needed, together with a comprehensive EU harmonization of the several regulations at national and regional level. Administrative burdens and time-consuming procedures can be very costly in terms of initial capital investment and discouraging the entrepreneur’s determination to operate. Differently, transparency, clearness, rationality, and timeliness should be fully ensured to attract investments.

5.9 Promoting an intelligent and flexible financial support

Usually, in the bioenergy sector, the unavailability of funds is not the main obstacle in hampering the sector investment; a major role is played mainly by the attractiveness and competitiveness of



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the investment itself in comparison to fossil-based systems. For this reason, it is necessary to launch policy instruments strengthening the market deployment and promoting an effective and fast technological “learning curve”. Parallel measures could be both strengthen R&I investments and increase the budget for R&I projects ^[5]. As reported already in a previous section, as far as technology is less competitive, technology development should be sustained, until a technological parity with other renewables is achieved.

A support strategy mainly consisting of well-fitted financial incentive schemes is able to have the highest impact on the market growth ^[5]. This is a very sensitive matter because financial subsidies and economic incentives should be adequate in sustaining the sector, particularly considering its weakest traits, but not disproportionate, thus producing a distorting effect and a sort of “dumping” with respect to other competitive sectors. Predictably, the support should be planned on a precise temporary horizon, not too long to avoid a market-anesthetizing outcome, but long enough to launch or reinforce the sector.

Another consideration pertains the difference between cross-cutting measures able to “level the playing field” and more specific measures tailored with respect to specific technologies or business models. Subsidies for energy production alone, without recognizing GHG savings and other benefits that can be associated with the production of renewable energy, could deliver sensible market distortions and in some cases lead to an increase in the GHG emissions ^[1]. Of course, the development of alternative fuels and renewable technologies greatly influence the market prospects for bioenergy. Therefore, cost reductions and performance improvements in one technology, as well as a reduction in the current fossil fuel price, generate an increased competition in bioenergy use. This obvious consideration, however, is largely emphasised when technology-neutral support measures are applied, thus generating a much wider distance between competing technologies and the parity conditions further diverging.

When considering investments in the biomass / bioenergy sector, some particular barriers should be taken into considerations. Bioenergy systems are generally more capital intensive than fossil fuel systems. These technologies still require high upfront investment costs when compared to other conventional technologies (in both the renewable and fossil energy sector). Therefore, the cost of the energy delivered is very sensitive to the cost of capital. The decision of whether to go for a new investment is closely linked to the cost of available capital and this is particularly challenging for private homeowners and small business owners. Most subsidy programmes are dedicated towards SMEs and municipalities, so outside these groups, major investors also need additional investment sources and subsidies to overcome the high upfront costs ^[5].

Policy measures of financial support should drive the rapid deployment of the lower-cost bioenergy solutions, promote the technological innovation in the sector and, meanwhile, ensure that the wider environmental, economic and social benefit of bioenergy deployment are fully considered ^[1].

There are several instruments available to support the sector deployment and its market. Their use varies largely from country to country and from technology to technology. However, it is always vital to focus on the quality of design and implementation, the correct setting, and the fine-tuning of the scheme, adapting it to the specific situation ^[5]. The key quality aspects of a financial instrument are its continuity (avoiding a ‘stop and go’ application), the coherence of the



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parameters, a clear target, quality criteria, a monitoring and evaluation system, simplicity of application and payment procedures, and flanking measures ^[5].

The primary objective of financial incentive schemes is to compensate for market failures and unfair competition. They are also intended to favour the deployment of a given technology by creating a secure investment environment catalysing an initial round of funding and thereby allowing the technology to progress along its learning curve. Hence, support schemes should be temporary and can be phased out as a technology reaches full competitiveness. At this final stage, when a complete and open market is assured, a level playing field is fully established ^[5].

Considering the policy options from the financial side, a variety of measures can play a key role in facilitating the deployment of well-selected bioenergy solutions. Many of the currently available financial support instruments for renewable technologies come in the form of investment aid (grants, loans and tax exemptions) and operational aid. Generally, these types of incentives are funded from government budgets ^[5].

Capital grants. A grant is a direct support to project investment provided by a public authority and can be offered either to the investor/developer or to the manufacturer, thus reducing their investment costs. This is a very common type of support provided in a number of European countries by local, regional and national governments. As the budget is usually bound, the number of accepted applications is limited, which restricts further market growth ^[5].

Operational aid. *Feed-in tariffs:* a fixed financial payment per unit of energy from renewable source, or *feed-in premiums:* a fixed or variable financial bonus for the green value of the renewable energy produced ^[5].

Fiscal incentives. A fiscal benefit such as a tax reduction has the advantage of not being tied to a limited budget and therefore to a restricted number of accepted applications. However, such a reduction in tax will usually only take effect a year or two following the completion of the project, which for some investors is less attractive than a grant ^[5].

In the past, renewable heating did not received financial support as much as renewable power or biofuel for transport; after all, this is observed still today. This different policy is mainly due, at least partially, to the lack of legislative tools and instruments supporting the market developing of H&C technologies ^[5].

Delivering an accelerated deployment of these financial measures will depend also on the establishment of supportive policy and market frameworks in order that investment for project development can be secured ^[1]. Furthermore, the supporting initiatives and the economic or financial schemes promoting bioenergy should be adequate and well fitted to local conditions, thus capturing interest and attention.

In the electricity sector, supportive policies can include mandatory targets for electricity generated from bioenergy and quotas or obligations on industry to provide a share of electricity from bioenergy ^[1]. Considering heat, supportive instruments generally include mandates insisting that a certain proportion of heat comes from renewable sources. The production of heat alongside electricity is often encouraged within schemes designed to promote biomass power generation by providing additional incentives or by excluding heat-only projects. Sometimes, such mandates are

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complemented by schemes that encourage best practice in installation by insisting that the heating systems and the installers meet quality standard via certification scheme. There are also requirements that the fuels meet sustainability standards ^[1]. Bioenergy market expansion should be undertaken in accordance with robust sustainability governance frameworks that include the benchmarking of performance against recognised environmental, social and economic indicators. These should also include life-cycle assessment of GHG emissions, including land use change, to allow comparison of bioenergy with other policy options ^[1].

5.10 Phasing out from fossil subsidies and Carbon pricing through taxation

The lack of competitiveness of biomass / bioenergy projects is not only due to the (relative) high costs of technologies, but also to the subsidised prices of fossil fuels. Low oil prices hinder the reduction of fossil fuel emissions and thus accelerate climate change.

In the recent past, one of the major risks affecting the development of bioenergy was the drop in oil prices. During June 2014 – December 2015, the oil prices dropped from US\$112 per barrel to US\$38 per barrel, a decrease of more than 65%. Early January 2016, it touched a low of US\$28 ^[6]. Although the production and consumption of bioenergy (pellets, liquid biofuels, wood chips etc.) was not affected much, however bioenergy equipment manufacturers have experienced a lot of trouble. In a recent survey ^[4], equipment producers reported struggling with lower investments, lower profit margins and less financial resources available for bioenergy development.

First, there is a need for policy makers to work towards eliminating fossil fuel subsidies globally and promote the phasing out from all kind of subsidies and supports to fossil fuels.

Carbon taxes, i.e. the implementation of a general tax on fossil CO₂ emissions (in the size of 100 euro/ton), is a further step needed. Carbon pricing is totally justified by considering the environmental externalities caused by fossil fuels. Tariffs from fossil energy sources usually do not include external costs, e.g. carbon emissions, pollution, gas infrastructure, etc. The application of a carbon tax might balance or reverse these conditions ^[4]. Such a step would encourage the growth of bioenergy and other renewables but also incentivise all efforts for better energy efficiency without any administrative burden. Gradually, the carbon tax should replace the ETS. As a carbon tax is introduced other taxes should be reduced to keep the tax burden for the economy and the society stable ^[4]. To be effective carbon pricing needs to cover all energy sector and scales of operation and reflect the real societal cost of carbon emissions ^[1].

Currently, a carbon tax is in place in only a limited number of Member States. In certain cases, such as Finland, Sweden, and Denmark, such a scheme has proven to be very successful for the market uptake of RES and energy efficiency ^[5].

5.11 Targeting effective technologies, value chains and business models

The contribution of bioenergy to the achievement of low-carbon scenarios should be based on pathways providing significant reductions in GHG emissions as compared to fossil fuels ^[29]. For this reason, scaling up bioenergy deployment will largely depend on the greater utilization of technically



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mature solutions. A scale-up of the best-performing bioenergy solutions would help to close the gap between current bioenergy deployment trends and the levels of market penetration required to meet the agreed targets. Moreover, a widespread adoption of these bioenergy solutions would provide an enabling environment for the delivering of those solutions currently at a lower technology readiness level ^[1].

In this respect, a number of mature technologies can be used including, among others, the production of *bioheat* (for households, district heating networks, industrial uses) as well as *biopower* (micro- and small-scale CHP, industrial CHP applications). These options can provide immediate benefits in the form of GHG savings, energy security and diversity, as well as complementary socio-economic benefits ^[1].

It should be specified that many of these technological options rely on an increased use of wastes and residues as feedstocks, thus providing an immediate relief with respect to complex issues, such as waste management or resource efficiency, as well as land use change ^[1].

Special emphasis should be placed on ensuring the commercial availability of reliable, cost-competitive, supply-secure, and environmentally friendly bioenergy solutions for different kind of energy producers and final consumers ^[5]. Specifically considering the APPR kind of feedstock, some bioenergy solutions are suitable for immediate scale up because of their technological maturity, already demonstrated at commercial scale. Besides the technological reason, these bioenergy solutions point out several other benefits. They are economical competitive compared to other types of renewables, a good levels of GHG savings is confirmed, residual biomass can be effectively used, thus avoiding any kind of food-versus-fuel conflict, they proved potential application in several geographies or sector conditions, and finally they have the ability of intercepting other non-energy-related policy objectives.

Below, some particular value chains have been selected; they have large potential to displace significant amount of fossils and push further on the sector development ^[1, 5]. For these reasons, public administration (at EU and national scale) should favour and sustain this kind of bioenergy solutions. Well-tailored promoting measures could be very useful when able to facilitate public or private investments, reduce the risks involved in the investments, make the process of plant settlement easier, for example in terms of fast and smooth administrative procedures, and also applying tax exemptions, at least partially.

Bioenergy-based *district heating* (DH) networks

This kind of bioenergy projects can be usefully deployed in urban areas and they meet heat demand for both household building, public buildings (offices, schools, gyms and swimming pools, etc.), and industry (although with limited temperature requirements). The typical fuel to be used includes residual wood chips from forestry and pellets; however, residues from agriculture can also be properly supplied. Municipal and local governments can contribute considerably to this kind of projects, through a different urban planning and better interpreting heat demands at local scale. Specific interventions are those foreseeing the conversion of pre-existing fossil district heating network to new, more efficient and biomass-based heating systems. The benefits related to these solutions are a lower GHG emission, especially when the heat supplied by fossils is directly replaced



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by biomass, a reduced emission of NO_x and SO_x when coal-fired systems are replaced, a more convenient economy of scale when a unique, larger plant substitutes several smaller heating systems in every household ^[1].

Medium scale CHP biomass plants

The solution consists in heating systems coupled with a flexible power generation in biomass plant of medium capacity supplied by wood chips or pellets in public and commercial buildings. Planning rules and building codes are very relevant instruments in order to favour this kind of applications. New installations are particularly suited in renovation programmes that include the upgrade of outdated heating plants based on fossils. Medium-large biomass systems facilitate lower investments costs through economies of scale. Fuel costs are significantly reduced and much more stable in time due to the switch to a biomass solid fuel as compared to heating oil. This kind of investment showed to be particularly fitted for an ESCO business model ^[1].

Micro- and small-scale CHP biomass plants

Small and micro-scale CHP constitutes a highly energy efficient solution (total sum of thermal and electrical efficiency > 85 %) for flexible electricity and thermal energy supply ^[31]. Micro-scale CHP systems are serial commercial appliances developed for residential scale heating with electricity production (possibly grid independent, typical P < 5 kWe) or as cogeneration systems for small industries, the service sector, or in micro grids (base heat for more than 2,000 hours/year, typical P < 50 kWe). Differently, small-scale CHP systems are specifically designed plants rather than serial commercial appliances for cogeneration in industries, the service sector, or DHC (base heat for more than 5,000 hours/year, typical P < 250 kWe) ^[5].

Large-scale industrial steam CHP biomass plants

Biomass use in industrial CHP plants (with high temperature heat potential up to 600 °C) and DH is expected to increase significantly, through the retrofitting of previously fossil-fuelled as well as new biomass plants. Biomass units should be flexible in terms of operation and biomass availability, in order to cover continuously the needs for heating/cooling and electricity demand ^[31]. Considering the increasingly strictness of air quality requirements (NO_x and SO_x, together with PM), emissions should be effectively controlled and further reduced, and the development of highly efficient and multi-fuel biomass systems is close to the commercial stage. In particular, CHP units should exhibit increased fuel flexibility allowing the use of more complex and low cost biomass fuel (e.g. agro-residues and waste) while increasing steam parameters and/or steam temperature ^[31]. The advantage of the industrial CHP units is the presence of an existing heat market that in many cases is not subject to seasonal demand variations, as is the case with DH networks. In addition, large-scale industrial units have a higher degree of fuel flexibility, which will allow for the mobilisation and effective utilisation of biomass resources that remain mostly unexplored, such as many types of agricultural residues, or waste derived fuels.

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Generally speaking, biomass based technologies can serve almost any residential application either as an individual biomass-only solution, or as part of hybrid packages providing heat (hot water, and ventilation) and air conditioning / cooling to residential buildings ^[5]. Moreover, large-scale biomass heat units for industrial applications are already capable of reaching high thermal efficiencies; therefore, large-scale biomass CHP units for industrial applications should be decisively promoted, since they can produce electricity, besides heat, an important value-added product with a lower subsidy level compared to biomass-fuelled electricity-only plants.

Also relevant to be considered when introducing the newest forms of biomass conversion systems is the high efficient polygeneration option. Bioenergy as a storable energy source presents a real advantage when its integration is planned in the overall renewable energy system. Besides the CHP option (combined heat and power) and CHP-C (combined heat, power and cooling), technologies are able to provide intermittent electricity, balancing both daily and seasonal changes in solar and wind electricity production and loads of boilers, increasing the plant capacity to sustain peak load duration. Depending upon the season, climatic condition, and time of day, the primary function of such biomass-fuelled units may change from electricity, heating and cooling to even bio-oil production (*polygeneration*) ^[5].

5.12 Quality standardisation of solid biofuels

Biomass and bioenergy markets would significantly gain from more harmonisation and cross compliance and from strengthening energy performance certificates, energy codes and legislative enforcement ^[5].

The biomass fuel supply could be widened impressively when compared to its current use through the development of standardised, sustainable *advanced biomass fuels* (such as thermally treated biomass fuels). Sustainable, innovative and cost-effective advanced feedstock production and pre-treatment technologies for different biomass sources need to be developed to meet the quality requirements for thermally treated biomass ^[5].

Fuels obtained from residual and waste biomass have less favourable characteristics than woody biomass fuels, such as higher ash content with lower ash melting temperatures and higher amount of chemical elements that are responsible for harmful emissions. Taking into consideration that the availability of high quality resources for wood fuel production in Europe is limited, one has to acknowledge that lower quality biomass fuels, coming from wood of short rotation forestry or from agricultural or agro-industrial residues, will gain increasing importance. At the same time, it is expected that strictness of air quality requirements will increase throughout Europe in the coming years ^[2].

Moreover, standards to be applied and indicators to be detected should not be too complex, and the certification process not too demanding or costly.

Development of frameworks for standardisation and benchmarking is also important for the financing party: standardisation of measurement and verification for project evaluations will reduce risk perception, increase reliability and certainty. Measurement and verification approaches in the

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different European countries should be assessed in order to harmonise calculation methodologies [31].

5.13 Eco-design and retrofitting technologies

The Ecodesign Directive

The European Union's Ecodesign Directive (Directive 2009/125/EC) establishes a framework to set mandatory ecological requirements for energy-using and energy-related products sold in all 28 Member States. Currently, its scope covers more than 40 product groups (such as boilers, lightbulbs, TVs and fridges) altogether responsible for around 40% of all EU greenhouse gas emissions.

The ultimate aim of the Ecodesign Directive is that manufacturers of energy-using products, at the design stage, will be obliged to reduce the energy consumption and other negative environmental impacts of products. While the Directive's primary aim is to reduce energy use and improve energy efficiency, it is also aimed at enforcing other environmental considerations including: use of materials; water use; polluting emissions; waste issues and recyclability.

The Ecodesign Directive is a framework directive, meaning that it does not directly set minimum ecological requirements. These latter are adopted through specific implementing measures for each group of products in the scope of the Directive. The implementing measures are adopted through the so-called *comitology procedure* [7]. Implementing measures are based on EU internal market rules governing which kind of products may be placed on the market. Manufacturers who begin marketing a product covered by an implementing measure in the EU area have to ensure that it conforms to the energy and environmental standards set out by the measure. In practice, the introduction of a new minimum requirement results in effectively banning all non-compliant products from being sold in the 28 Member States [8].

New and advanced fuels, as well as generally broadened biomass feedstock require appropriate conversion technologies ensuring the efficient and environmentally friendly use of the supplied fuels [31]. Taking into account the increasing strictness of air quality requirements (i.e. IED for large combustion plants and air quality package for medium-sized plants from 1 to 50 MW), and the limited availability of high quality wood resources in Europe, significant R&D efforts are required for the development of highly-efficient and multi-fuel biomass systems [5].

Fuel flexibility and multi-fuel energy units

Biomass CHP units should exhibit increased *fuel flexibility*, allowing the use of more complex and low cost biomass fuels (e.g. agro-biomass, crop residues, and waste recovered fuels) and new energy carriers (like thermally treated biomass fuels). Increasing steam parameters and/or heat temperature, the electrical efficiency component of the total CHP plant, as well as effectively addressing environmental issues (e.g. emission control and ash utilisation) are considered other relevant goals [5].

For small-scale biomass combustion appliances (such as boilers and stoves), many efforts have been undertaken to develop value chains based on highest quality fuels. However, some markets

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(depending on geographies and final energy uses) require the development of (small-scale) fuel flexible boilers. Such boilers should be able to handle ash rich fuel with challenging ash-melting characteristics. These systems should operate with sensors that identify type and quality of feedstock thus automatically adapting the operating parameters of the boiler ^[2].

Larger facilities, those exceeding 0.5 MWth, are expected to exploit more challenging solid biomass fuels instead of wood chips widely used today. In this way, wood chips utilized in such units will be reduced significantly, while less waste will be landfilled. Multi-fuel units, using a variety of solid biomass types and waste derived fuels, need to be developed. The final aim in larger units should be to get higher flexibility to exploit a great variety of biomass types, from industrial by-products to waste derived fuels, with remarkably high conversion rates and operational availability ^[2].

Energy efficiency and emission standards

Boilers and stoves with high emission standards for heating and healthier technical solutions are available, easily accessible, more efficient and cheaper in the long run. Ecodesign and energy labelling requirements for space and water heaters came into application in 2015. The sale of inefficient boilers is now banned.

- Ecodesign requirements for solid fuel boilers (LOT 15)

The ecodesign requirements apply to solid fuel boilers with a nominal heat output of 50 kW or less and commercial local space heaters a nominal heat output of the product or of a single segment of 120 kW or less. This ecodesign requirements entered into force in August 2015 and will be applied from 1 January 2022.

- Ecodesign requirements for solid fuel local space heaters (LOT 20)

Local room (or space) heating products can be defined as appliances that provide heat to indoor spaces by generating heat at the same location as it is needed. The appliances are self-contained heating units, wall-mounted or chimney bound.

Solid fuel space heaters. Solid fuel space heaters are covered by the ecodesign regulation 2015/1185. The regulation applies to solid fuel local space heaters with a nominal heat output of 50 kW or less. This ecodesign requirements entered into force in August 2015 and will be applied from 1 January 2022.

Technological improvement of energy conversion devices and new forms of residues utilization. Retrofitting opportunities.

Large-scale applications will require new technological solutions for reducing the environmental impact of biomass-to-energy schemes, e.g. through the reduction of gaseous pollutants, as well as the identification of new utilisation routes for process residues, such as biomass bottom and fly ashes.

Moreover, there is substantial improvement potential of old and inefficient biomass units that already operate and, if properly retrofitted, can be operated much more efficiently ^[5]. *Retrofitting* describes the measures taken to allow new or updated parts to be fitted to old or outdated assembled power plant, thus improving power plant efficiency, increasing output and reducing emissions.



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In District Heating & Cooling (DHC) systems, for example, the retrofitting of old and inefficient boilers to become more effective at high availability rates, while increasing their fuel flexibility is a key challenge and priority in linking biomass and DHC [5].

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6 PLANNING ACTIONS TO BOOST THE BIOENERGY SECTOR

“A crowd whose discontent has risen no higher than the level of slogans is only a crowd. But a crowd that understands the reasons for its discontent and knows the remedies is a vital community, and it will have to be reckoned with.”

Wendell Berry, The Art of the Commonplace: The Agrarian Essays

When considering specific measures and interventions proposed by stakeholders belonging to the bioenergy sector, a bottom-up approach is displayed, and the direct mobilization of the “actors” operating within the sector is therefore solicited from within.

The interventions reported in this section were suggested after an in-depth dialog with stakeholders, through interviews, bilateral meetings, focus groups that were performed in each partnering countries of the project with the collaboration of the corresponding project teams engaged.

All the actions warmly suggested by stakeholders should be properly planned and fully performed at national level. In this respect, it is worth to say that “uP_running” is currently operating on this field, and the project teams are actually working out several of the suggested measures in every country involved by the project.

The following is a tentative of exploring and summarizing the large and comprehensive set of goals, targets or objectives specifically recommended by stakeholders; in order to achieving these targets, a wide range of actions should be deployed. These actions have been grouped according to their own features and properties.

and , to be achieved and together with the corresponding actions deemed worth to be carried out in order to reach those targets.

The measures, actions, interventions reported below are the consequence of collecting, comparing and clustering the contributions received from stakeholders. Each project team performed the sector analysis at national scale in its own Country. Therefore, the joint outcome obtained putting together the results of the analysis can be considered very interesting, reporting a sort of comprehensive European “Action Plan”. At least, it can represent a first, broad but quite complete picture of the objectives and actions that the bioenergy sector is considering as the most important, urgent, or critical.

To represent (clearly but schematically) the bioenergy sector, it was needed to proceed into a clustering, thus identifying a good number of general, high-order objectives (N=12) exploring the main dimensions of the sector. Similarly, a comprehensive set of action fields (according to their nature and typology) was identified (N=6).

From the combination of “objectives” and “fields of action” a double entry matrix was arranged. *Table 6.1* shows the outcomes of this work. Considering every combination between objectives and actions, the number of asterisks (*) reported in the table is proportional to the number of measures or activities proposed by stakeholders in that specific field. These actions will be deeply discussed later on in the present section and better detailed.



Table 5.1 Summary of the Action Plan as the combination of “objectives” and “fields of action”. The number of asterisks is proportional to the number of measures or activities proposed by stakeholders for that specific target and field of action.

FIELDS OF ACTION → TARGETS or OBJECTIVES ↓	INFORMATION - COMMUNICATION DISSEMINATION	REPORTING & DOCUMENTATION PERFORMING ANALYSES	TRAINING KNOWLEDGE TRANSFER CONSULTANCY SUPPORT	DEMONSTRATION & PILOTING TECHNOLOGICAL TRANSFER	SUPPORTING AND PROMOTING BIOENERGY DEPLOYMENT	POLICY ADVOCACY SUPPORTING PUBLIC ADMINISTRATIONS	TOTAL
AGRO-ENERGY INTEGRATION	*	*	**	=	***	*	**
RURAL DEVELOPEMENT	***	=	=	=	***	*	**
NEW BUSINESS MODELS & ENERGY MARKET	***	***	*	***	**	**	***
RESEARCH & INNOVATION	=	=	=	***	=	=	*
BOTTOM-UP PARTICIPATION & NETWORKING / NEW FORMS OF POLICY / SOCIAL INNOVATION	***	*	=	=	***	**	**
ECONOMIC AFFORDABILITY / PROFITABILITY	**	***	*	=	=	=	*
RELIABLE BIOMASS SUPPLY SOURCES	=	**	**	*	**	=	**
TECHNICAL FEASIBILITY	***	***	***	**	***	*	***
SOCIAL ACCEPTANCE / PUBLIC AWARENESS	***	=	=	=	*	=	*
ENVIRONMENTAL STANDARDS & SUSTAINABILITY	***	***	=	=	***	=	**
MARKET SECURITY / CONTROLLED ECONOMIC RISK / FINANCIAL SUPPORT	***	**	=	*	***	=	**
RULES & REGULATIONS	*	*	=	=	**	***	**
TOTAL	***	**	*	*	***	*	



A set of three asterisks, for example, means that stakeholders assign a very high importance to those kind of actions. The importance is determined by how many times these actions are reported in every national analysis (**> 5 time; * 3-5 times; = 1-2 times; = never quoted).

The most reported targets (see the horizontal rows in *Table 6.1*) were, by large, related to a better understanding of the business model, specifically with respect to its capability in addressing market requests and the economic evaluation of the biomass project, together with the need to check the technical feasibility of the bioenergy value chain.

On the other side (see the vertical columns in *Table 6.1*), the most required types of actions are related to information, communication and dissemination, together with the application of direct supporting tools (mostly economic and financial measures).

6.1 Agro-energy integration

Objective →	Aiming at an efficient and integrated regional agro-energy system according to the bioeconomy model
- Information - Communication	Organization of match-making events between potential value chain actors and equipment providers
- Reporting - Documentation - Performing Analyses	Preparing a report on the potential development of the sector, widely communicated, particularly to policy makers and potential project leaders
- Training - Knowledge Transfer - Consultancy Support	- Training staff of cooperatives so that they can provide guidance on the setting up of APPR value chains from the field to the energy plant - Organization of campaigns to transfer business models to Agricultural Services Companies and agro-industry - Strengthen existing knowledge on the potential of the industry in the bioenergy sector
- Supporting and Promoting Bioenergy Deployment	- Entrepreneurship policy and priorities inclusion in rural development plans to give specific support to service companies to find more attractive APPR biomass harvesting option - Utilize opportunities and existing infrastructure of agro-industries (e.g. storage, dryers, energy conversion systems) in the APPR value chains - Take advantage of new legal framework to establish APPR energy cooperatives with the participation of agrarian cooperatives - Set-up these cooperatives as the missing link between the energy and agricultural sectors - Promotion of the collaboration between agrarian entities with biomass experience and energy supply companies or ESCOs - Establishment of collaboration clusters where farmers, agro-industries and bioenergy companies (ESCOs) can work together - Integrate wine and fruit professionals into regional biomass mobilization strategies
- Policy Advocacy - Supporting Public Administrations	Integrate bioeconomy and bioenergy into agricultural sector development plans

6.2 Rural development

Objective →	Sustainable APPR energy generation as a path to rural development

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- Information - Communication	• Matching APPR utilization with a “greener” branding of agricultural products on the European and global market • Convince farmers that they are a key element in the energy transition and the development of community energy projects • Diffusion and transfer campaigns to let the agrarian sector see an overall view of the biomass value chain: operation, role, profits, with the aim of understanding the needs and situations of ESCOs, biomass suppliers, intermediaries • To create farmers networks for experiences sharing • To encourage the recognition of APPR biomass as one of the rural development driving forces.
	- Supporting and Promoting Bioenergy Deployment • To promote APPR value chains within the Rural Development Plans, since the management of APPR residues can be considered a tool of local job creator • To incorporate into the farm income the tangible and intangible benefits of the APPR biomass energy use, obtaining fiscal benefits, deductions, etc. • Stimulating aggregation among farmers and forming “agro-energy district” within specific regional areas
	- Policy Advocacy - Supporting Public Administrations • New Rural Development Policy with the aim of including agro-residues as a strategic issue in rural development, bio-economy and circular economy • New CAP policy to recognize APPR biomass energy use in the conditionality for greening measures

6.3 New business models and energy market

Objective →	A market oriented APPR energy sector to intercept and satisfy society needs
- Information - Communication	• To highlight the possibilities for farmers to reduce dependency on oil for heating by using their own, local resource • To inform about the actual possibilities of APPR biomass and avoid unrealistic expectations (e.g. production of premium quality wood pellets from pruning) • To sensitize local councils, ESCOs and agro-industries with the aim of increasing APPR biomass facilities for heating (district heating increase) • Awareness and communication local campaigns to inform about specific technologies for APPR biomass energy use, competent installers and the development of a local APPR biomass market • Organize regional meetings and workshops to information on national strategies with local stakeholders of the wine and fruit sectors. Use this information to better understand the challenges of the sector and add APPR biomass to national energy and biomass plans, taking into account the information gathered • Identify innovative local projects and invite their project leaders to national workshops for the development of biomass strategies

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	• Communicate on development opportunities through regional presentations or documented feedback, targeting high-potential areas, integrating all stakeholders (communities, ESCO, farmers, etc.) • Write and distribute a statement on the need to promote appropriate practices
- Reporting - Documentation - Performing Analyses	• Investigate on business models involving agro-industries in agricultural areas with permanent crop plantations • Quantify the direct benefits to farmers from APPR biomass utilization compared to other alternatives • Highlight benefits of choosing APPR as a fuel (e.g. local availability, quantities, no competing uses, lower GHG emissions) • Evaluation of technical and economic indicators on the setting up of new value chains. Marketing research on the development of new value chains • Development of efficient networks across value chains • Presenting technical reports about logistics and the organization of the sector • Produce documents on possible and effective business models and disseminate about • Identify technical deficiency in machinery and processing equipment • Identify existing services on the field that can participate in the optimization of logistics chains and propose a report to the administration and other stakeholders • Make estimates and evaluations on real cases, disseminate results and conclusions • List existing logistical equipment, their characteristics and their advantages and disadvantages and communicate to operational stakeholders
- Training - Knowledge Transfer - Consultancy Support	• Training of technical teams providing support to companies operating in the industry of bioresidue management (projects' development, investors involvement)
- Demonstration - Technological Transfer	• To transfer the knowledge about actual cases with the aim of showing value chain and actors involved for a better understanding and new value chains designing • To show models for APPR biomass energy use, including value chain feasibility and financing mechanisms. • To transfer to the sector the need for transition in the waste management: waste producer can obtain savings but he needs to adapt residues management with more employees (e.g., collecting service) • Development of demonstrational chain on APPR's utilization based on existing consumers and companies which nowadays operate in hauling and storing of other types of biofuels (forestry companies, municipal companies, etc.) • Communicate or organize success case visits. Organize equipment demonstrations • Supporting pilot projects and the development of new energy products from APPR biomass, conversion processes and technologies in the bioenergy sector

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	Promoting flagship projects to be taken as representative models in the region, ready to be replicated
- Supporting and Promoting Bioenergy Deployment	- Support the development of APPR biomass-to-power installations - To support the creation of agricultural residues market to include in the biomass suppliers catalogues - Promoting the constitution of farmer cooperatives in order to significantly increase the “critical mass” of companies operating on the market and the total amount of APPR feedstock supplied to the market
- Policy Advocacy - Supporting Public Administrations	- Create a dedicated action plan, with the professionals of the sector, for the development approach of the APPR biomass sector - Public and transparent lobbying aimed at overcome barriers and obstacles which restrains innovative value chains based APPRs - Involvement of government representatives supporting the biomass energy industry.

6.4 Research and innovation

Objective →	Supporting an innovation trend in bioenergy technology and a shift to more efficient energy use from biomass
- Demonstration - Technological Transfer	- To take advantage of ongoing initiatives (e.g. Biomassud Plus, AGROinLOG) that have activities relevant to the understanding and certification of APPR biomass fuel properties - To initiate RTD projects aiming to develop local solutions for harvesting of APPR biomass with good fuel properties. - To initiate RTD projects aiming to develop appropriate technologies for the proper combustion of APPR biomass (e.g. new boiler models, new flue gas cleaning systems, etc.). - To elaborate a state-of-the-art and main requirements for the APPR biomass energy use and treatment technologies. - To promote the development of the biomass treatment technologies (dry, pyrolysis, torrefaction, etc.) with the target of improving APPR biomass properties. - To promote new adapted and proved boilers for using different types of APPR biomass. - To develop cost-effective dust removal systems. - To elaborate a state-of-the-art and main requirements for the APPR biomass harvesting technologies. - To promote novel technologies for APPR biomass harvesting. - R+D Programs promotion for agro-biomass technology: harvesting and treatment, small and medium size combustion technologies and gas cleaning systems. - Research of APPR’s biomass utilization options for alternative products’ production as bio composites, bio filters, compost, others

6.5 Bottom-up participation, new forms of policy, social innovation

Objective →	Triggering social and policy innovation in the APPR sector

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- Information - Communication	• Sensitize energy sector to farmers' needs and priorities with the aim of increasing their awareness of agrarian sector and finding synergies. • New specific agro-biomass networks to share the opinion and knowledge of the farmers, cooperatives, ESCOs, forestry companies, etc. • Campaign for providing visibility to companies with interest and capacity for joint ventures to start APPR biomass value chains. • Exchange of innovative projects, new business ideas and researches' results via practical implementation. Research for potential partners, best practices, and funding opportunities • Tuning up and consolidation engaged people network, its development devoted to a line of "operative group" intended to work among the group at regional level • Formation of operative groups with key value chain actors together with experienced consultants' involvement of governmental capital, discounted credits and other financial sources. • Propose brainstorming workshops with local stakeholders to develop new projects, by connecting all stakeholders involved in value chains • Membership campaign, targeting different sectors and stakeholders • Participate in the networking of the local stakeholders (e.g. by local workshop)
- Supporting and Promoting Bioenergy Deployment	• Organization of matchmaking events between potential value chain actors and equipment providers • Matchmaking activities between farmers, agro-industry and Agricultural Services Companies in order to promote new APPR biomass initiatives. • To engage potential large-scale consumers of biomass / APPR biomass so as to create a demand for the product • To make potential end-users in the public sector (e.g. public buildings) early adopters of APPR biomass so that a new market can be created. • Activating a good level of association among the key actors participating in the regional APPR sector in order to reinforce progressively collaborations and partnerships • Triggering collaborative links within the regional "stakeholders' network" connecting single entrepreneurs among them and with the regional government institutions • Promoting a large participation of farmers and farmer organizations, together with other stakeholder associations, in the establishment of operational groups (OPs) within the EIP (European Innovation Partnerships), specifically tailoring projects and investments in the APPR energy use and the valorization of solid energy carriers from APPR feedstock
- Policy Advocacy - Supporting Public Administrations	• To identify the threats and the bad practices that can limit APPR biomass local use: speculation, informal economy, open-air firing permissiveness, following up conditionality measures application, etc. • Encourage the Public Administration to support the development of initiative

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6.6 Economic affordability and profitability

Objective →	Consolidating the economic affordability of biomass use and the economic return along the value chain
- Information - Communication	Inform investors about the benefits (potential, security of supply, environmental, economic, regulatory compliance, etc.) of using APPR biomass as a fuel source in a biomass power plant. Dissemination campaigns to show the waste value, potential saving, models and financing (brochures, radio, press, and workshop)
- Reporting - Documentation - Performing Analyses	- Present economic data supporting the fact that APPR biomass is suitable for specific market niches - To prepare documentation with the potential saving and cost analysis of APPR biomass energy use, including figures and technical data - Value chain cost evaluation in order to identify the needs and promotion potentials for each agro-biomass - Propose documents on the various applicable business models, communicate, present the different financing opportunities - Comparing the economic and financial aspects of the different business models in the APPR energy sector, in order to outline the pros and cons and provide an overall judgment of profitability - Selecting the optimal “business model” adjusting the economic exercise to the specific conditions of the companies participating in the bioenergy project as well as to the market and economic conditions (best tailoring)
- Training - Knowledge Transfer - Consultancy Support	Offering financial counselling, advising or economic and financial guidelines in order to inform potential entrepreneurs about the economic feasibility of energy projects based on APPR biomass

6.7 Reliable biomass supply sources

Objective →	Boosting APPR biomass sources and setting up conditions to strengthen the APPR supply chain
- Reporting - Documentation - Performing Analyses	- Investigate supply chain models that make use of the presence of agro-industries in agricultural areas with permanent crop plantations - Perform measurements of the yields of APPR production per hectare according to the different regions. Draw potential maps
- Training - Knowledge Transfer - Consultancy Support	- Commitment of the regional farmers associations in disseminating the concept of pruning energy use, the know-how about the technical pruning management to supply the energy market, the usefulness of the biomass-to-energy conversion to satisfy the energy community needs - Carrying out analysis on regional and local APPR availability and, consequently, proceed to the realization of technical maps of APPR availability as a preliminary step to properly plan the APPR energy use and identify agro-energy districts within the region particularly suited to the setting up of supply chains and the installation of energy plants
- Demonstration - Technological Transfer	Reinforce final support for pilot logistics chains in the territories



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- Supporting and Promoting Bioenergy Deployment	- To promote the use of quality standards and tracking systems in order to assure the APPR biomass quality - Sustaining farmers in the development of new APPR projects in terms of both increasing the amount of available APPR biomass to be addressed to the energy market and promoting the direct and internal energy exploitation of this feedstock

6.8 Technical feasibility

Objective →	Proving the feasibility of the APPR value chains and its value in micro-generation projects
- Information - Communication	- Inform farmers about the low potential of APPR biomass in agricultural fertilization - Utilize the agrarian cooperatives expertise and human resources (e.g. local agronomists) to inform farmers about suitable practices in APPR value chains - To inform about the actual possibilities of APPR biomass and avoid unrealistic expectations (e.g. production of premium quality wood pellets from pruning) - To prepare workshops for guidelines, messages and good practices dissemination. - Dissemination campaigns to show that APPR biomass energy use is feasible. - Dissemination of the APPR biomass energy use for heating: it is an old practice but now it is technologically improved - Communicate on the possibility of developing logistic chains for the APPR biomass uses and the associated subsidies, in particular for the installations of boilers - Organize a promotion campaign on poly-fuel stoves and heating appliances
- Reporting - Documentation - Performing Analyses	- Present technical data supporting the fact that APPR biomass is suitable for specific market niches - Prepare simple but truthful facts relevant to the benefits of APPR utilization (e.g. cost / timesaving, emission savings, etc.) - Highlight the limitations of the alternative disposal methods of APPR (e.g. mulching). Preparation and transfer of good practices including knowledge about the APPR use as soil amendment: to know when is positive and to know the potential risks - Preparation and transfer of guidelines about the low value of APPR as crop fertilizer - Dissemination of handbooks, dossiers and guidelines by agrarian associations, agro-industries and cooperatives - Development of training handbook on APPR management by farmers - Propose feasibility studies by integrating different scenarios considering rising energy prices and carbon taxes - Conduct technical and comparative studies with several types of residues - Defining “best management practices” in the agricultural sector with reference to the APPR feedstock. Providing comprehensive information and advices on several issues about pruning removal,

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	including handling, logistics and economy. Advising farmers about possible impacts on soil carbon contents. Assessing when and where soil carbon contents are critical to preserve appropriate soil chemical and physical properties
- Training - Knowledge Transfer - Consultancy Support	• Organize workshops, training events, etc. • Set-up permanent support (e.g. through training of consultants) to farmers / cooperatives interested in developing APPR value chains • To provide more information to farmers and agrarian technicians in order to improve their knowledge about new harvesting ways and their costs • To transfer already exists technologies to the agrarian sector for using pruning wastes: combustion and composting • To create experts networks, technicians or consultants capable of advising and orientating the farmers • To transfer to the value chain actors the good practices in the APPR biomass management in order to assure the fuel quality and a stable composition • Accompany project carriers in their feasibility study (co-financing, free feasibility study) • Work with equipment manufacturers on existing gaps • Offer support as advice and feasibility studies • Technical training allowing the acquisition of new competences and expertise in the bioenergy sector, with particular regard to new technologies and distributed model of energy generation • Forming a regional “task force” made up of properly trained technicians and selected consultants or experts to provide technical support to those entrepreneurs determined in developing new APPR projects • Technical assistance, testing on existing and innovative technologies, establishing connections between experts, operators, technical installers, stakeholders and community
- Demonstration - Technological Transfer	• Organize “open-day” demonstrations of APPR biomass value chains in the framework of appropriate programs and initiatives • Organize equipment demonstrations
- Supporting and Promoting Bioenergy Deployment	• To promote cooperative ownership of relative expensive harvesting machines in order to speed up the amortize of capital expenditures • To promote among supply chain actors, including farmers, good harvesting and management practices that ensure the supply of APPR biomass with good properties and quality (e.g. ash content, etc.) • To support the retrofitting of industrial installations / boilers, so that they can accept APPR biomass as a fuel • Support the deployment of multi-fuel boilers capable of handling APPR biomass • To support technology providers (e.g. boiler manufacturers) developing solutions capable of handling APPR biomass • To promote multi-fuel biomass facilities capable of using APPR biomass and show their feasibility • Programs for machinery acquisition for APPR biomass collection • Promotion and support tools for the creation of biomass logistics centres and for biomass mobilization at local level

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	• Specific measures to increase heat production from agro-residue instead from forestry biomass • Technically support the actors in the field, in particular through contacts with competitiveness clusters or specialized consulting agencies
- Policy Advocacy - Supporting Public Administrations	• Technically support municipalities interested in developing APPR biomass logistic chains (feasibility studies, support in building the logistics chains)

6.9 Social acceptance and public awareness

Objective →	Reacting to an improper and deliberately misleading information by promoting full awareness and social acceptance
- Information - Communication	• To identify and to communicate APPR biomass advantages, both tangible and intangible • To inform local residents through public channels about the tangible and intangible benefits of APPR utilization (e.g. reduction in municipal taxes, reduction in GHG emissions, etc.) • To inform about the current reality of APPR biomass management • Evaluation and dissemination of the potential energy and emissions savings regarding fossil fuels • To identify and to communicate APPR biomass advantages, not only regarding exploitation costs but also vegetable health, fire risk reduction, etc. • To quantify intangible value of APPR biomass for dissemination and for politicians • To encourage the recognition of APPR biomass using as an economically attractive activity with the aim of harvesting services, commercialization and reduction of informal economy • Awareness campaigns to show local benefits of agro-residues using, and the threats regarding personal interests that can seriously damage APPR biomass energy use • Wide informational distribution of knowledge on the project and generally on opportunities and perspectives of APPR's biomass utilization for energy purposes devoted to building up a positive image for all value chain's actors and stakeholders, including locals • Preparation and distribution of information on fuel indicators, volumes of APPRs • Realize a web promotion campaign • Communicate at public events • Organize promotional campaigns on Youtube • Organize promotional campaigns on the valorization of APPR biomass for energy • Organize a campaign of information / integration with the different sectors • Organize a communication campaign for consumers • Communication: explaining the benefits of bioenergy based on APPR feedstock (both socio-economic and environmental) through workshops, community events, focus groups and forums, training

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	activities, social media, on-line platforms, press releases, well-known and trusted opinion leaders, etc. Dissemination: presenting successful cases, investing on an increase sense of responsibility of each person in front of his/her community
- Supporting and Promoting Bioenergy Deployment	Highlight that, due to the local benefits observed, APPR-to-power projects are expected to face lower public resistance

6.10 Environmental standards and sustainability

Objective →	Mitigating the environmental burdens along the bioenergy value chain, from farming operations to energy conversion
- Information - Communication	- To inform the public and stakeholders about the environmental issues associated with using other low-quality biomass fuels in unsuitable combustion facilities - To demand institutions to give example in their environmental actions, biomass management, etc. in order to minimize the open-air firing of wastes - Communicate on the positive externalities of APPR biomass projects - Communicate on the 3 pillars of sustainable development: economy, environment (sustainable energy, GHG), social (job creation)
- Reporting - Documentation - Performing Analyses	- Present environmental data supporting the fact that APPR biomass is suitable for specific market niches that may currently use fuels that cause excessive emissions - Highlight that proper combustion of APPR biomass is suitable systems is not responsible for smog - Quantify and disseminate the environmental benefits of APPR biomass utilization compared to alternatives. - Conduct studies to quantify positive externalities - Define a quality standard. Obtain product quality data and communicate - To demonstrate and quantify the capacity of APPR biomass to improve local air quality
- Supporting and Promoting Bioenergy Deployment	- To position APPR biomass as agrobiomass and not “wood biomass” in EU (e.g. the Ecodesign regulation) and national legislation so that it will not have to meet impossible emission limits. To avoid that APPR biomass could be considered as Wood in legislation since regulation would more restrictive in comparison with other agriculture biomass residues - To follow up boilers and emissions Ecodesign Directives in order to take into account APPR biomass in a specific way (not only as pellet or wood regulation) - To promote fuel certification schemes for APPR biomass. - Ensuring that bioenergy projects do not adversely impact the environment and its ecological resources, effectively save GHG emissions, displace fossils, preserve biodiversity and soil quality, through the application of a traceability system, chain of custody, and quality certification through compliance to standards

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6.11 Market security, controlled economic risk and financial support

Objective →	Withstanding the risk of a local APPR market failure
- Information - Communication	- Utilize existing commercial channels for biomass to promote APPR - Information diffusion among entrepreneurs aiming to increase capabilities to get funding for APPR's industry development - Communicate on available financial support mechanisms - Communicate on financing opportunities for innovation and renewable energies
- Reporting - Documentation - Performing Analyses	- Explanation of advantages in long-term contracts and authorization for biofuels production (technical requirements) - Study the incentive different mechanisms for the development of APPR biomass projects. Propose methods of Return on Investment calculation - Develop a guide on available financial support mechanisms available for the sector
- Demonstration - Technological Transfer	Reinforce subsidies proposing the installation of pilot logistics chains in the territories
- Supporting and Promoting Bioenergy Deployment	- To limit the risk of private investors by creating a demand in the public sector. - Financing the installation of dust removal systems in medium size facilities using APPR biomass. Fiscal benefits for companies utilizing APPR biomass (e.g. tax reductions, exemptions, etc.) - To promote Green taxes for fossil fuels, in order to improve the profitability of APPR biomass facilities. - VAT removal or reduction for biomass that need promotion. - Tax reduction for the agrarian good practices regarding residues management. - To promote supporting and financing measures to the entrepreneurship of APPR biomass management - Other supporting measures for new investments utilizing APPR biomass management - To propose taxes modification and support for CO2 emissions reduction. - Promotion mechanisms for biomass facilities that internalize their social and environmental benefits - To promote facilities consuming agro-biomass in the agro-industry sector - To encourage a prices transparency with the aim of increasing market stability (market observatory, supplier networks), etc. Direct / indirect support of investments in APPR biomass-to-energy projects (e.g. grants, tax reductions, etc.)

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6.12 Rules and regulation

Objective →	Resisting the complexity of the regulation system on bioenergy and the lacking of a farsighted vision about the sector
- Information - Communication	• Influence campaign in order to include APPR biomass in energy policy as renewable energy (end-user incentives, bonus, etc.).
- Reporting - Documentation - Performing Analyses	• Conduct a regulatory analysis of the laws that could affect the sector and transmit it to the competent authorities. Identify bad practices such as outside burning. Submit a report to the competent authorities
- Supporting and Promoting Bioenergy Deployment	• Inform policy makers about the possibilities of APPR biomass in the context of circular economy and rural development • To revise the NREAP and set targets for APPR biomass utilization • To take advantage of the revision of regulations / laws to incorporate appropriate measures favourable to APPR biomass • Include the collection of APPR biomass in the waste management framework of local municipalities • To follow up new Energy and Climate Plans (2021-2030) in order to include potential data, requirements and measures for APPR biomass promotion
- Policy Advocacy - Supporting Public Administrations	• Harmonizing regional, national and EU strategic plans on APPR bioenergy development • Promoting a strong simplification of legislative rules • Suggesting strategic policy guidelines (such as market instruments, taxation regimes, financial incentives, price subsidies, funding opportunities, environmental and agricultural framework, research & innovation, etc.) • To provide institutions with already exist models and examples of tenders prioritizing biomass and agricultural wastes use in high potential areas • To align institutions in order to bet for a sustainable waste management • To include the collection of APPR biomass wastes within institutions responsibility (not only MSW, water, etc.) • To favour the aggrupation of agriculture and energy lobbies around support declarations of APPR biomass energy use • To look after a clear separation between APPR and forestry biomass and to make strategies to request reviews or transition disposals for agro-residues regulation application • To prepare a memorandum in defence of APPR biomass and specific proposals for influent policies • Actions devoted to help receipt and approve from policy makers and opinion leaders: nudging for fossil fuels substitution by APPR's residues, simplification of administrative load on farmers and potential biofuel customers. Defeated timber black market

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7 CONCLUSIONS

This document traced a long path and two different types of “travellers” have crossed it, from the beginning to the end. The traveller of the first type can be identified in the policy maker (to give some examples: the member of the EU Parliament, or the executive manager in the EU Commission, the leading figure of inter-governmental organizations, and so on); he/she is observing from outside the bioenergy sector, trying to direct and guide the sector development. Differently, the traveller of the second type is to be thought as the “ideotype” of a stakeholder directly acting inside the bioenergy sector; his/her perspective is from within, while policy maker has a perspective from above the sector.

Both perspectives are interesting and relevant, they should be complementary and they have to be merged, thus becoming a unifying strategy to be applied for the sake of the sector itself and for society at large.

This long covered path is made of different steps or stages. The first consisted in identifying the “visions” capable of inspiring the role that the bioenergy sector can play in the coming years and the general functions that it can perform considering very influential issues such as energy, environmental sustainability, climate change, economic growth and improvement of social conditions.

The second stage along the path made possible to identify the “missions” and, therefore, the objectives and goals to be pursued in promoting the bioenergy sector development, orienteering the route on the right tracks.

Finally, with the third step, the path has been traced, also indicating the way in which it would be possible to reach the final goal, that is to say a fully developed bioenergy sector, able to significantly contribute in the European energy mix, mostly or entirely relying on renewable forms of energy.

A bioenergy value chain based on pruning residues (and plantation removal) could offer several relevant options considering both the agricultural and the industrial sector. It may represent a tool or leverage in performing an in-depth reconsideration of conventional agricultural practices, driving changes towards more sustainable agricultural practices. Just to make an example, pruning removal from the fruit plantation (to be performed only when specific soil conditions are met) can provide a convenient and useful alternative to the current crop residues management. More in details, the usual practice of free pruning burning in open-air conditions and directly in the field or at the field margin should be definitively forbidden, without considering exceptions or derogations. This wrong practise, indeed, should not be tolerated anymore. Pruning shredding followed by mulching or subsoiling unfortunately offer risks of pest and disease propagation and, unless certainly healthy, pruning should be better removed from the field. Of course, agronomic techniques aimed at preserving or restoring the content in soil organic matter should be applied, also considering some supplemental interventions (alternative to pruning shredding) such as cover cropping and soil amendment (with manure or compost). The so-called “conservative agriculture” is offering, today, very interesting evidence in improving soil cultural conditions.



	Document:	D2.2 Sector Analysis and Strategic Plan at National and EU level		
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Addressing pruning to energy uses can contribute effectively and significantly to the "decarbonisation" of the energy system, without competing at all with food crops due to the residual nature of the feedstock involved.

Pruning, therefore, can be the right feedstock and energy carrier in promoting new forms of agro-industrial integration and lessens the energy dependence of the agricultural sector. On this respect, energy value chains focused on pruning can be considered a helpful "flywheel" for rural development; being rooted at local scale, these kind of activities and investments foreshadow a community oriented, self-reliant, self-sustaining models of development. According to a multifunctional strategy so very common in the agricultural sector, bioenergy enhance the farm productive diversification and favour income integration through connected and parallel activities within the same sector but different from the traditional crop cultivation (although still of fundamental relevance).

Actions and measures can be promoted and applied with respect to a wide range of issues, related to both agriculture and industry sectors. Apart agro-energy integration and rural development, new business models should be displayed and the energy market should be supported according to a well-planned and collectively agreed policy, together with research and innovation that are essential to offer new and more effective energy conversion technologies (reducing emissions into the atmosphere and increasing the conversion efficiency).

Prospectively, there is a huge playing field considering the biomass/bioenergy sector and great opportunities to enlarge residual biomass use and valorisation. Biomass and bioenergy markets would significantly gain from more harmonisation and cross compliance and from strengthening energy performance certificates, energy codes and legislative enforcement. The biomass fuel supply could be widened impressively when compared to its current use through the development of standardised, sustainable biomass solid fuels. Sustainable, innovative and cost-effective advanced feedstock production and pre-treatment technologies for different biomass sources need to be developed to meet the fuel quality requirements. Biomass CHP units should exhibit increased fuel flexibility, allowing the use of more complex and low cost biomass fuels (e.g. agro-biomass and crop residues) and new energy carriers (like thermally treated biomass fuels). Increasing technical parameters of boilers and other commercial appliances, the efficiency of the CHP plant, as well as effectively addressing environmental issues (e.g. emission control and ash utilisation) are considered other relevant goals. Boilers and stoves with high emission standards for heating and healthier technical solutions are available, easily accessible, more efficient and cheaper in the long run. These commercial appliances should be sustained in order to make easier the substitution of old energy plants, with inadequate standards. Ecodesign and energy labelling requirements for space and water heaters came into application and should boost the market. In District Heating (DH) systems, the retrofitting of old and inefficient boilers to become more effective at high availability rates, while increasing their fuel flexibility is a key challenge and priority.

To make a long speech very short, the following are some relevant and critical policy issues that should be considered with great care in order to strategically setting up a plan targeting the future energy goals.

- Phasing out from inefficient fossil fuel subsidies and introduce CO₂ emission pricing schemes.



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	Reference:	D2.2 uP_running ID GA 691748	Date:	23/04/18

- Creating a stable, long-term policy framework for bioenergy, to increase investor confidence and allow for sustainable bioenergy production.
- Implementing sustainability governance frameworks based on GHG performance.
- Identifying and removing unnecessary administrative barriers to bioenergy deployment, consistent with sustainability objectives.
- Establishing low-carbon fuel standard approaches, providing technology-neutral support but ensuring significant benefits over fossil fuels and favouring those which offer the deepest decarbonisation for the least cost.
- Launching appropriate and dedicated financial mechanisms and instruments for advanced, low-carbon bioenergy systems that facilitate technological development and market deployment.
- Providing sufficient support (e.g. through grants and loan guarantees) that addresses the high investment risks related to commercial-scale advanced, low-carbon biofuel plants
- Introducing appropriate accounting in CO₂ pricing schemes (also considering negative emissions related to CCS on biomass-based installations).
- Increasing the number of national and regional roadmaps, strategies and sustainability regimes for bioenergy, especially in countries with significant resource where these are not in place.

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	Reference:	D2.2 uP_running ID GA 691748		Date: 23/04/18

ANNEXES

Annex list	Pages
Annex I: full sector analysis and action plan for the Demo Region in Spain (language: ES)	AI.1 to A1.33
Annex II: full sector analysis and action plan for the Demo Region in Italy (language: IT)	
Annex III: full sector analysis and action plan for the Demo Regions in Greece (language: EL)	
Annex IV: full sector analysis and action plan for the Demo Region in Ukraine (language: UA)	
Annex V: templates of the memorandums of understanding	

ANNEXES

Annex list

- Annex A1 +A2:** Sector Analysis and Developing a Strategic Plan at National and EU level – Spain (Language: English+ Spanish).
- Annex A3+ A4** Sector Analysis and Developing a Strategic Plan at National and EU level – Greece (Language: English + Greek).
- Annex A5+A6:** Sector Analysis and Developing a Strategic Plan at National and EU level – Ukraine (Language: English + Ukrainian).
- Annex A7+A8** Sector Analysis and Developing a Strategic Plan at National and EU level – Italy (Language: English+Italian).
- Annex A9 + A10:** Sector Analysis and Developing a Strategic Plan at National and EU level – Croatia (Language: English+Croatian).
- Annex A11+A12:** Sector Analysis and Developing a Strategic Plan at National and EU level – France (Language: English+ French).
- Annex A13+A14:** Sector Analysis and Developing a Strategic Plan at National and EU level – Portugal (Language: English+Portuguese).



ANNEX A1

WP2 – Task T2.3

**Performing an APPR Sector Analysis and
Developing a Strategic Plan at National and EU level
Spain**

	Document:	Task 2.3. Performing a bioenergy sector analysis and developing a strategies plan at national and EU level: SPAIN		
	Author:	CIRCE	Version:	13
	Reference:		Date:	20/11/2017

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A. National framework on APPR sources

Here we have not translated anything. The section is extensive and you can consult in EMDESK. If anything is needed to be translated please contact CIRCE.

It contains:

- *General data on Spain*
- *Areas by crop type and evolution in the last 5 years (to detect trends)*
- *Areas by Techniques for the maintenance of the soil cover (8 classes), and by status (abandoned, 1st year, young, productive)*

B. National potential of the APPR availability

Here we have synthesized:

- *The % of use of APPR biomass*
- *General data on Spain*
- *Areas by crop type and evolution in the last 5 years (to detect trends)*
- *Areas by Techniques for the maintenance of the soil cover (8 classes), and by status (abandoned, 1st year, young, productive)*

We did not translate:

- *About existing diseases*
- *About the variability in the final fate. Differences among regions, and differences inside regions and among neighbors. No unique practice for disposing the APPR residues.*
- *Some details of local factors allowing the open fire disposal of APPR biomass*

Figure 1 shows the distribution of the main crops in Spain. The map has been implemented with QGIS 2.14.0 – Essen versión. The crop coverages correspond to Corine Land Cover 2006 (v17, 2014) and have been downloaded from EEA – European Environmental Agency. The land use denoted as “Not specified” refers to Corine Land Cover Class 241 “Annual crops associated with permanent crops”, which indicates the existence of land with either vines, olive or fruit trees.

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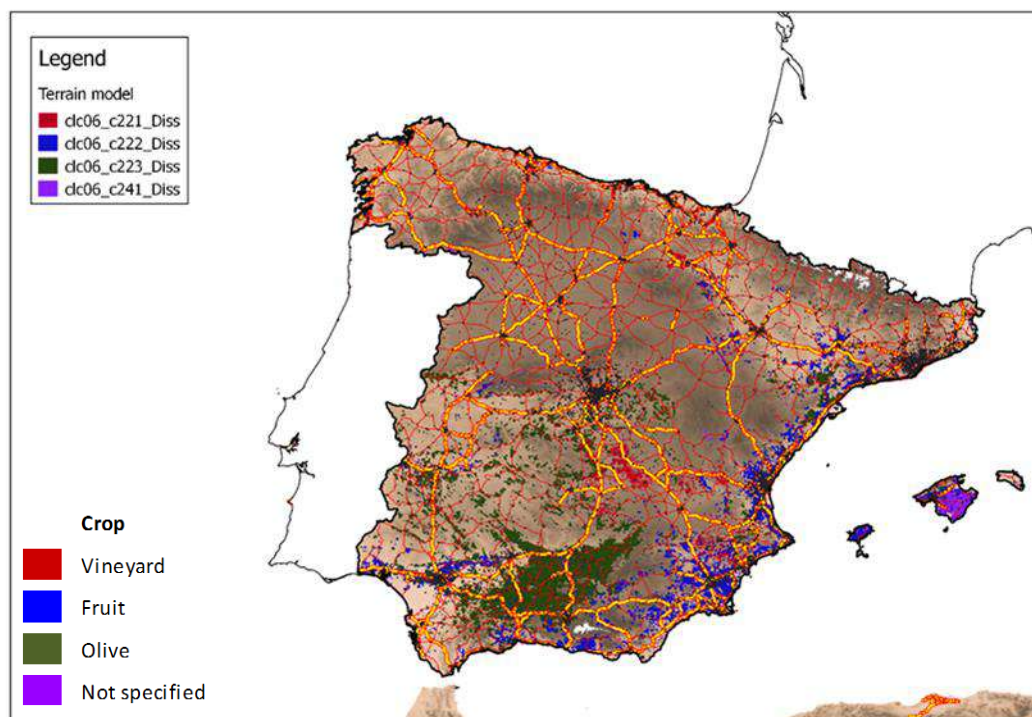


Figure 1. Map of the distribution of the main crops in Spain

An extensive analysis at national level was performed within the EuroPruning European Project where Spanish biomass data were collected in 2014 (EuroPruning, 2014).

According to EuroPruning results, Table 4 shows the reality of the country regarding the use and disposal of agricultural prunings. It has been obtained for several crops by the consultancy work done with country specialists on the management of permanent crop plantations.

Table 4. Current use of agricultural prunings in Spain (by crop type)

Final use / disposal	Olive	Vineyard	Seed fruit	Stone fruit	Cherry	Citrus	Almond
Piled and stored at field side	0	2	0	< 1	< 1	0	2
Piled and burned at field side	90 (x)	95	95	97	97	85	97 (↓)
Shredded and left/incorporated to soil	5	1	5	2	2	10 (↑)	1 (↑)
Local firewood	5 (*)	2	0	0	0	5 (*)	0
Commercialised for energy	0	0	0	0	0	0	0

(*) Only thick parts of branches. (x) Thin branches. (↑) Increasing practice. (↓) Decreasing practice. (<1) marginal, only local applications.

The general situation described before for the management of agricultural prunings in the country does not necessarily reflects the local situations along the country. For instance, in Andalucía olive pruning has been widely used in power plants originally designed for burning olive pomace (Puente Genil, Bioeléctrica de Linares, Oleícola El Tejar, etc.). This high pruning utilization is a particular case but it is not spread to the rest of the Spanish territory. ENCE power plant (Huelva) is a recent case. It was designed for burning wood residues from pulp and paper mills and forestry biomass (both stem forestry residues woochips). Since 2017, this company is using significant quantities of wood coming from fruit plantations removal and olive

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prunings. Hence, situation shows in Table 4 is not totally true. When the pruning “Commercialised for energy” is described to be 0%, this percentage of pruning use should be understood as a minority among the final fates for the pruning residue.

As some studies state (García-Galindo et al. 2010; IDAE, 2011) it can be considered that at least 10% of the total agriculture pruning are used for energy production, as firewood (traditional use) or chipped (modern boilers, like those described above, and the initiatives presented in Figure 6).

As Table 4 shows, open burning is the common practice for pruning removing. Even though this practice is not legal, there exist some regulations at local or regional level to allow it as an exception in the pruning management. The reality is that, given the traditional disposal through burning, and the absence in some areas of alternatives to the management, the way to facilitate a disposal is to extend a burning permission specific for the farmers that need it. However at national level, there is not a way or control mechanism to ensure that the burning in open fires is limited strictly to those cases where it is fully justified as the only or best practice.

Regarding the management of the plantation removals, it is similar to the pruning considerations.

A summary of the PRUNING potentials in Spain is detailed in next table.

Table 5. Theoretical potentials (t of dry matter per year) for agricultural pruning in Spain according to several data sources.

Theoretical potentials for agricultural prunings (t of dry matter per year)							
Study	Ref*	Vineyard	Olive	Dry fruit	Sweet fruit	Citrus	TOTAL
Biomass futures 2004	[1]	n.d.	n.d.	n.d.	n.d.	n.d.	8,304
S2BIOM 2012	[2]	912	3,192	770		555	5,429
Bionline-IDAE 2012	[3]	n.d.	n.d.	n.d.	n.d.	n.d.	8,865
Bioraise	[4]	1,138	2,342	1.898			5,377
EuroPruning	[5]	825	2,625	295	430	489	4,664
SUCELLOG	[6]	1,347	3,740	265	366	932	6,650
ACVCOCO	[7]	1,279	1,985	529	337	690	4,820

* See references in section of References; n.d.: not determined

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C. National state of art of the APPR sector

Here we have translated almost everything

- Energy consumption and role of Bioenergy in Spain (only graph, no text)
- Power generation by energy resource (only graph)
- Existing biomass sector (main figures by technology, and for heat)
- Main associations to be accounted to promote actions in favor of APPR
- Current consumption of biomass in Spain)
- Barriers and driving forces

We did not translate:

- Small paragraphs about the energy consumption diagrams

Bioenergy in Spain: main figures

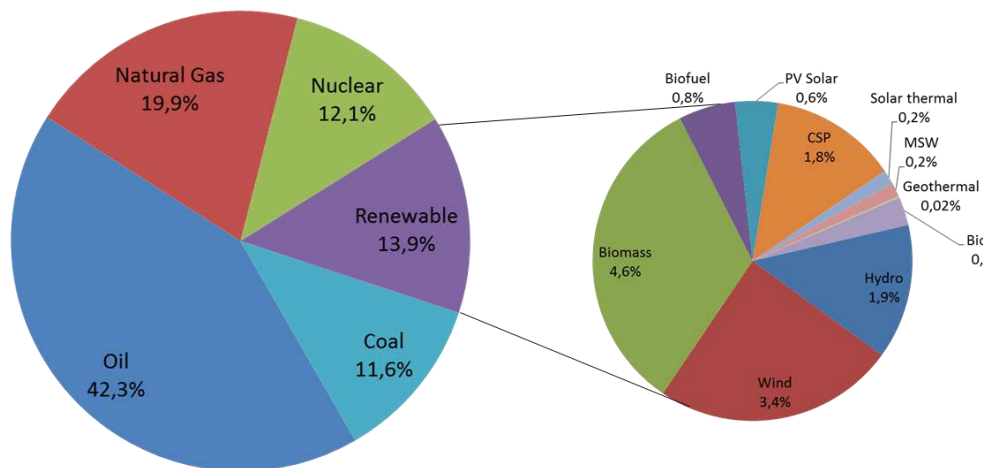


Figure 3. Primary energy consumption by energy source (MINETUR, 2015)

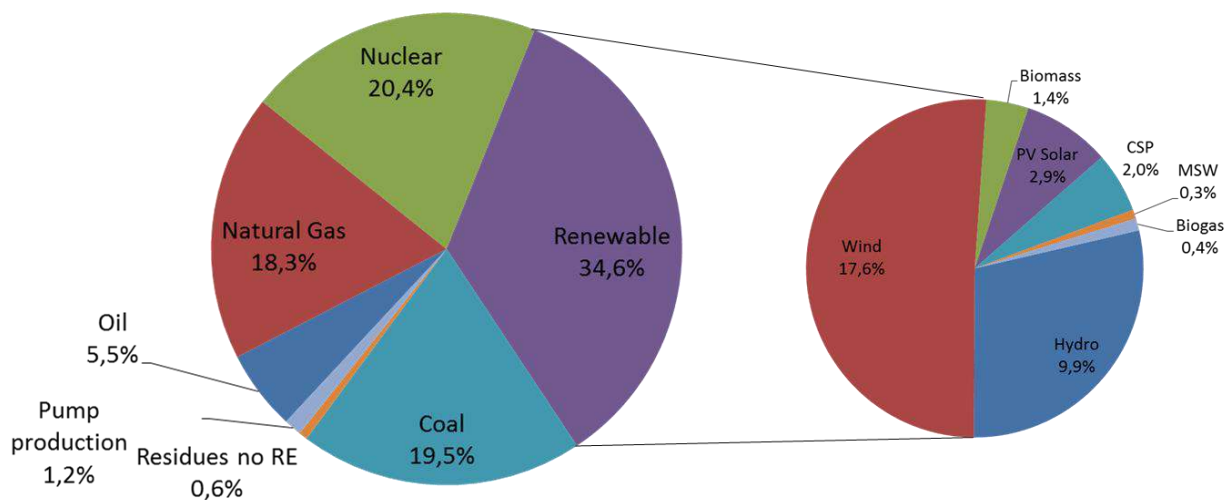


Figure 4. Electricity generation in Spain (MINETUR, 2015)

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Around 69% of the total renewable energy was used to produce electricity, while 25% was used for thermal purposes. 75% of these renewable thermal contributions were covered with biomass: 3,936 ktoe (548 ktoe correspond with heat consumption from biomass power plants and 3,388 ktoe correspond with thermal facilities, boilers, stoves, heaters located in residential, industrial and services sectors).

TOTAL energy consumption: 123.7 millions of toe

TOTAL renewable consumption: 17.2 millions of toe (13.9% of total energy consumption)

TOTAL biomass consumption: 5.7 millions of toe (4.6% of total energy consumption, 33.1% of total renewable consumption)

TOTAL thermal biomass consumption: 3,9 millions of toe (69% of total biomass consumption)

TOTAL electricity biomass consumption: 1,8 millions of toe (31% of total biomass consumption)

In the Spanish Renewable Energy Plan 2011-2020, biomass accounts 5% of the renewable energy mix for electricity generation. This entails an increase of 1,125 MWe regarding 2010 figures, considering 820 MWe coming from solid biomass exploitation. Table 6 collects current biomass facilities (2011) and planned installations for electricity generation.

Table 6. Biomass, biogas and pellets facilities. Current state and planned (APPA, 2011)

Biomass, biogas and pellets facilities (APPA, 2011)			
	Plant type	Nº	Power (MW)
Current state	Biomass	22	358.5
	Gasification	4	3.7
	Biogas	30	97.9
	MSW	4	49.6
	Pellets	5	-
	TOTAL	65	509.8
Planned	Biomass	62	831.9
	Gasification	4	3.7
	Biogas	9	12.3
	Pellets	4	-
	TOTAL	79	847.9

Looking at the figures, solid biomass power plants could achieve the targets of the Spanish Renewable Energy Plan (around 1,350 MWe). However, the renewable electricity sector has been hampered by the last changes in the legislation. So far, companies owning the residue were the developers of the biomass power plants. Likewise, the close future roadmap indicated large electrical companies were going to be in charge of the new projects and new facilities erection. However, current scenario appears uncertain and it seems that Plan's objectives are not going to be accomplished. Therefore, a new scenario was expected in order to achieve the 2020 aims: to reduce previous objectives or to encourage again the electricity generation using biomass by financing mechanisms.

During the last two years (2016 and 2017), some electric auctions have been carried out with the aim of promoting renewable energies participation in the electricity generation mix, assuring the consumption and the profitability of the facilities. Within the first auction (January, 2016), 500 MW of wind power and 200 MW of biomass were auctioned. The auction was won by the proposals offering a lower feed-in tariff. As result of this auction the feed-in tariff was set to zero, that is, all MW granted had offered to enter in the market without the need of any feed-in tariff. Therefore, these proposals granted will have opportunity to build the new windfarms and biomass power plants, ensure that 100% of their production is bought by

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the market, but at a market price (without any bonus). As a specific clause, all the MW awarded will be assured a minimum price in case of a dramatic fall of prices. During the next two auctions (May and July, 2017), there was no room for biomass (just 8,000 MW of wind energy and photovoltaic)

Regarding the use of biomass for thermal purposes, solid biomass leads renewable energies contribution to the renewable share in primary energy with a remarkable weight of 85%. It is expected an increase of 774 ktoe of solid biomass towards 2020. The main driving forces for this increase are the potential economy savings by biomass thermal generation instead of conventional fossil fuels and the spread of district heating facilities all around Spain.

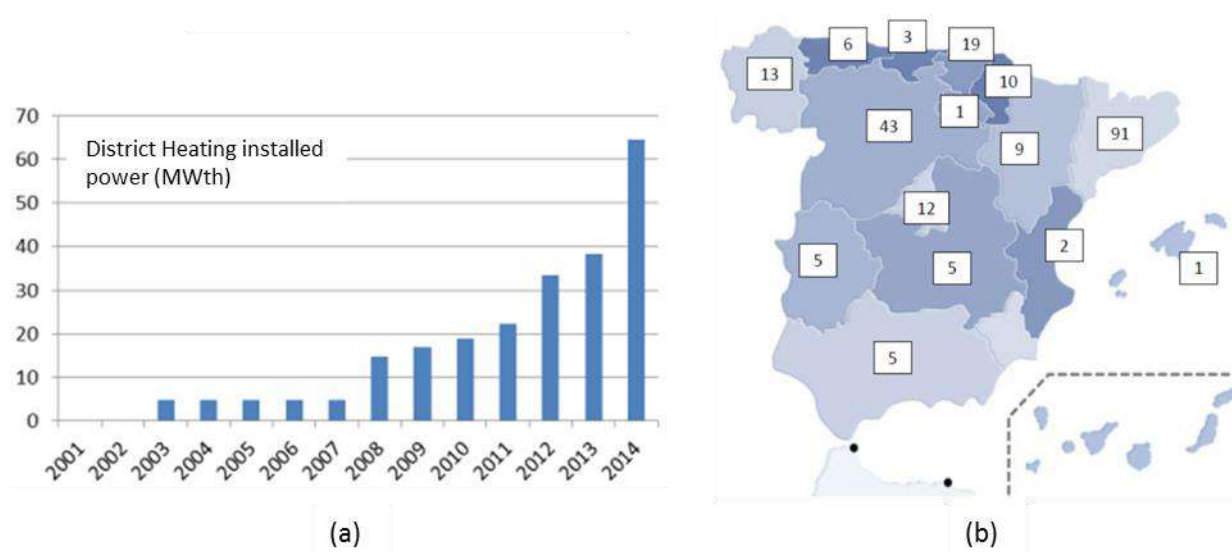


Figure 5. (a) District Heating installed power in Spain, MWth, (b) renewable energy District Heating in Spain

Figure 5a shows district heating power in Spain. In 2014, the power was around 94 MWth and in 2016 it was estimated 200 MWth. There were 225 district heating with consuming renewable energy, 218 of them with solid biomass (figure 5b).

Consumption of APPR biomass in Spain

Agroindustry and biomass power plants are the largest consumers of this kind of biomass in Spain. This the case of the Andalucía power plants. They burn olive pomace but they can also use olive pruning as secondary fuel. In the same way, some Spanish wine cellars use biomass pruning (Bodegas Torres, Codorniu, Vilarnau, Emina), and an agroindustry of cremogenates (fruit juices and purees) like NUFRI. There also exists some experiences promoted by local councils such as Vilafranca del Penedés (Barcelona) or Serra (Valencia). They use these local resources in municipal facilities. Recently, other large power plants using forestry biomass have started to diversify their fuel feeding, trying to consolidate novel APPR value chains. This is the case of ENCE power plants (Huelva) and Acciona Miajadas (Badajoz). At last, there are some specific cases which value chains are focused on the commercialization in biomass market, such as the "Pelets de la mancha" plant (Grupo Athisa, Ciudad real) and Reciclados Solamur (Murcia) that exports fruit pruning chips.

When biomass is picked clean and without dust, it can be managed in large logistic centres ready to consume, as in Andalucía. On the contrary, when biomass is not clean and with a high content of ground, the only consumers are the large biomass power plants or CHP plants. In vineyard regions, such as Vilafranca del Penedés, or Rioja Alavesa, this biomass is used for self-consumption by the cellars or the farmers, mostly for thermal purposes. In Andalucía, large amounts of forestry biomass are being burnt in the biomass power plants. In order to preserve these forests, other low quality biomass could be

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consumed. To this context, their facilities (boiler, dust filter, etc.) are suitable for APPR biomass. ENCE power plant in San Juan del Puerto (Huelva) is already using in the boiler olive pruning and some other crops.

A thermal use is being carried out in Serra (Valencia) and Calpe (Alicante), where the pruning is used for heating a swimming pool and some municipal building. Biomass is carried to a company, it is chipped and dried and finally, transport to the boiler in the swimming pool facilities. These examples, together with Vilafranca del Penedés show how the municipalities can take an active role in promoting the use of APPR biomass, in benefit of all the local community, and creating economic savings in the energy bill of the municipality.

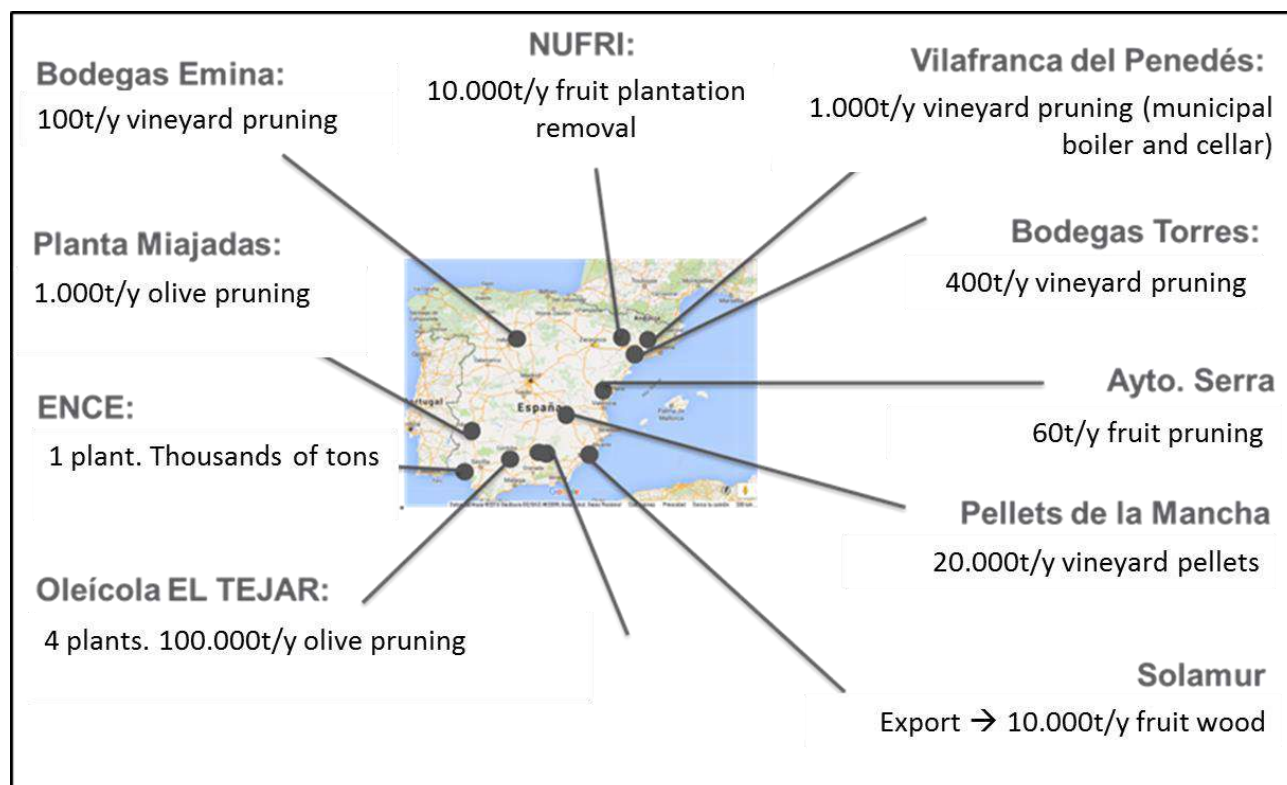


Figure 6. Main plants and projects of APPR biomass in Spain

Barriers to enter into the APPR value chain or to start up the value chain

Within this section, barriers detected by uP_running Project are shown. They are based on the results and conclusions from several interviews (see Acknowledgements section) and a workshop¹ performed during the Feria Expobiomasa, with multiple actors from the value chain. In addition, some barriers previously identified in Sectorial Analysis in Aragon have been adapted (D2.1).

Technical barriers

- APPR biomass has lower quality than woodchips and its characteristics are more variable depending on collection methodology.
- Biomass productivity: t/ha rather small and unknown.
- No specific machinery for harvesting and chipping.
- Not enough developed models for APPR harvesting and treatment (O&M costs, tractor impact, etc.).

¹ “Promoviendo la AGROBIOMASA en España: residuos leñosos de vid, olivo y frutales”. Evento realizado en fecha 26 de Septiembre de 2017 en la Feria de Valladolid. Más información en: <http://es.up-running.eu/category/news-events/>

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- APPR biomass use needs to adapt conventional boilers and to adjust combustion parameters.

Cultural barriers

- Reluctance to changes by the farmer in the APPR management.
- Belief APPR is not competitive: high costs and low quality.
- Farmers only see new costs, not the savings in APPR residues management. Farmer do not understand the potential saving and thus, transfer possibilities are limited.
- Farmer mistrust: other is making money out of my residues.
- Belief: best use of pruning is soil amendment (no risks are considered within this practice).
- Intangible benefits such as circular economy or local resources consumption related to APPR biomass, are not considered.
- Some Administration technicians are very sceptic about APPR biomass energy use.
- Unknown about APPR Energy use profits by Administration responsible persons.
- Perception about the biomass boilers: manual maintenance (feeding, ash cleaning, etc.).
- Scepticism about the cases of success and reluctance to innovation concepts.
- Belief: only large consumers can use APPR biomass.
- Engineers and ESCO do not trust in APPR biomass. They consider it is not a good option.

Legal barriers

- APPR is not considered as a national strategy.
- APPR is not considered in renewable energy national plans (not specific measures).
- Currently allowed disposal APPR in open-air fires (exist local permissions for farmers).
- Renewable Energy framework unstable: no security for new investments.
- European Ecodesign Directive for biomass boilers can limit APPR biomass use due to its higher ash content than forestry biomass.
- There exist subsidies when leaving APPR biomass on soil.
- Subsidies for pruning mulchers (to be left on soil), but not for pruning shredders/chippers with product collection in a hopper (to be utilized for any other purpose afterwards).
- Regulations that pressure farmer to eliminate residues in a short time (difficulties to manage the pruning harvesting).

Structural barriers

- Many unknowns and uncertainties surrounding APPR biomass business.
- Lack of understanding between agriculture and energy sectors. They do not understand each other and their interests in APPR business.
- No coordination between Government departments: agriculture, energy and environment.
- Lack of understanding between ESCO, biomass consumers and farmers.
- Informal economy is a barrier for ESCO in order to start a new business initiative.
- APPR is very widespread. More expensive and complicated management.
- Scarce interest in APPR biomass by the public authorities (for instance, no APPR in public buildings).
- No pressure to the Administration and Government (other interests are priority).
- Oil, gas and electricity lobbies are very powerful and they influence in politics.
- Administration prefers cheaper facilities (conventional fossil fuels or pellets) instead of APPR biomass.
- Fossil fuel companies offer very good conditions to make client stop thinking on biomass.

Market barriers

- Mistrust in biomass suppliers. Since APPR is unknown, mistrust is even higher.
- ESCO do not consider hybrid facilities (multi-fuel).

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- Fear about biomass price changes (curiously, there is no fear about conventional fuels prices speculation).
- Very competitive prices for forest biomass (high amount of biomass in the market).
- Few biomass suppliers can promote potential speculation.
- Scarce biomass platforms/yards to adequately treat APPR residues and assure fuel quality.
- There are not good examples in order to show pruning management, indicating roles and all actors earnings.

Value chain organization barriers

- Difficulties to put in agreement to different actors in order to organize an optimum APPR value chain.
- Difficulties to get a solid agreement with APPR biomass owners before starting the investment.
- Small parcels involve difficult organizing collection.

Economic barriers

- Low oil price during the last years. It entails low profitability.
- Margin of profit very small.
- Few tons of biomass per hectare (low productivity).
- Very variable / volatile prices of biomass.
- There are no APPR harvesting prices (service price). No framework and experience.
- Facilities burning APPR biomass are more expensive than facilities operating with pellets or forest biomass (higher investment).

Financing barriers

- High uncertainty and investment risks.
- VAT on biomass in Spain is 21% (10% in other European countries)
- Not specific funds to obtain or use APPR biomass.

Driving forces

Driving forces are regulations, opportunities, actions that can contribute to make a change in APPR biomass management at local or national level. Within this section, driving forces detected by uP_running Project are shown. They are based on the results and conclusions from several interviews and workshops. These forces can exist right now or can appear in the future.

- **OPPORTUNITY (framework, cannot be influenced)**
 - Huge potential of APPR biomass in Spain.
 - If price increases then biomass market can be established.
 - Oil price increase.
 - Social responsibility of companies: image, sustainability as differentiating element.
- **CONSUMPTION**
 - Start of a large consumer.
 - Increase of biomass self-consumption in agriculture sector.
 - Public sector creating new demand to give example: APPR is feasible.
 - Wine, fruit and olive oil industry integrating APPR biomass for self-consumption.

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- Strong promotion in areas of high APPR potential for increasing consumption.
- POLICY
 - Public declarations of the government stating the need to support APPR biomass new management.
 - Public administration promoting good environmental practices.
 - Segmenting incentives for renewable to favor those sources having more priority/social impacts.
 - Promotion of RTD in topics for bio-economy and closed loop solutions for wastes.
 - Incentives to use APPR biomass / to make more uneconomic other practices.
 - Energy certification for the agro-industrial facilities (high efficiency, renewable energy).
 - Sustainability increase in some agriculture sectors such as olive or vineyard (e.g. CO₂ footprint).
- AGRONOMIC PRACTICES IN THE APPR MANAGEMENT
 - List / Catalogue of environmentally friendly practices (sustainable and ecological use).
 - Incentives / advantages to the good agricultural practices.
 - More restrictive environmental policy regarding open-air burning.
 - As alternative: CO₂ tax for farmers making open-air burning as a choice.
- STABLE APPR BIOMASS MARKET DEVELOPMENT
 - Good professional (try to avoid deficient facilities).
 - Labels, standards to facilitate the quality assurance of biomass.
 - Creation of biomass yards (multipurpose logistic centres).
 - Cooperation, collaboration among farmers to facilitate coordinated harvest and large volumes.
 - Promotion of flagship cases.
 - Support to RTD for machinery and boilers ready for APPR.
- AWARENESS:
 - To spread the knowledge that APPR biomass is possible.
 - Dissemination of the success cases including business models.
 - Raising awareness of the intangible benefits of a change in APPR residues management (social, local employment, circular economy, environmentally friendly)
 - Raising awareness of the more environmentally friendly uses for the agriculture residues.
 - Rapprochement between farmers / cooperatives / agroindustry and ESCO / Energy sector.
 - To spread the knowledge about opportunities and advantages of APPR biomass using to the politicians.

Main organizations playing a role at national level

Main organizations playing a role at national level and addressing government and public opinion about biomass and bioenergy, capable to drive or to promote a change in current APPR energy use trend, can be national multipliers of the professional energy sector and agriculture and food groups. The national bioenergy association (AVEBIOM), includes all the biomass value chain actors and it promotes the sector development in Spain by communication campaigns and the participation in national and European projects.

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The Renewable Energy Producers Association (APPA) also work for the biomass promotion. The main objective is the valorization of solid waste, agriculture waste and in general to encourage the contribution of biomass. It includes more than 30 companies, and has a very high capacity of influence in the administration and in the renewable energy sector. Among their different activities, they carry out promotion events at national level, such as the Renewable Energy National Congress, located in Madrid at the end of October and where will be present the most important actors from the biomass sector ([Congreso Nacional de Energías Renovables, Madrid, octubre 2017](#)).

In addition, it is also necessary the presence and support from the agriculture and food organizations. The participation of agriculture unions such as “Coordinadora de Organizaciones de Agricultores y Ganaderos” (COAG), “Unión de Pequeños Agricultores y Ganaderos” (UPA) or “Asociación Agraria de Jóvenes Agricultores” (ASAJA) must encourage the Energy use of APPR and they must be the bridge between energy and agriculture sectors. Likewise, food associations such as “Federación Española de Industrias de Alimentación y Bebidas” (FIAB) and “Cooperativas agro-alimentarias de España” (SPANISH CO-OPS), can also urged to boost the energy use of olive and vineyard pruning.

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D. National Plan for Energy and Climate

Here we have translated everything

Renewable Energy Plan and Climate and Energy National Plan

According to the Spanish Renewable Energy Plan 2011-2020 (IDAE, 2011), forest pruning and olive pruning are considered as important energy resources. During 2006, 400,000 toe of olive pruning and other agriculture residues were consumed (around 1,600,000 t, LHV = 0,25 toe/t). The main use consisted of covering thermal demands.

This Plan 2011-2020 does not contain any specific proposal regarding APPR biomass promotion or energy using. Nevertheless, though it includes different general proposals that can be useful for the APPR biomass sector development (operation costs sharing between all value chain actors, promotion of new biomass logistic companies, creation of a stable biomass market, public info campaigns, etc.).

The scarce effect of these measures and hence, the no presence of APPR biomass in the Plans shall be explained as a consequence of the recent economic crisis in Spain (started in 2008). A lower industrial activity caused a reduction in the energy demand. In addition, energy prices were down (oil, gas, even biomass). Finally, Government funds and bonus for new renewable energy facilities were removed.

Regarding European Climate and Energy 2030 Policy, the main binding objectives have been already defined:

- 40% cut in greenhouse gas emissions (from 1990 levels).
- 27% of EU energy from renewables.
- 27% improvement in energy efficiency.

Spain is willing to apply more restrictive targets in order to speed up the renewable energy introduction in the energy mix. The draft proposes to increase to 35% the EU energy from renewables. With these figures, Spain target will be 36% of Spanish energy from renewables (more than the double of the current production). The Spanish Plan will be published in January 2018.

Agricultural policy

Agricultural policy regarding renewable energy in agricultural sector is essential to speed up the APPR energy use development. In any case, the prohibition of open-air fire of pruning could be a definitive driving force to force an enhanced use of the APPR biomass and the needed change of the awareness in Spanish regulation.

The coherence between agriculture, food&feed, energy, environment and economy policies must be assured. Directive 2009/28/EC does not content sustainability criteria for solid biomass. More specific measures could be introduced in the Regional Rural Development programs for the promotion of the use of agricultural biomass as renewable energy (promotion of the use and the investment in biomass transformation technologies), direct greening payments to activities including crop diversification that can consequently result in biomass promotion.

The current program of the EU Common Agricultural Policy is valid until 2020. The European Commission is working on a new proposal, the main topics of which are expected by the end of 2017. The CAP is currently based on three pillars: direct payments, market measures, and rural development policy. Regarding the support lines for direct payments (RD 1075/2014), there are currently no aids linked to the use of pruning as an energy source, although they existed between 2012 and 2014, regulated by RD 202/2012 in articles 41 to 45. There exist measures of conditionality (based on RD 486/2009):

- The removal of agriculture residues must be carried out according to the regulations.

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- No plantations removal must be carried out in zones with a slope greater or equal than 15%

It is expected a significant reduction in the budget for the next period of the CAP. The future of the CAP will affect the conditionality mechanisms for direct payments (could affect the burning of agricultural waste), as well as the priority lines for rural development (currently, one of them is energy efficiency that could be a driving force for the use of APPR biomass in the future).

Regulations and air quality policies

A new Air Quality and Atmosphere Protection National Plan (Plan AIRE) is being developed for 2017-2019. The main objective is to strengthen the measures of the previous Plan AIRE 2013-2016 for improving the air quality and complementing the actions included in the local and regional plans. These measures will try to reduce the pollutant emissions, dust, NO_x and ozone precursors.

The Spanish Government will continue with the review and adaptation of the emissions national regulations according to the European Directive. 172 millions of euros are earmarked to improve air quality: Environment Impulse Plan (PIMA) with the aim of modernizing the vehicles and to promote the buying of electric bicycles (PIMA Aire); tractors (PIMA Tierra); transportation of merchandise and passengers (PIMA Transporte) and more than 200 projects for CO₂ emissions reduction (Climate Projects). Likewise, more than 1,100 millions of euros were earmarked to the Efficient Vehicles Program (PIVE).

Regarding the previous Plan AIRE (2013-2016), APPR biomass was considered just in one line of action. Measure AGR 3.1 proposed the use of pruning from dry fruit plantations for energy purposes or for soil amendment. The execution degree was around 38%.

Directive 2015/2193 limits the pollutant emissions to the atmosphere for medium-size combustion facilities (nominal power greater or equal than 1 MW and lower than 50 MW without fuel distinction). In the case of existing facilities, member states must applied the necessary measures to assure no medium-size combustion facility above 5 MW will be in operation without permission after January the 1st, 2024. For instance, considering a biomass fire facility with a power greater than 1 MW the limit values would be 200 mg/Nm³ SO_x, 650 mg/Nm³ NO_x and 50 mg/Nm³ particles.

The Directive 2015/2193 considers as biomass any product composed by vegetal mater coming from agriculture or forestry that can be used as fuel and in addition, the agriculture or forestry residues. APPR biomass would be included in this Directive.

APPR biomass in the politic agenda

According to the opinions gathered through interviews and workshops, can be concluded that APPR biomass is not on the agenda of political actors in Spain. There are public institutions that are working with forest biomass and they do not see special interest in research in agricultural biomass because they assume that its properties are worst and in general, it has lower quality.

As an exception, the Basque Country has included on the public institutions agenda the promotion and use of agricultural wastes (with specific financing available). The use of pruning could significantly advance if the experiences and pilot projects that are currently being developed show good possibilities. There are therefore some promotional initiatives that can be extrapolated to other Regions. This promotion of the use of agricultural biomass has been framed within the prevention of fires and its combination with the forest biomass for energy use in public facilities. On the other hand, in Regions where olive and vineyard sectors play a significant role, the use of APPR biomass could be a suitable option for energy generation.

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E. Summarise a basic SWOT analysis

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SWOT Analysis

The following section includes a SWOT analysis. Firstly, the main Strengths, Weaknesses, Opportunities and Threats affecting APPR biomass development have been listed. For carrying out this analysis, APPR biomass sector should be considered as reference. However, this sector does not exist because there is no an extended use of the APPR biomass. Hence, the agriculture sector and the wine, olive and fruit transformation agro-industrial sector have been chosen as reference sectors. In addition, ESCOs and potential consumers have been also included in the analysis.

To this context, Weaknesses and Strengths are all inherent characteristics to the analyzed sector. On the other hand, Threats and Opportunities are all external factors to the sector conditioning APPR biomass sector development.

STRENGTHS

- S1. APPR biomass minimize greenhouse gas emissions regarding fossil fuels and even another biomass types (there are no impacts due to changes in the land use or biomass production).
- S2. The energy use of pruning can produce savings to the farmers in the management of APPR residues.
- S3. Agriculture is a strong sector in Spain with a high potential for dialogue and negotiation with the Government.
- S4. The wine, fruit and olive oil agro-industries are potential APPR biomass consumers promoting circular economy concept and self-consumption of their residues.
- S5. APPR biomass harvesting is seasonal depending on the species. A combination of biomass coming from different species can enlarge the operation time through the year.
- S6. Social and institutional acceptance: APPR biomass energy use acknowledged as rural job creator.
- S7. Proximity sense: APPR biomass intangible profit is better understood in local frame (e.g.: good practices regarding open-air firing).
- S8. Proximity to the APPR biomass source of consumers such as farms, fodder industries, local councils, etc.
- S9. Boilers suitable for APPR biomass consumption can use other different types of biomass. This fuel flexibility increases the supply security for the users.
- S10. Since there already exist different value chains for olive pit, olive pomace, grape pomace, grape skins after distillery, grape pit, peach stone or almond shells distribution, it is easier to create new value chains for APPR biomass.
- S11. Short Pay-back periods for biomass facilities for heating (depending on fossil fuels prices).

WEAKNESSES

- W1. Machinery for pruning harvesting (barely known, usually needing developed for a good and fast pruning harvesting).
- W2. Lower fuel quality than forest chip, olive pomace and pit, etc. (dust emission, combustion problems).
- W3. APPR biomass is not regulated and standardized (reduce confidence in the consumer, there is no reference for producers).
- W4. There are less combustion technologies than for other types of biomass.

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- W5. There are few specific facilities for APPR biomass consumption (just in Andalucia, in the south of Spain).
- W6. In general, APPR biomass energy potential and feasibility is unknown for the agriculture, energy sector and public sectors.
- W7. It is difficult to get private financing for APPR biomass projects development since there is a high uncertainty.
- W8. Value chain costs are high and the profitability of APPR biomass concept is quite tight.
- W9. APPR biomass is widely spread in territory therefore, logistic is more complex and value chain has a higher impact in costs.
- W10. Amount of biomass per hectare is lower than biomass in forestry exploitations. The risk to incur in cost overrun is higher.
- W11. There is not enough market for non conventional biomass.
- W12. There exists informal economy in the agriculture sector that can limit the emergence and development of ESCOs (funds for machinery are for own using, not for services to possible other clients).
- W13. Other renewable energies are higher in priority than biomass in Spain.
- W14. The National Energy Plan does not explicitly take into account the APPR biomass or promotion measures.
- W15. Farmer is focused on production and it is not concerned about the residue management.
- W16. There are not many ESCOs in Spain with experience in APPR biomass harvesting.
- W17. There is not a good knowledge in the agriculture sector about biomass energy facilities.
- W18. Energy sector and agriculture sector are far and there is not good understanding at all levels: companies, individuals, representatives, etc.
- W19. Energy sector does not understand the necessities of the agriculture sector (and vice versa).
- W20. Energy sector cannot influence in agrarian politics (and vice versa). It is very difficult to promote clusters and coordinated actions in order to promote APPR biomass.

OPPORTUNITIES

- O1. High APPR energy potential in Spain (5 million tons of dry matter per year).
- O2. Number of District Heating facilities is increasing every year in Spain (local council promotion).
- O3. ESCOs with interest in APPR projects and very capable to carry them out.
- O4. Wine sector produces CO₂. APPR biomass use can contribute to show a good image of the mark and in general of the sector by promoting efficiency and sustainability.
- O5. Fossil fuel prices are expected to raise (end 2017).
- O6. There exist quality seals for ESCOs carrying out a good and with quality work, that can give visibility to these companies in the APPR biomass sector.
- O7. Savings thanks to APPR biomass energy use in agriculture facilities.
- O8. Potential promotion to increase the biomass thermal objectives in the new Renewable Energy Directive and subsequent plans.
- O9. New rural development plans that promote and regulate the APPR biomass energy use.
- O10. More restrictive environmental politics in order to forbid the open-air fires in the near future.
- O11. Emission reduction requirement for the renewable energies (80% up to 2025 and 85% from 2026). This circumstance gives some chances for APPR biomass versus other types of biomass.
- O12. There is financing mechanisms for novel products and services development at local and national level (Leader Funds, Feader Funds, National RTD Plans, etc.).
- O13. Development of the specifications for an APPR biomass (olive and vineyard) standard creation within BIOMASUD project.
- O14. European impulse to the circular economy, pact of Spain already signed (an opportunity for developing promotion mechanisms for APPR biomass energy use).

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THREATS

- T1. Renewable Energies promotion without segmentation by type of energy (for instance, new European Directive does not set objectives by type of energy, otherwise globally).
- T2. Spanish Administration prefers to support other competitor sectors (natural gas network development during the 90s or another renewable energy instead of biomass).
- T3. Instability in politics, regulatory and economic frame: there are no medium/long term clear politics.
- T4. More restrictions in emissions can make more difficult to use APPR biomass in medium-size facilities (Directive 2015/2193 transposition December 19th, 2017).
- T5. Regarding emission limits in small-size combustion facilities (<50kWth) by eco-design regulation application, APPR biomass development is in danger if it is considered as “wood” since, particles emission levels requested are really low (attainable with forestry wood, not with most of agro-biomass).
- T6. Legislation could consider APPR as a residue, not as biomass (because of metals and inorganics content coming from phytosanitary treatments).
- T7. Too high expectations (try to avoid confusions between theoretical potential or technical potential, economic and usable).
- T8. Cultivated area reduction because of climate change and droughts.
- T9. Potential regression of the sector because of funds reduction to the agriculture, loss of competitiveness and relocation of the fruit, olive and grape production.
- T10. Very low prices for other agriculture wastes with very poor quality (even contaminated). Their use in combustion facilities must be controlled and/or avoided.
- T11. Informal economy by individuals providing services without permissions: can cut private initiative.
- T12. New companies without experience designing and erecting failed facilities (bad press and bad experience for APPR biomass).
- T13. Social rejection to new types of fuels or novel technology.
- T14. Alternative uses or measures promotion (soil amendment).
- T15. Seasonal variation of the biomass price (speculation) and yearly variation (depending on consumption and oil price).

Uncertainty and risk are the constant in the weaknesses and threats definition because of there are no success cases or models to follow. In addition, low oil price is another remarkable factor. They have not been considered as individual factors since they are the result of the current situation.

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Strategic Plan

① TO PROMOTE CLOSENESS BETWEEN AGRARIAN AND ENERGY SECTORS Strategy: Weakness + Opportunity → WO “Reorientation”	
W18. Energy sector and agriculture sector are far and there is not good understanding at all levels. W17. There is not a good knowledge in the agriculture sector about biomass energy facilities. W19. Energy sector does not understand the necessities of the agriculture sector (and vice versa). W20. Energy sector cannot influence in agrarian politics (and vice versa). It is very difficult to promote clusters and coordinated actions in order to promote APPR biomass.	O1. High APPR energy potential in Spain O7. Savings thanks to APPR biomass energy use in agriculture facilities. O9. New rural development plans that promote and regulate the APPR biomass energy use.
Objectives WO1. To promote the closeness between the agrarian and the Energy sectors in order to get an actual understanding, high potential collaboration and to avoid bad experiences.	
Actions / Activities - Promotion of the collaboration between agrarian entities with biomass experience and/or Energy supply systems, and ESCOs (to obtain biomass advice). - Diffusion and transfer campaigns to let the agrarian sector see an overall view of the biomass value chain: operation, role, profits, with the aim of understanding the needs and situations of ESCOs, biomass suppliers, intermediaries. - Sensitize energy sector to farmers’ needs and priorities with the aim of increasing their awareness of agrarian sector and finding synergies. - Transfer of actual cases by means of brochures, specific campaigns and facilities visits with the aim of showing value chain and actors involved for a better understanding and new value chains designing. - New specific agro-biomass networks to share the opinion and knowledge of the farmers, cooperatives, ESCOs, forestry companies, etc. - Collaboration clusters creation where farmers, agro-industries and ESCOs can work together.	

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② TO INFORM TO THE FARMER ABOUT THE REMOVAL AND ENERGY USE OF APPR	
Strategy: Weakness + Opportunity → WO “Reorientation”	
W1. Machinery for pruning harvesting (barely known, poorly developed for a good and fast pruning harvesting). W4. There are less combustion technologies than for other types of biomass. W6. In general, APPR biomass energy potential and feasibility is unknown for the agriculture sector, energy sector and public. W15. Farmer is focused on production and it is not concern about the residue management. W16. There are almost no ESCOs in Spain with experience in APPR biomass harvesting. W17. There is not a good knowledge in the agriculture sector about biomass energy facilities.	O3. ESCOs with interest in APPR projects and very capable to carry them out. O6. There exist quality seals for ESCOs carrying out a good and with quality work that can give visibility to these companies in the APPR biomass sector. O7. Savings thanks to APPR biomass energy use in agriculture facilities. O10. More restrictive environmental politics in order to forbid the open-air fires in the near future. O14. European impulse to the circular economy, pact of Spain already signed.
Objectives WO1. To supply to farmers and agro-industry the info about technologies and methods for pruning and plantations removal from field. WO2. To supply to farmers and agro-industry the info about technologies for APPR biomass energy use.	
Actions / Activities • Campaign for providing visibility to companies with interest and capacity for joint ventures to start APPR biomass value chains. • To provide more information to farmers and agrarian technicians in order to improve their knowledge about new harvesting ways and their costs. • To transfer already exists technologies to the agrarian sector for using pruning wastes: combustion and composting. • To create experts networks, technicians or consultants capable of advising and orientating the farmers. • To create farmers networks for experiences sharing.	

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③ TO INFORM TO THE FARMER ABOUT APPR BIOMASS ENERGY USE SUSTAINABILITY	
Strategy: Strength + Opportunity → SO “Attacking”	
S1. APPR biomass minimize greenhouse gas emissions regarding fossil fuels and even another biomass types. S4. The wine, fruit and olive oil agro-industries are potential APPR biomass consumers promoting circular economy concept and self-consumption of their residues. S7. Proximity sense: APPR biomass intangible profit is better understood in local frame.	O4. Wine sector produces CO2. APPR biomass use. O10. More restrictive environmental politics in order to forbid the open-air fires in the near future. O11. Emission reduction requirement for the renewable energies (80% up to 2025 and 85% from 2026). O14. European impulse to the circular economy, pact of Spain already signed (an opportunity for developing promotion mechanisms for APPR biomass energy use).
Objectives SO1. To supply the farmers the information about the APPR biomass energy use sustainability.	
Actions / Activities - Evaluation and dissemination of the potential energy and emissions savings regarding fossil fuels. - Preparation and transfer of guidelines about the low value of APPR as fertilizer. - Preparation and transfer of good practices including knowledge about the APPR use as soil amendment: to know when is positive and to know the potential risks. - To prepare workshops for guidelines, messages and good practices dissemination. - Dissemination of handbooks, dossiers and guidelines by agrarian associations, agro-industries and cooperatives.	

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④ TO PROMOTE THE CHANGE FROM INSTITUTIONS Strategy: Strength + Threat → ST “Defense”	
S3. Agriculture is a strong sector in Spain with a high potential for dialogue and negotiation with the Government. S6. Social and institutional acceptance: APPR biomass energy use as rural job creator. S9. Boilers suitable for APPR biomass consumption can use other different types of biomass. This fuel flexibility increases the supply security for the users. S11. Short Pay-back periods for biomass facilities for heating (depending on fossil fuels prices).	T1. Renewable Energies promotion without segmentation by type of energy. T2. Spanish Administration prefers to support other competitor sectors. T3. Instability in politics, regulatory and economic frame: there are no medium/long term clear politics. T13. Social rejection to new types of fuels or novel technology.
Objectives ST1. To achieve that Institutions and Public Administration promote the change in the APPR management by representative actions. ST2. To encourage promotion mechanisms from institutions supporting the APPR biomass energy use: incentives, Green Public Procurement, etc.	
Actions / Activities - To demand institutions to give example in their environmental actions, biomass management, etc. in order to minimize the open-air firing of wastes. - To align institutions in order to bet for a sustainable waste management. - To provide institutions with already exist models and examples of tenders prioritizing biomass and agricultural wastes use in high potential areas. - To include the collection of APPR biomass wastes within institutions responsibility (not only MSW, water, etc.). - To include more promotion of multifuel biomass facilities capable of APPR biomass using to show the feasibility.	

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⑤ TO GIVE VISIBILITY TO THE BENEFITS OF APPR BIOMASS ENERGY USE AND THE OPPORTUNITIES FOR THE FARMERS	
Strategy: Strength + Opportunity → SO “Attacking”	
S1. APPR biomass minimize greenhouse gas emissions regarding fossil fuels and even another biomass types. S2. The energy use of pruning can produce savings to the farmers in the management of APPR residues. S3. Agriculture is a strong sector in Spain with a high potential for dialogue and negotiation with the Government. S8. Proximity to the APPR biomass source of consumers such as farms, fodder industries, local councils, etc. S11. Short Pay-back periods for biomass facilities for heating (depending on fossil fuels prices).	O5. Fossil fuel prices are expected to raised (end 2017). O7. Savings thanks to APPR biomass energy use in agriculture facilities. O8. Promotion to increase the biomass thermal objectives in the new Renewable Energy Directive and subsequent plans. O9. New rural development plans that promote the APPR biomass energy use. O12. There is financing mechanisms for novel products and services development at local and national level (Leader Funds, Feader Funds, RTD National Plans, etc.). O14. European impulse to the circular economy, pact of Spain already signed.
Objectives SO1. To show and to transfer to farmers and companies the benefits of APPR biomass energy use and the potential economical saving. SO2. To provide to potential promoters with information and models to follow, support policies and financing.	
Actions / Activities - To prepare documentation with the potential saving and cost analysis of APPR biomass energy use, including figures and technical data. - To show models for APPR biomass energy use, including value chain feasibility and financing mechanisms. - Dissemination campaigns to show that APPR biomass energy use is feasible. - Dissemination campaigns to show the waste value, potential saving, models and financing (brochures, radio, press, workshop). - Dissemination of the APPR biomass energy use for heating: it is an old practice but now, it is more technological. - To transfer to the sector the need for transition in the waste management: waste producer can obtain savings but he needs to adapt residues management with more employees (e.g., collecting service).	

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⑥ DEVELOPMENT OF R+D+i IN TECHNOLOGY

Strategy: Weakness + Opportunity → **WO “Reorientation”**

W1. Machinery for pruning harvesting barely known.	O2. Number of District Heating facilities is increasing every year in Spain (local council promotion).
W2. Lower fuel quality than forest chip, olive marc and pit, etc. (dust emission, combustion problems).	O5. Fossil fuel prices are expected to raised (end 2017).
W4. There are less combustion technologies than for other types of biomass.	O8. Promotion to increase the biomass thermal objectives in the new Renewable Energy Directive and subsequent plans.
W5. There are few specific facilities for APPR biomass consumption.	O12. There is financing mechanisms for novel products and services development at local and national level (Leader Funds, Feader Funds, RTD National Plans, etc.).
W20. Energy sector cannot influence in agrarian politics (and vice versa). It is very difficult to promote clusters and coordinated actions in order to promote APPR biomass.	

Objectives

- WO1. Development and improvement of the APPR biomass energy use technology: combustion systems, gas cleaning and improvement of fuel quality to use APPR biomass in a clean and efficient way (with special attention to small and medium size facilities).
- WO2. Development and improvement of the APPR biomass harvesting and handle technologies: balers, shredders, chippers to upgrade the quality of the final product, make easier the handle of the biomass and reduce costs.

Actions / Activities

- To elaborate a state-of-the-art and main requirements for the APPR biomass energy use and treatment technologies.
- To promote the development of the biomass treatment technologies (dry, pyrolysis, torrefaction, etc.) with the target of improving APPR biomass properties.
- To promote new adapted and proved boilers for using different types of APPR biomass.
- To develop cost-effective dust removal systems.
- To elaborate a state-of-the-art and main requirements for the APPR biomass harvesting technologies.
- To promote novel technologies for APPR biomass harvesting.

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⑦ SPECIAL TAX IMPOSING AND SUPPORTING MEASURES FOR APPR BIOMASS Strategy: Weakness + Threat → WT “Surviving”	
W7. It is difficult to get private financing for APPR biomass projects development since there is a high uncertainty. W8. Value chain costs are high and the profitability of APPR biomass concept is quite tight. W10. Amount of biomass per hectare is lower than biomass in forestry exploitations. The risk to incur in cost overrun is higher. W11. There is not enough market for non conventional biomass.	T4. More restrictions in emissions can make more difficult to use APPR biomass in medium-size facilities. T9. Potential regression of the sector because of funds reduction to the agriculture, loss of competitiveness and relocation of the fruit, olive and grape production. T10. Very low prices for other agriculture wastes with very poor quality (even contaminated). T14. Alternative uses or measures promotion (soil amendment).
Objectives WT1. To improve the profit margin since it is currently so adjusted that a minor change in taxes can serve as an incentive for promoting APPR biomass energy use.	
Actions / Activities • Financing the installation of dust removal systems in medium size facilities using APPR biomass. • To promote Green taxes for fossil fuels, in order to improve the profitability of APPR biomass facilities. • VAT removal or reduction for biomass that need promotion. • Tax reduction for the agrarian good practices regarding residues management. • To promote supporting and financing measures to the entrepreneurship of APPR biomass management.	

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⑧ TO PROMOTE POLITICS THAT CREATE A STABLE FRAME PRO APPR BIOMASS DEVELOPMENT	
Strategy: Weakness + Opportunity → WO “Reorientation”	
W1. Machinery for pruning harvesting (barely known, poorly developed for a good and fast pruning harvesting). W2. Lower fuel quality than forest chip, olive marc and pit, etc. (dust emission, combustion problems). W3. APPR biomass is not regulated and standardize (reduce confidence in the consumer, there is no reference for producers). W4. There are less combustion technologies than for other types of biomass. W8. Value chain costs are high and the profitability of APPR biomass concept is quite tight. W9. APPR biomass is widely spread in territory therefore, logistic is more complex and value chain has a higher impact in costs. W10. Amount of biomass per hectare is lower than biomass in forestry exploitations. The risk to incur in cost overrun is higher. W16. There are almost no ESCOs in Spain with experience in APPR biomass harvesting.	O1. High APPR energy potential in Spain (5 million tons of dry matter per year). O8. Potential promotion to increase the biomass thermal objectives in the new Renewable Energy Directive and subsequent plans. O9. New rural development plans that promote and regulate the APPR biomass energy use. O11. Emission reduction requirement for the renewable energies (80% up to 2025 and 85% from 2026). O12. There is financing mechanisms for novel products and services development at local and national level (Leader Funds, Feader Funds, National RTD Plans, etc.). O14. European impulse to the circular economy, pact of Spain already signed.
Objectives	
WO1. To promote a more favorable frame for APPR biomass development due to its intangible benefits (rural development, emissions reduction, etc.)	
Actions / Activities	
- Value chain cost evaluation in order to identify the needs and promotion potentials for each agro-biomass. - Programs for machinery acquisition for APPR biomass collection. - Promotion and support tools for logistics centres creation and for biomass transfer at local level. - Influence campaign in order to include APPR biomass in energy policy as renewable energy (end-user incentives, bonus, etc.). - Entrepreneurship policy and priorities inclusion in rural development plans to give specific support to services companies to find more attractive APPR biomass harvesting option.	

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- R+D Programs promotion for agro-biomass technology: harvesting and treatment, small and medium size combustion technologies and gas cleaning systems.
- Specific measures to the heat production with agro-residue instead of the one produced with forestry biomass.

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⑨ TO TAKE ADVANTAGE OF THE INTANGIBLE VALUES OF APPR BIOMASS AS AN STRENGTH TO PROMOTE ITS USE	
Strategy: Strength + Opportunity → SO “Attacking”	
S1. APPR biomass minimize greenhouse gas emissions regarding fossil fuels and even another biomass types. S2. The energy use of pruning can produce savings to the farmers in the management of APPR residues. S3. Agriculture is a strong sector in Spain with a high potential for dialogue and negotiation with the Government. S4. The wine, fruit and olive oil agro-industries are potential APPR biomass consumers promoting circular economy concept and self-consumption of their residues. S6. Social and institutional acceptance: APPR biomass energy use as rural job creator. S7. Proximity sense: APPR biomass intangible profit is better understood in local frame. S8. Proximity to the APPR biomass source of consumers such as farms, fodder industries, local councils, etc.	O1. High APPR energy potential in Spain (5 million tons of dry matter per year). O4. Wine sector produces CO2. APPR biomass use can contribute to show a good image of the mark and in general of the sector by promoting efficiency and sustainability. O9. New rural development plans that promote and regulate the APPR biomass energy use. O10. More restrictive environmental politics in order to forbid the open-air fires in the near future. O14. European impulse to the circular economy, pact of Spain already signed.
Objectives SO1. To promote APPR biomass energy use by giving visibility to the intangible values regarding its use for energy production. SO2. To encourage the contact between local actors to take advantage of the intangible values of the APPR biomass as a new initiatives driving force.	
Actions / Activities - To identify and to communicate APPR biomass advantages, not only regarding exploitation costs but also vegetable health, fire risk reduction, etc. - To quantify intangible value of APPR biomass for dissemination and for politicians. - To propose taxes modification and support for CO2 emissions reduction. - To promote by Rural Development Plans since APPR residues management can be considered as a local job creator. - To incorporate to the farm income the tangible and intangible benefits of the APPR biomass energy use to obtain fiscal benefits, deductions, etc. - Promotion mechanisms for biomass facilities that internalize their social and environmental benefits.	

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⑩ TO TAKE ADVANTAGE OF SYNERGY WITH AGRO-INDUSTRY AND AGRICULTURAL SERVICES COMPANIES	
Strategy: Strength + Opportunity → SO “Attacking”	
S4. The wine, fruit and olive oil agro-industries are potential APPR biomass consumers promoting circular economy concept and self-consumption of their residues. S5. APPR biomass harvesting is seasonal depending on the species. A combination of biomass coming from different species can enlarge the operation time through the year. S10. Since there already exist different value chains for olive pit, olive pomace, grape pomace, grape pit, peach stone or almond shell distribution.	O4. Wine sector produces CO2. APPR biomass use can contribute to show a good image of the mark and in general of the sector. O8. Potential promotion to increase the biomass thermal objectives in the new Renewable Energy Directive and subsequent plans. O9. New rural development plans that promote and regulate the APPR biomass energy use. O12. There is financing mechanisms for novel products and services development at local and national level (Leader Funds, Feader Funds, RTD National Plans, etc.).
Objectives	
SO1. To take advantage of synergy with agro-industry and agricultural services companies, promoting the activities diversification and making use of their facilities, equipment and employees for APPR biomass management.	
Actions / Activities	
• Campaign to transfer business models to Agricultural Services Companies and agro-industry. • Matchmaking activities between farmers, agro-industry and Agricultural Services Companies in order to promote new APPR biomass initiatives. • Programs supporting innovation and competitiveness that include APPR biomass as an action line. • To promote facilities consuming agro-biomass in the agro-industry sector.	

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⑪ TO PROMOTE A NEW BIOMASS MARKET WITH AN ACTIVE PARTICIPATION OF THE APPR BIOMASS	
Strategy: Weakness + Opportunity → WO “Reorientation”	
W2. Lower fuel quality than forest chip, olive marc and pit, etc. (dust emission, combustion problems). W3. APPR biomass is not regulated and standardize (reduce confidence in the consumer, there is no reference for producers). W5. There are few specific facilities for APPR biomass consumption W11. There is not enough market for non conventional biomass. W12. There exists informal economy in the agriculture sector that can limit the emergence and development of ESCOs.	O2. Number of District Heating facilities is increasing every year in Spain (local council promotion). O6. There exist quality seals for ESCOs carrying out a good and with quality work, that can give visibility to these companies in the APPR biomass sector. O8. Potential promotion to increase the biomass thermal objectives in the new Renewable Energy Directive and subsequent plans. O9. New rural development plans that promote the APPR biomass energy use. O13. Development of the specifications for an APPR biomass (olive and vineyard) standard creation.
Objectives WO1. To create a stable market for APPR biomass (new installations or APPR biomass ready installations). WO2. To promote the conditions to favor the APPR biomass penetration in the market.	
Acciones / Actividades - To sensitize local councils, ESCOs and agro-industries with the aim of increasing APPR biomass facilities for heating (district heating increase). - To encourage the recognition of APPR biomass as one of the rural development driving forces. - To encourage a prices transparency with the aim of increasing market stability (market observatory, suppliers networks), etc. - To support the creation of agricultural residues market (platforms as Biobusca, to include in biomass suppliers catalogues). - To transfer to the value chain actors the good practices in the APPR biomass management in order to assure the fuel quality and a stable composition. - To promote the use of quality standards and tracking systems in order to assure the APPR biomass quality. - To encourage the recognition of APPR biomass using as an economically attractive activity with the aim of harvesting services, commercialization and reduction of informal economy.	

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⑫

LEGISLATION FOLLOW UP AND ACTIONS FOR APPR BIOMASS INCLUDING IN ENERGY OR ENVIRONMENTAL PLANS OR NEW REGULATION

Strategy: Weakness + Threat → WT “Surviving”

W2. Lower fuel quality than forest chip, olive marc and pit, etc. (dust emission, combustion problems). W3. APPR biomass is not regulated and standardize (reduce confidence in the consumer, there is no reference for producers). W13. Other renewable energies are higher priority than biomass in Spain. W14. The National Energy Plan does not explicitly take into account the APPR biomass or promotion measures. W18. Energy sector and agriculture sector are far and there is not good understanding at all levels: companies, individuals, representatives, etc.	T1. Renewable Energies promotion without segmentation by type of energy. T2. Spanish Administration prefers to support other competitor sectors. T3. Instability in politics, regulatory and economic frame: there are no medium/long term clear politics. T4. More restrictions in emissions can make more difficult to use APPR biomass in medium-size facilities. T5. Regarding emission limits in small-size combustion facilities (<50kWth) by eco-design regulation application, APPR biomass development is in danger if it is considered as “wood” since, particles emission levels are really low. T6. Legislation could consider APPR as a residue, not as biomass (because of metals and inorganics content coming from phytosanitary treatments). T7. Too high expectations (try to avoid confusions between theoretical potential or technical potential, economic and usable). T14. Alternative uses or measures promotion (soil amendment).

Objectives

- WT1. To monitor the development of new European and National legislation to avoid that APPR biomass stays out of biomass market.
- WT2. To activate sector interest to make them to influence in politicians for pushing them to act when an APPR biomass limitation appears in legislation or new regulations.

Actions / Activities

- To follow up boilers and emissions Ecodesign Directives in order to take into account APPR biomass in a specific way (not only as pellet or wood regulation).
- To avoid that APPR biomass could be considered as Wood in legislation since regulation would more restrictive in comparison with other agriculture biomass residues.
- To follow up new Energy and Climate Plans (2021-2030) in order to include potential data, requirements and measures for APPR biomass promotion.
- To follow up new CAP policy and Rural Development policy with the aim of including agro-residues as a strategic line for rural development, bio-economy and circular economy.

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- To follow up new CAP policy to recognize APPR biomass energy use in the conditionality for greening measures.
- To sensitive politicians and sector actors (agriculture and energy lobbies) about the possible threats.
- To favor the aggrupation of agriculture and energy lobbies around support declarations of APPR biomass energy use.
- To look after a clear separation between APPR and forestry biomass and to make strategies to request reviews or transition disposals for agro-residues regulation application.
- To prepare a memorandum in defense of APPR biomass and specific proposals for influent policies.

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⑬ TO ENCOURAGE LOCAL RESPONSIBILITY AND CONTROL OF ILLEGAL PRACTICES THAT CAN DAMAGE APPR BIOMASS ENERGY USE IMAGE AND FUTURE DEVELOPMENT	
Strategy: Strength + Threat → ST “Defense”	
S3. Agriculture is a strong sector in Spain with a high potential for dialogue and negotiation with the Government. S7. Proximity sense: APPR biomass intangible profit is better understood in local frame (good practices regarding open-air firing). S8. Proximity to the APPR biomass source of consumers such as farms, fodder industries, local councils, etc.	T10. Very low prices for other agriculture wastes with very poor quality (even contaminated). Their use in combustion facilities must be controlled and/or avoided. T11. Informal economy by individuals providing services without permissions: can cut private initiative. T12. New companies without experience designing and erecting failed facilities (bad press and bad experience for APPR biomass). T14. Alternative uses or measures promotion (soil amendment). T15. Seasonal variation of the biomass price (speculation) and yearly variation (depending on consumption and oil price).
Objectives ST1. To encourage awareness, confidence and proximity between actors and local people to remove any speculation threats (uncontrolled burning, residues with pollutants use in boilers, etc.). ST2. To encourage the surveillance and the responsibility in the residues management, agronomic practices and a right use of biomass.	
Actions / Activities - To identify the threats and the bad practices that can limit APPR biomass local use: speculation, informal economy, open-air firing permissiveness, following up conditionality measures application, etc. - Awareness campaigns to show local benefits of agro-residues using, and the threats regarding personal interests that can seriously damage APPR biomass energy use. - To increase the control of local authorities to avoid punishable practices that can seriously damage APPR biomass energy use. - Awareness and communication local campaigns to inform about specific technologies for APPR biomass energy use, competent installers and the development of a local APPR biomass market.	

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A workshop was held in Valladolid, as part of the Expobiomasa congress that took place from September 26th to 29th, 2017. This workshop was attended by farmers, cooperatives and agro-industry from the olive, wine and fruit sector, companies of agricultural services, manufacturers of biomass processing machinery, boiler installers and energy service companies, councils, responsible for regions development and environment, local action groups and potential biomass consumers (agro-industry, livestock sector, public administrations, etc.). We would like to thank all of them for their active participation.

Within Task T3.1 (beneficiaries selection), contacts have been made with farmers, entrepreneur companies and local councils, as well as with other actors. Although the purpose of these meetings was analyze the conditions to launch new APPR biomass exploitation chains, the dialogue has served to gather ideas and data that have been incorporated into this document. The vision provided by all of them is appreciated here.

On February 23rd, a visit was made to Vilafranca del Penedés, together with several sector agents from Aragon, in order to learn more about this initiative. We thank the City Council of Vilafranca del Penedés, specifically Mr. Jordi Cuyás (responsible for Strategic Projects) and Ms. Laura Carbo (Environmental Technician) for their reception. Their impressions, as well as those of the assistants, have been taken into account for this analysis. We also thank Bodegas Torres, Nou Verd, and Monreser S.L. for sharing their points of view.

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Fernando Santiso, President	Unión Biomasa Andalucía (Huelva)	Biomass sector agents representation.
Gregor Baer	Heizomat (Alicante)	Boiler manufacturer.
Jerónimo González Cortés, Biomass and bio-products Department	CICYTEX - Centro de Investigaciones Científicas y Tecnológicas de Extremadura. Instituto de Investigaciones Agrarias (Badajoz)	Research centre supporting rural development and biomass
Jordi Cuyás Soler, Strategic Projects Coordinator.	Ayuntamiento de Vilafranca del Penedés (Barcelona)	Public Administration, APPR biomass success case.
Susana Rivera, Services, Quality & Innovation Department.	Cooperativas agro-alimentarias España (Madrid)	Food Cooperatives Association and rural sector representation.

Note: CIRCE still needs to gather the official permission of these persons to be publicly acknowledged. We will solve before publishing D2.2

ANNEX A2

WP2 – Task T2.3

Desarrollo de un análisis del sector de biomasa de PARP (podas agrícolas y renovación de plantaciones) y desarrollo de un plan estratégico nacional - ESPAÑA

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A. Marco nacional para la biomasa de PARP

España, es un país soberano miembro de la Unión Europea, está organizado en diecisiete comunidades autónomas y dos ciudades autónomas, formadas estas, a su vez, por cincuenta provincias.

Se encuentra situado al sur de Europa Occidental, al norte de África. En Europa ocupa la mayor parte de la península ibérica, conocida como España peninsular, y el archipiélago de las islas Baleares (en el mar Mediterráneo occidental); en África se hallan las ciudades de Ceuta y Melilla, las islas Canarias (en el océano Atlántico nororiental), las islas Chafarinas (mar Mediterráneo), el peñón de Vélez de la Gomera (mar Mediterráneo), las islas Alhucemas (golfo de las islas Alhucemas), y la isla de Alborán (mar de Alborán).



Figura 1. Mapa político de España

Tiene una extensión de 505.370 km², siendo el cuarto país más extenso del continente, tras Rusia, Ucrania y Francia. Con una altitud media de 650 metros sobre el nivel del mar es uno de los países más montañosos de Europa. Su población es de 46.468.102 habitantes (2016). El territorio peninsular comparte fronteras terrestres con Francia y con Andorra al norte, con Portugal al oeste y con el territorio británico de Gibraltar, al sur. En sus territorios africanos, comparte fronteras terrestres y marítimas con Marruecos.

La agricultura emplea actualmente solo el 5 % de la población activa. Los principales cultivos son trigo, cebada, remolacha azucarera, maíz, patatas, centeno, avena, arroz, tomates y cebolla. El país tiene también extensos viñedos y huertos de cítricos y olivos. En lo que respecta a estos cultivos leñosos, la Tabla 1 recoge las superficies de cultivo en España así como las hectáreas de arranques en 2015 para cada especie, conforme a los datos presentados en el Anuario Estadístico del Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente (datos de los años 2015).

La figura 2 muestra la distribución espacial de los principales cultivos en España. El mapa se ha realizado con el software QGIS 2.14.0 – Essen. Las coberturas de cultivos se basan en datos de Corine Land Cover

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2006 (v17, de 2014), descargadas de la Agencia Europea del Medioambiente. El uso “indeterminado” se corresponde con la Clase de Corine 241 “Cultivos anuales asociados con cultivos permanentes”, indicando presencia de cultivo permanente, sin especificar el tipo.

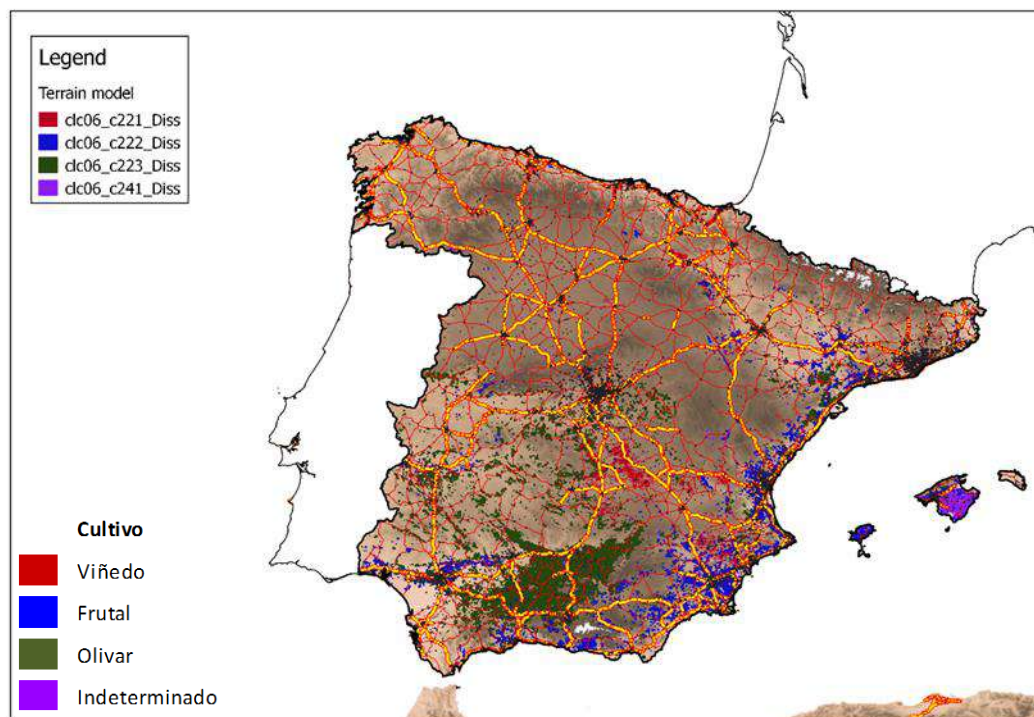


Figura 2. Mapa de distribución espacial de los principales cultivos en España

Al observar la tabla 1 por especies, se puede apreciar importantes superficies de olivar, viñedo y almendro principalmente. Las plantaciones de olivar comprenden la mayor extensión de cultivo con diferencia, en torno a 2 millones y medio de hectáreas, más del doble de la superficie dedicada a viñedos, alrededor de 1 millón de hectáreas, segundo cultivo leñosos del país. Finalmente, el tercer cultivo por superficie, es el del almendro con un total superior al medio millón de hectáreas. Dentro del grupo de los cítricos, el naranjo y mandarino ocupan entre ambos, aproximadamente 260.000 hectáreas. En cuanto a las hectáreas de arranques y renovación de plantaciones, mayoritariamente se llevan a cabo en viñedo, plantaciones de almendro, y ya en menor medida, olivar y cítricos.

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Tabla 1. Superficies (ha) por especie de cultivos permanentes de leñosos agrícolas en España (Anuario Estadístico 2016 del Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente)

Superficies 2015 (hectáreas)				
	Secano	Regadío	TOTAL	Arranques
Cítricos				
Naranja			145.862	4.070
Mandarino			111.467	5.329
Limonero			38.363	168
Pomelo			1.976	74
Otros			1.056	537
TOTAL Cítricos			298.724	10.178
No cítricos				
Frutales pepita				
Manzano	12.197	18.524	30.721	341
Peral	1.066	21.812	22.878	527
Frutales hueso				
Albaricoquero	2.371	16.451	18.822	611
Cerezo	15.375	11.115	26.490	245
Melocotonero	4.030	82.476	86.506	3.243
Ciruelo	2.494	13.570	16.064	1.393
Frutales fruto carnoso				
Higuera	10.561	2.190	12.751	25
Frutales de fruto seco				
Almendro	495.491	53.113	548.604	16.644
Nogal	3.334	5.592	8.926	100
Avellano	5.217	8.084	13.301	390
Castaño	35.120	778	35.898	9
Pistacho	7.642	2.887	10.529	6
TOTAL no cítricos	599.013	296.642	895.655	24.058
Viñedo				
Uva mesa	1.472	12.562	14.034	334
Uva vinificación	714.457	210.912	925.369	27.186
Uva pasa	1.698		1.698	
TOTAL Viñedo	717.627	224.324	941.951	27.520
Olivar				
Aceituna de mesa	110.817	52.597	163.414	957
Aceituna almazara	1.796.847	566.235	2.363.082	5.138
TOTAL olivar	1.907.664	618.832	2.526.496	6.095
TOTAL otros	39.988	1.519	41.507	1.199
TOTAL leñosos agrícolas	3.264.292	1.141.317	4.704.333	69.050

La figura 3 muestra la tendencia de la superficie cultivada por grupos y las hectáreas totales de arranques y renovación de plantaciones, en los últimos 6 años.

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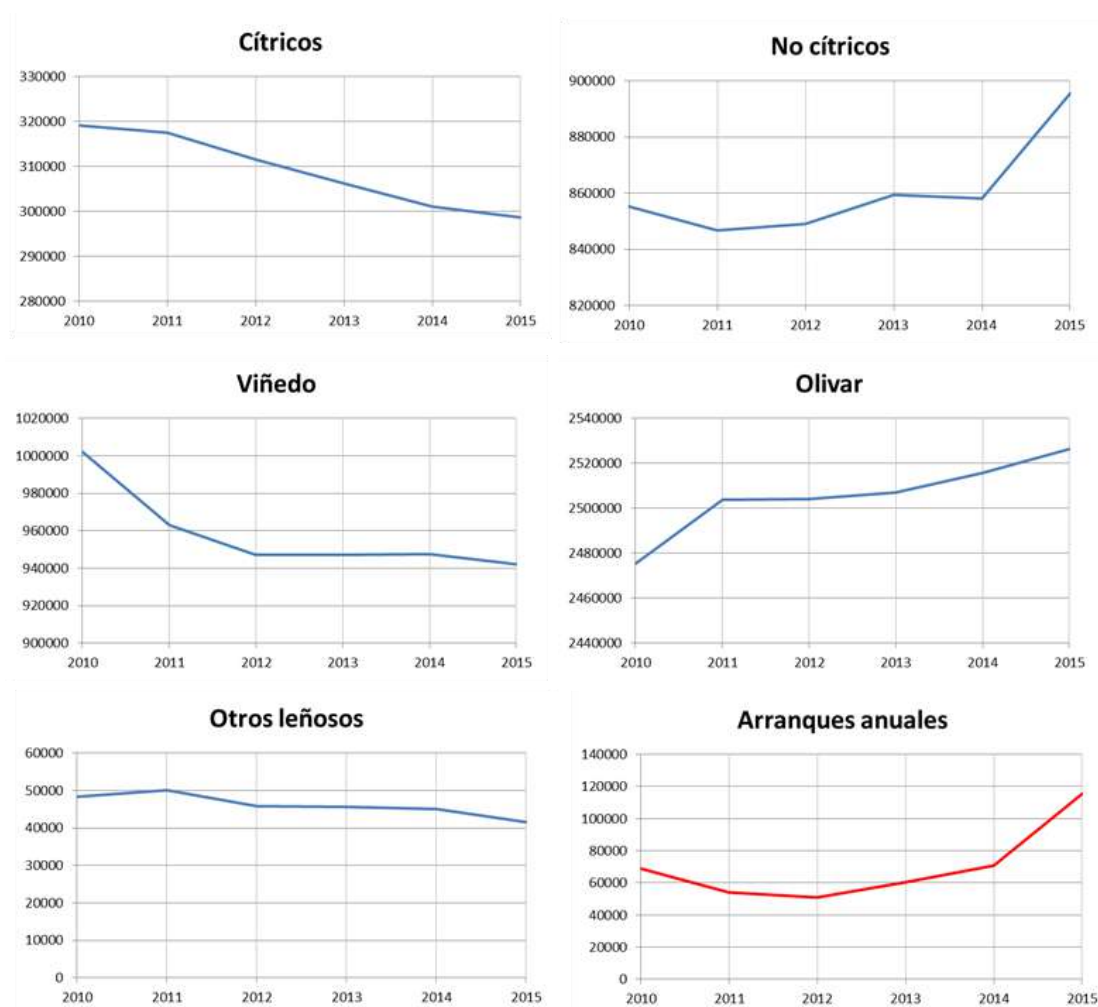


Figura 3. Evolución de las superficies (ha) de cultivo y arranques totales (2010-2015)

Cabe destacar el aumento en la superficie declarada de olivar, en contraposición a un retroceso en la de vid. Las plantaciones de cítricos presentan una tendencia descendente en los últimos cinco años. Los frutales de hueso tienden a aumentar la superficie cultivada, mientras que los de pepita están en un periodo de contracción. El almendro, si bien ha reducido superficie durante los últimos años, he tenido un importante repunte en 2015 de ahí ese incremento observado en la gráfica relativa a los no cítricos, que básicamente corresponde con la variación de superficie de almendro, con nuevas plantaciones entrando en producción. La superficie total de todos los cultivos permanentes en conjunto viene a mantenerse estable, lo que en principio hace prever que el potencial productivo de residuos de podas agrícolas y renovación de plantaciones no esté sujeto a una tendencia al alza o a su paulatina reducción.

En cuanto a las características de las cubiertas del suelo por cultivo leñoso, se puede distinguir entre las distintas técnicas de mantenimiento. La Tabla 2 presenta las técnicas utilizadas por especie de cultivo y por número de hectáreas según la encuesta sobre superficies y rendimientos de cultivos del Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente (2016)

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Tabla 2. Técnicas de mantenimiento del suelo cultivos leñosos (ha) (Encuesta sobre Superficies y Rendimientos de Cultivos del Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente (2016))

Técnicas de mantenimiento del suelo 2016 (hectáreas)															
	Cítricos		No cítricos						Viñedo		Olivar		Otros		TOTAL
			Frutales pepita		Frutales hueso		Otros frutales								
Laboreo tradicional	12.767	4,3%	1.805	3,1%	13.935	9,2%	195.179	22,1%	258.090	26,6%	275.986	10,5%	2.728	6,2%	760.490
Laboreo mínimo	50.687	17,0%	3.101	5,4%	39.843	26,2%	368.837	41,7%	616.272	63,6%	1.040.268	39,7%	14.680	33,2%	2.133.688
Cubierta vegetal espontánea	96.956	32,6%	43.638	76,1%	75.318	49,5%	133.494	15,1%	47.451	4,9%	769.083	29,3%	6.125	13,9%	1.172.065
Cubierta vegetal sembrada	1.001	0,3%	2.903	5,1%	1.317	0,9%	9.663	1,1%	2.028	0,2%	7.009	0,3%	1.293	2,9%	25.214
Cubierta inerte	31.307	10,5%	24	0,0%	1.332	0,9%	13.237	1,5%	2.694	0,3%	44.048	1,7%	644	1,5%	93.286
Sin mantenimiento	20.137	6,8%	3.979	6,9%	6.184	4,1%	131.017	14,8%	38.150	3,9%	172.846	6,6%	14.894	33,7%	387.207
No laboreo	84.393	28,4%	800	1,4%	14.202	9,3%	30.991	3,5%	3.119	0,3%	313.308	11,9%	3.812	8,6%	450.625
Sin información	287	0,1%	1.060	1,8%	108	0,1%	1.497	0,2%	964	0,1%	609	0,0%	36	0,1%	4.561
TOTAL	297.535		57.310		152.239		883.915		968.768		2.623.157		44.212		5.027.136

Laboreo tradicional - Alterar y remover, mediante implementos mecánicos, el perfil del suelo en una profundidad igual o superior a 20 cm.

Laboreo mínimo - Laboreo superficial mediante la utilización de cultivadores, gradas y arado de cincel, cuya profundidad es menor de 20 cm.

Cubiertas vegetales espontáneas - El suelo no recibe labor mecánica alguna, está protegido por una cubierta vegetal espontánea, cuyo crecimiento se controla ya sea de manera mecánica (siega), química (herbicidas) o pastoreo.

Cubiertas vegetales sembradas - El suelo no recibe labor mecánica alguna, está protegido por una cubierta vegetal sembrada de gramíneas (cebada, ballico, bromo, etc) o leguminosas (veas, altramuces, etc), cuyo crecimiento se controla ya sea de manera mecánica (siega), química (herbicidas) o pastoreo.

Cubiertas inertes - El suelo está cubierto de restos de poda, piedras u otros compuestos inertes.

Sin Mantenimiento - El terreno no ha recibido en la última campaña ninguna labor de mantenimiento ni de control de vegetación, ya sea mecánica, química o de pastoreo.

No laboreo - La calle de las plantaciones no recibe labor mecánica alguna, no se mantiene en ningún momento cubierta vegetal y suelen aparecer problemas de compactación.

Frente a otras técnicas, predomina el laboreo mínimo o la cubierta vegetal espontánea. En algunas plantaciones se llevan a cabo tareas más complejas enmarcadas dentro del grupo de laboreo tradicional, especialmente en viñedos y algunos frutales.

En los cultivos leñosos, para determinar los diferentes estados de producción de las plantaciones, se distingue entre plantación de primer año, plantación joven que aún no produce, plantación en producción y plantación cuyo cultivo se ha abandonado.

Asimismo, se diferencian los cultivos leñosos que no son plantaciones comerciales de frutales y que se sitúan en zonas marginales en las que la recolección se realiza normalmente en función de las condiciones del mercado, en algunos ocasiones se trata de plantaciones semiabandonadas que posiblemente no se recolectan pero que tienen gran importancia paisajística y medioambiental. En cuanto al estado de la producción, la Tabla 3 recoge el número de hectáreas por tipo de cultivo. La mayoría de cultivos presentan plantaciones ya asentadas en producción comercial, más de 4 millones de hectáreas (un 85% del total). Además se observa que este porcentaje se mantiene para cada tipo de cultivo.

Tabla 3. Superficie de cultivos leñosos según el estado de la producción (ha) (Encuesta sobre Superficies y Rendimientos de Cultivos del Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente (2016))

Superficie de cultivos leñosos según el estado de la producción 2016 (hectáreas)													
		Plantación de 1er año		Plantación joven		Plantación en producción		Plantación abandonada		Plantación no comercial		TOTAL	
Cítricos	Naranja		3.390	2,3%	9.346	6,4%	123.182	84,5%	9.168	6,3%	731	0,5%	145.817
	Mandarino		2.544	2,3%	15.006	13,8%	84.668	77,6%	6.745	6,2%	77	0,1%	109.040
	Limonero		1.843	4,6%	5.260	13,1%	30.652	76,3%	2.162	5,4%	273	0,7%	40.190
No cítricos	Frutales pepita	Manzano	585	1,7%	2.725	8,1%	24.655	73,2%	1.635	4,9%	4.103	12,2%	33.703
		Peral	318	1,5%	2.168	10,4%	16.635	79,5%	1.268	6,1%	523	2,5%	20.912
	Frutales hueso	Albaricoquero	1.911	8,0%	5.237	22,0%	15.796	66,4%	596	2,5%	247	1,0%	23.787
		Cerezo	978	3,0%	2.744	8,3%	24.929	75,5%	2.469	7,5%	1.885	5,7%	33.005
		Melocotonero	3.929	4,8%	17.853	21,8%	58.652	71,8%	619	0,8%	666	0,8%	81.719
		Ciruelo	740	5,4%	2.182	15,9%	9.723	70,8%	593	4,3%	492	3,6%	13.730
	Otros frutales	Almendro	50.984	6,9%	56.538	7,7%	512.393	69,6%	90.771	12,3%	25.029	3,4%	735.715
		Nogal	126	0,9%	2.081	15,7%	9.788	73,8%	570	4,3%	699	5,3%	13.264
		Avellano	341	2,0%	1.859	11,2%	11.680	70,2%	2.531	15,2%	230	1,4%	16.641
Viñedo		30.529	3,2%	71.993	7,4%	824.656	85,1%	34.592	3,6%	6.999	0,7%	968.769	
Olivar		27.643	1,1%	96.275	3,7%	2.360.733	90,0%	122.881	4,7%	15.624	0,6%	2.623.156	
TOTAL		125.861	2,6%	291.267	6,0%	4.108.142	84,5%	276.600	5,7%	57.578	1,2%	4.859.448	

Plantación 1er año - Implantación sobre el terreno en la misma campaña.

Plantación joven - Todavía no resulta económicamente rentable recolectar los frutos (se suele considerar de los 3 a 6 años).

Plantación en producción - Recolección económicamente rentable.

Plantación abandonada - Plantación deteriorada sin labores de cultivo, pero que todavía es recuperable para la producción comercial.

Plantación no comercial - Sin producción comercial.

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B. Potencial nacional y disponibilidad de biomasa de PARP

El estudio más amplio realizado a nivel nacional corresponde a EuroPruning, que recogió datos del estado de la biomasa a nivel nacional en 2015. Los siguientes párrafos recogen dicho análisis y se complementan con parte de los nuevos datos recabados por uP_running. La incorporación de la poda al suelo agrícola suele ser común en el caso de realizar un prepodado mecanizado. Sin embargo, persiste el miedo a fomentar la aparición de plagas al dejar la poda en el suelo. Algunos ejemplos de agentes infecciosos son:

- en viña: eutypa, esca, acariosis, etc.
- en plantaciones de manzano: chancro (*Neonectria galligena*), gusano (*Cydia pomonella* / *Laspeyresia pomorella*), and sesia (*Synanthedon myopiformis*), etc.

Cuando se decide picar a suelo, es recomendable por tanto, aplicar algún tipo de tratamiento con pesticidas previamente a la poda. A este respecto, no existe ningún tipo de legislación o restricción a nivel nacional a la hora de integrar la poda al suelo, aunque sí se aplica alguna regulación a nivel local o regional. La opción de quemar las podas resulta cada día más inadecuada debido a los problemas que acarrea a la hora de preparar el material y obtener los permisos necesarios para ejecutar la quema bajo condiciones controladas de seguridad. El aprovechamiento energético se reduce actualmente al consumo de leña de manera local procedente de ramas gruesas de olivar o plantaciones de frutales. También los brotes procedentes de viñas, se aprovechan energéticamente a nivel doméstico para barbacoas o en pequeños paquetes para uso local.

De acuerdo al trabajo realizado por EuroPruning la Tabla 4 recoge los principales usos en España de las podas agrícolas. Ha sido obtenida a partir de consultas a expertos y especialistas en la dirección de plantaciones de cultivos de vid, olivo y frutal.

Tabla 4. Uso actual de las podas agrícolas en España (por tipo de cultivo)

Uso final	Olivar	Viña	Frutal semilla	Frutal hueso	Cerezo	Cítricos	Almendra
Apiladas y almacenadas en campo	0	2	0	< 1	< 1	0	2
Apiladas y quemadas en campo	90 (x)	95	95	97	97	85	97 (↓)
Trituradas en incorporado al suelo	5	1	5	2	2	10 (↑)	1 (↑)
Leña local	5 (*)	2	0	0	0	5 (*)	0
Comercializadas para energía	0	0	0	0	0	0	0

(*) Solo ramas gruesas. (x) Ramas finas. (↑) Práctica en crecimiento. (↓) Práctica en retroceso.

(<1) Marginal solo aplicaciones locales.

La situación descrita previamente en el manejo de las podas agrícolas en España no refleja necesariamente algunas actuaciones a nivel local a lo largo del país. Por ejemplo es conocida la utilización desde hace varios años de podas de olivar en importantes cantidades en varias centrales eléctricas originalmente diseñadas para alperujo y orujillo de oliva situadas en Andalucía (Puente Genil, Bioeléctrica de Linares, Oleícola El Tejar, entre otras). El consumo en dichas zonas es alto, si bien corresponde a una situación particular que luego no se da en el resto del territorio. Un caso reciente es la central de ENCE de Huelva, diseñada para restos de madera descartados en las fábricas de producción de pasta de papel y celulosa, así como de biomasa forestal (astilla de fuste y ramas). Esta empresa está incorporando recientemente (año 2017) importantes cantidades de madera de arranques frutales y podas de olivo. Es así que aunque la Tabla 4 recoge como resumen un consumo nulo de restos de podas agrícolas con fines energéticos en España. Esta situación no es del todo cierta. La tabla debe entenderse como que la situación es minoritaria. Tal y como algunos trabajos indican (CIRCE, 2008 y García et al., 2010) así como las cifras que aporta el IDAE (IDAE,

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2011) se podría considerar que en general un 10% de los restos de podas agrícolas quedan utilizadas para energía, en forma de leñas (uso tradicional) o de astilla (calderas modernas).

Como muestra la Tabla 4, la práctica habitual para deshacerse de las podas es la quema al aire libre. De manera general, no existe una regulación en España prohibiendo este tipo de prácticas. No obstante, pueden existir regulaciones a nivel local o comarcal. A nivel nacional, no hay leyes vinculantes que regulen el manejo de las podas, tan solo alguna relativa a la eliminación de la poda mediante quema al aire libre. Para ello es necesario un permiso especial para quema de residuos de madera. Este es el caso de algunas áreas como El Bierzo (Castilla y León), Murcia y Sevilla (cítricos), Tarragona (Avellana), Villanueva de los Infantes (Castilla La Mancha, aunque una minoría se pica a suelo), frutal de hueso en Valencia, viña en Cariñena (Zaragoza) o Jaén (olivar). En la zona de viñedos, en las denominaciones de origen de Castilla y León, normalmente las podas se queman, pero por falta de planificación en la gestión de las mismas, ya que por lo general el viticultor no está a favor de esta práctica. En algunas denominaciones de la zona (Ribera de Duero), parte del sarmiento se recoge y utiliza en restaurantes (brasas).

En los viñedos de la Rioja Alavesa, la tendencia es similar al resto del territorio español. En la actualidad hay dos formas habituales y mayoritarias de gestionar las podas de sarmiento. Por una parte, se recogen de forma mecanizada con maquinaria específica (sarmientador) acumulándolo en los márgenes del viñedo para proceder posteriormente y previo permiso administrativo a la quema de esos restos con el potencial peligro para las zonas de monte cercanas que esto supone. Por otra parte, más habitual, se procede a la trituración de ese material con maquinaria adecuada para ello (trituradora), incorporándolo al suelo del viñedo, algo que en ocasiones puede convertirse en potenciales nidos de parásitos, hongos y enfermedades. De una manera más minoritaria, en ocasiones se recogen los sarmientos tanto de forma manual como mecanizada para realizar gavillas para otros usos posteriores, principalmente en asadores particulares y en empresas de restauración.

Estas regulaciones locales disponen como debe llevarse a cabo la quema. Por ejemplo, en Valencia tan solo se puede hacer la quema de poda del invierno al inicio del verano. Además, no está permitido quemar cerca de montañas. En estos casos, el triturado es obligatorio. El caso de Andalucía es similar y algunas localizaciones y periodos del año están totalmente prohibidos. Sin embargo, no existe la obligación de triturar.

En la Comunidad Autónoma de Murcia, durante los meses que van de Marzo a Octubre, se requiere de un permiso para la quema de poda. Si el campo está situado a menos de 200 metros de un área forestal, este permiso se requiere para cualquier época del año.

En la zona de Aragón y Cataluña tan solo hay una restricción de tipo sanitario en el manejo de las podas. Cuando aparece la bacteria causante del fuego bacteriano (*Erwinia amylovora*) es obligatorio arrancar el árbol y quemarlo. En general, las podas se trituran y se reincorporan al suelo. Lo mismo ocurre en otras zonas como las grandes plantaciones de manzano en Gerona o más al Sur, en Sevilla, en el caso de las plantaciones de naranjos.

En las plantaciones de olivo, el barrenillo se puede propagar fácilmente si las podas se dejan en campo sin tratar. Por lo tanto, la quema controlada o bien el triturado fino son prácticas habituales. Así pues, la obligación de tratar la poda de manera adecuada se aplica en varias regiones a nivel local o comarcal, como Andalucía, Castilla La Mancha o Aragón.

De acuerdo a las encuestas que realizó EuroPruning en 2014, se ha comprobado que en la mayoría de los casos, la poda es sacada del campo y quemada al aire libre en las inmediaciones. Esto coincide con el análisis realizado a nivel nacional. Este es el caso por ejemplo de Jaén, Extremadura o Villanueva de los Infantes para la poda de olivar o de Cariñena, para la poda de viña. Sin embargo, también se ha constatado que esta práctica comienza a decaer, debido por la aparición de nuevas regulaciones y también, una mayor concienciación de los propios agricultores, que saben del peligro de las quemas al aire libre y el alto riesgo asociado de propagación de incendios. Por ejemplo, si bien en Extremadura las podas se queman en campo y una parte se incorpora al suelo picada, en los últimos años, hay algunas empresas que están haciendo

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pruebas de recogida para su empleo principalmente en la obtención de energía eléctrica en centrales de biomasa, o térmica en calderas. Esto ocurre para olivo, vid y fruta de hueso. También han aparecido empresas actuando como centros logísticos que recogen biomasa de poda de frutales y olivos.

En cuanto a la gestión de arranques, el procedimiento suele ser similar a las podas. En Castilla La Mancha, las cepas de arranque suelen ir a las plantas eléctricas de biomasa de Andalucía y alguna empresa con secadero. Lo mismo ocurre en la zona de Extremadura y Andalucía, donde los restos de biomasa procedentes del arranque de plantaciones de frutales, olivar y viñedo se queman una parte en campo, y otra es llevada a centros logísticos de biomasa, donde se prepara para su posterior empleo en la generación de energía.

Se han visto áreas donde ambas prácticas son habituales: quemas y picado a suelo como enmienda orgánica. Es el caso de las plantaciones de cítricos y frutales de hueso en Murcia, almendro en Cataluña (Tarragona, Lérida y Barcelona), viñedo en Badajoz y Almendralejo (Extremadura). Otras áreas parecen adoptar el picado a suelo como el principal método de deshacerse de la poda, como por ejemplo en algunas plantaciones de frutales de hueso en La Almunia (Zaragoza). Andalucía se considera una de las zonas de España, e incluso de Europa, donde se le da un mayor uso energético a la poda de olivo, y así quedó patente tras analizar las encuestas y entrevistas llevadas a cabo en anteriores proyectos (EuroPruning). La biomasa de poda se consume en ese caso, tanto como leña a nivel más doméstico, como en instalaciones más grandes. En cualquier caso, en torno al 75% de las podas se siguen quemando en campo al aire libre o bien, triturada y reincorporada al suelo. También Extremadura muestra un tanto por ciento de uso de tipo energético de la poda agrícola. En cualquier caso a nivel doméstico y no más del 15% del potencial disponible.

Tabla 5. Potenciales teóricos de biomasa de podas en España de acuerdo a diferentes fuentes de información (kt m.s./año)

Potenciales de biomasa de podas agrícolas (kt de materia seca anuales)							
Estudio	Ref*	Viñedo	Olivo	Frutal seco	Frutal dulce	Cítricos	TOTAL
Biomass futures 2004	[1]	n.d.	n.d.	n.d.	n.d.	n.d.	8.304
S2BIOM 2012	[2]	912	3.192	770		555	5.429
Bionline-IDAE 2012	[3]	n.d.	n.d.	n.d.	n.d.	n.d.	8.865
Bioraise	[4]	1.138	2.342	1.898			5.377
EuroPruning	[5]	825	2.625	295	430	489	4.664
SUCELLOG	[6]	1.347	3.740	265	366	932	6.650
ACVCOCO	[7]	1.279	1.985	529	337	690	4.820

*Ver referencias en apartado de Bibliografía; n.d.: no determinado

C. Estado del arte del aprovechamiento de biomasa de PARP

La bioenergía en España: principales cifras

Tras cuatro años consecutivos de descenso de la demanda energética en España, el año 2015 supuso un incremento en el consumo de energía final respecto al anterior ejercicio. El consumo primario de energía se situó cerca de las 124 millones de tep, de las cuales, en torno al 14% fueron de origen renovable (ver figura 4). Dentro del mix de renovables, alrededor de un 33% se satisfizo a partir de recursos de biomasa, siendo el recurso renovable más utilizado, frente a la energía eólica (25%), la solar termoelectrica (13%) y los biocarburantes (6%).

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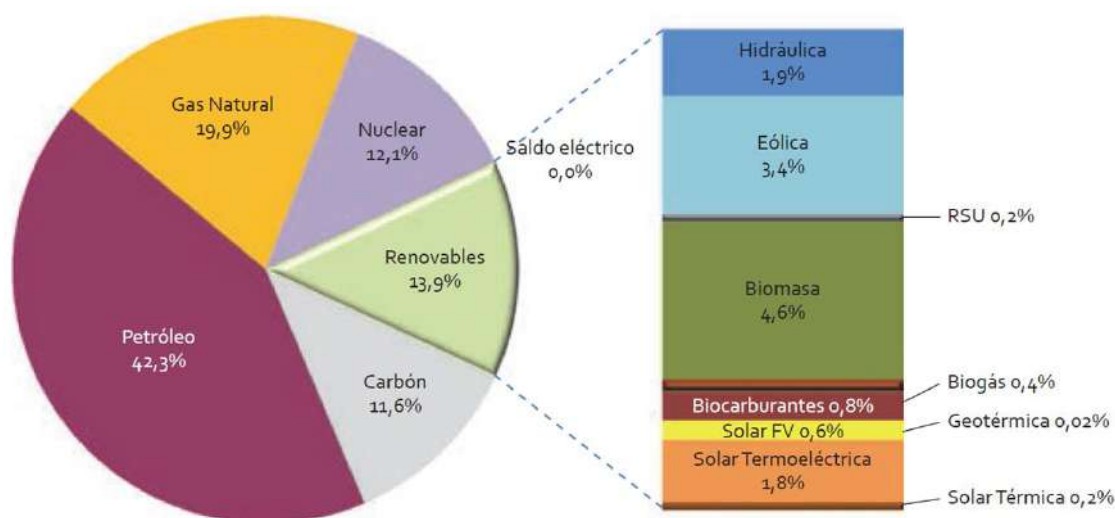


Figura 4. Consumo de energía primaria por fuentes energéticas (MINETUR, 2015)

En cuanto a la estructura de generación eléctrica (2015, ver figura 5), las energías renovables supusieron casi un 35% del total. El 51% de las producciones eléctricas con recursos renovables fue satisfecho por energía eólica y el 29% por hidráulica (exceptuando la generación eléctrica procedente de bombeo) pese a la disminución registrada de ambos recursos, el 14% fue satisfecho por la energía solar y el 6% restante por los recursos provenientes de la biomasa, el biogás y los residuos sólidos urbanos.

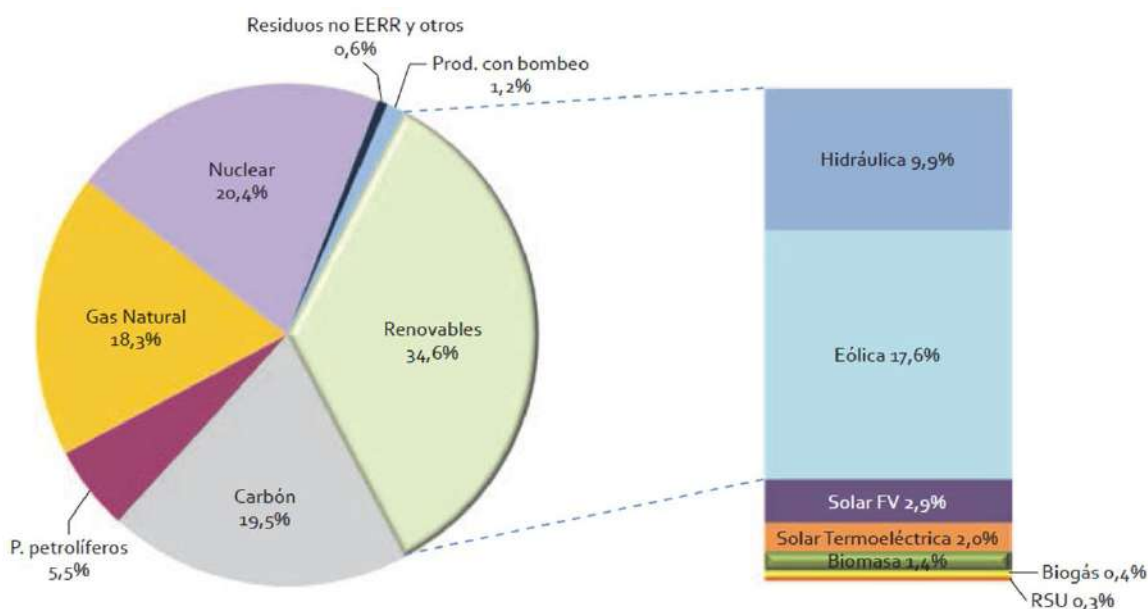


Figura 5. Estructura de generación eléctrica (MINETUR, 2015)

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En torno al 69% de toda la energía renovable se destinó a la producción eléctrica, mientras que la producción de calor supuso un 25%. Estas aportaciones térmicas de origen renovable, fueron cubiertas en tres cuartas partes por biomasa: 3.936 ktep, de los cuales 548 ktep se corresponden con consumos de calor útil procedentes de centrales termoeléctricas de biomasa y el resto, 3.388 ktep, a instalaciones térmicas, calderas, estufas y chimeneas, ubicadas en los sectores residencial, industrial y servicios.

TOTAL consumo energía: 123,7 millones de tep

TOTAL consumo renovable: 17,2 millones de tep (13.9% de la energía consumida)

TOTAL consumo biomasa: 5,7 millones de tep (4.6% de la energía consumida, 33.1% de la energía renovable consumida)

TOTAL consumo biomasa calor: 3,9 millones de tep (69% de la biomasa consumida)

TOTAL consumo biomasa electricidad: 1,8 millones de tep (31% de la biomasa consumida)

Dentro del Plan de Energías Renovables 2011-2020, se le ha asignado a la biomasa un peso del 5% respecto al total de EERR, para la generación de electricidad, lo que equivaldría a un incremento de 1125 MWe respecto a los valores de 2010, de los cuales, 820 MWe deberían ser aportados por biomasa sólida. La tabla 6 presenta las instalaciones existentes (2011) y proyectadas de biomasa para generación eléctrica.

Tabla 6. Inventario de plantas de biomasa, biogás y pellets. Estado actual y en proyecto (APPA, 2011)

Inventario de plantas de biomasa, biogás y pellets (APPA, 2011)			
Estudio	Tipo de planta	Nº	Potencia (MW)
Estado actual	Biomasa	22	358,5
	Gasificación	4	3,7
	Biogás	30	97,9
	FORSU	4	49,6
	Pellets	5	-
	TOTAL	65	509,8
En proyecto	Biomasa	62	831,9
	Gasificación	4	3,7
	Biogás	9	12,3
	Pellets	4	-
	TOTAL	79	847,9

Si bien a priori, las plantas de biomasa sólida serían suficientes para alcanzar los objetivos del Plan de EERR (en torno a 1350 MWe), el sector eléctrico ha sufrido un importante parón por el cambio de legislación que regula a las EERR. Hasta el momento, las empresas que tenían el recurso, es decir las productoras del residuo, eran las que promovían la instalación de las plantas de biomasa para generación eléctrica. Asimismo, el futuro inmediato parecía más propicio para las eléctricas que se iban a encargar de los nuevos proyectos. En cualquier caso, la coyuntura actual hace pensar que esto no va a ocurrir y la tendencia y objetivos establecidos en el Plan de EERR, no se van a cumplir. Por lo tanto, se prevé un posible cambio de panorama: o se reducen los objetivos fijados, o bien se vuelve a incentivar la biomasa para generación de electricidad.

A nivel general, sin discriminar por tipo de energía, se han efectuado los últimos años una serie de subastas eléctricas con el objetivo de promover e incentivar de alguna manera la inserción de energías de origen

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renovable en el mix de generación, asegurando el consumo de electricidad y rentabilidad de las instalaciones.

Durante la primera subasta eléctrica (Enero 2016), se subastaron 500 MW eólicos y 200 MW de biomasa. La subasta asignó por menor precio de retribución de prima. Los adjudicatarios sólo recibirán la retribución del mercado y sólo se aseguran un suelo de precio en caso de que hubiera una caída por debajo del mismo. En las dos subastas posteriores (Mayo 2017 y Julio 2017), no se volvió a poner en liza ni un solo MW más de biomasa (tan solo unos 8000 MW para eólica y fotovoltaica)

En cuanto al uso de biomasa para generación de calor, cobra fuerza en el total de renovables la presencia de biomasa sólida, con un peso cercano al 85% respecto del total de fuentes renovables. Se prevé un incremento de 774 ktep de biomasa sólida. Sin duda, las fuerzas impulsoras para llevar a cabo este incremento durante los próximos años son el potencial ahorro económico que supone la generación de calor con biomasa, respecto a otros combustibles fósiles convencionales y la proliferación de redes de calor de distrito en España.

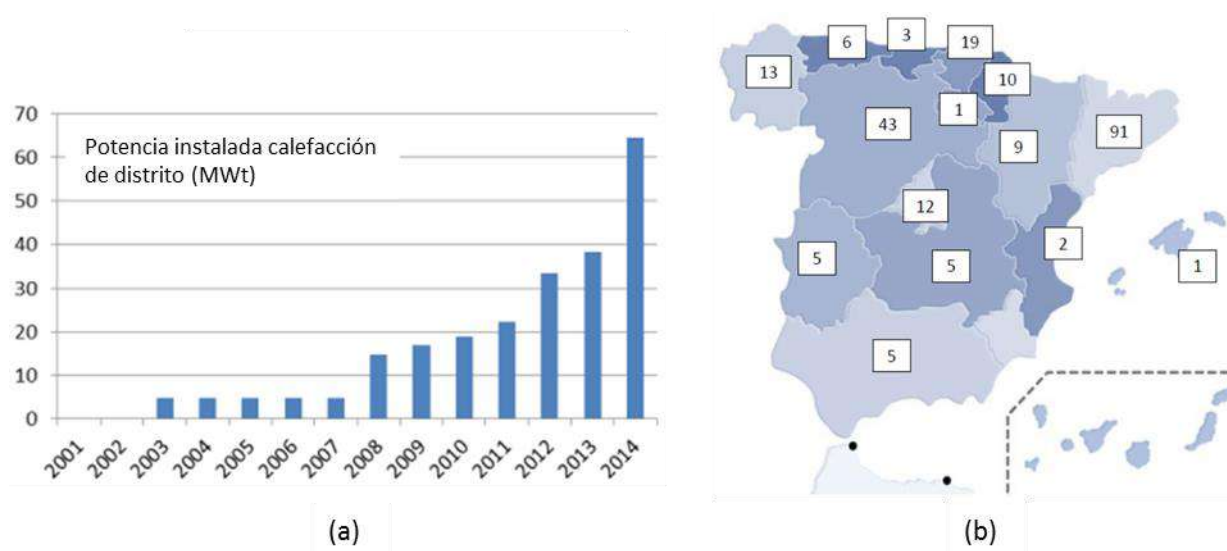


Figura 6. (a) Potencia térmica instalada en España en calefacción de distrito, MWt, (b) redes de calor operando con energías renovables en España

La figura 6a muestra la potencia instalada en España en calefacción de distrito. En el año 2014 había unos 94 MWt y se estima que en 2016 habrá unos 200 MWt. De las 225 redes de calor generado con renovables, 218 son de biomasa sólida (figura 6b).

En cuanto a las entidades más influyentes y con mayor fuerza para promover un cambio de tendencia en el uso de la biomasa de podas y arranques con fines energéticos, se deben considerar asociaciones profesionales del sector energético, al igual que agrupaciones del sector agrícola y alimentario. La Asociación Española de Valorización de Biomasa (AVEBIOM), engloba a todos los actores que participan en la cadena de valor de la biomasa y promueve el desarrollo del sector en toda España, mediante campañas de comunicación y la participación directa en proyectos tanto europeos como nacionales. La Asociación de Productores de Energías Renovables (APPA), si bien presenta un carácter más genérico, también tiene una fuerte presencia en el sector de la biomasa. La valorización de residuos urbanos, agrícolas y ganaderos y la contribución de la biomasa, como energía gestionable son los principales objetivos, de esta agrupación que incluye a más de treinta empresas dedicadas a la biomasa. Entre sus muchas actividades, destacan los eventos de promoción y comunicación a nivel nacional, como por ejemplo el Congreso Nacional de Energías

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Renovables, que tendrá lugar a finales de octubre en Madrid y que englobará a importantes agentes del sector ([Congreso Nacional de Energías Renovables, Madrid, octubre 2017](#))

Por otra parte, es necesario el apoyo y presencia de organizaciones de carácter agrícola y alimentario. La participación de sindicatos agrarios como la Coordinadora de Organizaciones de Agricultores y Ganaderos (COAG), la Unión de Pequeños Agricultores y Ganaderos (UPA) o la Asociación Agraria de Jóvenes Agricultores (ASAJA) deben activar el aprovechamiento energético de las podas y arranques y servir de puente entre el sector agrícola y el sector energético. Asimismo, entidades en el ámbito alimentario como la Federación Española de Industrias de Alimentación y Bebidas (FIAB) o las Cooperativas agro-alimentarias de España (SPANISH CO-OPS), también pueden hacer presión para el fomento del uso de las podas en sectores como el del olivo o el vino.

Consumo de biomasa de PARP en España.

En la relación a las principales fuentes de consumo de esta agrobiomasa, la agroindustria y las plantas bioeléctricas son los mayores consumidores en España. Es el caso de las plantas ubicadas en Andalucía para combustión de alperujos y orujillo, en las que se utilizan podas como combustible secundario. Así mismo en España existen varias bodegas que utilizan este tipo de biomasa (Bodegas Torres, Codorniu, Vilarnau, Emina), y una agro-industria de cremogenados (NUFRI). Existen también experiencias lideradas por ayuntamientos como en Vilafranca del Penedés (Barcelona) o en Serra (Valencia) que han apostado por el uso de los recursos locales en instalaciones municipales. Recientemente también se está dando el caso de grandes plantas orientadas al consumo de madera y residuos forestales que están iniciando una diversificación de sus fuentes de aprovisionamiento, comenzando a consolidar nuevas cadenas de valor de restos de podas y arranques agrícolas hacia sus instalaciones, como es el caso de las plantas de ENCE (Huelva) y Miajadas (badajoz). Por último, y como casos particulares, existen ciertas cadenas de valor orientadas a la comercialización en mercado, casos de la singular planta de Pelets de la mancha (Grupo Athisa, Ciudad real) y de la exportación de astilla de frutal que realiza Reciclados Solamur (Murcia).

En general, en la mayoría de los casos la biomasa que se recoge con poca tierra y preparada para ser consumida, o ser gestionada en centros logísticos de biomasa en el caso de cadenas de gran volumen, como en Andalucía. La biomasa, cuando se recoge con altos contenidos en tierra (restos de poda sin separar tierra, arranques con raíces), los únicos consumidores existentes actualmente son las grandes centrales eléctricas o plantas de cogeneración. En algunas zonas de viña, como Vilafranca o la Rioja Alavesa, esta biomasa se autoconsume, en bodegas o por el propio agricultor, especialmente para usos térmicos (leñas, estufas, asadores, etc.). En la zona de Andalucía, el panorama es un poco diferente. Las grandes plantas eléctricas están consumiendo una cantidad ingente de arbolado, que podría dedicarse a consumidor más moderado y preservar la masa arbórea, alimentándose estas grandes plantas de otras biomasa de menor calidad, pues sus calderas y filtro de emisión, están preparadas para hacerlo. También es cierto, que por ejemplo ENCE de San Juan del Puerto, (Huelva), está consumiendo restos de poda de olivar y algunos cultivos más que está probando, proveniente de leñas agrícolas.

Un ejemplo de uso térmico, es el de los municipios de Serra (Valencia) y Calpe (Alicante) donde las podas se utilizan en una piscina municipal. La poda es llevada a la empresa, allí se astilla, se seca y se lleva a la caldera de la piscina. Se trata de un proyecto demostrativo, para mostrar la logística y la posibilidad de aprovechamiento del recurso.

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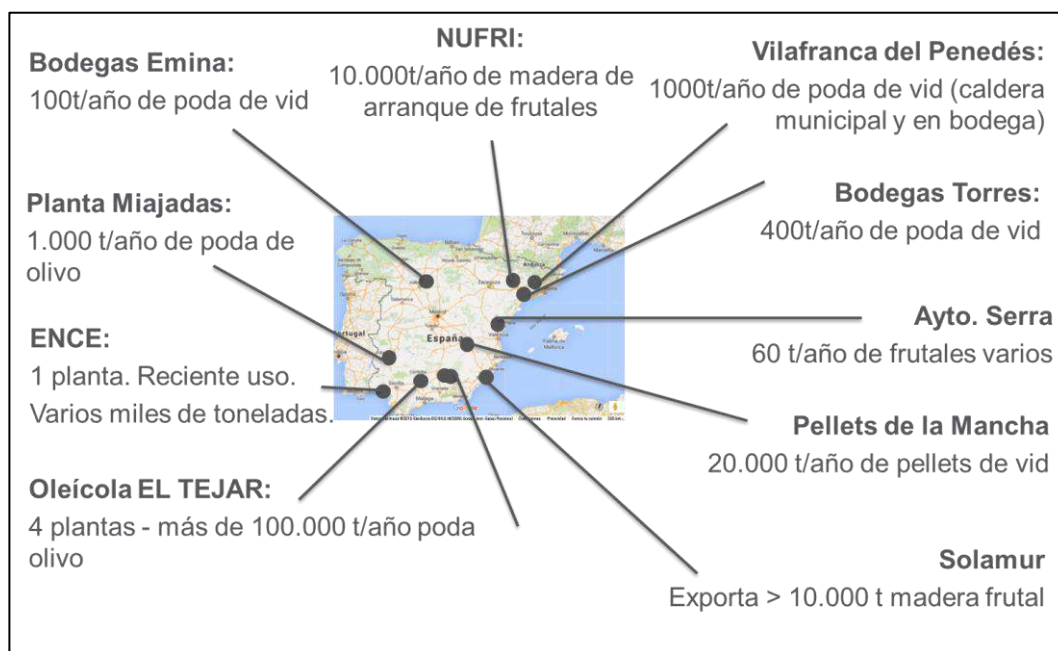


Figura 7. Principales plantas y proyectos de biomasa de PARP en España

Barreras existentes para el uso de biomasa de PARP

Los agricultores son muy conscientes de que la biomasa de PARP puede ser valorizada teniendo un aprovechamiento energético, al menos en cuanto al uso tradicional como leñas. Sin embargo, es cierto que no es habitual que conozcan la posibilidad técnica de utilizar el conjunto de la biomasa (tramas finas, raíces) como fuente de energía en calderas modernas. Muchas veces ocurre que entienden que es una biomasa con escaso valor energético respecto a la madera de pino, por ejemplo. En cualquier caso al no existir demanda, la salida que se da a la gestión del residuo habitualmente es su quema o su picado a suelo. Se necesita encontrar instalaciones de uso con las particularidades de cada tipo de biomasa. El establecimiento de exigencias agroambientales condicionadas por PAC pueden ser un buen acicate para obligar a dirigir las soluciones hacia planteamientos medioambientalmente sensatos.

Asimismo, otra de las barreras importantes son de origen económico. La recogida de los restos de poda y plantaciones arrancadas es una operación costosa. Los agricultores tienden a reducir los costes de operación, y en muchos casos lo más sencillo y económico es la quema. Los agricultores son, como se ha comentado, parcialmente conscientes de su posible uso como biomasa. En zonas como Andalucía donde hay varias plantas que consumen podas de olivar, esta visión es más clara, mientras que en otras en las que no existe o es conocida ninguna referencia de uso energético de podas (centro y norte de España, exceptuando casos aislados) esta visión no existe o se limita a entender el potencial uso como leña. En cualquier caso el agricultor requiere que la operación permita reducir costes o generar un beneficio a su actividad, para que consideren su aplicación con fines energéticos.

En general todos los actores de la cadena entienden que la logística no está lo suficientemente desarrollada y la rentabilidad de los trabajos que requeriría, no está clara. Esta es una barrera añadida, dado que una vez un emprendedor zonal identifica la oportunidad de ahorro que puede llevar el uso de la biomasa de PARP, se comienza a encontrar con múltiples dudas a la hora de configurar una cadena en la práctica. Por tanto, tanto la quema como el picado a suelo, se realizan principalmente por ser la manera más fácil, cómoda y barata de gestionar los restos de poda además de ser lo que siempre se ha hecho.

En cualquier caso, es necesario divulgar los conocimientos, las posibilidades que ofrece el sector de la biomasa, investigar y sobre todo demostrar, y buscar nuevos posibles clientes que tengan necesidad de

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energía térmica, para ofrecerles el combustible y también la caldera, que sea capaz de gestionar esos biocombustibles. Una fórmula con impacto es la transferencia de conocimientos prácticos y la realización de demostraciones. Así mismo visualizar los casos de éxito que se puedan aportar al usuario, sobre todo en calderas de un rango industrial (hasta 700-1000 kW).

Barreras que limitan actualmente el uso de la biomasa de PARP

A continuación, y de manera sintética se muestran las barreras detectadas por el proyecto uP_running. Se basan en los resultados de varias entrevistas realizadas (ver sección de agradecimientos al final del presente documento), así como del taller¹ realizado con múltiples agentes del sector en el marco de la Feria Expobiomasa. Así mismo se han adoptado parte de las barreras identificadas previamente en el análisis realizado para la Comunidad Autónoma de Aragón (uP_running, 2017).

Barreras técnicas

- Biomasa de PARP presenta peor calidad que la astilla forestal y sus características son muy variables según cómo se ha obtenido y gestionado.
- Cantidad producida por hectárea muy variable, y/o desconocida.
- Maquinaria de recolección y tratamiento no siempre conocida, y en algunos casos precisa desarrollo.
- Modelos para recogida de poda: muchos inmaduros (costes O&M, impactos en motor del tractor).
- La combustión de la biomasa de PARP en calderas de biomasa convencionales no siempre es posible, y de serlo necesita algunas adaptaciones previas.

Barreras culturales

- Resistencia al cambio en la gestión de residuos de PARP por parte del agricultor.
- Creencia de que es biomasa no competitiva: altos costes de obtención y menor calidad.
- Tendencia a no contabilizar el coste actual de gestión de la poda (triturado, o empuje, amontonado y quema). Limita las posibilidades de transferencia, y el agricultor no entiende el ahorro que consigue.
- Desconfianza del agricultor para transferir el residuo de PARP: percibe que alguien está ganando dinero con un sub-producto de su explotación.
- La creencia (en algunas zonas) de que la poda tiene que ser integrada en el suelo por defecto como mejor uso (sin considerar otros aspectos como el potencial riesgo de asentamiento de enfermedades, etc.).
- Desinterés en considerar los beneficios intangibles que genera la economía circular y de proximidad al utilizar biomasa de PARP.
- Escepticismo en técnicos de la administración ante el uso de biomasa de PARP
- Desconocimiento por parte de los agentes de toma de decisión (alcaldes, consejeros, jefes de servicio) de que el uso de la biomasa de PARP es factible.
- Percepción de algunos consumidores de que las calderas de biomasa requieren mucho mantenimiento manual (limpieza de cenizas, alimentación).
- Escepticismo y recelo ante la “innovación”: a pesar de ser informados o conocer casos reales de uso de biomasa de PARP, se desconfía, y no se da credibilidad.
- Creencia de que el único uso factible de PARP se puede dar en grandes plantas de biomasa.
- Instaladores de calderas / ESEs experimentados con biomasa convencional (pellets o astillas de madera forestal) consideran que la biomasa de PARP no es una opción.

Barreras regulatorias

- Ausencia de una estrategia nacional para priorizar la utilización de los residuos agrarios.

¹ “Promoviendo la AGROBIOMASA en España: residuos leñosos de vid, olivo y frutales”. Evento realizado en fecha 26 de Septiembre de 2017 en la Feria de Valladolid. Más información en: <http://es.up-running.eu/category/news-events/>

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- La biomasa de PARP no está considerada en los planes de fomento de las EERR de España (no hay medidas de apoyo específicas).
- La legislación vigente permite quemar residuos de PARP en hogueras al aire libre (bajo ciertas restricciones y previa obtención de una licencia, aunque depende de la Comunidad).
- La existencia de un marco regulatorio variable genera un alto grado de inseguridad causada por las instituciones (e.g. primas a renovables).
- Directiva europea de Ecodiseño para calderas de biomasa puede limitar el uso de residuos agrícolas (dado su mayor contenido en cenizas respecto a la madera).
- En algunas zonas existen subsidios para dejar la poda como cobertura del suelo en los campos.
- En algunas comunidades se ha incentivado programas de subvención para adquirir trituradoras de poda, sin contemplar trituradoras con recogida en tolva.
- Regulaciones que limitan la acumulación de residuos junto al campo por un periodo de tiempo (añade dificultad para coordinar recogida de restos de PARP en zonas con alta densidad de cultivos).

Barreras estructurales

- Hay múltiples incógnitas e incertidumbres para el actor que desea emprender un negocio de biomasa de PARP.
- Distancia y falta de entendimiento entre el sector agrícola y energético/industrial. Los agricultores no acaban de entender negocio e intereses de los agentes a los que ceden su residuo. Dichos agentes no entienden las necesidades y prioridades del agricultor.
- Ausencia de coordinación entre ministerios o consejerías de medioambiente, energía y agricultura. Los agro-residuos precisan de una visión y estrategia coordinada.
- Distancia entre las empresas de servicios energéticos, consumidores de biomasa y los agricultores y agroindustria, que limitan la aparición de nuevas iniciativas.
- Economía sumergida es un freno para el emprendimiento inicial para empresas de servicios agrícolas.
- La biomasa de PARP está muy dispersa en el territorio. Eso hace su gestión más cara y complicada.
- Escaso interés de las autoridades públicas: no apuestan por la biomasa en edificios públicos.
- Ausencia de presión a las instituciones para reclamar medidas (grupos de presión centrados en otros temas, no en agro-residuos).
- Influencia del sector del petróleo, gas y electricidad en las políticas actuales.
- La administración al optimizar los presupuestos públicos, opta por instalaciones más baratas (inversión reducida) lo que favorece a los combustibles convencionales, o a las calderas de pellets, frente a la biomasa de PARP.
- Alta competitividad de las empresas que ofrecen servicios de calor basados en gasóleo y gas (ofrecen instalaciones gratuitas, a cambio de contrato de suministro de combustible a largo plazo).

Barreras de mercado

- Falta de confianza en los suministradores de biomasa. Con la biomasa de PARP, como fuente escasamente conocida, la desconfianza es mayor.
- Ausencia de ESEs que apuesten por instalaciones híbridas (policombustible) que permitan usar no sólo astilla o pellet forestal, sino también otros tipos de biomasa.
- Temor a que el precio de la biomasa pueda variar (curioso, dado que el precio del gasóleo o del gas natural, varía, pero usuarios no lo ven tan problemático, o entienden que es debido a influencias del mercado global, no a intereses del suministrador).
- Exceso de biomasa forestal en el mercado y a precios competitivos.
- Ante un mercado de biomasa localizado, basado en escasos distribuidores, puede aparecer una potencial especulación.
- Falta de plataformas de biomasa que podrían tratar los residuos de PARP y asegurar cierta calidad.

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- Ausencia de ejemplos válidos en la forma de organizar el aprovechamiento (roles y ganancias de cada actor).

Barreras organizacionales

- Dificultad en poner de acuerdo a múltiples actores que es preciso participen para movilizar la biomasa de PARP.
- Dificultad de atar suministro y fidelizar antes de realizar la inversión.
- Zonas de minifundio o de parcelas muy pequeñas, la organización de la recogida de PARP es más compleja.

Barreras económicas

- Precio petróleo actual a la baja (últimos años): limita la rentabilidad y margen de beneficio
- Margen de beneficio muy justo para la biomasa.
- Cantidad de biomasa por hectárea baja (especialmente en caso de biomasa de podas).
- Precios variables de la biomasa.
- No existen precios del servicio de recogida de biomasa de PARP o en cualquier caso son muy variables (no hay un marco, ni experiencia).
- Las instalaciones que pueden quemar biomasa de PARP son más caras que las instalaciones que operan con astilla forestal o de pellets (requieren mayor inversión inicial).

Barreras financieras

- Alta incertidumbre: al tratarse la biomasa de PARP de nuevo negocio/actividad, sujeto a muchas incertidumbres, la inversión es arriesgada.
- El IVA sobre la biomasa es del 21% en España (10% en otros países europeos).
- No existen incentivos para obtener PARP como fuente de energía.

Fuerzas impulsoras

Por fuerzas impulsoras se entiende las acciones, regulaciones, oportunidades, situaciones coyunturales, que pueden dar lugar a desencadenar un cambio en el paradigma local, regional o nacional, en cuanto a la gestión de los residuos de PARP. Se citan a continuación las barreras detectadas a través de las entrevistas y talleres realizados en uP_running. Dichas fuerzas impulsoras no tienen por qué darse en la actualidad, pero su aparición, o su fomento, puede desencadenar una expansión en el uso de la biomasa de PARP.

- OPORTUNIDAD (fuerzas impulsoras sobre las que no se puede influir)
 - Gran potencial en España de biomasa de PARP.
 - Mercado de la biomasa (si precio tiende al alza).
 - Aumento del precio del petróleo.
 - Responsabilidad social corporativa (ej: imagen sostenible como estrategia aplicada por algunas empresas como elemento diferenciador).
- CONSUMO
 - Generar un primer consumidor (sirve de caso de ejemplo local y permite la réplica).
 - Promover el autoconsumo en el sector agrícola/ganadero de podas y arranques.
 - Creación de la demanda del sector público como ejemplarizante.
 - La agro-industria del vino, procesado de fruta y de aceite de oliva pueden iniciar el consumo, integrando así los residuos de PARP en conceptos de autoconsumo y km0.
 - Mecanismos que fomenten el consumo de biomasa local.

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- **POLITICAS**
 - Empuje a través de instituciones (declaraciones, planes energéticos, planes estratégicos)
 - Discriminar los concursos públicos de suministro energético por tipo de energía, o en su defecto que no se ciñan al suministro con gas, gasóleo o electricidad.
 - Apuesta por acciones de reducción de emisiones y buenas prácticas ambientales.
 - Priorización de sectores específicos de biomasa (segmentación) en la legislación.
 - Apoyo a innovación e I+D para promover bioeconomía y cierre de ciclo de subproductos (como biomasa de PARP).
 - Mejoras fiscales para uso de la biomasa (p.ej., reducción del IVA)
 - Calificación energética para las instalaciones agroindustriales (fomenta eficiencia y uso de renovables).
 - Incentivos derivados de las líneas marcadas en los planes energéticos.
 - La creciente exigencia de mayor sostenibilidad en ciertos sectores agrícolas (vino, oliva, frutal) (p.ej., certificado CO₂ o huella de carbono)
- **PRÁCTICAS AGRONÓMICAS EN GESTIÓN DE LOS RESTOS DE PARP**
 - Despejar el escenario de alternativas adecuadas al agricultor: catálogo de prácticas agro-ambientales (uso ecológico/sostenible como materia orgánica o como energía.
 - Incentivos / ventajas a las buenas prácticas agrícolas.
 - Política ambiental más restrictiva para las quemas: (solo cuando haya problemas reales de plagas, u otro condicionante de importancia).
 - Alternativamente, tasa de CO₂ para los agricultores que optan por la quema
- **DESARROLLO DE MERCADO ESTABLE PARA BIOMASA DE PARP**
 - Existencia de profesionales con solvencia (evitar instalaciones deficientes).
 - Garantizar de la calidad de la biomasa (por medio de sellos, etiquetas, marca).
 - Existencia de centros logísticos de importante tamaño, capaces de conseguir y distribuir biomasa de diferentes tipos.
 - La agrupación de agricultores para compartir gastos, maquinaria y aumentar volumen movilizado.
 - Nuevos consumos y proyectos piloto.
 - Mejora de las tecnologías de calderas o de recogida y tratamiento de biomasa de PARP (p.ej. gracias a apoyo a innovación empresarial).
- **SENSIBILIZACIÓN:**
 - Mayor conocimiento de que el uso de la biomasa de PARP es posible.
 - Diseminación de casos de éxito y modelos de negocio que están funcionando.
 - Mayor conciencia de los beneficios no tangibles asociados a la nueva gestión de biomasa de PARP (calidad ambiental, inmisiones, economía circular, empleo local).
 - Mayor conciencia de la sociedad sobre la necesidad de usos más amables en la gestión de residuos agrícolas.
 - Acercamiento entre agricultores/cooperativas/agroindustria y ESEs/ sector industrial energético.
 - Mayor conocimiento de las oportunidades y las ventajas del uso de PARP por parte de actores políticos.

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D. Plan nacional para la energía y el clima

Planes de Energías Renovables y Plan Nacional Integrado de Energía y Clima

Según el Plan de Energías Renovables 2011-2020, la distribución del consumo de biomasa según orígenes y aplicaciones para el año 2006, refleja la importancia de los usos de las leñas forestales y las podas de olivos y otros subproductos del sector de producción de aceite (orujos y orujillos). Concretamente, se consumieron 400.000 tep de leñas de olivos y otros cultivos agrícolas, alrededor de 1.600.000 t (considerando un PCIh medio de 0,25 tep/t). En cuanto al destino final de esa biomasa, básicamente se utilizó para fines térmicos.

Dentro de este Plan, las propuestas específicas para el desarrollo de la biomasa se han centrado principalmente en la búsqueda de mecanismos que repartan los costes de la producción de biomasa entre todos los sectores que se verán favorecidos por su desarrollo. Se fomentará la búsqueda del establecimiento de nuevas masas forestales o cultivos energéticos en zonas improductivas. Además de estas actuaciones el plan pretendía impulsar la creación de empresas de producción, transformación y logística de biomasa. Estas propuestas, unidas a las modificaciones normativas necesarias, permitirán, según dicho plan, conformar un mercado totalmente maduro de la biomasa como materia prima para instalaciones de producción de energía, ya fuera eléctrica o térmica. Además se consideraba necesario impulsar la formación e información a través de las correspondientes campañas que generen una imagen de confianza a los potenciales usuarios de biomasa. De manera explícita no se mencionan propuestas para el aprovechamiento energético de podas y arranques agrícolas, si bien la mayoría de propuestas son aplicables al sector y podrían haberle proporcionado un impulso importante.

Tabla 7. Propuestas para la promoción del sector de la biomasa (PER 2011-2020)

Propuestas genéricas para el sector de la biomasa (PER 2011-2020)	
Propuesta	Tipo
Análisis de instrumentos de fomento de los cultivos energéticos forestales	Estudios
Análisis del marco económico para el aprovechamiento de biomasa de masas forestales existentes y restos agrícolas para uso energético	Estudios
Análisis del marco económico para el aprovechamiento de biomasa procedente de masas forestales a implantar, o cultivos, con fines energéticos	Estudios
Redefinición de la Comisión Interministerial de la Biomasa	Planificación
Desarrollo de la regulación y normalización de los combustibles de biomasa	Normativa
Análisis de acciones de optimización técnico-económicas del transporte de biomasa, en colaboración con las CCAA y la administración local	Normativa
Establecer planes plurianuales de aprovechamientos forestales o agrícolas con uso energético	Normativa
Formación en biomasa para empleados públicos	Información/Formación
Seguimiento de los mercados de biomasa a nivel internacional	Estudios
Establecimiento de un sistema de certificación de biomasa según lo establecido en el RD 661/2007	Normativa

La realidad es que el sector energético se ha encontrado en España una situación crítica debido a la crisis financiera que comenzó ya durante el año 2008. La actividad industrial y económica se ha ralentizado desde entonces hasta 2015, llevando con ello asociada una menor demanda de energía eléctrica, la caída del precio del kWh, así como en paralelo a la bajada del precio del petróleo, una bajada sostenida de los precios de la biomasa. Estas causas estructurales están detrás de la retirada del sistema de primas a nuevas instalaciones en régimen especial (según RDL 1 de 2012), y puede haber afectado a la aplicación de las medidas propuestas, o al impacto que podrían haber generado.

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Respecto al Plan de Energía y Clima para 2030 de la Comisión Europea, todavía no existe un borrador definitivo, si bien ya se han esbozado sus objetivos principales:

- Al menos 40% de reducción de las emisiones de gases de efecto invernadero (en relación con los niveles de 1990)
- Al menos 27% de cuota de energías renovables.
- Al menos 27% de mejora de la eficiencia energética.

Estos objetivos serán vinculantes y de obligado cumplimiento para los países miembros. En ese sentido, el eurodiputado español José Blanco ha presentado un borrador de informe en el Parlamento Europeo con objetivos más restrictivos, que permitan acelerar la introducción de las energías renovables. El borrador del informe parlamentario sobre la nueva directiva eleva del 27% al 35% el objetivo del conjunto de la UE para 2030 en electricidad procedente de fuentes renovables. Y a diferencia de la propuesta de la Comisión, el documento parlamentario, establece objetivos nacionales vinculantes en cada uno de los países de la UE.

Para España, la cuota a alcanzar en 2030 sería del 36%, muy por encima del objetivo de 2020 (20%) y más del doble que la producción actual. Por otro lado, los ponentes de otra de las directivas del paquete energético también han endurecido el texto inicial. Los diputados del grupo Verde, Claude Turmes y Michèle Rivasi, piden en su informe que se fije 2050 como límite para alcanzar un nivel cero de emisiones de CO₂ y un mix energético 100% renovable para esa misma fecha (Cinco Días, 2017). Al respecto del estado de redacción de dicho plan para España, a estar preparado y listo para consulta publicar a partir de 1 de Enero de 2018, por el momento no hay ningún documento borrador disponible públicamente, si bien se han dado ciertos pasos. Entre ellos la primera reunión del grupo de trabajo interministerial para elaborar el anteproyecto de Ley de Cambio Climático y Transición Energética y del Plan de Energía y Clima se llevó a cabo en Abril de 2017. Posteriormente, en julio de 2017, el Ministerio de Energía, Turismo y Agenda Digital ha creado a fecha de julio de 2017 (según resolución 9067 del consejo de ministros) una Comisión de Expertos que deberá remitir al Gobierno un Informe que analice las posibles propuestas de política energética, el impacto medioambiental, las alternativas existentes y su correspondiente coste económico en los que basar la preparación del Plan Nacional Integrado de Energía y Clima, con el horizonte de 2030.

Políticas agrícolas

Las políticas de agricultura en relación al uso de energías renovables en el sector agrario son fundamentales para un correcto y rápido desarrollo del aprovechamiento de la biomasa procedente de agro-residuos. En cualquier caso, sería la prohibición de quemar restos agrícolas en el campo, como ya lo hacen diversos países, lo que impulsaría definitivamente el uso de PARP, así como un cambio de mentalidad en la normativa española de producción y consumo de energía verde. Se debe buscar la coherencia entre las políticas implementadas de agricultura, alimentación, energía, medioambiente y economía (cuestiones relacionadas con impuestos). La Directiva 2009/28/EC, no recoge criterios de sostenibilidad específicos para la biomasa sólida. En los programas de Desarrollo Rural regionales se debería introducir medidas más concretas para el fomento de la utilización de biomasa agrícola como energía renovable (fomento del uso y promoción de inversiones en tecnologías de transformación de biomasa), pagos directos “greening” que se inclinen a actividades de diversificación de cultivos que puedan derivar consecuentemente en movilizaciones de biomasa.

El programa actualmente en vigor de la Política Agrícola Común de la Unión Europea tiene vigencia hasta 2020. Desde la Comisión Europea se está trabajando en una nueva propuesta, cuyas principales líneas se esperan para final de 2017. Actualmente la PAC se basa en tres pilares: los pagos directos, las medidas de mercado, y la política de desarrollo rural. En relación a las líneas de apoyo para pagos directos (Real Decreto 1075/2014), actualmente no existen ayudas vinculadas al uso de la poda como fuente de energía, si bien sí que existieron entre 2012 y 2014, regulados por el Real Decreto 202/2012, en sus artículos 41 a 45. Dichos artículos desarrollaban el programa de ayudas para medidas que aporten mayores beneficios agroambientales en determinadas especies del sector de los frutos de cáscara. Esta medida era aplicable a

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la recogida y retirada para su utilización como biomasa, o a su recogida y triturado quedando extendidos sobre el suelo. Sin embargo desde 2015 ya no existe dicho mecanismo. Lo que sí existen son medidas de condicionalidad, que conforme al capítulo de buenas condiciones agrarias y medioambientales (basadas en el Real Decreto 486/2009) y que establecen que:

- Cuando se eliminen restos de cosecha de cultivos herbáceos y los de poda de cultivos leñosos se realizará, en su caso, con arreglo a la normativa establecida
- No se puede arrancar ningún pie de cultivos leñosos situados en recintos de pendiente igual o superior al 15%

En cuanto al futuro de la PAC para el siguiente periodo, aunque no existen declaraciones oficiales, se espera, por parte de varios agentes consultados, una reducción muy importante en los presupuestos para el siguiente periodo. Como quede la PAC a futuro afectará los mecanismos de condicionalidad para los pagos directos (podría afectar a la quema de residuos agrícolas), así como las líneas prioritarias para el desarrollo rural (actualmente una de ellas es la eficiencia energética, que si se refuerza para el siguiente periodo, podría ser una fuerza impulsora para el uso de biomasa de PARP).

Regulaciones y políticas en calidad de aire

Se está elaborando un nuevo Plan Nacional de Calidad del Aire y Protección de la Atmósfera (Plan AIRE) para el periodo 2017-2019, con el consenso de todos los agentes implicados. El objetivo será reforzar las actuaciones impulsadas en el Plan AIRE actual (2013-2016) para mejorar la calidad del aire complementando las actuaciones previstas en los planes autonómicos y locales, con la intención de reducir las emisiones de los principales contaminantes, incluidas partículas, dióxido de nitrógeno y precursores del ozono.

El Gobierno de España continuará con la revisión y la adaptación de la normativa nacional en emisiones de acuerdo a la Directiva de Techos, trabajando en un Real Decreto para reducir las emisiones de contaminantes atmosféricos y regular la elaboración del Inventario Nacional y Proyecciones de emisiones.

Se ha destinado un total de 172 millones de euros en iniciativas de mejora de la calidad del aire: los Planes de Impulso al Medio Ambiente (PIMA) para renovar el parque automovilístico con vehículos más eficientes y fomentar la compra de bicicletas eléctricas (PIMA Aire); tractores (PIMA Tierra); vehículos de transporte y pasajeros (PIMA Transporte); entre otros, así como los Proyectos Clima para reducir emisiones de CO2 apoyando más de 200 proyectos. Asimismo, se destinaron más de 1.100 millones de euros por parte del Gobierno, a través del Programa de Incentivos al Vehículo Eficiente (PIVE), para reducir el consumo energético nacional mediante la modernización del parque de vehículos.

En cuanto a las medidas que recogía el Plan Aire 2013-2016, la biomasa de PARP se contemplaba dentro de las medidas concretas aplicables al sector agrícola. La medida AGR 3.1 propone la recogida de restos de poda en plantaciones de frutos de cáscara para producción de biomasa o trituración y expansión sobre el terreno de dichos restos. El grado de ejecución es del 38% (Plan Nacional de Calidad del Aire 2017-2019)

La Directiva 2015/2193 regula la limitación de las emisiones a la atmósfera de determinados agentes contaminantes procedentes de las instalaciones de combustión consideradas medianas (potencia térmica nominal superior o igual a 1 MW e inferior a 50 MW con independencia del tipo de combustible utilizado)

En el caso de las instalaciones medianas existentes con anterioridad a la entrada en vigor de la Directiva 2015/2193, los Estados miembros deberán adoptar las medidas necesarias que garanticen que, a partir del 1 de enero de 2024, ninguna instalación de combustión mediana existente con una potencia térmica nominal superior a 5 MW esté en funcionamiento sin haber obtenido un permiso o sin haber sido registrada.

Así y a modo de ejemplo, tomando como referencia al primer grupo, (instalaciones con potencia igual o superior a 1 MW), y en el caso concreto de la biomasa sólida, los valores límite de dióxido de azufre serían de 200 mg/Nm3, 650 mg/Nm3 si se trata de dióxido de nitrógeno y 50 mg/Nm3 para otras partículas.

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La Directiva considera biomasa los productos compuestos por cualquier materia vegetal de origen agrícola o forestal que pueden ser utilizados como combustible para valorizar su contenido energético y a los residuos vegetales de origen agrícola y forestal. Por tanto, las podas y arranques estarían regulados por la transposición de la Directiva 2015/2193.

La biomasa de PARP en la agenda política

De acuerdo a las opiniones recabadas a través de entrevistas y talleres, actualmente y de manera genérica, se considera que la biomasa de PARP no está en la agenda de los actores políticos y, en los casos en que sí, se asocia siempre a la disponibilidad de biomasa forestal en detrimento de esta. Existen instituciones públicas que están trabajando muy de cerca con la biomasa forestal, fomentando trabajos de investigación para su mejora y que no ven interés en investigar en la biomasa agrícola porque presuponen que sus propiedades no van a arrojar buenos resultados.

La evolución de las políticas europeas seguramente será lo que marque el avance en el aprovechamiento energético de biomasa agrícola. Una excepción a este respecto, se está dando en el País Vasco, donde la promoción y el uso de agro-residuos sí está en la agenda de las instituciones públicas, disponiendo de partidas específicas para el desarrollo de este potencial. Se están dando pasos y apuestas reales en entidades locales del País Vasco en el uso de recursos forestales sobre todo, y en menor medida con agro-residuos. El aprovechamiento de podas y arranques podría avanzar sensiblemente si las experiencias y proyectos piloto que actualmente se están desarrollando evidencian posibilidades en su desarrollo. Existen por tanto algunas iniciativas de promoción que pueden ser extrapolables a otras Comunidades Autónomas.

Esta promoción del uso de biomasa agrícola ha venido encuadrada dentro de la prevención de incendios forestales y su combinación con la biomasa forestal para el uso energético en instalaciones públicas. Sin duda, esta acción ha resultado muy positiva. Por otra parte, en Comunidades Autónomas con importante representación en sectores como el del aceite de oliva y el del vino, podrían tomar como signos de avance el interés de los mismos por el aprovechamiento de residuos y fomentar este tipo de prácticas.

E. Resumen del análisis DAFO

La presente sección pretende realizar un análisis DAFO. Para ello en primer lugar se han resumido las Debilidades, Amenazas, Fortalezas y Oportunidades (D-A-F-O) que afectan al desarrollo del uso de la biomasa de PARP. Para dicho análisis debe considerarse como referencia el sector relacionado con el uso de PARP. Dado que dicho sector no existe en la actualidad, ya que apenas hay un uso de este tipo de biomasa, se ha tomado como sector de referencia el sector agrícola y agroindustrial dedicado al cultivo y transformación de la uva, oliva y fruta. Así mismo se incluye como parte del sector las ESEs y potenciales consumidores de biomasa de PARP.

De esta manera se consideran Debilidades y Fortalezas todas aquellas características intrínsecas al sector objeto de análisis. Por otra parte serán Amenazas u Oportunidades aquellos factores externos al sector y que pueden condicionar el desarrollo del mismo.

FORTALEZAS

- F1. La biomasa de PARP minimiza las emisiones de GEI respecto a combustibles fósiles y a otros tipos de biomasa (no tiene impactos por cambio de uso de tierras, ni por producción de la biomasa).
- F2. El uso como fuente de energía puede permitir ahorros a los agricultores en sus tareas de gestión de residuos de PARP.
- F3. El sector agrícola es fuerte en España, y sus representantes tienen capacidad de diálogo y negociación con el Gobierno y otros agentes.

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- F4. La agro-industria del vino, procesamiento de fruta y de aceite de oliva pueden erigirse como consumidores, integrando así los residuos de PARP en conceptos de autoconsumo, km0 y economía circular.
- F5. La poda y arranques de diferentes especies ocurren en diferentes épocas, lo que permite que se se pueda compaginar la recogida de biomasa de varias especies (mayor tiempo de operación a lo largo del año).
- F6. Aceptación social / institucional de que el uso de biomasa puede ser un motor de empleo rural.
- F7. Sentido de proximidad: en el entorno local se entienden mejor los beneficios intangibles derivados del uso de biomasa de PARP(ej: buena práctica respecto a la quema al aire libre).
- F8. Cercanía de consumidores como granjas o fábricas de piensos y ayuntamientos del entorno rural a la biomasa de PARP.
- F9. Calderas preparadas para PARP pueden consumir otros tipos de biomasa (aumenta flexibilidad seguridad de suministro del usuario).
- F10. Ya existen cadenas de distribución de hueso de aceituna, orujillo, orujos de uva y hollejo, pepita de vid, hueso de melocotón o cáscara de almendra (el montaje de nuevas cadenas de PARP es más sencillo).
- F11. Periodos de retorno de las instalaciones de biomasa para calor pueden ser muy cortos (si bien depende de precio gasóleo y gas).

DEBILIDADES

- D1. Maquinaria existente para recogida de podas (apenas conocida, a veces poco evolucionada para obtener biomasa de manera rápida, o en formato adecuado).
- D2. Calidad en general menor y más variable que la astilla forestal, hueso de aceituna, melocotón u orujillo (problemas en combustión o en emisiones de partículas).
- D3. La biomasa de PARP no está apenas regulada, ni estandarizada (reduce confianza de consumidor; fabricantes no tienen valores de referencia)..
- D4. Menor cantidad de tecnologías de combustión disponibles que para otros tipos de biomasa.
- D5. Salvo en zonas de Andalucía, limitada existencia de instalaciones orientadas a consumo de biomasa de PARP.
- D6. Desconocimiento del sector agrícola, energético y público del potencial y de que el uso de la biomasa de PARP puede ser viable.
- D7. Mayor dificultad de conseguir financiación privada en instalaciones de biomasa de PARP (al ser novedosas, sujetas a incertidumbre).
- D8. Costes de la cadena altos, que pueden llevar a un margen de rentabilidad muy ajustado.
- D9. La biomasa de PARP está muy dispersa en el territorio (mayor complejidad logística e impacto en costes)..
- D10. Cantidad de biomasa por hectárea menor que en explotaciones forestales, mayor riesgo de incurrir en sobrecostes..
- D11. No hay suficiente mercado de biomasa no convencionales.
- D12. Existe una importante economía sumergida en el entorno agrícola (servicios de agricultor a agricultor), que limita la expansión y el asentamiento de empresas de servicios agrícolas (agricultores reciben subvención para maquinaria, asumiendo uso propio, no para prestación de servicios a terceros).
- D13. En España otras energías renovables han sido consideradas prioritarias frente a la biomasa.
- D14. No se tiene en cuenta en los planes energéticos de manera explícita el uso de la biomasa de PARP, o las medidas de promoción necesarias..
- D15. El agricultor está totalmente centrado en la producción y se desvincula de la gestión del residuo.
- D16. Ausencia en la mayoría del territorio Español de empresas de servicios con capacidad para la recogida de biomasa de PARP.
- D17. Limitado conocimiento del sector agrícola sobre instalaciones energéticas o uso energético moderno de la biomasa.

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- D18. Distancia entre el sector energético y el agrícola: tanto a nivel de sus representantes como a nivel de empresas y particulares.
- D19. Escasa comprensión del sector agrícola y sus necesidades por parte del sector y actores del sector energético, y viceversa.
- D20. Limitada capacidad de influencia del sector energético en políticas agrarias, así como del sector agrícola en políticas energéticas: limita la promoción de clústeres mixtos o de acciones coordinadas para el uso de agro-biomasa.

OPORTUNIDADES

- O1. Existe un gran potencial en España de biomasa de PARP (casi 5 millones de t de materia seca por año de podas y arranques).
- O2. Aumento de redes de calor en España (se espera que siga la tendencia promovida principalmente desde ayuntamientos).
- O3. Existencia de ESEs (empresas de servicios energéticos) con interés y capaces de realizar instalaciones de garantías con biomasa de PARP.
- O4. Sector del vino emite CO₂. Uso de biomasa de PARP permite mostrar eficiencia, sostenibilidad, contribuyendo a la imagen de la marca y del sector.
- O5. Precio petróleo al alza según previsiones (de finales de 2017).
- O6. Existencia de sellos de calidad de ESEs con garantía de profesionalidad, que pueden visualizar a instaladores con experiencia en PARP.
- O7. Ahorro gracias a uso de biomasa de PARP en entornos / instalaciones agrícolas
- O8. Potencial promoción del aumento en los objetivos de calor con biomasa a partir de la nueva directiva de EERR y planes de renovables que se deriven de ella.
- O9. Nuevos planes de desarrollo rural o de política agrícola que regularicen o fomenten el uso de fuentes de energía de agro-biomasa.
- O10. Políticas ambientales cada vez más restrictivas que puedan limitar en el futuro las quemas al aire libre.
- O11. Aumento de exigencia en reducción de emisiones de las energías renovables (80% hasta 2025 y del 85% a partir de 2026), que posicionará los agro-residuos ventajosamente frente a otros tipos de biomasa.
- O12. Existencia de financiación para desarrollo de productos y servicios innovadores a nivel regional y nacional (fondos Leader, fondos Feader, plan nacional I+D, CDTI, etc.).
- O13. Desarrollo en la actualidad de las especificaciones para generar un estándar de biomasa de podas agrícolas (viñedo y olivar) a través del proyecto Biomasad.
- O14. Impulso Europeo a la economía circular, firma del pacto de España (oportunidad de que se generen mecanismos de promoción que puedan aprovecharse para movilizar la biomasa de PARP).

AMENAZAS

- A1. Promoción de las energías renovables sin segmentar por tipo (la nueva directiva Europea no marca objetivos por energía, sino de manera global).
- A2. Apuestas de la administración española por otros sectores competidores: ejemplo del desarrollo de la red gasística en los 90's y 2000, u otras renovables en las subastas eléctricas para régimen especial.
- A3. Inestabilidad en el marco político, regulatorio y de incentivos: no se perciben políticas a medio/largo plazo, se entiende que existe inestabilidad ante un cambio de legislatura.
- A4. Mayores restricciones en emisiones (trasposición de la directiva 2015/2193 de emisiones en instalaciones medianas a trasponer antes del 19 de Diciembre de 2017 puede hacer biomasa de PARP de difícil uso en instalaciones de mediano tamaño).

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- A5. Límites a las emisiones en instalaciones de pequeña potencia (< 500 kWt) por directiva de ecodiseño, si biomasa de PARP queda englobada como “madera” (se le exigen emisiones de partículas muy bajas), o si en su revisión de 2019 se regulan otros tipos de biomasa (herbácea, por ejemplo), y no se considera la de PARP (quedaría englobada con la “madera”, y su uso dificultado respecto a otros agro-combustibles).
- A6. La legislación podría considerar la madera de PARP como residuo, no como biomasa (por riesgo de contener metales y otros inorgánicos derivados de aplicar fitosanitarios).
- A7. Generación de expectativas demasiado altas (si se confunde potencial de biomasa teórico, con la cantidad disponible, económica y contratable).
- A8. Reducción de la superficie cultivada derivada de sequías y cambio climático.
- A9. Potencial retroceso del sector ante recortes en las ayudas a producción agrícola, pérdida de competitividad, y posible deslocalización de producción de fruta, uva y oliva. (Turquía, Magreb).
- A10. Precio de otros agro-residuos de baja calidad o de biomasa contaminadas (que pueden ser muy baratos, como la madera de aglomerados) si no se evita (medidas de control) su uso en instalaciones pequeñas y medianas.
- A11. Economía sumergida en la prestación de servicios por parte de particulares sin permisos: puede limitar la iniciativa privada.
- A12. Entrada de nuevos instaladores sin experiencia que realicen instalaciones inapropiadas (mala prensa y mala experiencia para la biomasa de PARP).
- A13. Rechazo social a lo novedoso o incierto como tipo de combustible (solo se piensa en astilla, pellet, etc.), nuevas tecnologías, etc..
- A14. Avance de otros usos alternativos (dejar como enmienda orgánica en el suelo, uso para atrapar barrenillo con el olivo, etc.) o promoción de prácticas que limiten su disponibilidad (medidas agro-ambientales de condicionalidad de la PAC, como el picado a campo).
- A15. Variaciones del precio de la biomasa estacionalmente (pueden estar sujetos a especulación) y anualmente (según tendencias del consumo y precio de petróleo).

Merece la pena resaltar que tanto en debilidades como en amenazas, la incertidumbre y el riesgo son una constante, dada la escasa cantidad de casos de éxito y modelos a seguir, así como otros factores coyunturales como el bajo precio del petróleo y la energía. No se han considerado explícitamente en los listados anteriores, por ser un resultado del conjunto del marco actual.

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① PROMOVER EL ACERCAMIENTO ENTRE SECTOR AGRARIO y ENERGÉTICO	
Estrategia: Debilidad + Oportunidad → DO “Reorientación”	
D18. Distancia entre el sector agrícola y el energético D17. Sector agrícola en general no experto en instalaciones energéticas o en biomasa D19. Sector energético no entiende necesidades del agrícola D20. Ausencia de redes, clústeres, o acciones que acerquen a ambos sectores	O1. Alto potencial de PARP en España O7. Ahorro gracias a uso de biomasa de PARP en entornos /instalaciones agrícolas O9. Nuevos planes de desarrollo rural o de política agrícola que promuevan el uso de agro-biomasa
Objetivos DO1. Promover el acercamiento entre sector agrario y sector energético, a fin de que haya mayor entendimiento y mayor potencial de colaboración, y se eviten malas experiencias.	
Acciones / Actividades • Promoción de la colaboración entre entidades agrarias con especialistas en biomasa y/o sistemas de suministro energético, y con ESEs (para obtener asesoramiento en biomasa). • Campañas de difusión y transferencia para facilitar al sector agrícola una visión de la cadena biomasa en conjunto, cómo funciona, su rol, posibles beneficios, a fin de entender las necesidades y problemas de agentes como ESEs, intermediarios, comercializadores de biomasa, etc. • Sensibilización al sector energético las necesidades y prioridades de los agricultores, a fin de que sean conscientes de la realidad del sector agrícola y de las formas en que pueden conseguir llegar a un acuerdo sinérgico con los agricultores. • Transferencia de casos reales a través de folletos, campañas o visitas técnicas a fin de mostrar la cadena de valor y los roles de los diferentes actores, a fin de facilitar el entendimiento y la creación de nuevas cadenas. • Generación de redes temáticas de agro-biomasa para que se comparta la visión y el conocimiento entre agricultores, cooperativas, ESEs, empresas forestales, etc. • Creación de clústers de colaboración en el que el sector agrícola y las agroindustrias participen, conjuntamente con ESEs.	

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② INFORMAR AL AGRICULTOR ACERCA DE LA RETIRADA y USO ENERGÉTICO DE LOS RESTOS DE PODA Y ARRANQUES	
Estrategia: Debilidad + Oportunidad → DO “Reorientación”	
D1. Maquinaria existente para recogida de podas apenas conocida, a veces poco evolucionada D4. Menor cantidad de tecnologías de combustión disponibles que para otros tipos de biomasa D6. Desconocimiento del sector agrícola, energético y público del potencial y de que el uso de la biomasa de PARP puede ser viable D15. El agricultor está totalmente centrado en la producción y se desvincula de la gestión del residuo D16. Ausencia en la mayoría del territorio Español de empresas de servicios con capacidad para la recogida de biomasa de PARP D17. Limitado conocimiento del sector agrícola sobre instalaciones energéticas o uso energético moderno de la biomasa	O3. Existencia de ESEs con interés y capacidad de realizar instalaciones de biomasa de PARP O6. Existencia de sellos de calidad de ESEs con garantía de profesionalidad, que pueden visualizar a instaladores con experiencia en PARP O7. Ahorro gracias a uso de biomasa de PARP en entornos / instalaciones agrícolas O10. Políticas ambientales cada vez más restrictivas que puedan limitar en el futuro las quemas al aire libre O14. Impulso Europeo a la economía circular, y existencia de un pacto en España
Objetivos DO1. Facilitar al agricultor / sector agrícola y agroindustrial la información necesaria sobre tecnologías y métodos para la retirada de podas y arranques del campo. DO2. Facilitar al agricultor / sector agrícola y agroindustrial la información necesaria sobre tecnologías aprovechamiento energético compatibles con biomasa de PARP.	
Acciones / Actividades • Campaña de visibilidad de empresas que tienen interés y capacidad para asociarse en la puesta en marcha de nuevas cadenas de biomasa de PARP. • Mayor información a los agricultores y técnicos de cooperativas y asociaciones agrarias para que entiendan qué formas de recogida hay, pros, contras, y costes asociados. • Transferencia de las tecnologías existentes al sector agrario para el aprovechamiento de residuos de podas: tanto compostaje como combustión. • Generación de redes de expertos, técnicos o consultores capaces de dar asesoramiento / orientación a los agricultores. • Generación de redes de agricultores para compartir sus experiencias.	

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③ INFORMAR AL AGRICULTOR ACERCA DE LA SOSTENIBILIDAD ASOCIADA AL USO DE BIOMASA DE PARP	
Estrategia: Fortaleza + Oportunidad → FO “Ataque”	
F1. La biomasa de PARP minimiza las emisiones de GEI respecto a combustibles fósiles y a otros tipos de biomasa F4. La agro-industria del vino, procesado de fruta y de aceite de oliva pueden erigirse como consumidores, integrando así los residuos de PARP en conceptos de autoconsumo, km0 y economía circular F7. Sentido de proximidad: en el entorno local se entienden mejor los beneficios intangibles derivados del uso de la biomasa de PARP	O4. Sector vino emite CO₂. Uso de biomasa de PARP contribuye a la imagen de la marca y del sector O10. Políticas ambientales cada vez más restrictivas que puedan limitar en el futuro las quemas al aire libre O11. Aumento de exigencia en reducción de emisiones de las energías renovables (80% hasta 2025 y del 85% a partir de 2026) O14. Impulso Europeo a la economía circular, y existencia de un pacto en España
Objetivos	
FO1. Facilitar al agricultor la información necesaria para que sea consciente de la sostenibilidad asociada al uso de biomasa de PARP con fines energéticos.	
Acciones / Actividades	
• Evaluación y diseminación del ahorro en emisiones y energía respecto a combustibles fósiles. • Preparación y transferencia de guías claras sobre el limitado valor de los restos de PARP como fertilizante. • Preparación y transferencia de buenas prácticas con indicaciones para conocer su utilidad real como enmienda orgánica: saber cuándo realmente puede ser positivo, así como conocer los potenciales riesgos. • Seminarios para la diseminación de los mensajes y buenas prácticas recopiladas. • Diseminación de manuales y dosieres a través de las asociaciones agrícolas, de agro-industria y cooperativas.	

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④ PROMOVER EL CAMBIO DESDE LAS PROPIAS INSTITUCIONES Estrategia: Fortaleza + Amenaza → FA “Defensa”				
F3.	El sector agrícola es fuerte en España, y sus representantes tienen capacidad de diálogo y negociación con el Gobierno y otros agentes	A1.	Promoción de las energías renovables sin segmentar por tipo	
F6.	Aceptación social / institucional de que el uso de biomasa puede ser un motor de empleo rural	A2.	Apuestas de la administración española por otros sectores competidores	
F9.	Calderas preparadas para PARP pueden consumir otros tipos de biomasa (aumenta flexibilidad seguridad de suministro del usuario)	A3.	Forma de actuar de la administración inestable según legislatura	
		A6.	La legislación podría considerar la madera de PARP como residuo, no como biomasa	
F11.	Periodos de retorno de las instalaciones de biomasa para calor pueden ser muy cortos (si bien depende de precio gasóleo y gas)	A13.	Rechazo social a lo novedoso o incierto como tipo de combustible (solo se piensa en astilla, pellet, etc.), nuevas tecnologías, etc.	
Objetivos FA1. Conseguir que sean las instituciones y administraciones públicas las que promuevan el cambio en la gestión de podas mediante acciones ejemplificadores. FA2. Fomentar que las instituciones activen mecanismos de promoción o favorecimiento del uso de biomasa de PARP: incentivación, licitaciones ecológicas (Green Public Procurement), etc.				
Acciones / Actividades • Demanda a las instituciones para dar ejemplo en sus acciones de trabajos ambientales, o gestión de residuos de biomasa, para que se limite al extremo la quema de residuos. • Alinear a las instituciones para que apuesten de manera decidida por una gestión más sostenible de residuos. • Facilitar a las instituciones ejemplos y fórmulas ya en práctica de licitaciones en que se priorice la biomasa, y en concreto, los residuos agrícolas en zonas de alta acumulación. • Incluir la recogida de residuos de biomasa de PARP dentro de sus competencias (no únicamente dedicarse a RSU, aguas, etc.). • Inducir una mayor promoción de instalaciones de biomasa policomcombustibles capaces de utilizar restos de podas y arranques para ejemplificar su factibilidad.				

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⑤

DAR VISIBILIDAD A LOS BENEFICIOS ASOCIADOS AL USO ENERGÉTICO DE LA BIOMASA DE PARP Y DE LAS OPORTUNIDADES QUE PUEDEN APROVECHAR LOS AGRICULTORES

Estrategia: Fortaleza + Oportunidad → FO “Ataque”

F1. La biomasa de PARP minimiza las emisiones de GEI respecto a combustibles fósiles y a otros tipos de biomasa	O5. Precio petróleo al alza según previsiones (de finales de 2017)
F2. El uso como fuente de energía puede permitir ahorros a los agricultores en sus tareas de gestión de residuos de PARP	O7. Ahorro gracias a uso de biomasa de PARP en entornos / instalaciones agrícolas
F3. El sector agrícola es fuerte en España, y sus representantes tienen capacidad de diálogo y negociación con el Gobierno y otros agentes	O8. Potencial promoción del aumento en los objetivos de calor con biomasa a partir de la nueva directiva de EERR y planes de renovables
F8. Cercanía de consumidores como granjas o fábricas de piensos y ayuntamientos del entorno rural a la biomasa de PARP	O9. Nuevos planes de desarrollo rural o de política agrícola que promuevan el uso de agro-biomasa
F11. Periodos de retorno de las instalaciones de biomasa para calor pueden ser muy cortos	O12. Existencia de financiación para desarrollo de productos y servicios innovadores a nivel regional y nacional (Leader, Feader, plan nacional I+D, CDTI, etc.)
	O14. Impulso a la economía circular y firma del pacto de España

Objetivos

- FO1. Poner de manifiesto y transferir a agricultores y empresas todos los beneficios asociados al uso de la biomasa de PARP como recurso energético, y la posibilidad de ahorro.
- FO2. Facilitar a los potenciales promotores de nuevas iniciativas de información y modelos a seguir, políticas de apoyo en línea con su iniciativa y mecanismos de financiación.

Acciones / Actividades

- Preparar documentación con los balances de costes / ahorros con cifras y datos al utilizar la biomasa de PARP.
- Mostrar modelos a seguir en el uso de biomasa de PARP, incluyendo la viabilidad de ese tipo de cadena, y mecanismos de apoyo y de financiación.
- Campañas de comunicación de que el uso energético de la biomasa de PARP es factible.
- Campañas generales, sobre el valor del residuo, el potencial ahorro (dípticos, radio, jornadas), modelos a seguir, financiación.
- Diseminar la imagen de que el calor con biomasa agrícola es algo que se lleva haciendo desde décadas, con la diferencia de que ahora está más tecnificado.
- Transmitir al sector la necesidad de transición en el modelo de gestión de residuos: el productor del residuo puede obtener ahorros, pero ha de adecuarse a una nueva forma de gestión, que puede implicar nuevas contrataciones (p.ej. para servicio de recogida).

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⑥ DESARROLLO DE I+D+i EN TECNOLOGÍA Estrategia: Debilidad + Oportunidad → DO “Reorientación”	
D1. Maquinaria existente para recogida de podas apenas conocida, a veces poco evolucionada D2. Calidad en general menor y más variable que la astilla forestal, hueso de aceituna, melocotón u orujillo (problemas en combustión o en emisiones de partículas) D4. Menor cantidad de tecnologías de combustión disponibles que para otros tipos de biomasa D5. Limitada existencia de instalaciones orientadas a consumo de biomasa de PARP D20. Ausencia de redes, clústeres, o acciones que acerquen a ambos sectores (agrícola y energético)	O2. Aumento de redes de calor en España (se espera que siga la tendencia promovida principalmente desde ayuntamientos) O5. Precio petróleo al alza según previsiones (de finales de 2016) O8. Potencial promoción del aumento en los objetivos de calor con biomasa a partir de la nueva directiva de EERR y planes de renovables O12. Existencia de financiación para desarrollo de productos y servicios innovadores a nivel regional y nacional (Leader, Feader, plan nacional I+D, CDTI, etc.)
Objetivos DO1. Desarrollo y mejora de la tecnología asociada al uso energético de PARP: sistemas de combustión, limpieza de gases, y de mejora de la calidad del combustible, de manera que puedan usarse la biomasa de PARP de manera limpia y eficiente (especialmente tecnologías de pequeña y mediana potencia). DO2. Desarrollo y mejora de las tecnologías de recogida y manejo de la biomasa de PARP (empacadoras, astilladoras, trituradoras) que mejoren la calidad del producto, faciliten su manejo y trasiego, y reduzcan costes,	
Acciones / Actividades • Elaboración de un estado del arte y necesidades de mejora de las tecnologías de tratamiento y combustión de biomasa de PARP. • Promoción del desarrollo industrial de tecnologías de tratamiento de biomasa (secado, torrefacción, pirolisis, etc.) a fin de mejorar las propiedades de la biomasa de PARP. • Promoción de nuevas calderas adaptadas y probadas para usar diferentes tipos de biomasa de PARP. • Desarrollo tecnológico de sistemas de captura de partículas sencillos, robustos y baratos. • Elaboración de un estado del arte y necesidades de mejora de las tecnologías de recogida de biomasa de PARP. • Promoción de tecnologías nuevas o mejoradas para la recogida de biomasa de PARP. • Creación de clústers de innovación y/o energéticos en el que el sector agrícola y las agroindustrias participen, conjuntamente con ESEs.	

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⑦ MEDIDAS DE TASACIÓN y APOYO ESPECIALES ESPECÍFICAS PARA BIOMASA DE PARP	
Estrategia: Debilidad + Amenaza → DA “Supervivencia”	
D7. Mayor dificultad de conseguir financiación privada en instalaciones de biomasa de PARP (al ser novedosas, sujetas a incertidumbre) D8. Costes de la cadena altos, que pueden llevar a un margen de rentabilidad muy ajustado D10. Cantidad de biomasa por hectárea menor que en explotaciones forestales, mayor riesgo de incurrir en sobrecostes D11. No hay suficiente mercado de biomasa no convencionales D15. El agricultor está totalmente centrado en la producción y se desvincula de la gestión del residuo	A4. Mayores restricciones en emisiones pueden hacer biomasa de PARP de difícil uso en instalaciones de mediano tamaño A9. Potencial retroceso del sector ante recortes en las ayudas a producción agrícola, posible deslocalización de producción de fruta, uva y oliva. A10. Precio de otros agro-residuos de baja calidad o de biomasa contaminadas (que pueden ser muy baratos) A14. Avance de otros usos alternativos (dejar como enmienda orgánica en el suelo, uso para atrapar barrenillo con el olivo, etc.) o promoción de prácticas que limiten su disponibilidad.
Objetivos DA1. Mejorar el margen de beneficio, ya que resulta tan ajustado actualmente que un pequeño cambio en los impuestos puede servir de acicate para el impulso del aprovechamiento energético de la biomasa de podas y arranques. DA2. Hacer más atractiva como práctica agronómica la alternativa del uso energético de la biomasa de podas y arranques	
Acciones / Actividades - Medidas para sufragar instalación de sistemas de limpieza de partículas en instalaciones de mediana potencia que usen biomasa de PARP. - Promoción de “Green taxes”, impuestos para fuentes fósiles, para mejorar la rentabilidad de iniciativas de uso de poda agrícolas y otros recursos renovables. - Exención del IVA, o reducción del IVA a biomasa que precisen una promoción. - Promoción de ventajas fiscales a las buenas prácticas agrícolas (en cuanto al tratamiento que se da a los residuos). - Promoción de medidas de apoyo y de financiación para el emprendimiento de buenas prácticas en la gestión y uso de residuos de biomasa de PARP.	

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⑧ PROMOVER POLÍTICAS QUE GENEREN UN MARCO FAVORABLE Y ESTABLE PARA LA BIOMASA DE PARP	
Estrategia: Debilidad + Oportunidad → DO “Reorientación”	
D1. Maquinaria existente para recogida de podas apenas conocida, a veces poco evolucionada D2. Calidad en general menor y más variable que la astilla forestal, hueso de aceituna, melocotón u orujillo (problemas en combustión o en emisiones de partículas) D3. La biomasa de PARP no está apenas regulada, ni estandarizada (reduce confianza de consumidor; fabricantes no tienen valores de referencia) D4. Menor cantidad de tecnologías de combustión disponibles que para otros tipos de biomasa D8. Costes de la cadena altos, que pueden llevar a un margen de rentabilidad muy ajustado D9. La biomasa de PARP está muy dispersa en el territorio (mayor complejidad logística e impacto en costes). D10. Cantidad de biomasa por hectárea menor que en explotaciones forestales, mayor riesgo de incurrir en sobrecostes D16. Ausencia en la mayoría del territorio Español de empresas de servicios con capacidad para la recogida de biomasa de PARP	O1. Existe un gran potencial en España de biomasa de PARP (casi 5 millones de t de materia seca por año de podas y arranques) O8. Potencial promoción del aumento en los objetivos de calor con biomasa a partir de la nueva directiva de EERR y planes de renovables O9. Nuevos planes de desarrollo rural o de política agrícola que promuevan el uso de agrobiomasa O11. Aumento de exigencia en reducción de emisiones de las energías renovables (80% hasta 2025 y del 85% a partir de 2026) O12. Existencia de financiación para desarrollo de productos y servicios innovadores a nivel regional y nacional (Leader, Feader, plan nacional I+D, CDTI, etc.) O14. Impulso Europeo a la economía circular, y existencia de un pacto en España
Objetivos	
DA1. Promover un marco general más favorable para la biomasa de PARP por su especial aportación de beneficios intangibles (desarrollo rural, reducción de emisiones, etc.)	
Acciones / Actividades	
• Evaluación de costes logísticos y de la cadena completa de valor, para identificar las necesidades y potenciales medios de promoción por tipo de agrobiomasa. • Programas de adquisición de maquinaria para la retirada de biomasa de PARP. • Instrumentos de promoción y apoyo para la creación de centros logísticos, o de transferencia de biomasa a nivel local o regional. • Incidencia para que se incluyan en políticas energéticas que primen la producción de energía renovable a través de biomasa agrícola (por ejemplo a través de incentivos al usuario final, primas). • Políticas de emprendimiento y prioridades de planes de desarrollo rural que doten de	

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apoyos específicos a empresas de servicios para que encuentren más atrayente la oferta de nuevos servicios de recogida o movilización de biomasa de PARP.

- Promoción de programas de I+D en las que las tecnologías precisas para el uso de la agro-biomasa tengan una relevancia: recolección y tratamiento, tecnologías eficientes y mejoradas de pequeña y mediana potencia de combustión de agro-residuos y de sistemas de limpieza de gases.
- Dotación de medidas específicas de apoyo al calor generado con agro-residuos frente a calor generado con biomasa forestal.

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⑨ APROVECHAR LOS VALORES INTANGIBLES DE LA BIOMASA DE PARP COMO ARGUMENTO PARA PROMOVER SU USO	
Estrategia: Fortaleza + Amenaza → FO “Ataque”	
F1. La biomasa de PARP minimiza las emisiones de GEI respecto a combustibles fósiles y a otros tipos de biomasa F2. El uso como fuente de energía puede permitir ahorros a los agricultores en sus tareas de gestión de residuos de PARP F3. El sector agrícola es fuerte en España, y sus representantes tienen capacidad de diálogo y negociación con el Gobierno y otros agentes F4. La agro-industria del vino, procesado de fruta y de aceite de oliva pueden erigirse como consumidores, integrando así los residuos de PARP en conceptos de autoconsumo, km0 y economía circular F6. Aceptación social / institucional de que el uso de biomasa puede ser un motor de empleo rural F7. Sentido de proximidad: en el entorno local se entienden mejor los beneficios intangibles derivados del uso de biomasa de PARP F8. Cercanía de consumidores como granjas o fábricas de piensos y ayuntamientos del entorno rural a la biomasa de PARP	O1. Existe un gran potencial en España de biomasa de PARP (casi 5 millones de t de materia seca por año de podas y arranques) O4. Sector del vino emite CO₂. Uso de biomasa de PARP contribuyen a la imagen de la marca y del sector O9. Nuevos planes de desarrollo rural o de política agrícola que promuevan el uso de agro-biomasa O10. Políticas ambientales cada vez más restrictivas que puedan limitar en el futuro las quemas al aire libre O14. Impulso Europeo a la economía circular, y existencia de un pacto en España
Objetivos	
FO1. Promover el uso energético de PARP frente a otros usos, mediante la visualización de los valores y beneficios intangibles asociados a su aprovechamiento para producción de energía. FO2. Fomentar el contacto entre agentes locales para aprovechar los valores intangibles que tiene la biomasa de PARP como fuerza impulsora de nuevas iniciativas.	
Acciones / Actividades	
- Identificación y comunicación de ventajas de uso de poda, no meramente asociadas a los costes de explotación y la nueva alternativa de gestión: salud vegetal, reducción riesgos incendios, etc. - Cuantificación del valor intangible del uso de biomasa de PARP, para su diseminación y puesta en manos de los actores políticos. - Propuesta de tasación o apoyos por reducción de emisiones de CO₂. - Fomento desde planes de desarrollo rural, al ser el uso de residuos agrícolas un elemento creador de empleo local.	

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- Incorporar a la renta de la explotación los beneficios tangibles e intangibles del uso de la poda, de manera que ante buenas prácticas, puedan tenerse beneficios fiscales, desgravaciones, etc.
- Mecanismos de promoción / licitación de instalaciones de biomasa que internalicen sus beneficios sociales y ambientales.

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⑩ APROVECHAR LA SINERGIA EXISTENTE CON LA AGRO-INDUSTRIA Y LAS EMPRESAS DE SERVICIOS AGRÍCOLAS	
Estrategia: Fortaleza + Oportunidad → FO “Ataque”	
F4. La agro-industria del vino, procesado de fruta y de aceite de oliva pueden erigirse como consumidores, integrando así los residuos en conceptos de autoconsumo, km0 y economía circular F5. La poda y arranques de diferentes especies ocurren en diferentes épocas, lo que permite que se pueda compaginar la recogida de biomasa de varias especies F10. Ya existen cadenas de distribución de hueso de aceituna, orujillo, orujos de uva y hollejo, pepita de vid, hueso de melocotón o cáscara de almendra	O4. Sector vino emite CO₂. Uso de biomasa de PARP contribuye a la imagen de la marca y del sector O8. Potencial promoción del aumento en los objetivos de calor con biomasa a partir de la nueva directiva de EERR y planes de renovables O9. Nuevos planes de desarrollo rural o de política agrícola que promuevan el uso de agrobiomasa O12. Existencia de financiación para desarrollo de productos y servicios innovadores a nivel regional y nacional (Leader, Feader, plan nacional I+D, CDTI, etc.)
Objetivos	
FO1. Aprovechar la sinergia con empresas de servicios agrícolas y en general con la agroindustria, fomentando la diversificación de sus actividades y haciendo uso de sus equipos y personal contratado, para la gestión de las podas.	
Acciones / Actividades	
• Campaña de transferencia de modelos de negocio a Empresas de Servicios Agrícolas y agro-industria. • Actividades de acercamiento y matchmaking entre agricultores, agroindustria, y empresas de servicios para dar lugar a nuevas iniciativas de uso de biomasa de PARP. • Programas de apoyo a la innovación y a la mejora de la competitividad que incluyan la nueva actividad en biomasa como una de las líneas de acción. • Promoción de instalaciones de consumo de agro-biomasa en el sector agro-industria.	

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⑪ PROMOVER UN NUEVO MERCADO DE LA BIOMASA CON PRESENCIA ACTIVA DE LAS PODAS AGRÍCOLAS Y ARRANQUES	
Estrategia: Debilidad + Oportunidad → DO “Reorientación”	
D2. Calidad en general menor y más variable que la astilla forestal, hueso de aceituna, melocotón u orujillo (problemas en combustión o en emisiones de partículas) D3. La biomasa de PARP no está apenas regulada, ni estandarizada (reduce confianza de consumidor; fabricantes no tienen valores de referencia) D5. Limitada existencia de instalaciones orientadas a consumo de biomasa de PARP D11. No hay suficiente mercado de la biomasa no convencionales D12. Existe una importante economía sumergida en el entorno agrícola (servicios de agricultor a agricultor), que limita la expansión y el asentamiento de empresas de servicios agrícolas	O2. Aumento de redes de calor en España (se espera que siga la tendencia promovida principalmente desde ayuntamientos) O6. Existencia de sellos de calidad de ESEs con garantía de profesionalidad, que pueden visualizar a instaladores con experiencia en PARP. O8. Potencial promoción del aumento en los objetivos de calor con biomasa a partir de la nueva directiva de EERR y planes de renovables O9. Nuevos planes de desarrollo rural o de política agrícola que promuevan el uso de agrobiomasa O13. Desarrollo en la actualidad de las especificaciones para generar un estándar de biomasa de podas agrícolas (viñedo y olivar) que puede derivar en redacción de estándares para biomasa de PARP
Objetivos DO1. Crear un mercado estable para la biomasa de PARP (nuevas instalaciones, o instalaciones preparadas para el consumo de dicha biomasa) DO2. Promover las condiciones para que la penetración de la biomasa de PARP dentro del mercado de la biomasa se favorezca.	
Acciones / Actividades - Sensibilizar a ayuntamientos, ESEs y agroindustrias a fin de incrementar instalaciones/plantas de consumo de biomasa de residuos agrícolas para calor (redes de calor en expansión). - Favorecer el reacomodamiento del uso de la biomasa como uno de los ejes de desarrollo rural. - Fomentar una mayor transparencia a nivel de precios para facilitar un marco de precios más estables, menos sujetos a variaciones y especulación (observatorios del mercado, redes de proveedores). - Apoyar la creación de un mercado de transferencia de restos agrícolas (plataformas web como Biobusca, incluir en catálogo de productos de proveedores de biomasa). - Transferir a los agentes de la cadena las buenas prácticas en la cadena biomasa para asegurar mayor calidad (ej: evitar pudrición, contenido de suelo, tierra, etc.) y menor variabilidad en su composición. - Promover el uso de sellos de calidad y de sistemas de seguimiento y aseguramiento de	

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la calidad para la biomasa de PARP.

- Fomentar el reconocimiento del uso de la biomasa como una actividad económica a fin de fomentar los servicios de recogida, la comercialización, y reducir la economía sumergida.

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⑫ SEGUIMIENTO DE LA LEGISLACIÓN y ACCIONES PARA QUE BIOMASA DE PARP NO QUEDE FUERA o DESFAVORECIDA EN PLANES ENERGÉTICOS o AMBIENTALES o NUEVAS REGULACIONES Estrategia: Debilidad + Amenaza → DA “Supervivencia”	
D2. Calidad en general menor y más variable que la astilla forestal, hueso de aceituna, melocotón u orujillo (problemas en combustión o en emisiones de partículas) D3. La biomasa de PARP no está apenas regulada, ni estandarizada (reduce confianza de consumidor; fabricantes no tienen valores de referencia) D14. No se tiene en cuenta en los planes energéticos de manera explícita el uso de la biomasa de PARP, ni las medidas de promoción necesarias D13. En España otras energías renovables han sido consideradas prioritarias frente a la biomasa D18. Distancia entre el sector agrícola y el energético (incluyendo entre departamentos de la administración)	A1. Promoción de las energías renovables sin segmentar por tipo (la nivel Europeo) A2. Apuestas de la administración española por otros sectores competidores A3. Forma de actuar de la administración inestable según legislatura A4. Mayores restricciones en emisiones pueden hacer biomasa de PARP de difícil uso en instalaciones de mediano tamaño A5. Límites a las emisiones en instalaciones de pequeña potencia (< 500 kWt) por directiva de ecodiseño (se le exigen emisiones de partículas muy bajas). Posibilidad de que se asigne límites como a la madera forestal (no como agro-residuo) A6. La legislación podría considerar la madera de PARP como residuo, no como biomasa (por riesgo de contener metales y otros inorgánicos derivados de aplicar fitosanitarios) A7. Generación de expectativas demasiado altas (si se confunde potencial de biomasa teórico, con la cantidad disponible, económica y contratable). A14. Avance de otros usos alternativos (dejar como enmienda orgánica en el suelo, uso para atrapar barrenillo con el olivo, etc.) o promoción de prácticas que limiten su disponibilidad
Objetivos DA1. Vigilar la aparición de nueva legislación nacional y europea para evitar que la biomasa de PARP pueda quedar potencialmente fuera de varios nichos de mercado del sector de la biomasa DA2. Activar los intereses del sector para que realicen incidencia en los agentes políticos ante la cosntatación de planes o políticas que desfavorecen o limitan el uso de biomasa de PARP	
Acciones / Actividades Seguimiento de las directivas de Ecodiseño de calderas y de Emisiones para que sea tenida en cuenta con sus características especiales (no se regule sólo para pellet y	

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madera).

- Evitar que la biomasa de PARP se considere “madera” (Wood), en las regulaciones existentes, en agravio respecto a otras agrobiomasas herbáceas cuya regulación pudiera ser menos estricta.
- Seguimiento de los nuevos planes de Energía y Clima (2021-2030) para que se incluyan datos del potencial, necesidades y medidas para la promoción de biomasa de PARP.
- Seguimiento de las nuevas políticas PAC y de Desarrollo Rural, a fin de que los agro-residuos se incluyan como una de las líneas de desarrollo rural, bioeconomía y economía circular.
- Seguimiento de las nuevas políticas PAC, para que se reconozca el uso de la biomasa de PARP en la condicionalidad por medidas de “greening”.
- Sensibilizar a agentes políticos así como del sector (lobbies agrícola y energético) sobre la posible amenaza
- Favorecer la agrupación de lobbies agrícolas y energéticos en torno a declaraciones de apoyo a favor de la biomasa de PARP.
- Velar por un trato diferenciado de la biomasa de PARP respecto a la biomasa forestal, y trazar estrategias de presión para solicitar revisiones o periodos de transición especiales para aplicar las normativas a los agro-residuos.
-
- Preparación de un argumentario en defensa de la biomasa de PARP, así como de una serie de propuestas específicas para las políticas que potencialmente pueden influir negativamente en su desarrollo.

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⑬ FOMENTO DE LA RESPONSABILIDAD EN EL ENTORNO LOCAL, y DE LA VIGILANCIA y CONTROL DE PRÁCTICAS ILÍCITAS QUE VAN EN DETRIMENTO DEL USO DE LA BIOMASA DE PARP Estrategia: Fortaleza + Amenaza → FA “Defensa”	
F3. El sector agrícola es fuerte en España, y sus representantes tienen capacidad de diálogo y negociación con el Gobierno y otros agentes F7. Sentido de proximidad: en el entorno local se entienden mejor los beneficios intangibles derivados del uso de biomasa de PARP (ej: buena práctica respecto a la quema al aire libre) F8. Cercanía de consumidores como granjas o fábricas de piensos y ayuntamientos del entorno rural a la biomasa de PARP.	A10. Precio de otros agro-residuos de baja calidad o de biomasa contaminadas (que pueden ser muy baratos, como la madera de aglomerados) si no se evita (medidas de control) A11. Economía sumergida en la prestación de servicios por parte de particulares sin permisos: puede limitar la iniciativa privada A12. Entrada de nuevos instaladores sin experiencia que realicen instalaciones inapropiadas (mala prensa y mala experiencia para la biomasa de PARP) A14. Avance de otros usos alternativos (dejar como enmienda orgánica en el suelo, uso para atrapar barrenillo con el olivo, etc.) o promoción de prácticas que limiten su disponibilidad A15. Variaciones del precio de la biomasa estacionalmente (pueden estar sujetos a especulación) y anualmente (según tendencias del consumo y precio de petróleo).
Objetivos FA1. Fomentar una mayor concienciación, confianza y proximidad entre los actores y población local para que el uso de biomasa quede libre de amenazas derivadas de intereses particulares (especulación, quema incontrolada, uso de residuos con impregnación en calderas, etc.) FA2. Fomentar la vigilancia y el sentido de responsabilidad en la ejecución de las labores de gestión del residuos, de las prácticas agronómicas y del uso adecuado de la biomasa	
Acciones / Actividades - Identificación de las amenazas o malas prácticas que pueden limitar el uso de la biomasa de PARP localmente: especulación con biomasa, prestación de servicios de manera informal (economía sumergida), permisividad en las quemas, seguimiento a la correcta aplicación de las medidas de condicionalidad, etc. - Campañas de concienciación para ilustrar los beneficios locales que puede llevar el uso	

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de los agro-residuos, y de las amenazas que los intereses particulares pueden jugar localmente en contra del bien común y del uso de la biomasa de PARP

- Mayor control de las autoridades locales en controlar y evitar parte de las prácticas sancionables y que suponen un agravio para el uso de la biomasa de PARP
- Campañas de concienciación e información a las comunidades locales, sobre la necesidad de tecnologías capaces de utilizar adecuadamente la biomasa de PARP, de instaladores competentes, y del establecimiento de un mercado local estable para la biomasa de PARP

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Agradecimientos		
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Juan Jesús Ramos	AVEBIOM - Asociación Española de Valorización Energética de la Biomasa (Valladolid)	Representación de agentes del sector biomasa
Fernando Santiso, Presidente	Unión Biomasa Andalucía (Huelva)	Representación de agentes del sector biomasa.
Gregor Baer	Heizomat (Alicante)	Empresa fabricante de calderas.
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Jordi Cuyás Soler, Coordinador de proyectos estratégicos.	Ayuntamiento de Vilafranca del Penedés (Barcelona)	Administración pública, caso de éxito biomasa PARP
Susana Rivera, Servicios, calidad e innovación	Cooperativas agro-alimentarias España (Madrid)	Asociación de cooperativas agro-alimentarias, representación del sector rural.

ANNEX A3

WP2 – Task T2.3

Performing an APPR Sector Analysis and Developing a Strategic Plan at National and EU level Greece

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	Author:	CERTH	Version:	v2
	Reference:		Date:	28/02/2018

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SECTOR ANALYSIS

A. National framework on APPR sources

Greece is located at the southernmost tip of the Balkan Peninsula in South-Eastern Europe. It shares land borders with Albania to the northwest, the Former Yugoslav Republic of Macedonia and Bulgaria to the north and Turkey to the northeast. It has a total surface area of 131.957 km² and a population of around 11 million inhabitants in 2016 (2.1% of the EU total). Some particular geographical characteristics are:

- The country's numerous islands, of which only 227 are inhabited. Greece has one of the longest coastlines in the world and the longest in the EU.
- The mountainous / hilly nature of the landscape: more than 80 % of the country is mountainous, one of the highest percentages in the EU.



Figure 1: Map of Greece showing NUTS2 and NUTS3 regions

In 2015, the Utilized Agricultural Land (UAA) in Greece corresponded to 3,282.52 thousand ha, 52.9 % of which was devoted to the cultivation of arable crops. According to ELSAT, permanent crops accounted to 33.9 % of the UAA, while vegetables and fallow land amounted to 2 % and 11.2 %. Eurostat reports that Greece has the highest percentage of the total UAA for permanent crops among all member states and is one of the three member-states (along with Cyprus and Portugal) with a higher share than 20 % of the total UAA. This is attributed to the favorable climatic conditions for growing permanent crops.

Table 1 presents the main statistics (surface for compact plantations, number of trees and total production) for the most important permanent crop species based on data from ELSTAT and Eurostat. The two dataset are not in perfect agreement and large differences can often be observed, the most important of which is the production level of olives for olive oil production. Variances in statistical data are a factor that should be considered in any estimation of the APPR biomass potential (as will be presented in the next section).

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Table 1: Main statistics of most important permanent crop species in Greece

Permanent crops, main statistics (2015)							
Crop Specie		Area (1,000 ha)		Production (1,000 t)		# trees, total	# trees, compact plantations
Source		(1) ¹	(2)	(1)	(2)	(1)	(1)
Olive Trees	For olive oil	710.30	856.75	2,477.20	965.75	150,351,619	141,991,652
	Edible olives	110.91	113.15	430.67	304.10		
Grapes	For wine	54.46	65.63	516.31	574.13	N/A	N/A
	Table grapes	8.81	16.19	228.87	248.71		
	For raisins	14.56	32.57	60.26	259.37		
Citrus Trees	Orange	31.26	33.63	808.65	880.92	14,591,222	14,073,530
	Lemon	4.19	3.87	61.04	44.80	2,068,060	1,469,283
	Mandarin	6.92	8.53	161.15	158.49	3,346,027	3,108,034
Fruit Trees	Apple	9.83	11.76	267.02	289.98	8,801,765	8,532,614
	Pear	3.79	4.43	94.88	66.09	2,924,618	2,353,210
	Peach	38.65	44.35	521.11	776.97	16,748,292	16,624,440
	Apricot	7.31	7.24	94.80	87.71	2,959,049	2,790,480
	Cherry	14.21	14.46	75.19	82.19	5,355,838	5,229,017
	Fig (fresh)	N/A	2.35	9.18	9.68	439,113	87,703
	Fig (dry)	4.32	N/A	11.76	N/A	767,473	637,206
Nut Trees	Almond	11.86	11.11	37.57	20.46	3,870,996	3,272,016
	Walnut	8.96	11.34	25.95	24.04	2,124,570	1,539,167
	Chestnut	N/A	8.29	30.05	28.94	1,645,739	1,451,066
	Hazelnut	0.21	0.35	0.49	0.88	77,182	63,419
(1) ELSTAT, Agricultural production statistics, 2015.							
(2) EUROSTAT, Crop statistics (from 2000 onwards), [apro_acs_a]. Last update: 15-12-2017							

Figure 2 presents the spatial distribution of the main permanent crop types in Greece. The following paragraphs consider in more detail some key characteristics for the main tree categories considered (olive, vineyard, citrus, fruit and nut trees) that are of general relevance and also of importance when considering APPR biomass production.

¹ Area of compact plantations only.

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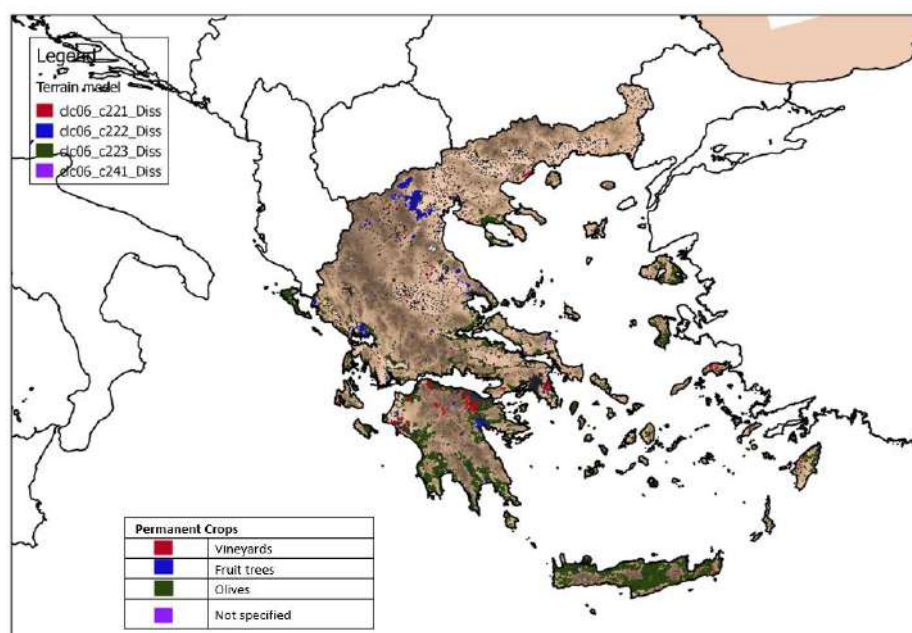


Figure 2: Spatial distribution of the main permanent crop types in Greece²

Olive trees

Olive tree cultivations are mainly found in Crete, Southern Peloponnese, Aegean and Ionian islands (e.g. Lesvos and Corfu respectively) and coastal areas. The share of olive tree plantations in the total UAA for Greece is higher compared to the other Mediterranean countries. EUROSTAT reports 531,000 olive farm holdings in Greece, with an average size of 1.5 ha, much lower than Spain (5.5 ha) but a little higher than Italy (1.3 ha).

According a study by the International Olive Oil Council, the olive groves in Greece can be mainly classified in the following types:

- S2: Traditional irrigated on steep slopes. Irrigated orchards with a gradient > 20% and < 180 trees/ha.
- S3: Traditional rain-fed on moderate slopes. Rain-fed orchards with a gradient < 20% and < 180 trees/ha.
- S6: Intensive irrigated. Irrigated orchards with 180–800 trees/ha.

As can be seen in Figure 3 (based on Eurostat data), more than half of the olive groves in Greece have an age of 50 years or more and planted at less than 140 trees/ha.

² The map has been implemented with QGIS 2.14.0 – Essen version. The crop coverages correspond to Corine Land Cover 2012 (v18.5, Prepared by GISAT 02/2016, available at <http://www.copernicus.eu/>). The land use denoted as “Not specified” refers to Corine Land Cover Class 241 “Annual crops associated with permanent crops”, which indicates the existence of land with either vines, olive or fruit trees

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Figure 3: Age and density classes of olive trees in Greece (source: Eurostat)

Another classification of olive groves in Greece is presented by Prof. Vemmos of the Agricultural University of Athens. Three main grove types can be found in Greece:

- **Traditional olive groves** require minimum inputs and offer important ecological, social and environmental services (e.g. avoidance of soil erosion); their productivity is limited.
- **Intensive traditional olive groves** have higher productivities and require higher inputs. They are the main planting system for olives currently in Greece.
- **Modern intensive olive groves** reach even higher productivities, but also require increased intakes of fertilizers, water and herbicides.

Table 2: Comparison of main olive grove regimes in Greece (Source: S. Vemmos, 2011)

Comparison of main olive grove types in Greece			
Characteristic	Traditional	Intensive traditional	Intensive, traditional
Planting density	40 - 120	80 - 250	200 - 500
Fruit yield (kg/ha)	200 – 1,500	1,500 – 4,000	4,000 – 12,000
Irrigation	Zero to minimal	Partly (drip irrigation)	Yes (drip irrigation)
Fertilizers	Only organic	2-6 kg/tree	High demands (e.g. 150 – 350 kg N/ha)
Herbicides	Zero to minimal	2-10 times per year	Frequent use

It should be noted that a large part of the olive plantations in Greece are located in mountainous and semi-mountainous areas. This has clear implications to the production cost, as well as the to the extraction cost of prunings for energetic utilization schemes.

The National Variety Catalogue lists 64 different officially recognized olive trees varieties that are cultivated in Greece. Greek varieties are by far the most commonly cultivated. *Koroneiki* is the most common variety for olive oil production, amounting around 60 % of the olive oil production. *Kalamon* is the most well-known edible olive variety, both in Greece and worldwide.

Table 3: Distribution of main varieties and production level per olive production area of Greece

Permanent crops, main statistics (2015)							
Region	Varieties	Olive oil				Table Olives	
		Fruit Production (1)		Olive Oil Production (1)		Varieties	Fruit Production (1)
		(1,000 t)	(%)	(1,000 t)	(%)		(1,000 t)

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Permanent crops, main statistics (2015)								
Region	Varieties	Olive oil				Table Olives		
		Fruit Production (1)		Olive Oil Production (1)		Varieties	Fruit Production (1)	
		(1,000 t)	(%)	(1,000 t)	(%)		(1,000 t)	(%)
Peloponnese	Koroneiki, Mastoeidis, Kothreiki, Agouromanakoelia, Koutsourelia, Megaritiki	1,154.85	46.6	160.28	48.1	Kalamon, Gaidourolia, Megaritiki	43.87	10.2
Crete	Koroneiki, Mastoeidis, Throumpolia	591.67	23.9	91.01	27.3	Throumpolia, Kalamon	2.22	0.5
Central Greece	Megaritiki, Mastoeidis, Kolimpada, Amfissis, Kothreiki	89.82	3.6	15.41	4.6	Amfissis, Karidolia, Kalamon, Kothreiki	92.69	21.5
Ionian Islands	Lianolia Kerkyras, Asprolia, Kalokairida	163.59	6.6	20.71	6.2	Vasilikada, Amfissis	0.64	0.1
Aegean Islands	Valanolia, Adramitini, Throumpolia	91.77	3.7	13.45	4.0	Valanolia, Throumpolia	10.58	2.5
Macedonia	Chalkidikis, Throumpa Thassou	123.26	5.0	12.79	3.8	Chalkidikis	142.51	33.1
Epirus	Lianolia Kerkiras, Amfissis	149.44	6.0	7.46	2.2	Amfissis	31.14	7.2
Aitolokarnania	Koutsourelia, Koroneiki, Kothreiki	30.21	1.2	3.29	1.0	Amfissis, Kalamon, Karidolia, Kothreiki	34.50	8.0
Country total	-	2,477.20	100.0	333.31	100.0	-	430.67	100.0
(1) ELSTAT, Agricultural production statistics, 2015.								

Vineyards

As a permanent crop, **vineyards** rank second in terms of UAA devoted to their cultivation in Greece. The area under vines is has decreased since 2000, following the same EU trend that is partly attributed to the results of the 2008 Reform.

Greece is 5th in the EU-28 in the number of vineyard holdings (188,896). The average area per holding however is only 0.55 ha; out of the 17 major wine producers in the EU-28, only Slovenia, Croatia and Romania have lower averages as can be seen in Figure 4.

Vineyards can be found almost all over Greece; the following table presents the distribution of the cultivated areas for the Greek NUTS2 regions. Peloponnese is the major wine and raisin producing region, but other regions like Macedonia, Crete, Central Greece and Attica are not far behind.

Table 4: Cultivated areas of vineyards in production, 2015 (Source: Eurostat, vit_t1)

Cultivated areas of vineyards in production, Greece, 2015 (ha)					
NUTS2 Region	PDO wine	PGI wine	Wines neither PDO or PGI	Dual purpose grapes	Raisins
East Macedonia & Thrace	-	1,326	284	414	-
Central Macedonia	797	2,563	628	396	-
West Macedonia	-	1,559	340	-	-
Epirus	136	438	190	-	-
Thessaly	345	2,528	339	764	-
Ionian Islands	-	2,139	530	-	1,745
West Greece	1,789	5,052	1,269	42	7,674
Central Greece	-	6,094	585	5	-
Peloponnese	3,475	5,268	998	130	15,303

Cultivated areas of vineyards in production, Greece, 2015 (ha)					
NUTS2 Region	PDO wine	PGI wine	Wines neither PDO or PGI	Dual purpose grapes	Raisins
Attica	-	5,910	81	-	-
North Aegean	1,836	750	277	2	-
South Aegean	2,373	749	764	26	-
Creta	2,599	4,199	442	413	14,801
Greece - total	14,126	38,574	6,727	2,206	39,522

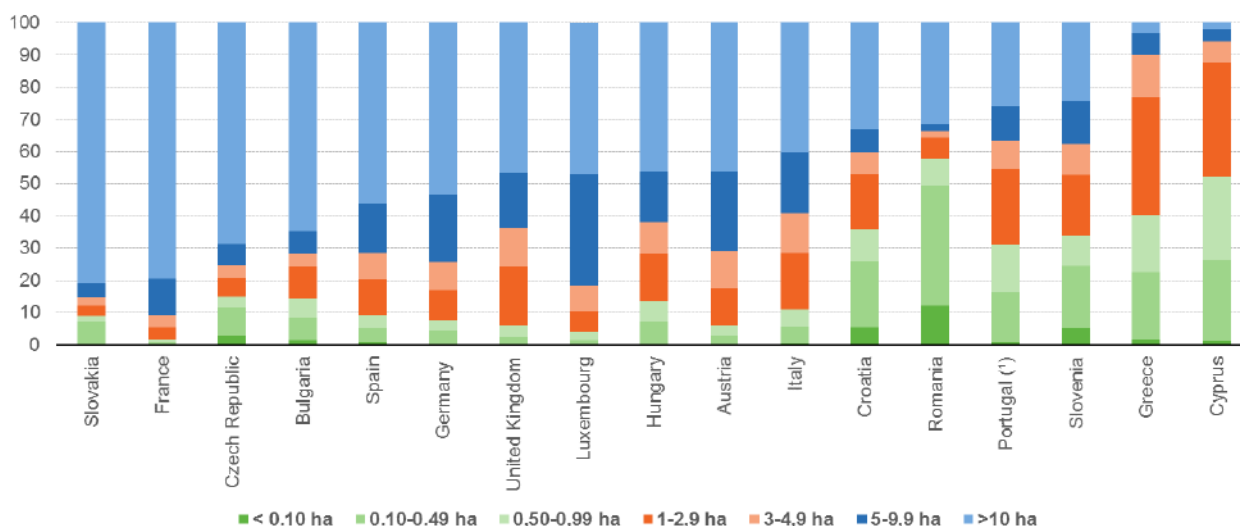


Figure 4: Area of vineyards by size class of the wine-grower holding, 2015. Percentage of total vineyard area (Source: Eurostat)

According to Eurostat, in 2015 41.4 % of the vineyards for wine area in Greece was cultivated with red (R) varieties, 38.1 % with white (W) varieties and 20.6 % with other (O) colour varieties. Eurostat specifically mentions 11 R, 8 W and 2 O main wine varieties³, although numerous more local varieties are also cultivated. *Savvatiano* (W) is the most common variety, followed by *Roditis* (O). Other important varieties are *Agiorgitiko* (R), *Liatiko* (R), *Muscat Hamburg* (R), *Xinomavro* (R), *Cabernet Sauvignon* (R) and *Assyrtiko* (W). Table 5 presents the main grape varieties used for wine production in Greece.

Table 5: Main vineyard varieties for wine production in Greece, 2015 (Source: Eurostat, vit_t4)

Main varieties for wine production in Greece, 2015		
Variety	Cultivated area (ha)	Percentage (%)
Red varieties (R)	21,709	41.4
Agiorgitiko	3,365	6.4
Xinomavro	2,152	4.1
Liatiko	2,620	5.0
Cabernet Sauvignon	1,995	3.8
Muscat Hamburg	2,325	4.4
Mavroudi	1,670	3.2
White varieties (W)	19,962	38.1
Savvatiano	10,355	19.7
Assyrtiko	1,911	3.6
Muscat a petits grains blancs	1,633	3.1

³ According to Regulation (EC) No 1337/2011, the "Main vine varieties" are those having a cultivation area bigger than 500 ha at national level.

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Main varieties for wine production in Greece, 2015		
Variety	Cultivated area (ha)	Percentage (%)
Muscat of Alexandria	834	1.6
Other colours (O)	10,781	20.6
Roditis	9,000	17.2
Total	52,451	100.00

It is also interesting to note that – apart from vines for wine production - Greece is reported to be the 2nd largest table grape producer in the EU-28 (behind Italy) and the only Member State with a significant area of vineyards for the production of raisins (mostly in the regions of Peloponnese and Crete). The *Soultanina* and *Korinthiaki* varieties are well suited for raisin production. For table grapes, the leading varieties are Sultana (Thompson Seedless) and Victoria. Other varieties of tables grapes cultivated include *Crimson Seedless*, *Prime*, *Superior*, *Flame* and *Cardinal*.

Citrus trees

Citrus plantations in Greece are mostly found in the coastal areas, the plains of the southern mainland and islands. Orange, lemon and tangerine trees are the most frequently cultivated citrus trees in Greece.

Greece is the 3rd largest **orange** producer in the EU-28, behind Spain and Italy. Main areas of cultivation are Peloponnese and Aitolakarnania (western Greece), while the main varieties are *Washington Navel*, *Commons*, *Valencia*, *Navelina*, and *Newhall*. Around 20 % of the orange production undergoes processing.

Lemon production in Greece has suffered by the severe frost of 2004, but is currently on an increasing trend through new plantations. The main cultivation areas are all in Southern Greece: Achaia, Korinthos, Crete and Laconia. The main lemon variety is *Maglini*, which is said to represent more than half of the total production.

Tangerines are mostly cultivated in the Peloponnese; *Clementine* is the most important variety grown in Greece; the late *Nova* and *Ortanique* varieties can also be found, while the *Chios* variety is grown in the namesake island. Argolida is the main area of cultivation.

Fruit trees

Greece is the 3rd largest producer of **peaches and nectarines** in the EU-28 (behind Spain and Italy and after France) and the leading peach processor. Peaches and nectarines are one of the most significant permanent crops in terms of surface area in the country. In the last years, low producer prices for the crops have resulted in the decrease of the cultivation area. Production takes place mostly in Macedonia (Imathia, Pella, Pieria, Kozani, Larissa, Kilkis) and Thessaly, located in northern Greece.

Greece is the 4th largest **apricot** producer in the EU-28, behind Spain, Italy and France. The major centre for apricot production in Greece is in Peloponnese (Argolida and Korinthia), but cultivated areas are also in Thessaly, Crete and Macedonia. *Bebekou* is the leading apricot variety, while *Diamantopoulou* and *Aurora* are also well known.

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Apple trees are cultivated mostly in the following regional units: Kastoria, Kozani (West Macedonia); Pella, Imathia (Central Macedonia); Magnesia, Larissa (Thessaly). Red varieties, especially *Red Delicious* correspond to around 53 % percent of Greek apple orchards. Green varieties, mostly Granny Smith, are estimated at 15 %, while *Fuji* and *Golden Delicious* are at 9 % each. Other varieties such as *Gala*, *Jonagold*, *Jonagored* and new apple varieties take up the remaining 14 %. Practically little to no apple processing takes place in Greece.

Pear trees are mostly grown in the following areas: Larissa (Thessaly); Pella and Imathia (Central Macedonia); Corinth (Peloponnese). The leading variety is *Krystalli*; other cultivated varieties include *Williams*, *Kondoules*, *Santa Maria*, *Passacrassana*, *Abate Fetel*, and *Coscia-Ercollin*.

The cultivation of **cherry trees** has exhibited an upward trend in the last few years, since it was generally considered as a crop that could provide a good income to the farmers even from the 2nd or 3rd year from its planting. Pella (mostly) and Imathia in Central Macedonia amounts to around 65 - 70 % of the cultivated cherry tree area; however, cherry trees are spread all over Greece, including the islands. The leading varieties are the standard ones: *Bigarreau Burlat*, *Larian*, *Lapins*, *B.S. Hardy Giant*, *Ferrovía*, *Van*, *Germersdorfer*, *Tragana Edessis* and *Mpakirtzeika*. New varieties are also adopted in newer plantations, while many other varieties, well-suited to local conditions, are also cultivated.

Fig trees correspond to a very versatile crop that can be grown in a variety of fields (flat, semi-mountainous, mountainous) under difficult conditions for most other crops (carbonaceous soils and xerothermic conditions) and requires minimal farmer attention. Adding to the versatility is the fact that figs can be marketed as fresh or dry. Fig trees in Greece are systematically cultivated mostly in the Peloponnese, the island of Evvoia and several Aegean islands. Varieties includes *Kalamon*, *Vasiliki Black*, *Mavra Markopoulou*, *Politiko*, *Prasinosikia Lesvou*, *Frakasana* and *Vasikiki White*.

It is estimated that more than 9,000 ha of **kiwi trees** are already in cultivation in Greece. Greece is 2nd in the EU-28 for kiwi production and one of the leading producers in the world. An expansion of the cultivation area and the production volume is foreseen for the coming years.

Nut trees

Nut tree plantations exhibit a general upward trend in the last years, due to the growing popularity of nuts in the food market. Additionally, dry nuts can be stored more easily and can be sold in a time and way that is of benefit to the producers.

Greece is the 3rd largest **almond** producer in the EU-28, behind Spain and Italy. Almond production takes place mostly in Northern Greece, in the regional units of Katerini, Serres and Kavala of Central Macedonia and Magnisia and Larissa of Thessaly. Frequently cultivated varieties are *Ferragnes*, *Texas*, *Troito*, and *Retsou*.

Two cultivation regimes are prevalent for **walnut** trees in Greece: traditional walnut groves, which are on a decreasing trend, and new groves, more intensively managed, that are become more popular. Walnuts are mostly cultivated in Achaia, Arkadia (Peloponnese), Kozani (West Macedonia), Trikala, Larissa (Thessaly) and the island of Evoia (Central Greece). The *Chandler*

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variety is the most widespread; *Serr, Gustine, Hartley, Pedro, Vina* and *Lara* are also considered as productive varieties.

Chestnut trees are a plantation that is especially suited for mountainous or semi-mountainous areas; it can help maintain rural income and development, while it can be cultivated both for its fruits and wood. Exports to Italy have increased in the last years and have thus renewed the interest for this permanent crop.

Greece is the largest **pistachio** producer in the EU-28; market sources indicate that the cultivation extended to more than 1,200 ha in 2017, while the typical production level is between 2,500 and 4,000 t. The main cultivation areas are the island of Aegina (Attica), Fthiotida (Central Greece) and Larissa (Thessaly). Increased consumption levels have renewed interest in this crop.

The cultivation of **hazelnut trees** was quite developed in the previous decades in Greece but the crop gradually fell out of favour with the producers due to diseases of nut trees and low producer prices that were caused by Turkish imports. Currently, hazelnut production is very limited in Greece, but it exhibits signs of rapid growth and great interest on the part of the producers.

B. National potential of the APPR availability

APPR biomass can be distinguished into two main categories: prunings, which are produced on a frequent basis throughout a permanent crop plantation lifetime and the plantation removal material at the end of the plantation's lifetime. In the following paragraphs, considerations about the potential of these two main types of biomass in Greece are presented.

Biomass from agricultural prunings

For most permanent crops in Greece, a typical annual pruning frequency is assumed. The exception is olive trees, for which pruning frequencies ranging from yearly to once every three years are observed, depending on crop variety, local conditions and prevalent agronomic practices. In most cases, pruning is performed with shears (e.g. in vineyards) or chainsaws.

To our knowledge, there exists no comprehensive study about the fate of agricultural prunings after the cutting in Greece. Open-field burning seems to be the most widespread option; it is even included as an acceptable management option in the "Code of Good Agricultural Practices". Limitations to its application have mostly to do with the risk of fire hazards and the operation is only allowed to take place during the winter months, otherwise very strict measures for the avoidance of fires have to be applied. Still, in some areas it is estimated that 25 – 30 % of the fires during a year are due to the open-field burning of prunings, often at times when the practice is actually not allowed⁴. The main advantage of open-field burning for farmers is that it is often performed by the same teams that perform the pruning and in many cases at the same time. Therefore, it allows for the quick disposal of the prunings, without a lot of additional costs.

⁴ Quote by the Commander of the Fire Brigade for the area of Irakleio, Creta (28.03.2016):

<http://www.yraithros.gr/%CF%80%CE%B1%CE%B1-%CE%B5%CE%BB%CE%B1%CE%B9%CF%8C%CE%BA%CE%BB%CE%B1%CE%B4%CE%B1-%CF%83%CF%84%CE%BF%CE%BD-%CE%BA%CE%B1%CF%84%CE%B1%CF%83%CF%84%CF%81%CE%BF%CF%86%CE%AD%CE%B1-%CE%B5%CF%80%CE%B9%CE%B4/>

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Two alternative disposal practices that are gaining in popularity are treatment with mulchers or small-sized chippers / shredders. Mulchers can usually manage the prunings in shorter times but produce larger pieces on the ground that may be an obstacle to some farmers. Moreover, mulchers have a higher purchase cost, require tractors and higher fuel consumption for their operation, while it may not be possible to operate them in fields with high slopes. Chippers / shredders are less costly, can produce finer material but the handling of prunings is more time consuming.

Typically, large pieces of prunings (e.g. with diameters of 5 cm or more) are collected separately and used as firewood.

Finally, traditional uses of prunings are observed in some cases. These include their use as animal feed material or – especially for vineyard prunings – their use in barbeques, grills and the traditional Easter cooking on spits.

Despite the importance of permanent crops in the Greek agricultural sector, there are no recent national surveys based on field data regarding the availability of APPR biomass in Greece. The standard reference study for agricultural prunings – and agricultural biomass in general – in Greece is a study of *Apostolakis et al.* dating from 1987. The study presents residue-to-product ratios (RPR) for the prunings produced from various types of permanent crops in Greece and estimates the potential of agricultural prunings based on crop production statistics from 1980.

The RPR ratios from *Apostolakis et al.* were also used by CERTH for estimating the pruning potential at national level in the framework of the Biomassud Plus H2020 project. More recent, Eurostat crop production statistics from the year 2014 were used for the calculations.

Another way to estimate the agricultural pruning potential is via the biomass supply tool developed in the FP7 S2Biom project. This tool forecasts the pruning potential from permanent crops for 2020 and for all the EU-28 countries. The evaluation is based on applying country specific residue-to-surface ratios (RSRs) for certain tree crop types (olive, vineyards, citrus and fruit trees) to projections of the surface area used for the cultivation of these crops, as taken from the CAPRI model.

In all cases, a typical 40 % moisture content of the prunings was assumed for all crops, apart from olive prunings for which it was considered equal to 35 % wt. Table 6 compares the dry matter potential of the prunings for these three references, while Figure 5 graphically depicts the results.

It should be highlighted that the inaccuracies associated with the estimation of the pruning potential by using global RPR or RSR values on a national level are high. An additional source of uncertainty are also the official statistics for crop production from permanent crops which, as shown in the previous section, can vary a lot depending on the source. Moreover, the actual crop species considered in each study are slightly different. In any case, the total pruning potential in Greece is estimated as being in the range of 1.5 - 2.7 Mt dry matter, which is a huge untapped biomass source.

All studies agree that olive tree prunings are by far the largest source of agricultural pruning biomass in Greece. Field measurements of biomass productivity from olive tree prunings

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performed by CERTH within the uP_running project suggest that even though the RSR can vary depending on the crop variety and planting density, the RPR suggested by *Apostolakis et al.* is acceptable for a first estimation of the potential in most cases.

Vineyard prunings are considered as the second largest source of pruning biomass when the RPR values of *Apostolakis et al.* are employed. However, an analysis of new field measurements of pruning biomass productivity in vineyards by CERTH suggests that the RPR value used in this study is too high and that by using it the vineyard pruning potential is overestimated. The vineyard pruning potential calculated by the S2Biom tool is a more conservative estimation that may be closer to reality.

For citrus, fruit and nut trees, it is not possible to assess the accuracy of the estimations, since no new field measurements have yet been performed. A post-analysis of the RPR values of *Apostolakis et al.* suggest that they could be acceptable for a first, general estimation, but it seems unlikely that they will be able to cover all the variabilities observed under local conditions.

Table 6: Potentials (kt of dry matter per year) for agricultural prunings in Greece according to several data sources.

Biomass potentials for agricultural prunings (kt of dry matter per year)								
Source	Reference Year	Methodology	Olive	Vine	Citrus	Fruit	Nut	TOTAL
Apostolakis et al. (1987)	1980	RPR + national production statistics	1,135	566	203	340	118	2,362
Biomassud Plus (2016)	2014	- // -	1,718	398	232	277	104	2,729
S2Biom (2016)	2020	RSR + CAPRI surface projections	1,165	93	73	211	N/A	1,542

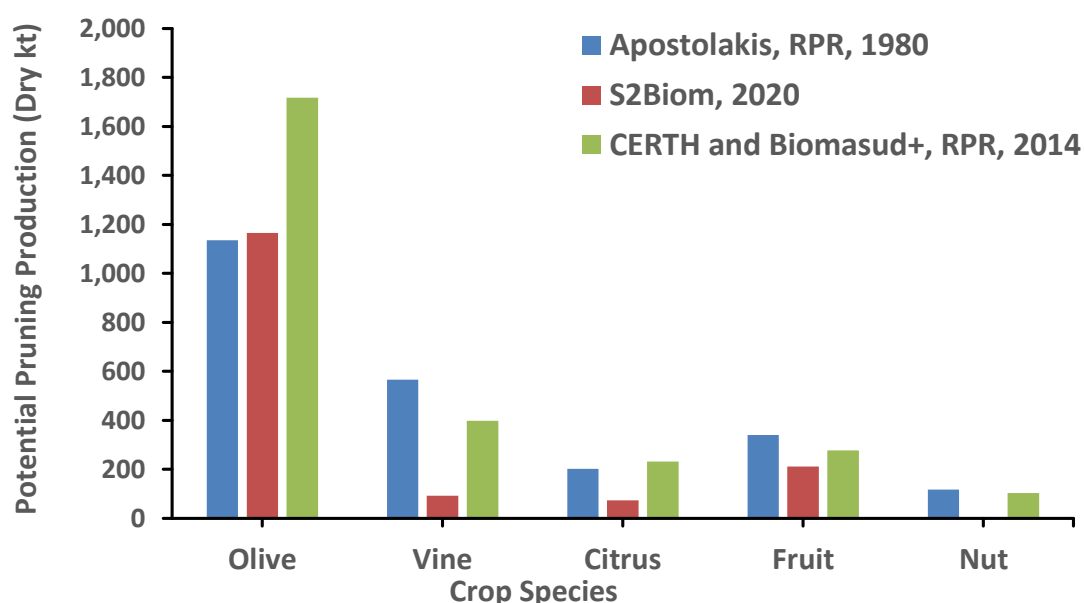


Figure 5: Potential Pruning production (dry tons) from various crop species based on different references

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Biomass from permanent crop removals

To our knowledge, there is a lack of surveys / studies assessing the potential for plantation removal biomass on a national scale and very little information about local cases. Some vague indications can be gained from data collected by the Hellenic Statistical Authority, which reports that 629.6 kt of firewood from agricultural holdings were produced in 2014. This number probably includes larger cuttings from olive trees and hence does not correspond entirely to plantation removal biomass. In any case, firewood from citrus, almond and apple trees can often be found in specialized dealers and this is assumed to have originated from plantation removals.

It has to be considered that the typical lifetime of a permanent crop is not the only factor that affects the frequency of uprooting circles. In fruit trees, economic reasons are frequently a reason for the uprooting of a plantation and its replacement by other varieties.

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C. National state of art of the APPR sector

The role of biomass in the Greek energy sector

In 2015, biomass amounted to 6 % of the Total Primary Energy Supply (TPES) in Greece, equivalent to all three other main RES together (hydro, wind and solar). The share of biomass in the TPES is equivalent to the average of the IEA countries.

TPES: 23.2 Mtoe, 12% renewables (IEA average 10%)

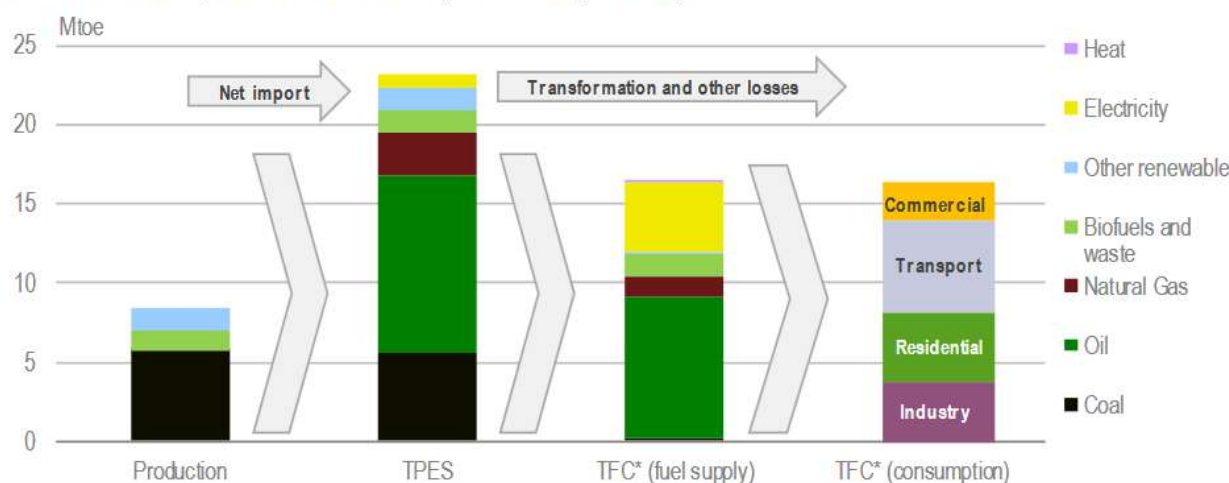


Figure 6: Energy production, supply and demand in Greece, 2015 (Source: IEA)

Statistical data from the Ministry of Environment and Energy (YPEKA) put the total primary energy production at 8,408 ktoe in 2015, 31.4 % of which (2,641 ktoe) was derived from RES. A more detailed distribution per fuel source is presented in the following figure. Solid biomass was the single largest contributor to the total primary energy production. Biogas and biodiesel also have meaningful shares, though lower than most other RES, with the exception of geothermal energy.

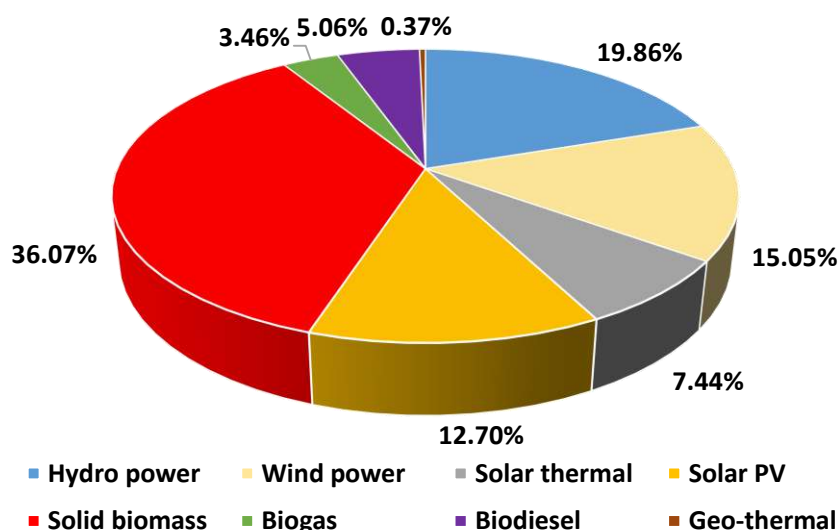


Figure 7: RES Primary Energy Production in Greece, 2015 (Source: YPEKA)

Despite the fact that it is the most RES in the total primary energy production of Greece, biomass could be considered as a “neglected” energy source. Figure 8 provides a first explanation about

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why this is so: the share of the category “biofuels and waste” in the electricity generation is only 1 %, the lowest of any category considered.

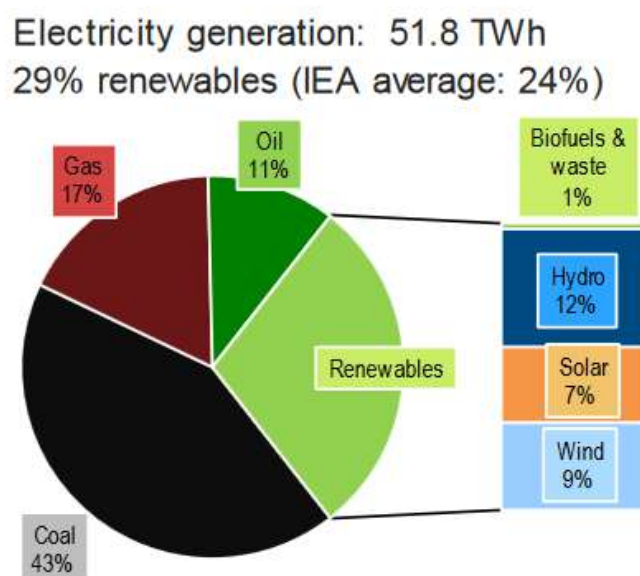


Figure 8: Electricity generation in Greece, 2015 (Source: IEA)

Table 7 presents the final energy consumption of solid biomass in different sectors in Greece for the year 2015. Solid biomass is an important energy source for the wood products industry, the food and tobacco industry, the residential sector and finally, the agricultural and forestry sector. In terms of volume used, the residential sector is by far the largest consumer (77.6 %), followed by the food and tobacco industries (14.37 %). This analysis provides a second reason about the non-visibility of biomass in the energy discourse in Greece: its main consumers are households and agro-industries.

It should be noted that Eurostat reports for 2015 a 952.4 ktoe domestic production of solid biomass and 62.8 ktoe of imports. Exports were very low, reported to be 1.9 ktoe.

Table 7: Role of solid biomass in the final energy consumption of Greece, 2015 (Source: Eurostat)

Solid biomass in final energy consumption per sector, 2015			
Sector	Final Energy Consumption (ktoe)	% of solid biomass in sector FEC	% of total solid biomass per sector
Residential	4,400.5	17.8 %	77.61 %
Agriculture / Forestry	257.9	10.7 %	2.73 %
Services	1,872.6	1.0 %	1.80 %
Other	252.3	0.0 %	0.00 %
Industry (total)	3,128.0	5.8 %	17.85 %
- food & tobacco	523.0	27.8 %	14.37 %
- paper, pulp and print	83.3	3.4 %	0.28 %
- wood and wood products	30.7	54.1 %	1.64 %
- other industrial sectors	2,491.0	0.6 %	1.56 %
Total	16,501.8	-	100 %

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Solid biomass and the domestic sector

The domestic heating sector is the primary solid biomass consumer in Greece. Historically, solid biomass, especially firewood, always has a presence in the energy mix of the households. Since 2011 however, biomass has grown in importance as a fuel source for domestic heating. This was due to two developments. The first was an increase in the taxation of the heating oil, which forced many consumers to look for lower-cost alternatives. The second was a lifting of a long ban in using biomass as a fuel source in urban areas. Overall, biomass is currently the second most important energy source for domestic heating, after heating oil and ahead of natural gas.

Firewood is the by far the most important solid biofuel for the domestic heating sector and the main biofuel consumer in Greece. According to a survey of the Hellenic Statistical Authority for the heating period of 2011-2012, firewood contributed to 23.8 % of the total thermal energy consumption of households and amount to 95.41 % of the biomass fuels used for space heating in the residential sector.

Comprehensive statistics for the firewood consumption are hard to find. An initial assessment was performed by CERTH within the Biomass Plus project and suggested that the firewood consumption in the residential sector of Greece could be in the range of 2 Mt dry biomass. Figure 9 presents an estimation of the potential sources of firewood. A sizeable part is estimated to originate from agricultural holdings and is essentially APPR biomass (large branches from olive trees, uprooted trees).

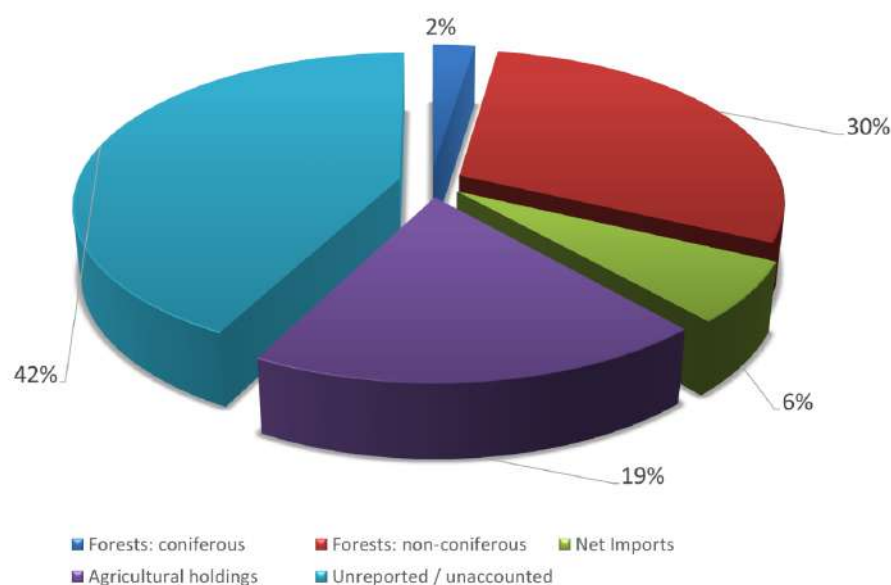


Figure 9: Indicative values for the origin of firewood consumed by the residential sector in Greece, 2014 (Source: CERTH, Biomass Plus)

Wood pellets in Greece, according to Hellenic Statistical Authority, correspond to 0.7 % of the total thermal energy consumed in the Greek residential sector or 3.39 % of the biomass consumed. The wood pellets market in Greece has grown a lot since 2010. Estimations based on statistical sources indicate typical annual consumption in the range of 50,000 – 65,000 t, but market sources claim even higher numbers, up to 180,000 t.

Furthermore, wood briquettes only consist 0.28 % of the biomass consumed for space heating in the Greek residential sector [8].

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Residues from the olive oil production process, such as **exhausted olive cake**, are another traditional biomass source in the domestic heating sector. Exhausted olive cake amounts 0.4 % of the total thermal energy consumed in the Greek residential sector and 2.34 % of the domestic heating biomass consumption; its usage is taking place almost exclusively in rural and semi-rural areas. In urban centers, the odors associated with exhausted olive cake make it a difficult fuel to use without complains.

Finally, **other types of biomasses** amount to the remaining 0.17 % of biomass consumption for space heating in the residential sector. There are no published data about the origins of this type of biomass but it is considered that they are agro-industrial residues such as nut shells, walnuts, peach kernels etc.

Solid biomass and the agricultural / agro-industrial sector

As aforementioned, the food and tobacco sector is an important consumer of solid biomass in Greece. The following types of agro-industries are known to consume biomass.

- **Pomace mills:** around 35 such industries operate in Greece, in areas of significant olive oil production (mostly Crete and Peloponnese). Such industries receive wet pomace from numerous olive mills and perform the extraction of the residual (pomace) oil. The solid by-product of the process, e.g. the exhausted olive cake, known in Greece as “pirinoksilo”, is used by the pomace mills themselves to dry the incoming wet pomace and to produce steam for the oil extraction. The self-consumption levels have increased in the last years, since many primary olive mills have made the transition to the two-phase production method that produces a much wetter pomace, needing more thermal energy to dry. Still, left-over quantities of exhausted olive cake are available and sold as fuel to various end-users, from households, to bakeries, greenhouses and many others.
- **Rice mills:** rice mills use the rice husk produced in the process as a fuel for cooking rice. Usually, there are no leftover quantities of this fuel to the market.
- **Peach canning plants:** around 17 canning plants are in operation in Northern Greece. Peach kernel is produced in the first stages of the canning process. In earlier times, the material was sold on the domestic heating market, but currently 5 such plants self-consume it.
- **Cotton ginning plants:** like rice mills, cotton ginning plants self-consume the residual material they produce.

As can be seen, the biomass consumption in these industries is coming from their own residues. In a few cases where the material is not enough (e.g. in some peach canning plants), other suitable fuels are used. Sunflower husk pellets for example is an attractive option for plants in Northern Greece, since it is imported at very competitive prices from Bulgaria or Ukraine.

Greenhouses are also important biomass consumers in the agricultural sector. Contrary to agro-industries, they source their biomass from other sources, including agro-industries. Again, sunflower husk pellets (imported) or domestic exhausted olive cake are attractive options, price-wise.

To our knowledge, there is no meaningful APPR biomass consumption in the agricultural or agro-industrial sector. However, some industries like pomace mills or canning plants operate in areas with a high density of permanent crops (olive trees and peach trees respectively). Therefore, they could have a role in the formation of an APPR sector, either by consuming APPR biomass at their

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facilities or by transforming into intermediate logistics centres for APPR biomass. The latter could be achieved through utilization of equipment (e.g. dryers) and storage space.

Solid biomass and the power sector

Greece has employed a feed-in tariff (FiT) system for the financial support of different RESe technologies since 2006. The FiT system underwent several revisions, but generally distinguished the level of the feed-in tariff received by a RES producer based on several parameters, the most important being a) the type of technology and installed capacity of the RES plant, b) whether electricity was supplied to the interconnected mainland grid or to non-interconnected islands and c) whether the investment was supported by public funds or not. FiTs allowed for a significant development of the solar and wind power in Greece; however other RES types like biomass and geothermal energy still only have marginal contributions to the RES installed capacity.

In 2016, the support framework for RES electricity in Greece was revised and is currently based on a combination of feed-in premiums (FiPs) and tenders. A major feature of the new support scheme is that RES producers will participate directly in the wholesale electricity market, while their electricity production will be remunerated at the level of the Reference Tariffs (RTs), which were calculated so that each RES investors is able to achieve a reasonable IRR taking into account the levelised cost of electricity (based on typical CAPEX, OPEX, capacity factors), weighted average cost of capital and accounting rules. The FiP is calculated as the difference between the reference market price RMP and the RT for each technology and is guaranteed for a period of 20 years for most RES types. The Law attempts to further control fiscal expenses associated with RES support, while also being in line with European Commission's Energy and Environmental State Aid Guidelines for the period 2014-2020 (EEAG) and promoting the national targets for RES production.

Table 8 compares the level of financial support enjoyed by electricity producers from different types of biomasses in Greece under the two latest support schemes as well as the installed capacity of biomass power plants. In general biomass power is very underdeveloped. Most of the installed capacity is coming from plants using landfill gas. Anaerobic digestion has expanded, while solid biomass power plants only amount to a little over 3 MW_e, all from units with installed capacities lower or equal to 1 MW_e.

Table 8: Comparison of the feed-in and reference tariffs for electricity produced from various biomass types and installed capacity for biomass power plants

Support schemes and sector status for biopower in Greece					
Type of installation	Capacity	Law 4254/2014	Law 4414/2016		Installed capacity (MWe) as of Oct. 2017
		Feed-in tariff (€/MWh)	Reference Tariff for 2016 (€/MWh)	IRR	
Gases released from landfills	≤ 2 MW	131	129	9%	3.219
	> 2 MW	108	106	9%	42.008
Biogas from anaerobic digestion	≤ 3 MW	230	225	10%	12.6
	> 3 MW	209	204	9%	---
Biomass for thermal processes	≤ 1 MW	198	184 (combustion or pyrolysis) 193 (gasification)	9%	3.17
	> 1 MW & ≤ 5 MW	170	162	9%	---
	> 5 MW	148	140	9%	---
Note: financial support levels indicated are without any type of public support for the investment					

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APPR biomass consumption in Greece

From the analysis above it should be clear that – other than firewood from agricultural holdings – there is practically no APPR biomass consumption in Greece and that the biomass market is actually quite small compared to other Mediterranean countries.

Some small-scale or briquette producers in Greece occasionally utilize APPR biomass, mostly prunings from olive trees. The total level of APPR biomass consumption is not known and it is not clear whether this activity is frequent or only performed sporadically. This is further investigated by CERTH in the framework of the uP_running WP6 activities and the search for new value chains and potential flagship cases. So far, the following cases have been identified:

- **Aegean Biomass** (<http://www.aegean-biomass.gr>), located in Plomari, Lesvos, has produced olive tree pruning pellets in the past and is currently upgrading its pellet production line. Moreover, the company is investigating possibilities for power production from olive tree prunings. The company has used a mobile shredder for the initial pruning treatment in the field.
- **Aenaon Bioenergies** (<http://aenaon-bioenergies.gr>), located in the Industrial Area of Patra, is a pellet & briquette producing company that possess a modified mulcher⁵ for pruning collection. The company is occasionally producing pruning pellets for the industrial market.
- **E.A.M.E.B.** (“Εταιρεία Ανάκτησης Μεταποίησης Εμπορίας Βιομάζας”) (<http://eameb.gr>) is a Northern Greek company offering uprooting services to cultivators of permanent crops. The uprooted trees are transformed to wood chips and sold to industrial consumers.

Barriers for the development of the APPR Sector in Greece

The main sector barriers identified for Greece are presented in the table below. Several of those are inherent to APPR biomass in general, while other are more country-specific.

Table 9: APPR Sector Barriers in Greece

Sector Barriers in Greece	
Sector Barriers	
Technical	Technical constraints for end-users, especially for feeding systems; market has developed for wood pellets and granular material, not chips and hog-fuels
	Immature management (harvesting) machinery. No major manufacturers of APPR biomass harvesting equipment
	Several boilers and other heating systems not adapted to the use of biomass chips
	Unknown or low biomass productivity from APPR
Cultural	Reluctance to changes (mainly farmers)
	Farmers want things to be easy, no further complications
	Farmers only see the new costs, not the savings in APPR residue management
	Belief: that biomass boilers are too troublesome to operate (more manual work, less automation)
	Belief: biomass combustion is polluting even in modern plants, NIMBY syndrom
Regulatory	Belief: solutions and best practices from other European countries cannot be transferred to Greek conditions
	APPR biomass is absent from national energy planning
	Currently, it is allowed to dispose APPR in open fires during specific times of the year

⁵ The modifier mulcher is produced by a Greek manufacturer “Φωτόπουλος Σαράντης & Υιοί” located in Northern Greece. It discharges prunings in a big bag.

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Sector Barriers in Greece	
Sector Barriers	
	Ecodesign regulations consider prunings as wood biomass and have too low emissions limits for APPR biomass boilers up to 500 kW
	Subsidies under consideration for farmers to mulch prunings, rather than collect them for energetic utilization
Structural	Unawareness on the potential solutions
	Absence of local / national examples for replication
	APPR as biomass unknown
	Small holdings limit the amount of APPR biomass an individual farmer can bring in the market
	Semi-mountainous / mountainous terrain in many permanent crop areas (especially olive groves) can make mechanized extraction of prunings very difficult
Market	Large (potential) consumers of APPR are hard to find
	Small size of Greek biomass market
	Scarce biomass companies able to integrate APPR as new feedstock
	High VAT for solid biofuels in Greece (24 %)
	Cheap & low-quality biomass fuels available on the market and limited control or knowledge about impact of fuel properties (e.g. ash, nitrogen content, etc.)
	Manufacturers (machinery builders, boilers) have little interest to start business in the Greek market
Organizational	APPR biomass logistics is complex
	Sharing machinery, not always easy to arrange
	Distrust to external companies operating on own fields
	Difficult to secure fuel contracts with APPR biomass owners
	Intermediate actors in APPR biomass logistics are lacking
Economic & financing	Investment uncertainty due to financial crisis
	Difficulties in mobilizing bank loans
	Low fossil fuel prices
	Very tight profit margin for APPR, cost uncertainty
	Machinery costs require to mobilise important volumes of biomass
	Boilers adapted for APPR are more expensive
	No specific funds to obtain or use APPR biomass

Drivers for the development of the APPR Sector in Greece

The main sector drivers identified for Greece are presented in the table below. As with the barriers, many are inherent to this type of biomass, while others are country specific.

Table 10: APPR Sector Drivers in Greece

Sector Drivers in Greece	
Sector Drivers	
Consumption	Industries are interested in reducing costs and turning to biomass fuels
	Agro-industries working close to the farming sector (olive mills, pomace mills, canning plants) can become APPR consumers or logistic centers
	A few biomass power plants under construction / schedule that could become potential APPR consumers
Structural	Large areas cultivated with permanent crop plantations
	Huge potential of APPR biomass at national level
	Forest biomass resources are limited; forest residues are difficult to extract
Policy	More strict political outlook towards open-field burning and potential revision of the CAP
	Statements from regional / local authorities in favour of APPR utilization
	Statements from regional / local authorities in favour of APPR utilization
	Promotion of RTD in topics related to bio-economy and circular economy

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Sector Drivers in Greece	
Sector Drivers	
	Revision of CAP and potential links of energetic utilization of APPR with the second pillar
	National agricultural and rural development programmes ongoing that could target APPR biomass
Market	Volatility of fossil fuel prices triggers interest in biomass fuels
	Expansion of biomass logistics and upgrading (e.g. pellet, briquette) facilities
	Farmers interested to explore new sources of income (or reduce costs) and investigate biomass opportunities
	Cooperative schemes (including agrarian, energy and social cooperatives) are formed and can address management and utilization of APPR biomass as a business line
	Investor interest in biopower as the wind and solar RES market is becoming more saturated
Awareness	Increased recognition that open-field burning is an energetic waste and a polluting practice
	Increased recognition that at least the Greek countryside should avoid the consumption of imported heating oil and turn to local resources
	High interest to learn of best practices (e.g. uP_running flagship cases) and how they can be applied in Greece

Main Organizations for Bioenergy and Biomass in Greece

The main organizations playing a role at national level and addressing government and public opinion about biomass and bioenergy are the following:

Biomass sector associations

Hellenic Association for the Development of Biomass (HELLABIOM), <http://www.hellabiom.gr>: HELLABIOM is a non-profit organisation that is a member of the European Biomass Association (AEBIOM). HELLABIOM has the following aims:

- The recording, promotion and coordination of scientific research regarding the production, trade, energy exploitation and agricultural practices of biomass
- the dissemination and support of biomass uses at national level.
- the implementation of statistical studies and economic techno-economic assessments related to the biomass sector.

In order to achieve its goals, HELLABIOM undertakes actions such as the submission of studies, proposals, position papers, etc. to relevant stakeholders and authorities. It can also communicate and cooperate with other relevant Associations or Organizations. HELLABIOM is organizing – together with research organizations like CERTH and CRES – the annual “Biomass Day” event every April; in 2017, it co-organized with CERTH the Greek activities of the European Bioenergy Day campaign launched by AEBIOM.

Ministries

Ministry of Environment and Energy (YPEN), <http://www.ypeka.gr>: YPEN has the responsibility for the definition and implementation of the national energy policy as well as the coordination of the energy sector, including the promotion of renewable energy sources. The responsible organisational unit within YPEN is the General Secretariat for Energy and Climate Change and in particular the Directorate for Renewable Energy Sources and Alternative Fuels. YPEN supervises several authorities, organizations and entities related to the Greek energy sector, such as the Regulatory Authority for Energy (RAE), Public Power Corporation S.A. (PPC) and Public Power

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Corporation Renewables, the Hellenic Transmission System Operator S.A. and the Centre for Renewable Energy Sources and Saving.

Ministry of Rural Development and Food (YPAN), <http://www.minagric.gr>: YPAN works in collaboration with farmers and other stakeholders with a view to promoting sustainable agriculture, food safety and security, the viability of the sector and the prosperity of rural areas in Greece. The ever changing international environment affects our policy making and strategy for agriculture and rural development, taking into account the competitiveness of our products and the restructuring of the countryside. YPAN is responsible for the implementation of the Common Agricultural Policy in Greece and manages the Rural Development Programme.

Research and Academia

There are several research organizations and academic departments in Greece that are working on the energetic utilization of biomass in the framework of national, European and international funded projects. **Centre for Research and Technology Hellas (CERTH)** is a project partner of the uP_running project and undertakes activities relevant to the utilization of APPR biomass in the framework of the BIOMasud Plus and AGROinLOG H2020 projects. Other organizations include the Biomass Department of the **Centre for Renewable Energy Sources and Saving (CRES)**, the Agricultural University of Athens (AUA) and the **National Technical University of Athens (NTUA)**.

Agricultural, food and agro-industrial sector associations

Organizations from the agricultural, food and agro-industrial sectors have to play a critical role in the promotion of APPR biomass as a renewable energy source, being the main link between the primary (agricultural) and energy sectors.

NEA PASEGES (<http://www.neapaseges.gr>), which is the inheritor organization of the Panhellenic Confederation of Unions of Agricultural Cooperatives (PASEGES) is one such organization. From 1935, PASEGES has been the main highest professional and coordinating body of the Greek agricultural cooperative movement. Through the **Institute of Agricultural & Cooperative Economy (INASO-PASEGES)**, it actively participates in the market uptake and innovation actions related to APPR biomass in Greece through the H2020 projects uP_running and AGROinLOG.

Associations & organizations relevant to the agro-industrial sectors or specific food products include the **Association of Olive Kernel Oil Producers of Greece** (“Σύνδεσμος Πυρηνελουργών Ελλάδας – ΣΠΕΛ”), the **Greek Canneries Association** (“Ένωση Κονσερβοποιών Ελλάδας – ΕΚΕ”), the **Central Cooperative Union of Vineyard Products** (“Κεντρική Συνεταιριστική Ένωση Αμπελοοινικών Προϊόντων - ΚΕΟΣΟΕ”), the **National Inter-professional Organization for Vineyards and Wine** (“Εθνική Διεπαγγελματική Οργάνωση Αμπέλου και Οίνου – ΕΔΟΑΟ”) and the **National Inter-professional Organization for Olive Oil and Olives** (“Εθνική Διεπαγγελματική Οργάνωση Ελαιολάδου και Ελιάς - ΕΔΟΕΕ”).

Out of the numerous agricultural cooperatives operating in Greece, it is worth mentioning those five that have expressed a greater interest in the energetic utilization of APPR biomass and cooperate with the uP_running project for the implementation of demonstration actions in Greece: **EAS Lakonias**, **VAENI Cooperative**, **AOS Koropiou**, **Agrinio Union** and **Aichmeas Cooperative**. The cooperation with the **Agios Konstantinos Cooperative** in Central Greece, which will assist in the larger-scale demonstration activities of the AGROinLOG project should also be mentioned.

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D. National Plan for Energy and Climate

National Renewable Energy Action Plan

Greece has adopted its own National Renewable Energy Action Plans, as all EU-member states, in order to describe the type of actions that should be taken to meet the renewables targets (20-20-20). According to the EU Directive 2009/28/EC, Greece has to achieve a RES target of 18 % (4,341 ktoe) in gross final energy consumption by 2020, starting from 6.9 % in 2005. This target has been increased to 20 % through Law 3851/2010, which also set specific RES targets for gross electricity consumption (40 %), final energy consumption for heating and cooling (20 %), and final energy consumption for transport (10 %) until 2020.

As mentioned in a next section of this report (“Bioenergy for power production”), the NREAP targets for biomass are quite modest. The only reference to APPR biomass is the use of prunings as firewood by local communities. No quantification of its potential is included. The NREAP has more emphasis on the mobilization of new biomass resources, e.g. energy crops on marginal or abandoned lands, and covering biomass demand for biodiesel production.

Based on the 2020 climate and energy package, the 2030 climate and energy framework was adopted by the EU leaders in October 2014 and sets the following three objectives for the year 2030:

- At least 40 % cuts in greenhouse gas emissions (from 1990 levels)
- At least 27 % share of renewable energy
- At least 27 % improvement in energy efficiency

Most recently (January 2018), the European Parliament voted on the Renewable Energy (REDII) Directive and proposed a 35 % binding target for the share of renewable energy at EU level. Member states will have to set binding national targets in order to reach the EU objective. Public statements by the Greek prime minister, Alexis Tsipras, suggest that the Greek government is willing to pursue even higher goals, e.g. 50 % of renewable energy share.

The National Committee responsible for the elaboration of the National Energy and Climate Plan for Greece was only recently established and held its first meeting on the 21st February 2018. The uP_running project partners in Greece will seek opportunities to present the potential of APPR biomass to relevant sub-committees so that it is properly considered in the development of the new national policy framework.

Bioenergy for heating applications

The most important Programme related to the promotion of RES and energy savings at the domestic sector is “Saving at Home” (“ΕΞΟΙΚΟΝΟΜΩ ΚΑΤ’ ΟΙΚΟΝ”), which is co-funded by the Greek State and the European Union through the National Strategic Reference Framework. The Programme intends to promote energy efficiency in the residential sector by providing incentives for the implementation of energy saving measures.

The Programme is targeting mainly residences with low price zones and of low energy performance (Category less than or equal to D). The target for savings achieved from program

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interventions was to increase the Class by at least one category or to achieve primary energy savings of at least 30% of the energy consumption of the reference building.

One of the eligible actions under the Programme included the upgrading of the heating and hot water production system(s) of an eligible residence. Installation of a new RES heating system, e.g. a biomass boiler, can be supported in the framework of this action.

The Programme was on hold for several years and since it had used up all its allocated funds. It is expected to resume in early March 2018.

Other programmes included in the National Strategic Reference Framework (NSRF) may also include the support of enterprises, public sector, etc. for the installation of biomass heating systems. For example, the Operational Programme “Environment and Sustainable Development” allocated a budget of 2 M€ for the installation of biomass systems in municipal buildings.

Bioenergy for power production

As indicated in Table 8, the currently installed biomass (solid biofuels + biogas) capacity in Greece amounted to 61 MW, far below the 2014 and 2020 targets of 200 and 350 MW set by the Joint Ministerial Decree 19598. The National Renewable Energy Action Plan also indicates very low targets for bioenergy from solid biomass: 40 MW till 2020, corresponding to 0.3 % of the total RES installed capacity and 1.3 % of the total RES electricity production.

Considering these very low targets, it is not surprising that biopower has received relatively low attention by policy makers and that there have been few specific policy instruments targeting its deployment. Despite this, there have been recent movements in the market, spurred by the fact that the wind and solar market have matured and that investors are looking into other alternatives.

Proposed installations of new biomass power plants in Greece, even those of relatively low capacity, have often met with strong opposition from local populations. In order to ease tensions, the Ministry of Environment and Energy recently proposed an amendment to the law, that would require biomass power plants installed on high productivity agricultural land to have a maximum 30 km sourcing radius for raw material coming from agricultural, forestry or livestock holdings. The reasoning behind this is to tie biomass energetic utilization with the local residue production and to avoid the transformation of agricultural land to industrial purposes without a solid local need.

Agricultural policy

The Common Agricultural Policy (CAP) forms the main legislative framework for the operation of the agricultural sector in all Member States, Greece being no exception. The CAP does not provide direct financial support to the producers for the production of biomass for energy. However, the EU rural development policy includes measures aimed at encouraging the production and use of renewable energy.

The current CAP framework has not provided many direct incentives for permanent crop producers to consider the energetic utilization of APPR biomass. The impending CAP reform after 2020 (with final decisions expected in 2018) will create a new general framework; it is expected to

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have an impact on the APPR biomass sector, although its extent or whether it will be positive or negative is unclear at this point. Ongoing discussions however hint at more strict environmental policies that may severely limit the open-field burning of prunings and thus indirectly promote their energetic utilization.

In the national framework, the Rural Development Programme 2014-2020 is the main tool for supporting the development of the agricultural sector in Greece. The total budget of the Programme is in the range of 4.7 M€. To our knowledge, the Programme does not include any actions specifically targeting or promoting the energetic utilization of APPR biomass⁶, but there are actions to promote RES in the agricultural sector. The most relevant identified so far are the following:

- **Sub-measure 4.1.3**, providing support for the investment in RES at agricultural holdings, on the basis of covering their energy demands, good practices for the handling of wastes and by-products and their utilization for energy production.
- **Measure 16** is a new action aiming to promote innovation in the agricultural and agro-food sectors. The Measure is intended for members of “operational groups”⁷. It includes the following sub-measures relevant to APPR biomass.
 - **Sub-measure 16.1-16.2** promotes the establishment of cooperation in actions related to the development of new products, processes and technologies in the agricultural sector for enhancing the competitiveness of primary sector (agricultural holdings) and food sector enterprises. *The list of actions includes the utilization of agricultural by-products for energy production.*
 - **Sub-measure 16.1-16.5** promotes the establishment of cooperation for the development of new agricultural and production practices aiming to protect the environment and adapt to climate change. *The list of actions includes the use of RES for the reduction of fossil fuel inputs.*
- **Sub-measures 4.2.1, 4.2.2 and 4.2.3** support investments related to processing, trade and/or development of agricultural products. Investments in RES are not supported as stand-alone actions, but as parts of a complete investment scheme.

Bioenergy and air emissions

The quality of air is a frequently discussed issue related to biomass utilization in Greece. Over the last years and due to the economic crisis and increased taxation of heating oil, the levels of biomass utilization in the Greek domestic heating sector have increased. However, this increase came by to a large extent through the use of inappropriate heating systems (e.g. not properly

⁶ Sub-measure 4.4 of the Rural Development Programme foresees a subsidy of 140 €/ha to olive tree growers for a five-year period. The subsidy is intended to cover the purchase cost of shredders, chippers or mulchers for the treatment of olive tree prunings, which are intended to remain on the soil for at least six months; the purpose is to avoid open-field burning while simultaneously increasing the soil organic carbon. The removal of prunings for energetic utilization is not foreseen by the sub-measure. At the time of writing of this report, this sub-measure was not open for applications.

⁷ An «operational group» has many collaborators with a common interest for a specific and practical innovation plan. Members of an operation group should come from different sectors such as primary production (e.g. farmers), business (e.g. enterprises) and research (e.g. scientists).

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designed open fireplaces and inefficient stoves) and low quality fuels (including waste wood). This resulted in the reappearance of smog in many Greek urban centers during the winter.

In order to control the smog, Greek authorities have undertaken the following measures:

- Information campaigns to suggest the avoidance of such devices and fuels, promote proper firewood trading practices and informing about the CE requirements for heating devices.
- Reduced electricity bills for domestic consumers during smog days to promote electrical heating solutions.
- Establishment of requirements for all types of solid biofuels for non-industrial use and establishment of market monitoring mechanisms.

Moreover, the Law related to the central heating systems requires that biomass boilers (up to 500 kW) conform with the efficiency and emission limit requirements of EN 303-5, Class 3. However, enforcement is rare and many biomass boilers available on the Greek market have not undertook proper type testing.

In Greece, like all Member States, biomass installations with a rated thermal input between 1 and 50 MW have to comply with the emission limits of the Medium Combustion Plant Directive (EU) 2015/2193. For larger installations, the limits of the Industrial Emissions Directive 2010/75/EU apply. There is currently a regulatory gap – both in Greece and on the EU level – for the emission limits of installations ranging from 500 kW to 1 MW; this can be very relevant for APPR biomass heating systems.

Bioenergy and research / innovation

Several national funded research and innovation programs exist that could support activities related to biomass and bioenergy. For example, the program “ΕΡΕΥΝΩ-ΔΗΜΙΟΥΡΓΩ-ΚΑΙΝΟΤΟΜΩ” (in English “Research-Create-Innovate”) is co-funded from the European Union and Greek government for the period 2014-2020 (Partnership Agreement 2014-2020). Aim of the program is the connection between research and innovation with the Greek industries. The available grant for proposals regarding “Energy” and “Environment & Sustainability” is 31 M€ and 40 M€ respectively.

APPR biomass in the political agenda

Based on the information provided about as well as the opinion of CERTH, formed after discussions, interviews and workshops with several stakeholders and the study of publicly available material, it can be concluded that the energetic utilization of APPR biomass is practically absent on the national political agenda as a strategic goal. Occasionally, references to APPR biomass utilization might make their way into public statements, but they are not supported by any specific policy measures targeting the sector. Moreover, the biomass sector in general is quite undeveloped and not subject to dedicated political backing.

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On a regional level, APPR biomass is given more considerations and is sometimes references in Regional Development plans or Waste Management plans. Again, little concrete actions are undertaken towards supporting its utilization.

The uP_running project activities in Greece aim to provide more visibility to the APPR sector and its potentials. Already, in July 2017 a joint memorandum for the promotion of APPR biomass was signed by representatives of the Region of Peloponnese, municipalities in the NUTS3 region of Lakonia and several agricultural cooperatives in the area. This is a first step towards the implementation of more concrete measures.

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E. Summarise a basic SWOT analysis

The following table summarizes a basic SWOT analysis for the APPR biomass in Greece. A distinct “APPR biomass sector” is actually non-existent, since the actual utilization level of these type of biomass is practically zero, with the exception of the fractions that are used as firewood. Therefore, factors in the SWOT analysis (strengths, weakness, opportunities, threats) are most relevant to the following main established sectors:

- Agricultural sector, including farmers and farmer associations, cultivating permanent crops.
- Industrial sector, in particular the agro-industrial sector using as input materials permanent crop products (e.g. olive mills, pomace mills, wineries, canneries, etc.).
- Energy sector (e.g. utilities, power plants, ESCOs) and end-users.

Weaknesses and Strengths are all inherent characteristics to the analyzed sector. On the other hand, Threats and Opportunities are all external factors to the sector conditioning APPR biomass sector development.

STRENGTHS

- S1. Huge potential of APPR biomass at national level.
- S2. Large areas cultivated with permanent crop plantations, in various locations in Greece.
- S3. The agricultural sector is a key economic activity in Greece, with high potential for influencing government decisions.
- S4. Energetic utilization of prunings can help farmers save time and income that would be spent on the management of the residues.
- S5. Benefits of APPR biomass utilization are easy to observe in local conditions (e.g. avoidance of emissions and pollution from open-field fires, cost savings achieved in APPR management, fossil fuel savings, etc.)
- S6. Agro-industries working closely with permanent crop farmers are present (olive mills, pomace mills, canning plants) and can serve as consumers or intermediate logistics centers for APPR biomass.
- S7. Local biomass value chains exist (e.g. olive pomace, nut shells, firewood from permanent crops) that could be used to promote the use of APPR biomass.
- S8. Biomass boilers and combustion systems capable of handling APPR are also capable of combustion other biomass types, thus enhancing the security of supply.
- S9. Replacement of fossil fuels (e.g. heating oil) with biomass for heating applications can have a short pay-back time.
- S10. Compared to fossil fuels, APPR biomass leads to reduction of GHG emissions. The reduction can be higher than the use of other biomass types.
- S11. Compared to other residues from the agricultural sector (e.g. straw) there are not many or even no competing uses for APPR biomass. APPR biomass is also readily available now, and not a possible future reality (like energy crops).

WEAKNESSES

- W1. Small holdings limit the amount of APPR biomass an individual farmer can bring in the market

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- W2. More uncertainties in initiatives focusing on APPR biomass means difficulties in attracting funds from banks or private sector
- W3. Machinery for harvesting APPR biomass is not well known, more emphasis is placed on machines that can quickly dispose APPR (e.g. mulchers)
- W4. Cooperative sharing of agricultural machinery required for pruning harvesting is not easy to arrange
- W5. Difficulty to convince some farmers to accept external companies working on their fields with machines
- W6. Few local manufacturers produce machines capable of harvesting APPR biomass
- W7. Open-field burning of APPR is a practice that is tolerated by local & national authorities
- W8. Lower fuel quality of APPR biomass compared to forest wood biomass, which affects operational and environmental behavior of combustion systems
- W9. APPR biomass utilization requires specific combustion technologies
- W10. No standardization / fuel certification scheme for APPR biomass yet
- W11. Phytosanitary treatments may affect the fuel properties of APPR biomass (e.g. increased copper content)
- W12. Lack of awareness on possibilities for APPR utilization
- W13. No successful cases to imitate in Greece
- W14. APPR biomass is not explicitly considered in the National Renewable Energy Action Plan
- W15. Estimations on APPR biomass potential based on general literature values, which may be irrelevant to the local specificities
- W16. Management of APPR is a marginal issue for farmers, which are focused on the production of the primary agricultural products
- W17. Farmers are more interested in the quick disposal of APPR and unwilling to adopt practices (e.g. on-field drying) that can have a positive impact on its quality
- W18. Low APPR productivity (in t/ha) in some cases can influence the economics of the value chain
- W19. Value chain costs can be high and therefore the profitability of an APPR initiative may be limited
- W20. Limited market for non-conventional biomass (such as APPR) and almost no major large-scale biomass consumer for market take-off
- W21. Agricultural and energy sectors not well connected

OPPORTUNITIES

- O1. Farmers interested to explore new sources of income (or reduce costs) and investigate biomass opportunities
- O2. Increased taxation and high cost of fossil fuels for heating have created interest in biomass fuels
- O3. Industries are interested in reducing energy costs and considering biomass fuels
- O4. Expansion of the BIOmasud® certification scheme to olive tree and vineyard pruning biomass
- O5. Financing opportunities available from local, national and EU sources (e.g. Rural Development Programme, NSRF, etc.)
- O6. Due to financial crisis, consumers show increased interest in local raw materials and resources

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- O7. Agro-industries interested in developing a “greener” image and get CO₂-neutral certification, by utilizing by-products and residues
- O8. Farmers, local authorities and other stakeholders recognize that open-field burning of residues is a practice that could be outlawed in the future
- O9. New EU regulations and directives (e.g. RED2) indirectly favour the utilization of local resources, such as APPR biomass
- O10. Circular economy and rural development is on the political agenda
- O11. A feed-in premium mechanism is in place for biomass-to-power installations
- O12. Increased interest in bioelectricity due to saturation of the other RESe sources (e.g. solar, wind, etc.)
- O13. New forms of community energy projects on the rise (e.g. energy cooperatives)

THREATS

- T1. Unreasonable expectations (too high yields, production of high quality wood pellets from APPR) may result in failures of new initiatives due to wrong assessment of costs or market potential
- T2. The Greek biomass market development is focusing on pellets, not on chipped biomass
- T3. Cheap, low-quality biomass fuels available on the market and limited control or knowledge about impact of fuel properties
- T4. High VAT tax of solid biofuels in Greece (24 %) creates problems in the development of new initiatives
- T5. Financial crisis limits investments and makes market conditions insecure
- T6. Short-term decreases in heating oil price discourage potential adopters
- T7. EU policies may create unfavourable conditions for APPR biomass (e.g. not able to comply with Ecodesign limits if it is considered as “wood biomass”, high electrical efficiency may be required by the RED2, etc.)
- T8. Unfavourable public perception on biomass due to the smog formed by improper firewood combustion in both urban and rural areas
- T9. Inconsistencies in the political planning and no medium/long term clear goals
- T10. Alternative utilization of APPR (e.g. mulching) is increasing

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STRATEGIC PLAN

SO Strategies (Strategies employing strengths in order to profit by opportunities). These are the max-max type of strategies, in the sense that they combine the most favorable elements to building a strategy. SO strategies use strengths and powerful elements in order to make it benefit from external opportunities. The strategy becomes dynamic and aggressive (attacking).

① Inform and train farmers about the benefits of the energetic utilization of APPR Strategy: Strengths + Opportunities → SO “Attack”	
S4. Energetic utilization of prunings can help farmers save time and income that would be spent on the management of the residues. S5. Benefits of APPR biomass utilization are easy to observe in local conditions (e.g. avoidance of emissions and pollution from open-field fires, cost savings achieved in APPR management, fossil fuel savings, etc.)	O1. Farmers interested to explore new sources of income (or reduce costs) and investigate biomass opportunities O7. Agro-industries interested in developing a “greener” image and get CO2-neutral certification, by utilizing by-products and residues O8. Farmers, local authorities and other stakeholders recognize that open-field burning of residues is a practice that could be outlawed in the future
Objectives SO1. Convince farmers of the benefits that APPR energetic utilization can bring	
Actions / Activities • Inform farmers of the low potential of APPR biomass for fertilization • Prepare simple but truthful facts relevant to the benefits of APPR utilization (e.g. cost / time savings, emission savings, etc.) • Organize workshops, training events, etc. • Set-up permanent support (e.g. through training of consultants) to farmers / cooperatives interested in developing APPR value chains	

② Develop agro-industries as APPR biomass consumers and intermediates Strategy: Strengths + Opportunities → SO “Attack”	

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② Develop agro-industries as APPR biomass consumers and intermediates Strategy: Strengths + Opportunities → SO “Attack”	
S6. Agro-industries working closely with permanent crop farmers are present (olive mills, pomace mills, canning plants) and can serve as consumers or intermediate logistics centers for APPR biomass S7. Local biomass value chains exist (e.g. olive pomace, nut shells, firewood from permanent crops) that could be used to promote the use of APPR biomass. S8. Biomass boilers and combustion systems capable of handling APPR are also capable of combustion other biomass types, thus enhancing the security of supply. S9. Replacement of fossil fuels (e.g. heating oil) with biomass for heating applications can have a short pay-back time. S10. Replacement of fossil fuels (e.g. heating oil) with biomass for heating applications can have a short pay-back time. S11. Compared to other residues from the agricultural sector (e.g. straw) there are not many or even no competing uses for APPR biomass. APPR biomass is also readily available now, and not a possible future reality (like energy crops).	O2. Increased taxation and high cost of fossil fuels for heating have created interest in biomass fuels O3. Industries are interested in reducing energy costs and considering biomass fuels O4. Expansion of the BIOmasud® certification scheme to olive tree and vineyard pruning biomass O5. Financing opportunities available from local, national and EU sources (e.g. Rural Development Programme, NSRF, etc.) O6. Due to financial crisis, consumers show increased interest in local raw materials and resources O7. Agro-industries interested in developing a “greener” image and get CO2-neutral certification, by utilizing by-products and residues O11. A feed-in premium mechanism is in place for biomass-to-power installations O12. Interested in bioelectricity due to saturation of the other RESe sources (e.g. solar, wind, etc.)
Objectives SO1. Create real forms of cooperation between agriculture and agro-industries, transforming the agro-industries into major end-users and / or intermediate trade centers for APPR biomass	
Actions / Activities - Investigate business and supply chain models that make use of the presence of agro-industries in agricultural areas with permanent crop plantations - Utilize opportunities and existing infrastructure of agro-industries (e.g. storage space, dryers, energy conversion systems) in APPR value chains - Support the development of APPR biomass-to-power installations - Organization of match-making events between potential value chain actors and equipment providers	

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③ Promote tangible & intangible benefits of APPR biomass utilization Strategy: Strength + Opportunity → SO “Attacking”	
S1. Huge potential of APPR biomass at national level. S2. Large areas cultivated with permanent crop plantations, in various locations in Greece. S3. The agricultural sector is a key economic activity in Greece, with high potential for influencing government decisions. S4. Energetic utilization of prunings can help farmers save time and income that would be spent on the management of the residues S5. Benefits of APPR biomass utilization are easy to observe in local conditions (e.g. avoidance of emissions and pollution from open-field fires, cost savings achieved in APPR management, fossil fuel savings, etc.). S9. Replacement of fossil fuels (e.g. heating oil) with biomass for heating applications can have a short pay-back time. S10. Compared to fossil fuels, APPR biomass leads to reduction of GHG emissions. The reduction can be higher than the use of other biomass types. S11. Compared to other residues from the agricultural sector (e.g. straw) there are not many or even no competing uses for APPR biomass. APPR biomass is also readily available now, and not a possible future reality (like energy crops).	O1. Farmers interested to explore new sources of income (or reduce costs) and investigate biomass opportunities. O2. Increased taxation and high cost of fossil fuels for heating have created interest in biomass fuels. O3. Industries are interested in reducing energy costs and considering biomass fuels. O6. Due to financial crisis, consumers show increased interest in local raw materials and resources. O7. Agro-industries interested in developing a “greener” image and get CO2-neutral certification, by utilizing by-products and residues O8. Farmers, local authorities and other stakeholders recognize that open-field burning of residues is a practice that could be outlawed in the future O9. New EU regulations and directives (e.g. RED2) indirectly favour the utilization of local resources, such as APPR biomass O10. Circular economy and rural development is on the political agenda
Objectives SO1. To “brand” APPR biomass energy as an opportunity to increase the competitiveness of the Greek economy. SO2. To highlight the intangible benefits of APPR biomass utilization and the improvement in the quality of life and compliance with the EU regulations.	
Actions / Activities - To identify and to communicate APPR biomass advantages, both tangible and intangible. - To demonstrate and quantify the capacity of APPR biomass to improve local air quality. - To match APPR utilization with a “greener” branding of Greek agricultural products on the European and global market.	

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④ Establish APPR biomass-to-power projects Strategy: Strength + Opportunity → SO “Attacking”	
S1. Huge potential of APPR biomass at national level. S2. Large areas cultivated with permanent crop plantations, in various locations in Greece. S4. Energetic utilization of prunings can help farmers save time and income that would be spent on the management of the residues S5. Benefits of APPR biomass utilization are easy to observe in local conditions (e.g. avoidance of emissions and pollution from open-field fires, cost savings achieved in APPR management, fossil fuel savings, etc.). S10. Compared to fossil fuels, APPR biomass leads to reduction of GHG emissions. The reduction can be higher than the use of other biomass types. S11. Compared to other residues from the agricultural sector (e.g. straw) there are not many or even no competing uses for APPR biomass. APPR biomass is also readily available now, and not a possible future reality (like energy crops).	O1. Farmers interested to explore new sources of income (or reduce costs) and investigate biomass opportunities. O9. New EU regulations and directives (e.g. RED2) indirectly favour the utilization of local resources, such as APPR biomass O11. A feed-in premium mechanism is in place for biomass-to-power installations O12. Increased interest in bioelectricity due to saturation of the other RESe sources (e.g. solar, wind, etc.)
Objectives SO1. To take advantage of the favorable and/or changing conditions for bioelectricity to set-up APPR biomass-to-power plants	
Actions / Activities - Inform investors about the benefits (potential, security of supply, environmental, economic, regulatory compliance, etc.) of using APPR biomass as a fuel source in a biomass power plant. - Highlight that due to the local benefits observed, APPR-to-power projects are expected to face lower public resistance.	

WO Strategies (Strategies seeking to alleviate the effect of weaknesses by taking advantage of opportunities). They are strategies of the min-max type, in the sense that they combine inside weaknesses with external opportunities. The strategy attempts to use opportunities in order to eliminate or alleviate weaknesses (reorientation).

⑤ Demonstrations of APPR biomass value chains Strategy: Weaknesses + Opportunities → WO “Reorientation”	
W3. Machinery for harvesting APPR biomass is not well known, more emphasis is placed on machines that can quickly dispose APPR (e.g. mulchers) W12. Lack of awareness on possibilities for APPR utilization W13. No successful cases to imitate in Greece	O5. Financing opportunities available from local, national and EU sources (e.g. Rural Development Programme, NSRF, etc.)

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Objectives

WO1. Overcome lack of knowledge by executing and promoting “hands-on” examples and demonstrations

Actions / Activities

- Organize “open-day” demonstrations of APPR biomass value chains in the framework of appropriate programs and initiatives
- Visualize and disseminate results

⑥ Transform agrarian cooperatives to APPR biomass / energy cooperatives

Strategy: Weaknesses + Opportunities → WO “Reorientation”

W1. Small holdings limit the amount of APPR biomass an individual farmer can bring in the market	O1. Farmers interested to explore new sources of income (or reduce costs) and investigate biomass opportunities
W4. Cooperative sharing of agricultural machinery required for pruning harvesting is not easy to arrange	O5. Financing opportunities available from local, national and EU sources (e.g. Rural Development Programme, NSRF, etc.)
W5. Difficulty to convince some farmers to accept external companies working on their fields with machines	O13. New forms of community energy projects on the rise (e.g. energy cooperatives)
W16. Management of APPR is a marginal issue for farmers, which are focused on the production of the primary agricultural products	
W17. Farmers are more interested in the quick disposal of APPR and unwilling to adopt practices (e.g. on-field drying) that can have a positive impact on its quality	
W18. Low APPR productivity (in t/ha) in some cases can influence the economics of the value chain	
W19. Value chain costs can be high and therefore the profitability of an APPR initiative may be limited	
W21. Agricultural and energy sectors not well connected	

Objectives

WO1. To develop energy cooperatives from the “traditional” agrarian cooperatives able to cost-effectively mobilize significant volumes of APPR biomass

WO2. To ensure the cooperation of farmers as the primary link in any APPR biomass value chain

Actions / Activities

- Take advantage of new legal framework to establish APPR energy cooperatives with the participation of agrarian cooperatives
- Train staff of cooperatives so that they can provide guidance on the setting up of APPR value chains from the fields
- Promote cooperative ownership of relative expensive harvesting machines in order to make the quickly amortize capital expenditures in the value chain
- Utilize the agrarian cooperatives expertise and human resources (e.g. local agronomists) in order to inform farmers about suitable practices in APPR value chains
- Set-up these cooperatives as the missing link between the energy and agricultural sectors

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⑦ Empowering farmers and the agricultural sector for APPR biomass utilization

Strategy: Weakness + Opportunity → **WO “Reorientation”**

W3. Machinery for harvesting APPR biomass is not well known, more emphasis is placed on machines that can quickly dispose APPR (e.g. mulchers) W5. Difficulty to convince some farmers to accept external companies working on their fields with machines W7. Open-field burning of APPR is a practice that is tolerated by local & national authorities W12. Lack of awareness on possibilities for APPR utilization W16. Management of APPR is a marginal issue for farmers, which are focused on the production of the primary agricultural products W17. Farmers are more interested in the quick disposal of APPR and unwilling to adopt practices (e.g. on-field drying) that can have a positive impact on its quality	O1. Farmers interested to explore new sources of income (or reduce costs) and investigate biomass opportunities O2. Increased taxation and high cost of fossil fuels for heating have created interest in biomass fuels O5. Financing opportunities available from local, national and EU sources (e.g. Rural Development Programme, NSRF, etc.) O6. Due to financial crisis, consumers show increased interest in local raw materials and resources O8. Farmers, local authorities and other stakeholders recognize that open-field burning of residues is a practice that could be outlawed in the future O13. New forms of community energy projects on the rise (e.g. energy cooperatives)

Objectives

WO1. To make energetic utilization of APPR biomass an important issue in the farmers’ mindset and activities

Actions / Activities

- Quantify the direct benefits to the farmers from APPR biomass utilization compared to other alternatives
- Highlight that the current situation will not last for ever and that early comers will be better positioned in a future market
- Highlight the possibilities for farmers to reduce dependency on oil for heating by using their own, local resource
- Convince farmers that they are a key element in the energy transition and the development of community energy projects

⑧ Technological development through RTD and innovation actions

Strategy: Weakness + Opportunity → **WO “Reorientation”**

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⑧ Technological development through RTD and innovation actions Strategy: Weakness + Opportunity → WO “Reorientation”	
W6. Few local manufacturers produce machines capable of harvesting APPR biomass. W8. Lower fuel quality of APPR biomass compared to forest wood biomass, which affects operational and environmental behavior of combustion systems. W9. APPR biomass utilization requires specific combustion technologies. W10. No standardization / fuel certification scheme for APPR biomass yet.	O4. Expansion of the BIOmasud® certification scheme to olive tree and vineyard pruning biomass O5. Financing opportunities available from local, national and EU sources (e.g. Rural Development Programme, NSRF, etc.) O10. Circular economy and rural development is on the political agenda
Objectives WO1. Utilize funding opportunities for improvement of technological components of APPR biomass value chains and fuel quality	
Actions / Activities - To take advantage of ongoing initiatives (e.g. Biomassud Plus, AGROinLOG) that have activities relevant to the understanding and certification of APPR biomass fuel properties - To initiate RTD projects aiming to develop local solutions for harvesting of APPR biomass with good fuel properties. - To initiate RTD projects aiming to develop appropriate technologies for the proper combustion of APPR biomass (e.g. new boiler models, new flue gas cleaning systems, etc.).	

⑨ Placement of APPR biomass on the political agenda Strategy: Weakness + Opportunity → WO “Reorientation”	
W12. Lack of awareness on possibilities for APPR utilization W14. APPR biomass is not explicitly considered in the National Renewable Energy Action Plan	O9. New EU regulations and directives (e.g. RED2) indirectly favour the utilization of local resources, such as APPR biomass O10. Circular economy and rural development is on the political agenda
Objectives WO1. To revise the national strategic framework in favor of APPR biomass	
Actions / Activities - Inform policy makers about the possibilities of APPR biomass in the context of circular economy and rural development. - To revise the NREAP and set targets for APPR biomass utilization. - To take advantage of the revision of regulations / laws to incorporate appropriate measures favorable to APPR biomass.	

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⑩ To foster the creation of an APPR biomass market in various energy sectors Strategy: Weakness + Opportunity → WO “Reorientation”	
W8. Lower fuel quality of APPR biomass compared to forest wood biomass, which affects operational and environmental behavior of combustion systems W9. APPR biomass utilization requires specific combustion technologies W10. No standardization / fuel certification scheme for APPR biomass yet W17. Farmers are more interested in the quick disposal of APPR and unwilling to adopt practices (e.g. on-field drying) that can have a positive impact on its quality W20. Limited market for non-conventional biomass (such as APPR) and almost no major large-scale biomass consumer for market take-off	O2. Increased taxation and high cost of fossil fuels for heating have created interest in biomass fuels O3. Industries are interested in reducing energy costs and considering biomass fuels O4. Expansion of the BIOMasud® certification scheme to olive tree and vineyard pruning biomass O11. A feed-in premium mechanism is in place for biomass-to-power installations O12. Interested in bioelectricity due to saturation of the other RESe sources (e.g. solar, wind, etc.)
Objectives WO1. To develop suitable end-uses for APPR biomass so that the market can expand	
Actions / Activities - To inform about the actual possibilities of APPR biomass and avoid unrealistic expectations (e.g. production of premium quality wood pellets from prunings) - To identify specific market sectors for which APPR biomass can have a presence (e.g. power / CHP production, agro-industries, greenhouses, etc.) and highlight to operators the benefits from its use - To promote among supply chain actors, including farmers, good harvesting and management practices that ensure the supply of APPR biomass with good properties and quality (e.g. ash content, etc.) - To engage potential large-scale consumers of biomass / APPR biomass so as to create a demand for the product - To support the retrofitting of industrial installations / boilers, so that they can accept APPR biomass as a fuel	

ST Strategies (Strategies that employ strengths in order to prevent or minimize threats). They are strategies of the max-min type, in the sense that they use the strengths in order to avoid or reduce external threats (defense).

⑪ Adoption of APPR by public institutions Strategy: Strength + Threat → ST “Defense”	

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⑪ Adoption of APPR by public institutions Strategy: Strength + Threat → ST “Defense”	
S1. Huge potential of APPR biomass at national level. S2. Large areas cultivated with permanent crop plantations, in various locations in Greece. S3. The agricultural sector is a key economic activity in Greece, with high potential for influencing government decisions. S5. Short Pay-back periods for biomass facilities for heating (depending on fossil fuels prices Benefits of APPR biomass utilization are easy to observe in local conditions (e.g. avoidance of emissions and pollution from open-field fires, cost savings achieved in APPR management, fossil fuel savings, etc.) S8. Biomass boilers and combustion systems capable of handling APPR are also capable of combustion other biomass types, thus enhancing the security of supply S9. Replacement of fossil fuels (e.g. heating oil) with biomass for heating applications can have a short pay-back time. S10. Compared to fossil fuels, APPR biomass leads to reduction of GHG emissions. The reduction can be higher than the use of other biomass types	T1. Unreasonable expectations (too high yields, production of high quality wood pellets from APPR) may result in failures of new initiatives due to wrong assessment of costs or market potential. T5. Financial crisis limits investments and makes market conditions insecure. T6. Short-term decreases in heating oil price discourage potential adopters. T8. Unfavorable public perception on biomass due to the smog formed by improper firewood combustion in both urban and rural areas.
Objectives ST1. To encourage development of the APPR sector through early adoption by the public sector.	
Actions / Activities - To make potential end-users in the public sector (e.g. public buildings) early adopters of APPR biomass so that a new market can be created. - To inform local residents through public channels about the tangible and intangible benefits of APPR utilization (e.g. reduction in municipal taxes, reduction in GHG emissions, etc.) - To provide institutions with existing models and examples of tenders prioritizing biomass and agricultural wastes use in high potential areas. - Include the collection of APPR biomass in the waste management framework of local municipalities. - To limit the risk of private investors by creating a demand in the public sector.	

⑫ Position APPR biomass in the fuel market Strategy: Strengths + Threats → ST “Defence”	
S1. Huge potential of APPR biomass at national level S4. Large areas cultivated with permanent crop plantations, in various locations in Greece S7. Local biomass value chains exist (e.g. olive pomace, nut shells, firewood from permanent	T2. The Greek biomass market development is focusing on pellets, not on chipped biomass T3. Cheap, low-quality biomass fuels available on the market and limited control or knowledge about impact of fuel properties T7. EU policies may create unfavorable

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⑫ Position APPR biomass in the fuel market Strategy: Strengths + Threats → ST “Defence”	
crops) that could be used to promote the use of APPR biomass S8. Biomass boilers and combustion systems capable of handling APPR are also capable of combustion other biomass types, thus enhancing the security of supply S10. Compared to fossil fuels, APPR biomass leads to reduction of GHG emissions. The reduction can be higher than the use of other biomass types. S11. Compared to other residues from the agricultural sector (e.g. straw) there are not many or even no competing uses for APPR biomass. APPR biomass is also readily available now, and not a possible future reality (like energy crops).	conditions for APPR biomass (e.g. not able to comply with Ecodesign limits if it is considered as “wood biomass”, high electrical efficiency may be required by the RED2, etc.) T8. Unfavourable public perception on biomass due to the smog formed by improper firewood combustion in both urban and rural areas
Objectives ST1. Position APPR biomass in the fuel market by finding appropriate market niches for it.	
Actions / Activities • Support the deployment of multi-fuel boilers capable of handling APPR biomass • Present techno-economic and environmental data supporting the fact that APPR biomass is suitable for specific market niches that may currently use fuels that cause excessive emissions • Highlight that proper combustion of APPR biomass is suitable systems is not responsible for smog • Highlight benefits of choosing APPR as a fuel (e.g. local availability, quantities, no competing uses, lower GHG emissions) • Utilize existing commercial channels for biomass to promote APPR	

WT Strategies (Strategies that alleviate weaknesses and seek to reduce the impact of threats). They are min-min type strategies seeking to minimize weaknesses if external threats can be avoided (surviving).

⑬ Financial support for deployment of APPR utilization Strategy: Weakness + Threat → WT “Surviving”	

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⑬ Financial support for deployment of APPR utilization Strategy: Weakness + Threat → WT “Surviving”	
W2. More uncertainties in initiatives focusing on APPR biomass means difficulties in attracting funds from banks or private sector W18. Low APPR productivity (in t/ha) in some cases can influence the economics of the value chain W19. Value chain costs can be high and therefore the profitability of an APPR initiative may be limited W20. Limited market for non-conventional biomass (such as APPR) and almost no major large-scale biomass consumer for market take-off	T1. Unreasonable expectations (too high yields, production of high quality wood pellets from APPR) may result in failures of new initiatives due to wrong assessment of costs or market potential. T4. High VAT tax of solid biofuels in Greece (24 %) creates problems in the development of new initiatives. T5. Financial crisis limits investments and makes market conditions insecure T6. Short-term decreases in heating oil price discourage potential adopters
Objectives WT1. To create a more secure and attractive environment for APPR biomass-to-energy investments through appropriate financial measures.	
Actions / Activities • Direct / indirect support of investments in APPR biomass-to-energy projects (e.g. grants, tax reductions, etc.) • Reduction of VAT for APPR biomass. • VAT removal or reduction for biomass that need promotion. • Fiscal benefits for companies utilizing APPR biomass (e.g. tax reductions, exemptions, etc.) • Other supporting measures for new investments utilizing APPR biomass management.	

⑭ Development of technologies and regulations tailored to APPR fuel properties Strategy: Weakness + Threat → WT “Surviving”	
W8. Lower fuel quality of APPR biomass compared to forest wood biomass, which affects operational and environmental behavior of combustion systems W9. APPR biomass utilization requires specific combustion technologies W10. No standardization / fuel certification scheme for APPR biomass yet W11. Phytosanitary treatments may affect the fuel properties of APPR biomass (e.g. increased copper content)	T2. The Greek biomass market development is focusing on pellets, not on chipped biomass T3. Cheap, low-quality biomass fuels available on the market and limited control or knowledge about impact of fuel properties T7. EU policies may create unfavourable conditions for APPR biomass (e.g. not able to comply with Ecodesign limits if it is considered as “wood biomass”, high electrical efficiency may be required by the RED2, etc.). T8. Unfavourable public perception on biomass due to the smog formed by improper firewood combustion in both urban and rural areas.

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⑭ Development of technologies and regulations tailored to APPR fuel properties Strategy: Weakness + Threat → WT “Surviving”	
Objectives WT1. To influence EU / national / regional legislation so that APPR biomass can have a meaningful market presence. WT2. To develop technologies capable of handling APPR with low emissions.	
Actions / Activities - To position APPR biomass as agrobiomass and not “wood biomass” in EU (e.g. the Ecodesign regulation) and national legislation so that it will not have to meet impossible emission limits. - To promote fuel certification schemes for APPR biomass. - To support technology providers (e.g. boiler manufacturers) develop solutions capable of handling APPR biomass. - To inform the public and stakeholders about the environmental issues associated with using other low-quality biomass fuels in unsuitable combustion facilities.	

⑮ Alleviate the NIMBY issue for APPR energetic utilization and highlight the limitations of other pathways Strategy: Weakness + Threat → WT “Surviving”	
W7. Open-field burning of APPR is a practice that is tolerated by local & national authorities W17. Farmers are more interested in the quick disposal of APPR and unwilling to adopt practices (e.g. on-field drying) that can have a positive impact on its quality	T8. Unfavorable public perception on biomass due to the smog formed by improper firewood combustion in both urban and rural areas T10. Alternative utilization of APPR (e.g. mulching) is increasing
Objectives WT1. To convince the public and other stakeholders (e.g. NGOs) that energetic utilization of APPR is a viable and sustainable pathway over alternatives.	
Actions / Activities - Inform about the current reality of APPR biomass management. - Highlight the limitations of the alternative disposal methods (e.g. mulching). - Quantify and disseminate the environmental benefits of APPR biomass utilization compared to alternatives.	

The following table summarizes the 15 specific measures included in the strategic plan for the development of the APPR sector in Greece. Most of the specific actions belong in the following

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main categories, most of which are already addressed to a certain extent by the uP_running project:

- Dissemination and training, especially targeted to the agricultural sector and policy makers.
- Demonstrate the feasibility and support the development of early adopters.
- Development of appropriate technologies for utilization and harvesting.
- Setting up favorable conditions, e.g. legislation and appropriate support schemes.

Table 11: Summary of the APPR biomass strategic actions for Greece

SO: Attack strategy	ST: Defense strategy
1. Inform and train farmers about the benefits of the energetic utilization of APPR 2. Develop agro-industries as APPR biomass consumers and intermediates 3. Promote tangible & intangible benefits of APPR biomass utilization 4. Establish APPR biomass-to-power projects	11. Adoption of APPR by public institutions I 12. Position APPR biomass in the fuel market
WO: Reorientation strategy	WT: Surviving strategy
5. Demonstrations of APPR biomass value chains 6. Transform agrarian cooperatives to APPR biomass / energy cooperatives 7. Empowering farmers and the agricultural sector for APPR biomass utilization 8. Technological development through RTD and innovation actions 9. Placement of APPR biomass on the political agenda 10. To foster the creation of an APPR biomass market in various energy sectors	13. Financial support for deployment of APPR utilization 14. Development of technologies and regulations tailored to APPR fuel properties 15. Alleviate the NIMBY issue for APPR energetic utilization and highlight the limitations of other pathways

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ANNEX A4

Ενότητα Εργασίας 2 – Δραστηριότητα 2.3

**Ανάλυση Τομέα και Στρατηγικό Σχέδιο για τη βιομάζα από
μόνιμες καλλιέργειες στην Ελλάδα**

	Έγγραφο:	Ανάλυση Τομέα και Στρατηγικό Σχέδιο για τη βιομάζα από μόνιμες καλλιέργειες στην Ελλάδα		
	Συγγραφέας:	ΕΚΕΤΑ, ΙΝΑΣΟ-ΠΑΣΕΓΕΣ	Έκδοση:	v2
	Αναφορά:		Ημερομηνία:	28/02/2018

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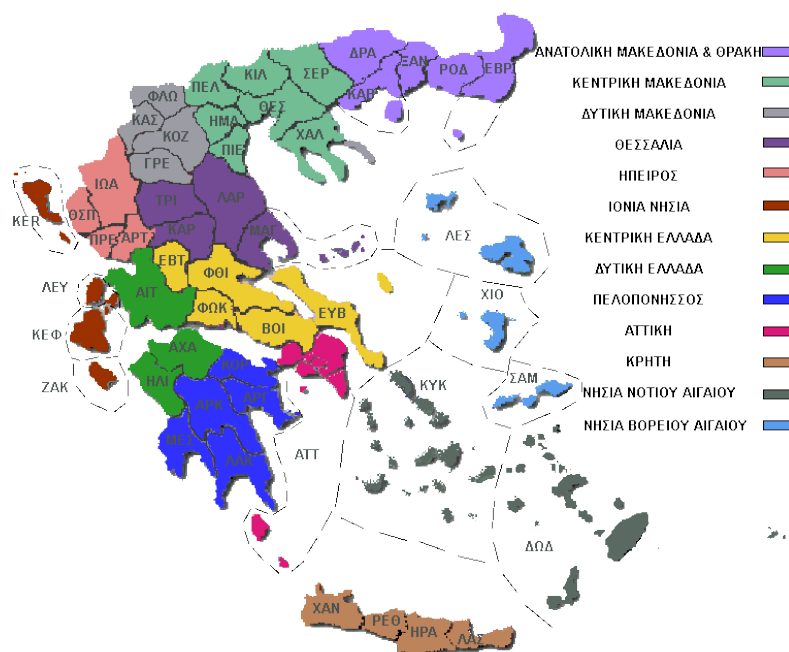
	Έγγραφο:	Ανάλυση Τομέα και Στρατηγικό Σχέδιο για τη βιομάζα από μόνιμες καλλιέργειες στην Ελλάδα		
	Συγγραφέας:	ΕΚΕΤΑ, ΙΝΑΣΟ-ΠΑΣΕΓΕΣ	Έκδοση:	v2
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ΑΝΑΛΥΣΗ ΤΟΜΕΑ

Α. Εθνικό πλαίσιο για τις μόνιμες καλλιέργειες

Η Ελλάδα βρίσκεται στο νοτιότερο άκρο της Βαλκανικής Χερσονήσου στη Νοτιοανατολική Ευρώπη. Συνορεύει με την Αλβανία στα βορειοδυτικά, την Πρώην Γιουγκοσλαβική Δημοκρατία της Μακεδονίας και τη Βουλγαρία στα βόρεια και την Τουρκία στα βορειοανατολικά. Έχει συνολική έκταση 131,957 km² και πληθυσμό περίπου 11 εκατ. κατοίκους το 2016 (2.1 % του συνόλου της ΕΕ). Ορισμένα ιδιαίτερα γεωγραφικά χαρακτηριστικά είναι:

- Τα πολυάριθμα νησιά της χώρας, από τα οποία μόνο 227 κατοικούνται. Η Ελλάδα έχει μία από τις μεγαλύτερες ακτογραμμές στον κόσμο και την μακρύτερη στην ΕΕ.
- Ο ορεινός / λοφώδης χαρακτήρας του τοπίου: πάνω από το 80 % της χώρας είναι ορεινό, ένα από τα υψηλότερα ποσοστά στην ΕΕ.



Εικόνα 1. Χάρτης των διοικητικών υποδιαιρέσεων της Ελλάδας

Το 2015, η Χρησιμοποιούμενη Γεωργική Έκταση (ΧΓΕ) στην Ελλάδα αντιστοιχούσε σε 3,282.52 χιλ. εκτάρια, εκ των οποίων το 52.9 % αφορούσε αροτραίες καλλιέργειες. Σύμφωνα με την ΕΛΣΤΑΤ, οι μόνιμες καλλιέργειες αντιστοιχούσαν στο 33.9 % της ΧΓΕ, ενώ τα οπωροκηπευτικά και οι εκτάσεις σε αγρανάπαυση ανήλθαν σε 2 % και 11.2 % αντίστοιχα. Η Eurostat αναφέρει ότι η Ελλάδα έχει το υψηλότερο ποσοστό της συνολικής ΧΓΕ για μόνιμες καλλιέργειες μεταξύ όλων των κρατών μελών και είναι ένα από τα τρία κράτη-μέλη (μαζί με την Κύπρο και την Πορτογαλία) με ποσοστό μεγαλύτερο του 20 % της συνολικής ΧΓΕ. Αυτό οφείλεται στις ευνοϊκές κλιματολογικές συνθήκες για την καλλιέργεια μόνιμων καλλιεργειών.

Ο Πίνακας 1 παρουσιάζει τα βασικά στατιστικά στοιχεία για τα σημαντικότερα είδη μόνιμων καλλιεργειών με βάση τα στοιχεία της ΕΛΣΤΑΤ και της Eurostat. Οι δυο βάσεις στατιστικών δεδομένων δεν είναι σε άριστη συμφωνία και συχνά παρατηρούνται μεγάλες διαφορές, η σημαντικότερη από τις οποίες είναι η ποσότητα παραγωγής ελιών για την παραγωγή ελαιόλαδου. Οι αποκλίσεις στα στατιστικά στοιχεία είναι ένας παράγοντας που πρέπει να ληφθεί

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	Συγγραφέας:	ΕΚΕΤΑ, ΙΝΑΣΟ-ΠΑΣΕΓΕΣ	Έκδοση:	v2
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υπόψη σε οποιαδήποτε εκτίμηση του δυναμικού βιομάζας από μόνιμες καλλιέργειες (όπως θα παρουσιαστεί και στην επόμενη ενότητα).

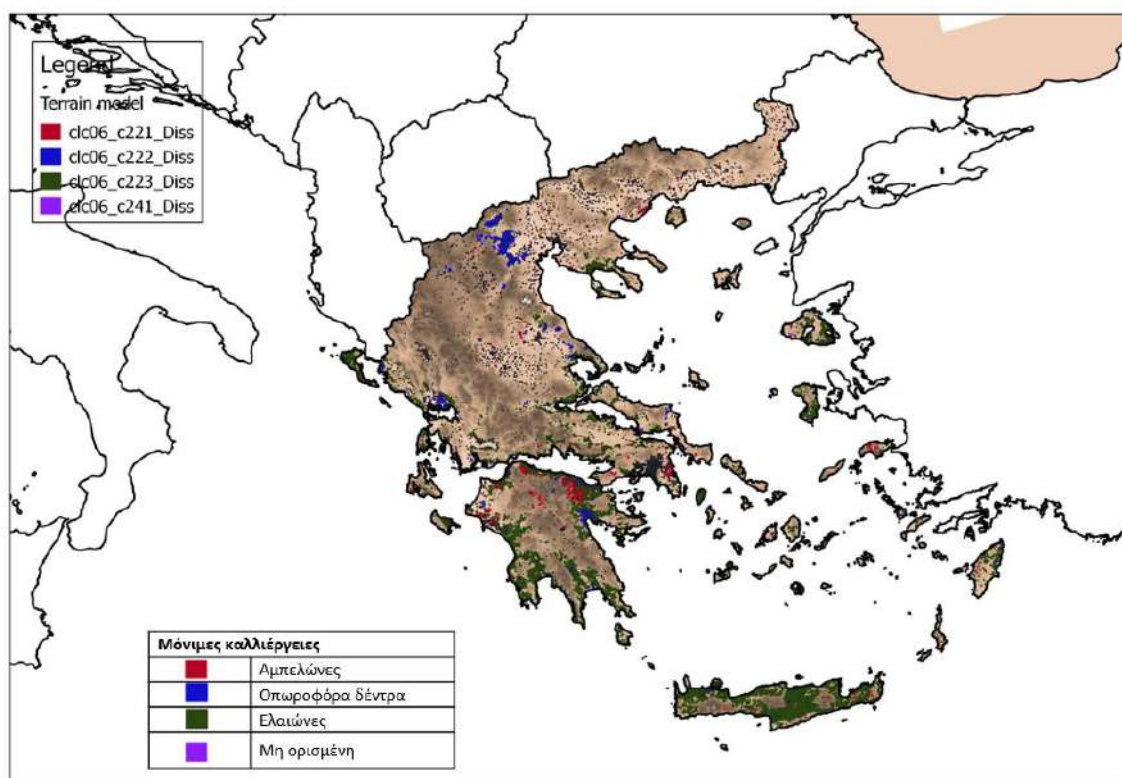
Πίνακας 1. Βασικά στατιστικά στοιχεία των σημαντικότερων ειδών μόνιμων καλλιεργειών στην Ελλάδα

Μόνιμες καλλιέργειες, βασικά στατιστικά στοιχεία (2015)							
Είδος καλλιέργειας		Επιφάνεια (1,000 ha)		Παραγωγή (1,000 t)		# δένδρων, σύνολο	# δένδρων, σε κανονικούς δενδρώνες
Πηγή		(1) ¹	(2)	(1)	(2)	(1)	(1)
Ελαιόδεντρα	Για ελαιόλαδο	710.30	856.75	2,477.20	965.75	150,351,619	141,991,652
	Επιτραπέζιες ελιές	110.91	113.15	430.67	304.10		
Αμπέλια	Για οινοποίηση	54.46	65.63	516.31	574.13	N/A	N/A
	Επιτραπέζια σταφύλια	8.81	16.19	228.87	248.71		
	Για σταφίδα	14.56	32.57	60.26	259.37		
Εσπεριδοειδή	Πορτοκαλιές	31.26	33.63	808.65	880.92	14,591,222	14,073,530
	Λεμονιές	4.19	3.87	61.04	44.80	2,068,060	1,469,283
	Μανταρινιές	6.92	8.53	161.15	158.49	3,346,027	3,108,034
Οπωροφόρα	Μηλιές	9.83	11.76	267.02	289.98	8,801,765	8,532,614
	Αχλαδιές	3.79	4.43	94.88	66.09	2,924,618	2,353,210
	Ροδακινιές	38.65	44.35	521.11	776.97	16,748,292	16,624,440
	Βερυκοκιές	7.31	7.24	94.80	87.71	2,959,049	2,790,480
	Κερασιές	14.21	14.46	75.19	82.19	5,355,838	5,229,017
	Συκιές (φρέσκα)	N/A	2.35	9.18	9.68	439,113	87,703
	Συκιές (αποξηραμένα)	4.32	N/A	11.76	N/A	767,473	637,206
Ακρόδρυα	Αμυγδαλιές	11.86	11.11	37.57	20.46	3,870,996	3,272,016
	Καρυδιές	8.96	11.34	25.95	24.04	2,124,570	1,539,167
	Καστανιές	N/A	8.29	30.05	28.94	1,645,739	1,451,066
	Φουντουκιές	0.21	0.35	0.49	0.88	77,182	63,419
(1) ΕΛΣΤΑΤ, Ετήσια Γεωργική Στατιστική Έρευνα, 2015							
(2) EUROSTAT, Crop statistics (from 2000 onwards), [apro_acs_a]. Τελευταία ενημέρωση: 15-12-2017							

Η Εικόνα 2 παρουσιάζει τη χωρική κατανομή των κύριων τύπων μόνιμων καλλιεργειών στην Ελλάδα. Οι ακόλουθες παράγραφοι παρουσιάζουν λεπτομερέστερα ορισμένα βασικά χαρακτηριστικά των κύριων κατηγοριών δέντρων (ελαιόδεντρα, αμπέλια, εσπεριδοειδή, οπωροφόρα και ακρόδρυα) τα οποία δίνουν μια γενικότερη εικόνα του κλάδου αλλά έχουν και ιδιαίτερη σημασία για την εξέταση της παραγωγής βιομάζας από μόνιμες καλλιέργειες.

¹ Περιοχή μόνο κανονικών δενδρώνων. Τα δέντρα σε έναν κανονικό δενδρώνα είναι φυτεμένα με συστηματικό τρόπο και σε συγκεκριμένο μοτίβο φύτευσης ή, είναι σε πολύ πυκνή φύτευση, ακόμα κι αν είναι φυτεμένα με ακανόνιστο τρόπο.

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Εικόνα 2. Χωρική κατανομή των κύριων τύπων μόνιμων καλλιεργειών στην Ελλάδα²

Ελαιοκαλλιέργεια

Οι ελιές καλλιεργούνται κυρίως στην Κρήτη, στη Νότια Πελοπόννησο, στο Αιγαίο και στα Ιόνια νησιά (π.χ. στη Λέσβο και στην Κέρκυρα αντίστοιχα) και σε παράκτιες περιοχές. Το ποσοστό των ελαιόδεντρων στη συνολική ΧΓΕ για την Ελλάδα είναι υψηλότερο σε σύγκριση με τις άλλες Μεσογειακές χώρες. Η Eurostat αναφέρει 531,000 ελαιοκομικές εκμεταλλεύσεις στην Ελλάδα, με μέσο μέγεθος 1.5 εκτάρια, πολύ χαμηλότερο από την Ισπανία (5.5 εκτάρια), αλλά λίγο υψηλότερο από την Ιταλία (1.3 εκτάρια).

Σύμφωνα με μελέτη του Διεθνούς Συμβουλίου Ελαιολάδου (International Olive Council), οι ελαιώνες στην Ελλάδα μπορούν να ταξινομηθούν κυρίως στους ακόλουθους τύπους:

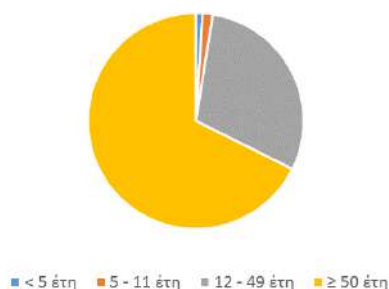
- S2: Παραδοσιακά αρδεύονται σε απότομες πλαγιές. Αρδευόμενοι ελαιώνες με κλίση > 20% και <180 δέντρα / εκτάριο.
- S3: Παραδοσιακά ξηρικοί σε μέτριες πλαγιές. Ξηρικοί ελαιώνες με κλίση <20% και <180 δέντρα / εκτάριο.
- S6: Εντατική άρδευση. Αρδευόμενοι ελαιώνες με 180-800 δέντρα / εκτάριο.

² Ο χάρτης έχει φτιαχτεί με χρήση του προγράμματος QGIS 2.14.0 – Essen version. Οι χρήσει γης από μόνιμες καλλιέργειες αντιστοιχούν στη βάση δεδομένων Corine Land Cover 2012 (v18.5, GISAT 02/2016, διαθέσιμη στην ιστοσελίδα <http://www.copernicus.eu/>). Η κατηγορία χρήσης γης που αναφέρεται ως «μη ορισμένη» αντιστοιχεί στο επίπεδο 241 του Corine Land Cover 241 «Ετήσιες καλλιέργειες που σχετίζονται με μόνιμες καλλιέργειες», η οποία υποδηλώνει την ύπαρξη γης που περιλαμβάνει αμπελίες, οπωροφόρα δέντρα ή ελαιώνες.

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Όπως φαίνεται στην Εικόνα 3 (με βάση στοιχεία της Eurostat), περισσότεροι από τους μισούς ελαιώνες στην Ελλάδα έχουν ηλικία 50 ετών ή μεγαλύτερη και πυκνότητες φύτευσης μικρότερες από 140 δέντρα / εκτάριο.

Ηλικιακές κλάσεις ελαιόδεντρων στην Ελλάδα



Πυκνότητα φύτευσης ελαιόδεντρων στην Ελλάδα



Εικόνα 3: Κατηγορίες ηλικίας και πυκνότητας ελαιόδεντρων στην Ελλάδα (Πηγή: Eurostat)

Μια άλλη ταξινόμηση των ελαιώνων στην Ελλάδα δίνεται από τον Καθηγητή Σ. Βέμμο του Γεωπονικού Πανεπιστημίου Αθηνών. Οι τρεις κύριοι τύποι ελαιώνων που απαντώνται στην Ελλάδα είναι:

- **Οι παραδοσιακοί ελαιώνες**, οι οποίοι απαιτούν ελάχιστες εισροές και προσφέρουν σημαντικές οικολογικές, κοινωνικές και περιβαλλοντικές υπηρεσίες (π.χ. αποφυγή της διάβρωσης του εδάφους). Η παραγωγικότητά τους όμως είναι περιορισμένη.
- **Οι εντατικοί παραδοσιακοί ελαιώνες**, οι οποίοι έχουν υψηλότερη παραγωγικότητα και απαιτούν υψηλότερες εισροές. Είναι το κύριο σύστημα φύτευσης για τα ελαιόδεντρα που υπάρχουν σήμερα στην Ελλάδα.
- **Οι σύγχρονοι εντατικοί ελαιώνες**, οι οποίοι επιτυγχάνουν ακόμη υψηλότερη παραγωγικότητα, αλλά απαιτούν επίσης αυξημένες προσλήψεις λιπασμάτων, νερού και ζιζανιοκτόνων.

Πίνακας 2. Σύγκριση των κύριων τύπων ελαιώνων στην Ελλάδα (Πηγή: Σ. Βέμμος, 2011)

Σύγκριση των κύριων τύπων ελαιώνων στην Ελλάδα			
Χαρακτηριστικά	Παραδοσιακοί	Εντατικοί παραδοσιακοί	Εντατικοί, παραδοσιακοί
Πυκνότητα φύτευσης (δέντρα / εκτάριο)	40 - 120	80 - 250	200 - 500
Στρεμματική απόδοση (kg / εκτάριο)	200 – 1,500	1,500 – 4,000	4,000 – 12,000
Άρδευση	Ελάχιστη έως μηδενική	Μερική (στάγδην άρδευση)	Ναι (στάγδην άρδευση)
Λίπανση	Οργανική	2-6 kg/δένδρο	Υψηλές απαιτήσεις (π.χ. 150 – 350 kg N/εκτάριο)
Ζιζανιοκτόνα	Ελάχιστα έως μηδενικά	2-10 φορές το χρόνο	Συχνή χρήση

Πρέπει να σημειωθεί ότι μεγάλο μέρος των ελαιώνων στην Ελλάδα βρίσκονται σε ορεινές και ημιορεινές περιοχές. Αυτό έχει σαφείς επιπτώσεις στο κόστος παραγωγής, καθώς και στο κόστος απομάκρυνσης των κλαδεμάτων για ενεργειακούς σκοπούς.

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Ο Εθνικός Κατάλογος Ποικιλιών απαριθμεί 64 διαφορετικές ποικιλίες ελαιόδεντρων που αναγνωρίζονται επίσημα και καλλιεργούνται στην Ελλάδα. Οι Ελληνικές ποικιλίες είναι μακράν οι πιο συχνά καλλιεργούμενες. Η *Κορωνέικη* είναι η συνηθέστερη ποικιλία για την παραγωγή ελαιόλαδου καθώς αντιστοιχεί σε περίπου 60 % της παραγωγής αυτού. Η *Καλαμών* είναι η πιο γνωστή επιτραπέζια ποικιλία ελιάς, τόσο στην Ελλάδα όσο και σε παγκόσμιο επίπεδο.

Πίνακας 3. Κατανομή των κύριων ποικιλιών και του επιπέδου παραγωγής ανά ελαιοπαραγωγική περιοχή της Ελλάδας.

Μόνιμες καλλιέργειες, βασικά στατιστικά στοιχεία (2015)								
Περιοχή	Ελαιόλαδο					Επιτραπέζιες ελιές		
	Ποικιλίες	Παραγωγή καρπού (1)		Παραγωγή ελαιόλαδου (1)		Ποικιλίες	Παραγωγή καρπού (1)	
		(1,000 t)	(%)	(1,000 t)	(%)		(1,000 t)	(%)
Πελοπόννησος	Κορωνέικη, Μαστοειδής, Κοθρεϊκή, Αγουρομανακοελιά, Κουτσουρελιά, Μεγαρείτικη	1,154.85	46.6	160.28	48.1	Καλαμών, Γαιδουρελιά, Μεγαρείτικη	43.87	10.2
Κρήτη	Κορωνέικη, Μαστοειδής, Θρουμπολιά	591.67	23.9	91.01	27.3	Θρουμπολιά, Καλαμών	2.22	0.5
Στερεά Ελλάδα	Μεγαρείτικη, Μαστοειδής, Κολυμπάδα, Αμφίσσης, Κοθρεϊκή	89.82	3.6	15.41	4.6	Αμφίσσης, Καρυδολιά, Καλαμών, Κοθρεϊκή	92.69	21.5
Ιόνια νησιά	Λιανολιά Κερκύρας, Ασπρολιά, Καλοκαιρίδα	163.59	6.6	20.71	6.2	Βασιλικάδα, Αμφίσσης	0.64	0.1
Νησιά Αιγαίου	Βαλανολιά, Αδραμιτινή, Θρουμπολιά	91.77	3.7	13.45	4.0	Βαλανολιά, Θρουμπολιά	10.58	2.5
Μακεδονία	Χαλκιδικής, Θρούμπα, Θάσσου	123.26	5.0	12.79	3.8	Χαλκιδικής	142.51	33.1
Ήπειρος	Λιανολιά Κερκύρας, Αμφίσσης	149.44	6.0	7.46	2.2	Αμφίσσης	31.14	7.2
Αιτωλοακαρνανία	Κουτσουρελιά, Κορωνέικη, Κοθρεϊκή	30.21	1.2	3.29	1.0	Αμφίσσης, Καλαμών, Καρυδολιά, Κοθρεϊκή	34.50	8.0
Σύνολο Χώρας	-	2,477.20	100.0	333.31	100.0	-	430.67	100.0
(1) ΕΛΣΤΑΤ, Ετήσια Γεωργική Στατιστική Έρευνα, 2015.								

Αμπέλια

Ως μόνιμη καλλιέργεια, οι **αμπελώνες** κατέχουν τη δεύτερη θέση ως προς την ΧΓΕ στην Ελλάδα. Η έκταση που καλλιεργείται με αμπέλια μειώνεται από το 2000, ακολουθώντας την ίδια τάση στην ΕΕ, η οποία εν μέρει αποδίδεται στα αποτελέσματα της μεταρρύθμισης της κοινής οργάνωσης της αμπελοοινικής αγοράς που πραγματοποιήθηκε το 2008.

Η Ελλάδα είναι η 5^η στην ΕΕ-28 στον αριθμό των αμπελουργικών εκμεταλλεύσεων (188,896). Ωστόσο, η μέση έκταση ανά εκμετάλλευση είναι μόνο 0.55 εκτάρια. Μεταξύ των 17 μεγαλύτερων παραγωγών οίνου στην ΕΕ-28, μόνο η Σλοβενία, η Κροατία και η Ρουμανία έχουν χαμηλότερους μέσους όρους, όπως φαίνεται και στην Εικόνα 4.

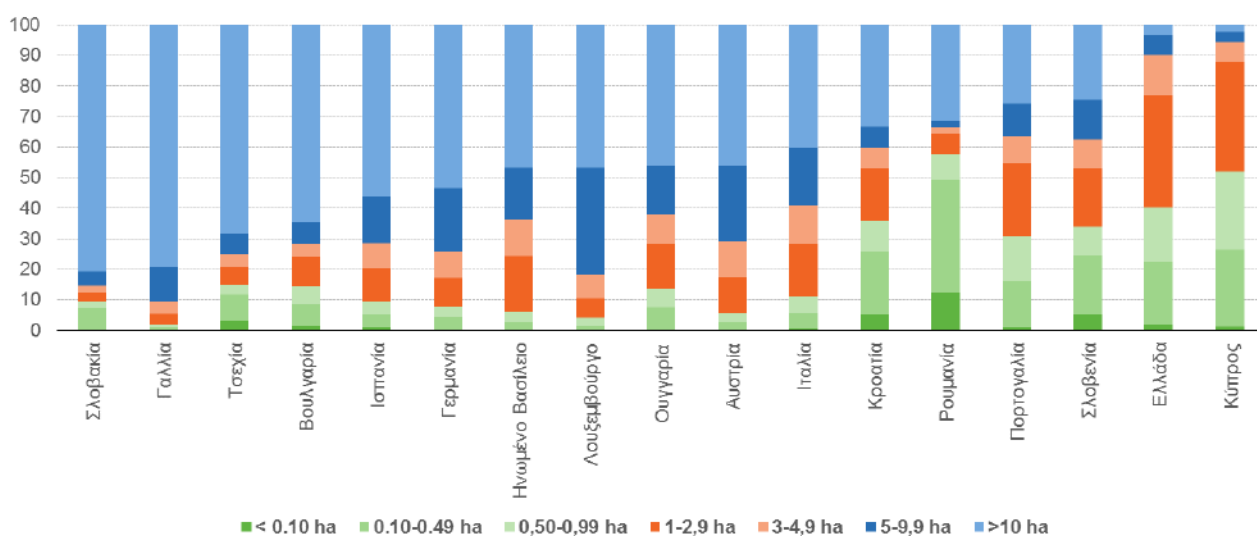
Η καλλιέργεια του αμπελιού είναι διαδεδομένη σε όλα τα γεωγραφικά διαμερίσματα της Ελλάδας. Ο Πίνακας 4 παρουσιάζει την κατανομή των καλλιεργούμενων εκτάσεων για τις Ελληνικές περιφέρειες. Η Πελοπόννησος είναι η σημαντικότερη περιοχή παραγωγής κρασιού και

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σταφίδας, αλλά και άλλες περιοχές όπως η Μακεδονία, η Κρήτη, η Κεντρική Ελλάδα και η Αττική δεν απέχουν πολύ.

Πίνακας 4. Καλλιεργούμενες εκτάσεις αμπελώνων στην παραγωγή, 2015 (Πηγή: Eurostat, vit_t1)

Καλλιεργούμενες εκτάσεις αμπελώνων στην παραγωγή, Ελλάδα, 2015 (ha)					
Περιφέρεια	Οίνος ΠΟΠ	Οίνος ΠΓΕ	Οίνος που δεν είναι ΠΟΠ ή ΠΓΕ	Σταφύλια διπλής χρήσης	Σταφίδες
Ανατολική Μακεδονία & Θράκη	-	1,326	284	414	-
Κεντρική Μακεδονία	797	2,563	628	396	-
Δυτική Μακεδονία	-	1,559	340	-	-
Ήπειρος	136	438	190	-	-
Θεσσαλία	345	2,528	339	764	-
Ιόνια Νησιά	-	2,139	530	-	1,745
Δυτική Ελλάδα	1,789	5,052	1,269	42	7,674
Στερεά Ελλάδα	-	6,094	585	5	-
Πελοπόννησος	3,475	5,268	998	130	15,303
Αττική	-	5,910	81	-	-
Βόρειο Αιγαίο	1,836	750	277	2	-
Νότιο Αιγαίο	2,373	749	764	26	-
Κρήτη	2,599	4,199	442	413	14,801
Ελλάδα- σύνολο	14,126	38,574	6,727	2,206	39,522



Εικόνα 4. Έκταση αμπελώνων ανά τάξη μεγέθους της αμπελουργικής εκμετάλλευσης, 2015. Ποσοστό επί του συνόλου των αμπελώνων (Πηγή: Eurostat)

Σύμφωνα με την Eurostat, το 2015 το 41.4 % των αμπελώνων για την αμπελουργική έκταση στην Ελλάδα καλλιεργήθηκε με κόκκινες ποικιλίες (Κ), 38.1 % με λευκές ποικιλίες (Λ) και 20.6 % με άλλες ποικιλίες (Α). Η Eurostat αναφέρει συγκεκριμένα 11 κόκκινες, 8 λευκές και 2 άλλες ποικιλίες ως «κύριες»³ - φυσικά, καλλιεργούνται επίσης πολλές άλλες ποικιλίες σε τοπικό επίπεδο. Το Σαββατιανό (Λ) είναι η πιο κοινή ποικιλία, ακολουθούμενη από τον Ροδίτη (Ο). Άλλες

³ Σύμφωνα με τον Κανονισμό της Ευρωπαϊκής Κοινότητας Νο 1337/2011, «κύριες» ποικιλίες αμπέλου θεωρούνται αυτές που καλλιεργούνται σε επιφάνεια μεγαλύτερη των 500 εκταρίων σε εθνικό επίπεδο.

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σημαντικές ποικιλίες είναι το *Αγιωργίτικο* (Κ), το *Λιάτικο* (Κ), το *Μοσχάτο Αμβούργου* (Κ), το *Ξινόμαυρο* (Κ), το *Cabernet Sauvignon* (Κ) και το *Ασσύρτικο* (Λ). Ο Πίνακας 5 συνοψίζει τα βασικά στοιχεία για τις κυριότερες ποικιλίες σταφυλιών που χρησιμοποιούνται για οινοπαραγωγή στην Ελλάδα.

Πίνακας 5. Κύριες ποικιλίες σταφυλιών για οινοπαραγωγή, 2011-2012 (Πηγή: Υπουργείο Γεωργίας, 2013)

Κύριες ποικιλίες σταφυλιών για οινοπαραγωγή στην Ελλάδα, 2015		
Ποικιλία	Καλλιεργούμενη έκταση (ha)	Ποσοστό (%)
Κόκκινες ποικιλίες	21,709	41.4
Αγιωργίτικο	3,365	6.4
Ξινόμαυρο	2,152	4.1
Λιάτικο	2,620	5.0
Cabernet Sauvignon	1,995	3.8
Μοσχάτο Αμβούργου	2,325	4.4
Μαυρούδι	1,670	3.2
Λευκές ποικιλίες	19,962	38.1
Σαββατιανό	10,355	19.7
Ασσύρτικο	1,911	3.6
Λευκό Μοσχάτο	1,633	3.1
Μοσχάτο Αλεξανδρείας	834	1.6
Άλλα χρώματα	10,781	20.6
Ροδίτης	9,000	17.2
Σύνολο	52,451	100.00

Είναι επίσης ενδιαφέρον να σημειωθεί ότι - εκτός από τα αμπέλια για την παραγωγή κρασιού - η Ελλάδα αναφέρεται ως ο 2^{ος} μεγαλύτερος παραγωγός επιτραπέζιων σταφυλιών στην ΕΕ-28 (μετά από την Ιταλία) και ως το μόνο κράτος μέλος με σημαντική έκταση αμπελώνων για την παραγωγή σταφίδων (κυρίως στις περιοχές της Πελοποννήσου και της Κρήτης). Οι ποικιλίες *Σουλτανίνα* και *Κορινθιακή* είναι κατάλληλες για την παραγωγή σταφίδας. Για τα επιτραπέζια σταφύλια, οι κυριότερες ποικιλίες είναι η *Sultana (Thompson Seedless)* και η *Victoria*. Άλλες ποικιλίες επιτραπέζιων σταφυλιών που καλλιεργούνται περιλαμβάνουν *Crimson Seedless*, *Prime*, *Superior*, *Flame* και *Cardinal*.

Εσπεριδοειδή

Οι φυτείες των εσπεριδοειδών στην Ελλάδα βρίσκονται κυρίως στις παράκτιες περιοχές, στις πεδιάδες της νότιας ηπειρωτικής χώρας και στα νησιά. Οι πορτοκαλιές, οι λεμονιές και τα μανταρινιά είναι τα πιο συχνά καλλιεργημένα εσπεριδοειδή στην Ελλάδα.

Η Ελλάδα είναι ο τρίτος μεγαλύτερος παραγωγός **πορτοκαλιών** στην ΕΕ-28, μετά την Ισπανία και την Ιταλία. Οι κυριότερες περιοχές καλλιέργειας είναι η Πελοπόννησος και η Αιτωλοακαρνανία (Δυτική Ελλάδα), ενώ οι κύριες ποικιλίες είναι η *Washington Navel*, η *Commons*, η *Valencia*, η *Navelina*, και η *Newhall*. Περίπου το 20 % της παραγωγής πορτοκαλιού υφίσταται επεξεργασία για παραγωγή χυμών.

Η παραγωγή **λεμονιών** στην Ελλάδα υπέστη σοβαρή ζημιά μετά τον σοβαρό παγετό του 2004, αλλά σήμερα βρίσκεται σε αυξανόμενη τάση μέσω νέων φυτειών. Οι κύριες περιοχές

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καλλιέργειας βρίσκονται όλες στη Νότια Ελλάδα: Αχαΐα, Κόρινθος, Κρήτη και Λακωνία. Η κύρια ποικιλία λεμονιών είναι η *Maglini*, η οποία λέγεται ότι αντιπροσωπεύει περισσότερο από το ήμισυ της συνολικής παραγωγής.

Τα **μανταρίνια** καλλιεργούνται κυρίως στην Πελοπόννησο. Η *Κλεμεντίνη* είναι η σημαντικότερη ποικιλία που καλλιεργείται στην Ελλάδα. Οι όψιμες ποικιλίες *Nona* και *Ortanique* είναι επίσης διαδεδομένες, ενώ γνωστό είναι επίσης και το *Χιώτικο* μανταρίνι. Η Αργολίδα είναι η κύρια περιοχή καλλιέργειας.

Οπωροφόρα δέντρα

Η Ελλάδα είναι ο τρίτος μεγαλύτερος παραγωγός **ροδάκινων και νεκταρινιών** στην ΕΕ-28 (μετά την Ισπανία και την Ιταλία και πριν τη Γαλλία) και ο κυριότερος επεξεργαστής ροδάκινων. Τα ροδάκινα και τα νεκταρίνια αποτελούν μία από τις σημαντικότερες μόνιμες καλλιέργειες ως προς τη ΧΓΕ στην Ελλάδα. Τα τελευταία χρόνια, οι χαμηλές τιμές παραγωγών είχαν ως αποτέλεσμα τη μείωση της καλλιεργούμενης έκτασης. Η παραγωγή γίνεται κυρίως στη Μακεδονία (Ημαθία, Πέλλα, Πιερία, Κοζάνη, Λάρισα, Κιλκίς) και στη Θεσσαλία.

Η Ελλάδα είναι ο τέταρτος μεγαλύτερος παραγωγός **βερίκοκων** στην ΕΕ-28, μετά την Ισπανία, την Ιταλία και τη Γαλλία. Το μεγαλύτερο κέντρο παραγωγής βερίκοκων στην Ελλάδα βρίσκεται στην Πελοπόννησο (Αργολίδα και Κορινθία), αλλά καλλιεργούμενες περιοχές βρίσκονται επίσης στη Θεσσαλία, την Κρήτη και τη Μακεδονία. Η *Μπεμπέκου* είναι η πιο διαδεδομένη ποικιλία βερίκοκων, ενώ η *Διαμαντοπούλου* και η *Aurora* είναι επίσης γνωστές.

Τα **μήλα** καλλιεργούνται κυρίως στις ακόλουθες περιφερειακές ενότητες: Καστοριά, Κοζάνη (Δυτική Μακεδονία), Πέλλα, Ημαθία (Κεντρική Μακεδονία), Μαγνησία, Λάρισα (Θεσσαλία). Οι κόκκινες ποικιλίες, ειδικά τα *Red Delicious*, αντιστοιχούν στο 53 % περίπου των Ελληνικών μηλεώνων. Οι πράσινες ποικιλίες, ως επί το πλείστον η *Granny Smith*, εκτιμώνται σε 15 %, ενώ η *Fuji* και η *Golden Delicious* είναι κατά 9 % η κάθε μία. Άλλες ποικιλίες όπως η *Gala*, η *Jonagold*, η *Jonagored* και νέες ποικιλίες μήλων απορροφούν το υπόλοιπο 14 %. Στην Ελλάδα πραγματοποιείται πρακτικά μικρή ή και καθόλου επεξεργασία μήλων για παραγωγή χυμών.

Τα **αχλάδια** αναπτύσσονται κυρίως στις ακόλουθες περιοχές: Λάρισα (Θεσσαλία), Πέλλα και Ημαθία (Κεντρική Μακεδονία), Κόρινθος (Πελοπόννησος). Η κορυφαία ποικιλία είναι το *Κρυστάλι*. Άλλες καλλιεργούμενες ποικιλίες είναι οι εξής: *Williams*, *Κοντούλα*, *Santa Maria*, *Passacrassana*, *Abate Fetel* και *Coscia-Ercollin*.

Η καλλιέργεια των **κερασιών** έχει παρουσιάσει ανοδική τάση τα τελευταία χρόνια, καθώς θεωρήθηκε γενικά ως καλλιέργεια που θα μπορούσε να προσφέρει ένα καλό εισόδημα στους αγρότες ακόμη και από το 2^ο ή το 3^ο έτος από τη φύτευση της. Η Πέλλα (κατά κύριο λόγο) και η Ημαθία στην Κεντρική Μακεδονία αντιστοιχούν σε περίπου 65 – 70 % της καλλιεργούμενης έκτασης της κερασιάς. Ωστόσο, κερασιές βρίσκονται σε όλη την Ελλάδα, συμπεριλαμβανομένων των νησιών. Οι κύριες ποικιλίες είναι οι κλασικές: *Bigarreau Burlat*, *Larian*, *Lapins*, *B.S. Hardy Giant*, *Ferrovía*, *Van*, *Germersdorfer*, *Τραγανά Έδεσσας* και *Μπακιρτζέικα*. Νέες ποικιλίες υιοθετούνται επίσης σε νεότερες φυτείες, ενώ υπάρχουν και πολλές άλλες τοπικές ποικιλίες, πολύ καλά προσαρμοσμένες στις εκάστοτε συνθήκες.

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Τα **σύκα** αντιστοιχούν σε μια πολύ ευέλικτη καλλιέργεια που μπορεί να καλλιεργηθεί σε διάφορα εδάφη (επίπεδες, ημιορεινές, ορεινές) και κάτω από δύσκολες συνθήκες για τις περισσότερες άλλες καλλιέργειες (π.χ. ανθρακούχα εδάφη και ξηροθερμικό περιβάλλον) και απαιτεί ελάχιστες καλλιεργητικές φροντίδες. Επιπλέον τα σύκα μπορούν να διατεθούν στο εμπόριο ως φρέσκα ή ξηρά, δίνοντας έτσι μια πρόσθετη ευελιξία στον παραγωγό. Οι συκιές στην Ελλάδα συστηματικά καλλιεργούνται κυρίως στην Πελοπόννησο, στην Εύβοια και σε πολλά νησιά του Αιγαίου. Οι ποικιλίες περιλαμβάνουν την *Καλαμών*, τη *Βασιλική Μαύρη*, τα *Μαύρα Μαρκοπούλου*, το *Πολιτικό*, την *Πρασινουσικιά Λέσθου*, τη *Φρακασάνα* και τη *Βασική Λευκή*.

Εκτιμάται ότι περισσότερα από 9.000 εκτάρια **ακτινιδίων** καλλιεργούνται ήδη στην Ελλάδα. Η Ελλάδα είναι η 2^η χώρα στην ΕΕ-28 για την παραγωγή ακτινιδίων και μια εκ των κορυφαίων παραγωγών στον κόσμο. Για τα επόμενα χρόνια προβλέπεται αύξηση της καλλιεργούμενης έκτασης και του όγκου παραγωγής.

Ακρόδρυα

Τα ακρόδρυα παρουσιάζουν μια γενική ανοδική τάση τα τελευταία χρόνια, λόγω της αυξανόμενης δημοτικότητας των ξηρών καρπών στην αγορά τροφίμων. Επιπλέον, οι ξηροί καρποί μπορούν να αποθηκευτούν ευκολότερα και μπορούν να πωληθούν σε χρόνο και τρόπο που ωφελεί τους παραγωγούς.

Η Ελλάδα είναι ο 3^{ος} μεγαλύτερος παραγωγός **αμυγδάλων** στην ΕΕ-28, μετά την Ισπανία και την Ιταλία. Η παραγωγή αμυγδάλων γίνεται κυρίως στη Βόρεια Ελλάδα, στις περιφερειακές ενότητες Κατερίνης, Σερρών, Καβάλας, Μαγνησίας και Λάρισας. Συχνά καλλιεργημένες ποικιλίες είναι οι *Ferragnes*, *Texas*, *Troito* και *Ρέτσου*.

Δύο καλλιεργητικά καθεστώτα επικρατούν για τις **καρυδιές** στην Ελλάδα: οι παραδοσιακές καλλιέργειες καρυδιού, οι οποίες παρουσιάζουν φθίνουσα τάση, και οι νέες καλλιέργειες, με εντατική διαχείριση, που γίνονται πιο δημοφιλείς. Τα καρύδια καλλιεργούνται κυρίως στην Αχαΐα, την Αρκαδία, την Κοζάνη, τα Τρίκαλα, τη Λάρισα και την Εύβοια. Η ποικιλία *Chandler* είναι η πιο διαδεδομένη. Η *Serr*, η *Gustine*, η *Hartley*, η *Pedro*, η *Vina* και η *Lara* θεωρούνται επίσης ως παραγωγικές ποικιλίες.

Οι **καστανιές** θεωρούνται ως μια καλλιέργεια που είναι ιδιαίτερα κατάλληλη για ορεινές ή ημιορεινές περιοχές. Μπορεί να συμβάλει στη διατήρηση του αγροτικού εισοδήματος και της ανάπτυξης, ενώ μπορεί να καλλιεργηθεί τόσο για τα φρούτα όσο και για το ξύλο. Οι εξαγωγές κάστανων προς την Ιταλία αυξήθηκαν τα τελευταία χρόνια και, συνεπώς, ανανέωσαν το ενδιαφέρον για αυτή τη μόνιμη καλλιέργεια.

Η Ελλάδα είναι ο μεγαλύτερος παραγωγός **φιστικιών** στην ΕΕ-28. Πηγές της αγοράς δείχνουν ότι η καλλιέργεια επεκτάθηκε σε περισσότερα από 1,200 εκτάρια το 2017, ενώ το τυπικό επίπεδο παραγωγής κυμαίνεται μεταξύ 2,500 και 4,000 τόνων. Οι κύριες περιοχές καλλιέργειας είναι η Αίγινα, η Φθιώτιδα και η Λάρισα. Η αυξημένη κατανάλωση έχει ανανεώσει το ενδιαφέρον για αυτή την καλλιέργεια.

Η καλλιέργεια των **φουντουκιών** ήταν αρκετά αναπτυγμένη κατά τις προηγούμενες δεκαετίες στην Ελλάδα, αλλά η καλλιέργεια σταδιακά έχασε το ενδιαφέρον των παραγωγών λόγω των

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ασθενειών των καρπών και των χαμηλών τιμών παραγωγών που προκλήθηκαν από εισαγωγές από του Τουρκία. Προς το παρόν, η παραγωγή φουντουκιών είναι πολύ περιορισμένη στην Ελλάδα, αλλά παρουσιάζει ενδείξεις ταχείας ανάπτυξης και έντονο ενδιαφέρον εκ μέρους των παραγωγών.

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B. Εθνικό δυναμικό βιομάζας από μόνιμες καλλιέργειες

Η βιομάζα από τις μόνιμες καλλιέργειες μπορεί να διακριθεί σε δυο βασικές κατηγορίες: στα **κλαδέματα**, που παράγονται σε συχνή βάση κατά τη διάρκεια ζωής μιας μόνιμης καλλιέργειας και στις **εκριζώσεις**, που παράγονται στο τέλος του κύκλου ζωής της καλλιέργειας. Στις επόμενες ενότητες, παρουσιάζονται εκτιμήσεις για το δυναμικό των δυο αυτών κατηγοριών βιομάζας στην Ελλάδα.

Βιομάζα από αγροτικά κλαδέματα

Για τις περισσότερες μόνιμες καλλιέργειες στην Ελλάδα η τυπική ετήσια κλαδέματος είναι ετήσια. Εξαίρεση είναι τα ελαιόδεντρα, για τα οποία η τυπική συχνότητα κλαδέματος μπορεί να είναι από ετήσια μέχρι μια φορά τα τρία χρόνια. Η συχνότητα κλαδέματος στα ελαιόδεντρα εξαρτάται από την ποικιλία της καλλιέργειας, τις τοπικές συνθήκες και τις αγρονομικές πρακτικές που εφαρμόζονται. Στις περισσότερες καλλιέργειες, το κλάδεμα πραγματοποιείται με ψαλίδια (π.χ. στα αμπέλια) ή με αλυσοπρίονα.

Απ' όσο γνωρίζουμε, δεν υπάρχει κάποια αναλυτική μελέτη για τη διαχείριση των αγροτικών κλαδεμάτων μετά την κοπή τους. Η καύση τους στα χωράφια φαίνεται να είναι η πιο διαδεδομένη επιλογή⁴. Θεωρείται επίσης και ως αποδεκτή επιλογή διαχείρισης στον "Κώδικα Καλών Αγροτικών Πρακτικών". Οι περιορισμοί στην εφαρμογή της αφορούν κυρίως τον κίνδυνο πυρκαγιάς και η καύση επιτρέπεται μόνο κατά τους χειμερινούς μήνες⁴. Διαφορετικά, πρέπει να εφαρμόζονται πολύ αυστηρά μέτρα για την αποφυγή πυρκαγιών. Εντούτοις, σε ορισμένες περιοχές εκτιμάται ότι το 25-30 % των πυρκαγιών κατά τη διάρκεια ενός έτους οφείλεται στην καύση κλαδεμάτων στην ύπαιθρο, συχνά σε περιόδους όπου η πρακτική δεν επιτρέπεται⁴. Για τους αγρότες, το κύριο πλεονέκτημα της καύσης κλαδεμάτων στην ύπαιθρο είναι ότι εκτελείται συχνά από τις ίδιες ομάδες εργατών που εκτελούν το κλάδεμα και σε πολλές περιπτώσεις την ίδια στιγμή. Επομένως, η καύση επιτρέπει τη γρήγορη διαχείριση των κλαδιών, χωρίς πολύ μεγάλο κόστος.

Δύο εναλλακτικές πρακτικές διάθεσης είναι η επεξεργασία με καταστροφείς (mulchers) ή μικρού μεγέθους θρυμματιστές / τεμαχιστές (chippers / shredders). Οι καταστροφείς μπορούν συνήθως να χειριστούν τα κλαδέματα γρηγορότερα, αλλά παράγουν μεγαλύτερα κομμάτια τεμαχισμένου κλαδιού που παραμένουν στο έδαφος και μπορεί να είναι ενοχλητικά για αρκετές αγροτικές εργασίες (π.χ. για το στρώσιμο των ελαιόπανων). Επιπλέον, οι καταστροφείς έχουν υψηλότερο κόστος αγοράς, απαιτούν ελκυστήρες και έχουν υψηλότερη κατανάλωση καυσίμου, ενώ μπορεί να μην είναι δυνατή η λειτουργία τους σε αγροτεμάχια με μεγάλες πλαγιές. Οι θρυμματιστές / τεμαχιστές κοστίζουν συνήθως λιγότερο, παράγουν λεπτότερο υλικό αλλά ο χειρισμός των κλαδεμάτων είναι χειρωνακτικός και πιο χρονοβόρος.

⁴Αναφορά του διοικητή της Πυροσβεστικής Υπηρεσίας για την περιοχή του Ηρακλείου της Κρήτης (28.03.2016): <http://www.ypaithros.gr/%CF%80%CE%B1%CE%B1-%CE%B5%CE%BB%CE%B1%CE%B9%CF%8C%CE%BA%CE%BB%CE%B1%CE%B4%CE%B1-%CF%83%CF%84%CE%BF%CE%BD-%CE%BA%CE%B1%CF%84%CE%B1%CF%83%CF%84%CF%81%CE%BF%CF%86%CE%AD%CE%B1-%CE%B5%CF%80%CE%B9%CE%B4/>

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Συνήθως, τα μεγάλα κομμάτια ξύλου από τα κλαδέματα (π.χ. με διάμετρο 5 εκατοστά ή μεγαλύτερα) συλλέγονται χωριστά και χρησιμοποιούνται ως καυσόξυλα.

Τέλος, σε ορισμένες περιπτώσεις παρατηρούνται παραδοσιακές διαχειρίσεις των κλαδεμάτων. Αυτές περιλαμβάνουν τη χρήση τους ως ζωτροφή ή - ειδικά για κλαδέματα αμπελώνων - τη χρήση τους σε μπάρμπεκιου, σχάρες και το παραδοσιακό Πασχαλινό μαγείρεμα σε σούβλες.

Παρά τη σημασία των μόνιμων καλλιεργειών στον ελληνικό αγροτικό τομέα, δεν υπάρχουν πρόσφατες έρευνες βασισμένες σε δεδομένα πεδίου σχετικές με το δυναμικό βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα. Η κύρια μελέτη αναφοράς για τα αγροτικά κλαδέματα - και την αγροτική βιομάζα εν γένει - στην Ελλάδα είναι μια μελέτη του ΕΛΚΕΠΑ χρονολογούμενη από το 1987. Η μελέτη παρουσιάζει τους δείκτες υπολειμμάτων-προς-προϊόντα (Residue to Product Ratio - RPR) για τα κλαδέματα που παράγονται από διάφορες μόνιμες καλλιέργειες στην Ελλάδα και εκτιμά το δυναμικό των αγροτικών κλαδεμάτων με βάση στατιστικά στοιχεία αγροτικής παραγωγής για το έτος 1980.

Οι δείκτες RPR της μελέτης του ΕΛΚΕΠΑ χρησιμοποιήθηκαν από το ΕΚΕΤΑ για την εκτίμηση του δυναμικού κλαδεμάτων σε Εθνικό επίπεδο στα πλαίσια του Ευρωπαϊκού έργου Biomass Plus. Για τους υπολογισμούς, χρησιμοποιήθηκαν πιο πρόσφατα στατιστικά αγροτικής παραγωγής από τη Eurostat και για το έτος 2014.

Ένας άλλος τρόπος για να εκτιμηθεί το δυναμικό των αγροτικών κλαδεμάτων είναι μέσω του διαδικτυακού εργαλείου για τον υπολογισμό της διαθεσιμότητας που αναπτύχθηκε στο Ευρωπαϊκό έργο S2Biom που χρηματοδοτήθηκε από το 7^ο Πρόγραμμα Πλαίσιο. Το εργαλείο αυτό μπορεί να χρησιμοποιηθεί για την εκτίμηση του δυναμικού των κλαδεμάτων από μόνιμες καλλιέργειες και για όλες τις χώρες της ΕΕ-28 έως και σε επίπεδο NUTS3⁵. Η εκτίμηση βασίζεται στην χρήση, ειδικών για κάθε χώρα, δεικτών υπολειμμάτων-προς-επιφάνεια (Residue to Surface Ration - RSR) για ορισμένους τύπους καλλιεργειών (ελαιόδεντρα, αμπελώνες, εσπεριδοειδή και οπωροφόρα δένδρα). Οι δείκτες αυτές χρησιμοποιούνται σε συνδυασμό με την πρόβλεψη για την καλλιεργούμενη επιφάνεια διαφόρων ειδών για το έτος 2020, όπως προκύπτει από το μοντέλο CAPRI.

Σε όλες τις περιπτώσεις, θεωρήθηκε ότι η τυπική περιεκτικότητα σε υγρασία των κλαδεμάτων για όλες τις μόνιμες καλλιέργειες ανέρχεται στο 40 % κατά βάρος (ως έχει), εκτός από τα κλαδέματα ελιάς για τα οποία θεωρήθηκε τιμή ίση με 35 %. Ο Πίνακας 6 συγκρίνει το δυναμικό των κλαδεμάτων (ξηρής ύλης) για αυτές τις τρεις μεθοδολογίες, ενώ η Εικόνα 5 απεικονίζει γραφικά τα αποτελέσματα.

Πρέπει να τονιστεί ότι οι ανακρίβειες που συνδέονται με την εκτίμηση του δυναμικού κλαδεμάτων με τη χρήση μιας σταθερής τιμής των δεικτών RPR ή RSR σε εθνικό επίπεδο είναι υψηλές. Μια πρόσθετη πηγή αβεβαιότητας είναι επίσης οι επίσημες στατιστικές για τις μόνιμες καλλιέργειες οι οποίες, όπως φάνηκε στην προηγούμενη ενότητα, μπορούν να διαφέρουν πολύ ως προς το ύψος της παραγωγής ανάλογα με την πηγή. Επιπλέον, τα συγκεκριμένα είδη καλλιεργειών που εξετάζονται σε κάθε μελέτη έχουν μικρές διαφορές. Σε κάθε περίπτωση, το

⁵ Αντιστοιχεί στις Περιφερειακές Ενότητες (κατά βάση πρώην Νομαρχίες) για τα Ελληνικά δεδομένα.

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συνολικό δυναμικό αγροτικών κλαδεμάτων στην Ελλάδα εκτιμάται ότι κυμαίνεται από 1.5 έως 2.7 Mt ξηράς ύλης, αποτελούν δηλαδή μια τεράστια πηγή ανεκμετάλλευτης βιομάζας.

Όλες οι μέθοδοι συμφωνούν ότι τα κλαδέματα ελιάς είναι μακράν η μεγαλύτερη πηγή βιομάζας αγροτικών κλαδεμάτων στην Ελλάδα. Οι επιτόπιες μετρήσεις της παραγωγικότητας της βιομάζας από κλαδέματα ελιάς που πραγματοποιήθηκαν από το ΕΚΕΤΑ στα πλαίσια του έργου uP_running υποδηλώνουν ότι, αν και ο δείκτης RSR μπορεί να διαφέρει ανάλογα με την ποικιλία της καλλιέργειας και την πυκνότητα φύτευσης, ο δείκτης RPR που προτείνεται από τη μελέτη του ΕΛΚΕΠΑ είναι αποδεκτός για μια πρώτη εκτίμηση του δυναμικού.

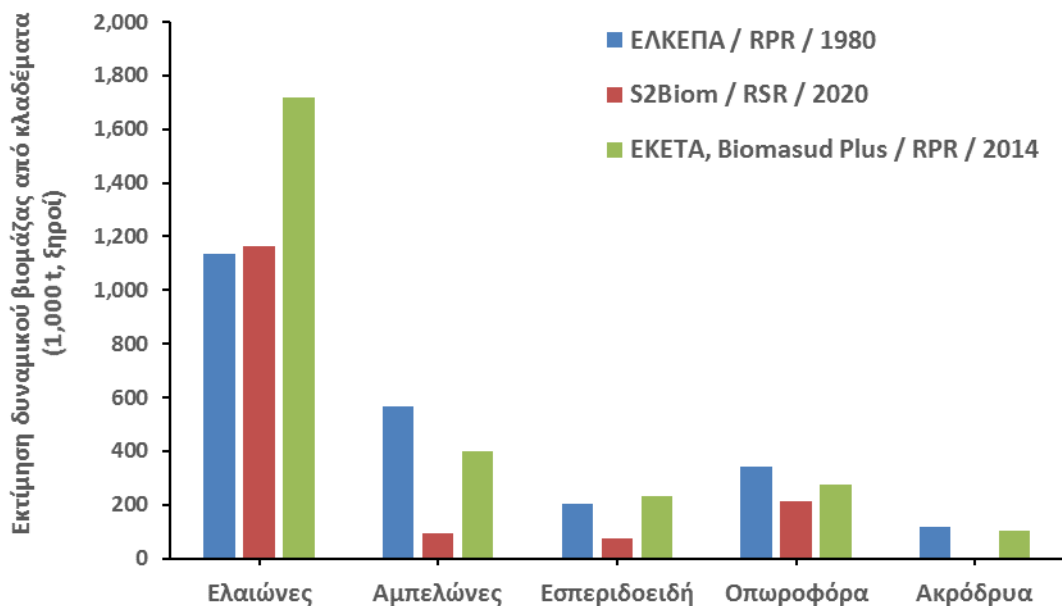
Τα κλαδέματα αμπελώνων θεωρούνται ως η δεύτερη μεγαλύτερη πηγή βιομάζας κλαδέματος όταν γίνεται χρήση των δεικτών RPR της μελέτης του ΕΛΚΕΠΑ. Ωστόσο, η ανάλυση νέων, επιτόπιων μετρήσεων στα αγροτεμάχια σχετικά με την παραγωγικότητα κλαδεμάτων σε αμπελώνες από το ΕΚΕΤΑ, δείχνει ότι η τιμή RPR που χρησιμοποιείται σε αυτή τη μελέτη είναι υπερβολικά υψηλή και ότι με τη χρήση της το δυναμικό κλαδεμάτων από τους αμπελώνες υπερεκτιμάται. Το δυναμικό κλαδεμάτων αμπελώνων που υπολογίζεται από το εργαλείο S2Biom είναι μια πιο συντηρητική εκτίμηση, η οποία μπορεί να είναι πιο κοντά στην πραγματικότητα.

Για τα εσπεριδοειδή, τα οπωροφόρα και τα ακρόδρυα δέντρα, δεν είναι δυνατόν να προσδιοριστεί η ακρίβεια των εκτιμήσεων, δεδομένου ότι δεν έχουν πραγματοποιηθεί ακόμη νέες επιτόπιες μετρήσεις στις αντίστοιχες καλλιέργειες. Μια εκ των υστέρων ανάλυση των δεικτών RPR της μελέτης του ΕΛΚΕΠΑ υποδηλώνουν ότι θα μπορούσαν να γίνουν αποδεκτές για μια πρώτη, γενική εκτίμηση, αλλά φαίνεται απίθανο ότι θα είναι σε θέση να καλύψουν όλες τις διαφορές που παρατηρούνται υπό τις τοπικές συνθήκες των καλλιεργειών.

Πίνακας 6: Δυναμικό αγροτικών κλαδεμάτων στην Ελλάδα σύμφωνα με διάφορες πηγές/ μεθόδους

Δυναμικό βιομάζας από αγροτικά κλαδέματα (1,000 t ξηράς ύλης ετησίως)								
Πηγή	Έτος Αναφοράς	Μεθοδολογία	Ελαιώνες	Αμπέλια	Εσπεριδοειδή	Οπωροφόρα	Ακρόδρυα	Σύνολο
ΕΛΚΕΠΑ (1987)	1980	RPR + εθνικά στατιστικά παραγωγής (ΕΛΣΤΑΤ)	1,135	566	203	340	118	2,362
ΕΚΕΤΑ, Biomassud Plus (2016)	2014	RPR + στατιστικά παραγωγής (Eurostat)	1,718	398	232	277	104	2,729
S2Biom (2016)	2020	RSR + CAPRI προβλέψεις καλλιεργήσιμης επιφάνειας	1,165	93	73	211	N/A	1,542

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Εικόνα 5: Σύγκριση δυναμικού αγροτικών κλαδεμάτων στην Ελλάδα από διάφορες μόνιμες καλλιέργειες και με χρήση διαφορετικών πηγών

Βιομάζα από εκριζώσεις μόνιμων καλλιεργειών

Απ' όσο γνωρίζουμε, δεν υπάρχει καμία έρευνα / μελέτη που να αφορά το δυναμικό βιομάζας από εκριζώσεις σε Εθνικό επίπεδο – απουσία αντίστοιχων μελετών υπάρχει και σε Ευρωπαϊκό επίπεδο. Ορισμένες ασαφείς ενδείξεις μπορούν να αντληθούν από στοιχεία που συνέλεξε η Ελληνική Στατιστική Αρχή, η οποία αναφέρει ότι το 2014 παρήχθησαν 629.6 χιλιάδες τόνοι καυσόξυλων από αγροτικές εκμεταλλεύσεις. Αυτός ο αριθμός πιθανώς περιλαμβάνει μεγαλύτερα κλαδέματα από ελαιόδεντρα και ως εκ τούτου δεν ανταποκρίνεται εξ ολοκλήρου σε βιομάζα από απομάκρυνση καλλιεργειών. Σε κάθε περίπτωση, καυσόξυλα από εσπεριδοειδή, ακρόδρυα και οπωροφόρα δέντρα μπορούν συχνά να βρεθούν σε σημεία πώλησης καυσόξυλων. Οι εκριζώσεις φαίνεται να είναι η κύρια πηγή προέλευσης αυτών των καυσόξυλων.

Σε κάθε περίπτωση, θα πρέπει να ληφθεί υπόψη ότι η τυπική διάρκεια ζωής μιας μόνιμης καλλιέργειας δεν είναι ο μόνος παράγοντας που επηρεάζει τη συχνότητα των κύκλων εκριζώσεων. Στα οπωροφόρα δένδρα για παράδειγμα, οι οικονομικοί λόγοι (μεγαλύτερο κέρδος από άλλες καλλιέργειες ή οι χαμηλές τιμές παραγωγού) αποτελούν συχνό λόγο για την εκρίζωση ενός δενδρώνα και την αντικατάστασή του με δέντρα άλλων ποικιλιών ή ειδών.

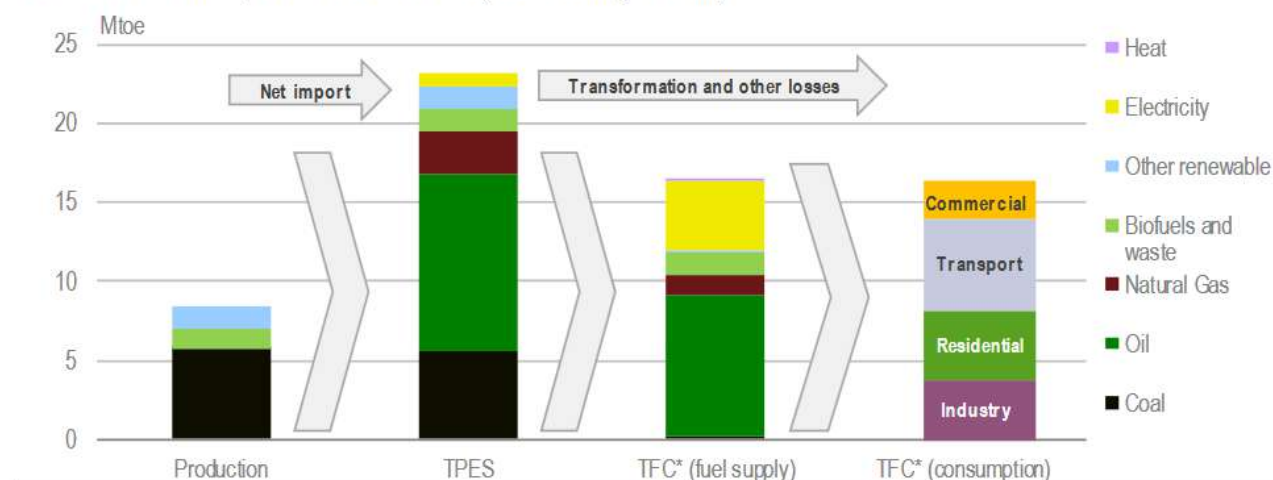
	Έγγραφο:	Ανάλυση Τομέα και Στρατηγικό Σχέδιο για τη βιομάζα από μόνιμες καλλιέργειες στην Ελλάδα		
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Γ. Εθνική κατάσταση του τομέα βιομάζας

Ο ρόλος της βιομάζας στον Ελληνικό ενεργειακό τομέα

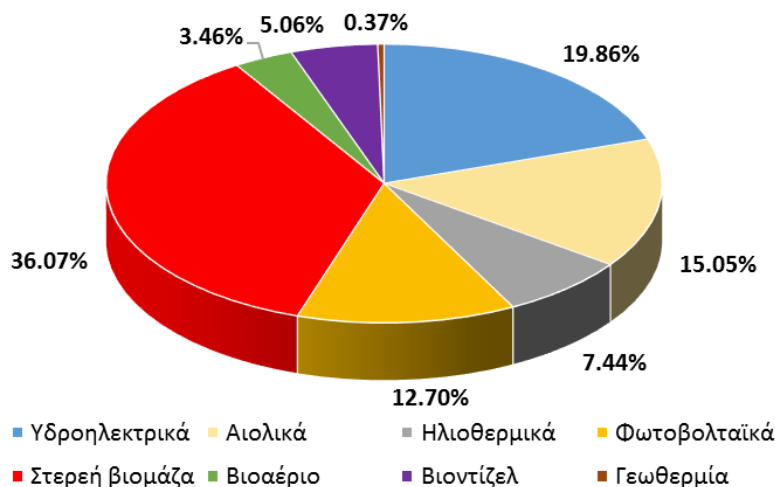
Το 2015, η βιομάζα ανήλθε στο 6 % της Συνολικής Πρωτογενούς Ενέργειας (ΣΠΕ) στην Ελλάδα, ισοδύναμη με τις τρεις άλλες κυριότερες ΑΠΕ (υδροηλεκτρική, αιολική και ηλιακή). Το μερίδιο της βιομάζας στη ΣΠΕ ισοδυναμεί με το μέσο όρο των χωρών της IEA (International Energy Agency).

TPES: 23.2 Mtoe, 12% renewables (IEA average 10%)



Εικόνα 6: Παραγωγή Ενέργειας, προσφορά και ζήτηση στην Ελλάδα, 2015 (Πηγή: IEA)

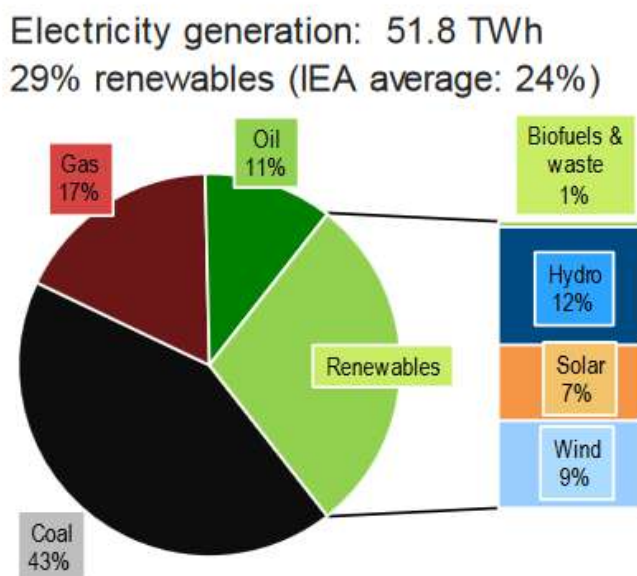
Στατιστικά στοιχεία από το Υπουργείο Περιβάλλοντος και Ενέργειας (ΥΠΕΝ) έθεσαν τη συνολική παραγωγή πρωτογενούς ενέργειας σε 8,408 ktOE το 2015, εκ των οποίων το 31.4 % (2,641 ktOE) προέρχεται από ΑΠΕ. Μια πιο λεπτομερής κατανομή ανά πηγή καυσίμου παρουσιάζεται στην Εικόνα 7. Η στερεή βιομάζα, με ποσοστό 36.07 % είχε και τη μεγαλύτερη συνεισφορά στη παραγωγή πρωτογενούς ενέργειας από ΑΠΕ. Το βιοαέριο και το βιοντίζελ είχαν επίσης σημαντικά μερίδια, αν και χαμηλότερα από τα περισσότερα άλλα είδη ΑΠΕ, με την εξαίρεση της γεωθερμικής ενέργειας.



Εικόνα 7: Πρωτογενής παραγωγή ενέργεια από ΑΠΕ ανά είδος ενέργειας για την Ελλάδα, 2015 (Πηγή: ΥΠΕΝ)

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Παρά το γεγονός ότι η βιομάζα κατέχει το μεγαλύτερο μέρος συνεισφοράς των ΑΠΕ στην παραγωγή πρωτογενούς ενέργειας στην Ελλάδα, θα μπορούσε να θεωρηθεί ως μια «παραγνωρισμένη» πηγή ενέργειας. Η Εικόνα 8 παρέχει μια πρώτη εξήγηση για το λόγο που συμβαίνει αυτό: το μερίδιο της κατηγορίας "βιοκαύσιμα και απόβλητα" στην παραγωγή ηλεκτρικής ενέργειας είναι μόνο 1 %, το χαμηλότερο από κάθε είδος ενεργειακής πηγής που εξετάζεται.



Εικόνα 8: Ενεργειακό μείγμα για την παραγωγή ηλεκτρικής ενέργειας στην Ελλάδα, 2015 (Πηγή: IEA)

Ο Πίνακας 6 παρουσιάζει την Τελική Κατανάλωση Ενέργειας (ΤΚΕ) από στερεή βιομάζα σε διάφορους τομείς στην Ελλάδα για το έτος 2015. Η στερεή βιομάζα αποτελεί σημαντική πηγή ενέργειας για τη βιομηχανία προϊόντων ξύλου, τη βιομηχανία τροφίμων και καπνού, τον οικιακό τομέα και, τέλος, τον αγροτικό και δασικό τομέα. Όσον αφορά τις χρησιμοποιούμενες ποσότητες καυσίμου, ο οικιακός τομέας είναι ο μεγαλύτερος καταναλωτής (77.61 %), ακολουθούμενος από τις βιομηχανίες τροφίμων και καπνού (14.37 %). Η ανάλυση αυτή παρέχει έναν δεύτερο λόγο για τη μη προβολή της βιομάζας στην ενεργειακή κατάσταση της Ελλάδας: κύριοι καταναλωτές της είναι τα νοικοκυριά και οι αγροτοβιομηχανίες, δηλαδή δραστηριότητες που πραγματοποιούνται κατά βάση σε τοπικό επίπεδο, χωρίς εθνική προβολή.

Πρέπει να σημειωθεί ότι η Eurostat αναφέρει για το 2015 πως παρήχθησαν εγχώρια 952.4 ktoe στερεής βιομάζας ενώ οι εισαγωγές ανήλθαν στα 62.8 ktoe. Οι εξαγωγές στερεής βιομάζας ήταν πολύ χαμηλές και φτάνουν τα 1.9 ktoe.

Πίνακας 7: Ο ρόλος της στερεάς βιομάζας στην Τελική Κατανάλωση Ενέργειας (ΤΚΕ) στην Ελλάδα, 2015 (Πηγή: Eurostat)

Κατανάλωση Στερεάς βιομάζας για ενέργεια ανά τομέα, 2015				
Τομέας	ΤΚΕ (ktoe)	% στερεής βιομάζας στην ΤΚΕ του τομέα	% της συνολικής κατανάλωσης στερεάς βιομάζας	
Οικιακό	4,400.5	17.8 %	77.61 %	
Γεωργία/ Δασοκομία	257.9	10.7 %	2.73 %	
Υπηρεσίες	1,872.6	1.0 %	1.80 %	
Άλλο	252.3	0.0 %	0.00 %	
Βιομηχανία (σύνολο)	3,128.0	5.8 %	17.85 %	

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Κατανάλωση Στερεάς βιομάζας για ενέργεια ανά τομέα, 2015				
Τομέας	ΤΚΕ (ktoe)	% στερεής βιομάζας στην ΤΚΕ του τομέα	% της συνολικής κατανάλωσης στερεάς βιομάζας	
- τρόφιμα & καπνός	523.0	27.8 %	14.37 %	
- χαρτί, πολτός και εκτύπωση	83.3	3.4 %	0.28 %	
- ξύλο και προϊόντα ξύλου	30.7	54.1 %	1.64 %	
- άλλοι βιομηχανικοί τομείς	2,491.0	0.6 %	1.56 %	
Σύνολο	16,501.8	-	100 %	

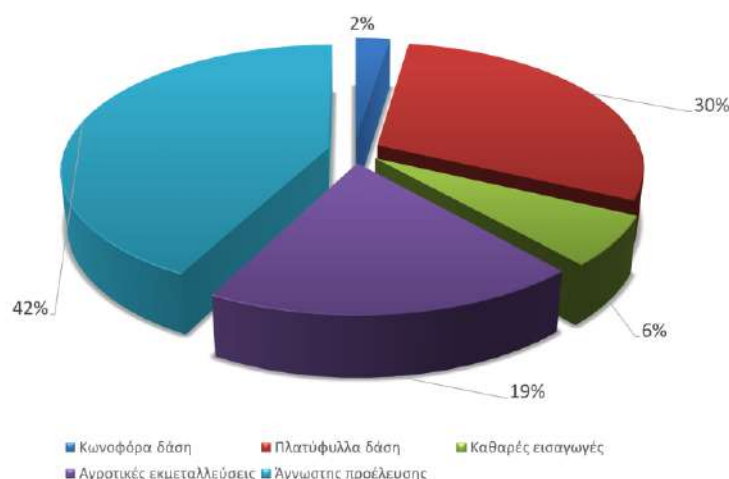
Στερεή βιομάζα και ο οικιακός τομέας

Οι εφαρμογές οικιακής θέρμανσης αποτελούν τον κύριο καταναλωτή στερεής βιομάζας στην Ελλάδα. Ιστορικά, η στερεή βιομάζα - και ιδίως τα καυσόξυλα - συμμετείχε από πάντα στο ενεργειακό μείγμα των νοικοκυριών. Από το 2011, ωστόσο, η βιομάζα έχει αποκτήσει μεγάλη σημασία ως πηγή καυσίμου για οικιακή θέρμανση. Αυτό οφείλεται σε δύο εξελίξεις. Η πρώτη ήταν η αύξηση της φορολογίας του πετρελαίου θέρμανσης, που ανάγκασε πολλούς καταναλωτές να αναζητήσουν εναλλακτικές λύσεις χαμηλότερου κόστους. Η δεύτερη ήταν η άρση μιας μακροχρόνιας απαγόρευσης χρήσης της βιομάζας ως πηγή καυσίμου στις αστικές περιοχές. Συνολικά, η βιομάζα είναι σήμερα η δεύτερη πιο σημαντική πηγή ενέργειας για οικιακή θέρμανση, με πρώτη το πετρέλαιο θέρμανσης και τρίτη το φυσικό αέριο.

Τα **καυσόξυλα** αποτελούν τη πιο σημαντική κατηγορία στερεών βιοκαυσίμων για την οικιακή θέρμανση. Σύμφωνα με έρευνα της Ελληνικής Στατιστικής Αρχής για την περίοδο θέρμανσης 2011-2012, τα καυσόξυλα συνεισέφεραν στο 23.8 % της συνολικής κατανάλωσης θερμικής ενέργειας των νοικοκυριών και ανέρχονται στο 95.41 % των καυσίμων βιομάζας που χρησιμοποιούνται για τη θέρμανση χώρων στον οικιακό τομέα.

Πλήρη στατιστικά για την κατανάλωση καυσόξυλων είναι δύσκολο να βρεθούν. Μια πρώτη αξιολόγηση πραγματοποιήθηκε από το ΕΚΕΤΑ στο πλαίσιο του έργου Biomassud Plus και κατέληξε ότι η κατανάλωση καυσόξυλων στον οικιακό τομέα της Ελλάδας ανέρχεται σε περίπου 2 εκατομμύρια τόνοι ξηρής βιομάζας. Η Εικόνα 9 παρουσιάζει μια ποσοτική εκτίμηση των πιθανών πηγών καυσόξυλων στην Ελλάδα. Ένα σημαντικό τμήμα υπολογίζεται ότι προέρχεται από γεωργικές εκμεταλλεύσεις και είναι ουσιαστικά βιομάζα από μόνιμες καλλιέργειες (μεγάλα κλαδιά από ελαιόδεντρα, εκριζωμένα δέντρα).

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Εικόνα 9: Ενδεικτική προέλευση καυσόξυλων που καταναλώνονται στον οικιακό τομέα στην Ελλάδα, 2014 (Πηγή: ΕΚΕΤΑ, Biomassud Plus)

Σύμφωνα με την Ελληνική Στατιστική Αρχή, **οι πελλέτες ξύλου** στην Ελλάδα αντιστοιχούν στο 0.7 % της συνολικής θερμικής ενέργειας που καταναλώνεται στον Ελληνικό οικιακό τομέα ή στο 3.39 % της συνολικής καταναλισκόμενης βιομάζας. Η αγορά των πελλετών ξύλου στην Ελλάδα έχει αυξηθεί σημαντικά από το 2010. Οι εκτιμήσεις που βασίζονται σε στατιστικές πηγές δείχνουν τυπική ετήσια κατανάλωση από 50,000 έως 65,000 τόνους πελλετών, αλλά οι πηγές της αγοράς αναφέρονται σε ακόμα μεγαλύτερους αριθμούς, έως και 180,000 τόνους.

Επιπλέον, οι μπρικέτες ξύλου αντιπροσωπεύουν μόνο το 0.28 % της βιομάζας που καταναλώνεται για θέρμανση χώρων στον Ελληνικό οικιακό τομέα.

Τα υπολείμματα από τη διαδικασία παραγωγής ελαιόλαδου, όπως το **πυρηνόξυλο**, είναι μια άλλη παραδοσιακή πηγή βιομάζας για οικιακή θέρμανση στην Ελλάδα. Το πυρηνόξυλο ανέρχεται στο 0.4 % της συνολικής θερμικής ενέργειας που καταναλώνεται στον Ελληνικό οικιακό τομέα και στο 2.34 % της καταναλισκόμενης βιομάζας για οικιακή θέρμανση· η χρήση του πραγματοποιείται σχεδόν αποκλειστικά σε αγροτικές και ημι-αγροτικές περιοχές. Στα αστικά κέντρα, οι οσμές που συνδέονται με το πυρηνόξυλο, περιορίζουν τη χρήση τους, καθώς η καύση του μπορεί να προκαλέσει διαμαρτυρίες.

Τέλος, **άλλοι τύποι βιομάζας** ανέρχονται στο υπόλοιπο 0.17 % της συνολικά καταναλισκόμενης βιομάζας για θέρμανση χώρων στον οικιακό τομέα. Δεν αναφέρονται συγκεκριμένα δεδομένα σχετικά με την προέλευση αυτών των ειδών βιομάζας, αλλά θεωρείται ότι είναι κυρίως υπολείμματα αγροτοβιομηχανιών όπως τα τσόφλια ξηρών καρπών (κυρίως αμυγδάλων), πυρήνες ροδάκινων κλπ.

Στερεά βιομάζα και ο αγροτικός / αγροτοβιομηχανικός τομέας

Όπως προαναφέρθηκε, ο τομέας τροφίμων και καπνού είναι ένας σημαντικός καταναλωτής στερεής βιομάζας στην Ελλάδα. Οι παρακάτω τύποι αγροτοβιομηχανιών είναι γνωστό ότι καταναλώνουν βιομάζα.

- **Πυρηνελαιουργεία:** περίπου 35 βιομηχανίες δραστηριοποιούνται στην Ελλάδα, σε περιοχές με σημαντική παραγωγή ελαιόλαδου (κυρίως στην Κρήτη και στην Πελοπόννησο). Τα πυρηνελαιουργεία παραλαμβάνουν υγρό ελαιοπυρήνα από πολυάριθμα ελαιοτριβεία και εκτελούν την εξαγωγή του υπολειπόμενου λαδιού

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(πυρηνόξυλο). Το στερεό, εκχυλισμένο παραπροϊόν της διαδικασίας είναι γνωστό στην Ελλάδα ως "πυρηνόξυλο" και καταναλώνεται από τα ίδια τα πυρηνελαιουργεία για την παραγωγή ατμού που χρησιμοποιείται στη διαδικασία της εκχύλισης και για την ξήρανση του εισερχόμενου υγρού ελαιοπυρήνα. Τα επίπεδα ιδιοκατανάλωσης έχουν αυξηθεί τα τελευταία χρόνια, δεδομένου ότι τα ελαιοτριβεία έχουν κάνει τη μετάβαση στη τεχνολογία παραγωγής δύο φάσεων και παράγουν πολύ πιο υγρό πυρήνα, με αποτέλεσμα τα πυρηνελαιουργεία να χρειάζονται περισσότερη θερμική ενέργεια για την ξήρανση. Οι εναπομένουσες ποσότητες πυρηνόξυλου είναι διαθέσιμες και διατίθενται ως καύσιμα σε διάφορους τελικούς χρήστες, από νοικοκυριά έως αρτοποιεία, θερμοκήπια και πολλά άλλα. Τα ελαιοτριβεία είναι επίσης σημαντικοί καταναλωτές πυρηνόξυλου.

- **Μύλοι ρυζιού:** οι μύλοι ρυζιού χρησιμοποιούν το φλοιό ρυζιού που παράγεται στη διαδικασία ως καύσιμο για το ρύζι. Συνήθως, δεν υπάρχουν υπολειπόμενες ποσότητες αυτού του καυσίμου για την αγορά.
- **Εγκαταστάσεις κονσερβοποίησης ροδάκινων:** περίπου 17 εργοστάσια κονσερβοποίησης λειτουργούν στη Βόρεια Ελλάδα. Ο πυρήνας ροδάκινου παράγεται στα πρώτα στάδια της διαδικασίας κονσερβοποίησης. Σε παλαιότερες εποχές, το υλικό πουλιόταν στην αγορά οικιακής θέρμανσης, αλλά σήμερα 5 τέτοια εργοστάσια το καταναλώνουν για παραγωγή θερμικής ενέργειας.
- **Μονάδες εκκόκκισης βαμβακιού:** όπως οι μύλοι ρυζιού, έτσι και τα εκκοκκιστήρια βάμβακος χρησιμοποιούν τα υπολείμματα που παράγουν για ιδιοκατανάλωση.

Όπως φαίνεται, η κατανάλωση βιομάζας στις βιομηχανίες αυτές προέρχεται από τα ίδια τα υπολείμματα τους. Σε μερικές περιπτώσεις όπου το υλικό δεν είναι αρκετό (π.χ. σε μερικά εργοστάσια κονσερβοποίησης ροδάκινου), χρησιμοποιούνται άλλα κατάλληλα καύσιμα. Για παράδειγμα, οι πελλέτες ηλίανθου είναι μια ελκυστική επιλογή για τα εργοστάσια στη Βόρεια Ελλάδα, δεδομένου ότι εισάγονται σε πολύ ανταγωνιστικές τιμές από τη Βουλγαρία ή την Ουκρανία.

Τα θερμοκήπια είναι επίσης σημαντικοί καταναλωτές βιομάζας στον αγροτικό τομέα. Σε αντίθεση με τις προαναφερθείσες αγροτοβιομηχανίες, προμηθεύουν τη βιομάζα τους από τρίτες πηγές, συμπεριλαμβανομένων των αγροτικών βιομηχανιών. Και πάλι, οι πελλέτες ηλίανθου (εισαγόμενες) ή το (εγχώριο) πυρηνόξυλο είναι ελκυστικές επιλογές λόγω των καλών τιμών τους.

Απ' όσο γνωρίζουμε, δεν υπάρχει σημαντική κατανάλωση βιομάζας από μόνιμες καλλιέργειες στον αγροτικό ή αγροτοβιομηχανικό τομέα. Εντούτοις, ορισμένες βιομηχανίες, όπως τα πυρηνελαιουργεία ή οι κονσερβοποιίες, λειτουργούν σε περιοχές με υψηλή πυκνότητα μόνιμων καλλιεργειών (ελαιόδεντρα και ροδακινιές αντίστοιχα). Ως εκ τούτου, θα μπορούσαν να διαδραματίσουν ρόλο στη δημιουργία μιας αγοράς για αυτά τα είδη βιομάζας, είτε άμεσα, μέσω της κατανάλωσης τέτοιων ειδών στις εγκαταστάσεις τους για την κάλυψη των ενεργειακών τους αναγκών, είτε έμμεσα, με τη μετατροπή των εγκαταστάσεων τους σε ενδιάμεσα κέντρα εφοδιαστικής βιομάζας. Το τελευταίο θα μπορούσε να επιτευχθεί με την αξιοποίηση υφιστάμενου εξοπλισμού (π.χ. ξηραντήριων) και του χώρου αποθήκευσης αυτών των εγκαταστάσεων.

Στερεή βιομάζα και ο τομέας της ηλεκτροπαραγωγής

Η Ελλάδα έχει υιοθετήσει ένα σύστημα εγγυημένων τιμών (Feed-in Tariff - FiT) για τη οικονομική υποστήριξη διαφόρων τεχνολογιών ΑΠΕ από το 2006. Το σύστημα FiT υποβλήθηκε σε πολλές

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αναθεωρήσεις αλλά γενικά διέκρινε το επίπεδο των εγγυημένων τιμών που λάμβανε ένας παραγωγός ΑΠΕ με βάση διάφορες παραμέτρους, με τις πιο σημαντικές να είναι α) ο τύπος της τεχνολογίας και η εγκατεστημένη ισχύ της εγκατάστασης ΑΠΕ, β) το εάν η ηλεκτρική ενέργεια παραδόθηκε στο διασυνδεδεμένο ηπειρωτικό δίκτυο ή σε μη διασυνδεδεμένα νησιά και γ) αν η επένδυση υποστηρίχθηκε με δημόσιους πόρους ή όχι. Οι FiT οδήγησαν σε σημαντική ανάπτυξη της ηλιακής και αιολικής ενέργειας στην Ελλάδα· ωστόσο, άλλοι τύποι ΑΠΕ, όπως η βιομάζα και η γεωθερμία, εξακολουθούν να έχουν μόνο οριακές συνεισφορές στην εγκατεστημένη ισχύ των ΑΠΕ.

Το 2016, το πλαίσιο στήριξης της ηλεκτρικής ενέργειας από ΑΠΕ στην Ελλάδα αναθεωρήθηκε και επί του παρόντος βασίζεται σε ένα συνδυασμό εγγυημένης διαφορικής τιμής (Feed-in Premium - FiP) και προσφορών. Ένα σημαντικό χαρακτηριστικό του νέου καθεστώτος στήριξης είναι ότι οι παραγωγοί ΑΠΕ θα συμμετέχουν άμεσα στην αγορά χονδρικής ηλεκτρικής ενέργειας, ενώ η παραγόμενη ηλεκτρική τους ενέργεια θα ανταμείβεται στο επίπεδο των Τιμών Αναφοράς (TA), οι οποίες υπολογίστηκαν έτσι ώστε κάθε επενδυτής ΑΠΕ να είναι σε θέση να επιτύχει ένα εύλογο Εσωτερικό Βαθμό Απόδοσης (IRR) της επένδυσης του λαμβάνοντας υπόψη το σταθμισμένο κόστος του ηλεκτρισμού (με βάση τυπικά μεγέθη δαπανών κεφαλαίου / CAPEX, λειτουργικών εξόδων/ OPEX, συντελεστές δυναμικότητας), ένα μέσο σταθμισμένο κόστος κεφαλαίου και τους λογιστικούς κανόνες. Η FiP υπολογίζεται ως η διαφορά μεταξύ της τιμής αναφοράς της αγοράς (Reference Market Price/RMP) και της TA για κάθε τεχνολογία και είναι εγγυημένη για μια περίοδο 20 ετών για τους περισσότερους τύπους ΑΠΕ. Ο νόμος επιχειρεί να ελέγξει περαιτέρω τα δημοσιονομικά έξοδα που σχετίζονται με την υποστήριξη των ΑΠΕ ενώ παράλληλα συμβαδίζει με τις κατευθυντήριες γραμμές της Ευρωπαϊκής Επιτροπής για την Ενέργεια και την Περιβαλλοντική Πολιτική για την περίοδο 2014-2020 (EEAG) και προωθεί τους εθνικούς στόχους για την παραγωγή από ΑΠΕ.

Ο Πίνακας 7 συγκρίνει το επίπεδο οικονομικής στήριξης που απολαμβάνουν οι παραγωγοί ηλεκτρικής ενέργειας από διαφορετικούς τύπους βιομάζας στην Ελλάδα στα δύο τελευταία προγράμματα στήριξης καθώς και την εγκατεστημένη ισχύ των μονάδων παραγωγής ενέργειας από βιομάζα. Σε γενικές γραμμές, η ηλεκτρική ενέργεια από βιομάζα είναι πολύ υποανάπτυκτη. Το μεγαλύτερο μέρος της εγκατεστημένης δυναμικότητας προέρχεται από εγκαταστάσεις που χρησιμοποιούν αέριο χώρων ταφής. Η αναερόβια χώνευση έχει επεκταθεί, ενώ οι μονάδες παραγωγής ηλεκτρικής ενέργειας από στερεά βιομάζα ανέρχονται σε λίγο πάνω από 3 MW_e, από μονάδες με εγκατεστημένη ισχύ μικρότερη ή ίση με 1 MW_e.

Πίνακας 1: Σύγκριση των εγγυημένων τιμών και τιμών αναφοράς για την ηλεκτρική ενέργεια που παράγεται από διάφορους τύπους βιομάζας και την εγκατεστημένη ισχύ για μονάδες παραγωγής ενέργειας από βιομάζα

Πίνακας 8: Σύγκριση των καθεστώτων ενίσχυσης της ηλεκτροπαραγωγής από βιομάζα και εγκατεστημένη ισχύς μονάδων ηλεκτροπαραγωγής βιομάζας στην Ελλάδα

Καθεστώτα ενίσχυσης και εγκατεστημένη ισχύς από βιομάζας στην Ελλάδα					
Τύπος Εγκατάστασης	Δυναμικότητα	N. 4254/2014	N. 4414/2016		Εγκατεστημένη Ισχύς (MW _e) από Οκτ. 2017
		FiT (€/MWh)	TA για 2016 (€/MWh)	IRR	
Αέρια από χώρους ταφής	≤ 2 MW	131	129	9%	3.219
	> 2 MW	108	106	9%	42.008
Βιοαέριο από αναερόβια χώνευση	≤ 3 MW	230	225	10%	12.6
	> 3 MW	209	204	9%	---

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Καθεστώς ενίσχυσης και εγκατεστημένη ισχύς από βιομάζας στην Ελλάδα					
Τύπος Εγκατάστασης	Δυναμικότητα	N. 4254/2014	N. 4414/2016		Εγκατεστημένη Ισχύς (MW _e) από Οκτ. 2017
Βιομάζα για θερμικές διεργασίες	≤ 1 MW	198	184 (καύση ή πυρόλυση)	9%	3.17
	> 1 MW & ≤ 5 MW	170	162	9%	---
	> 5 MW	148	140	9%	---
Σημείωση: τα επίπεδα οικονομικής υποστήριξης που αναφέρονται αφορούν επενδύσεις που έχουν πραγματοποιηθεί χωρίς κάποιο είδος δημόσιας στήριξης					

Η κατανάλωση βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα

Από την ανωτέρω ανάλυση πρέπει να καταστεί σαφές ότι - εκτός από τα καυσόξυλα από γεωργικές εκμεταλλεύσεις - στην Ελλάδα δεν υπάρχει πρακτικά κατανάλωση βιομάζας από μόνιμες καλλιέργειες, καθώς και ότι η αγορά βιομάζας είναι στην πραγματικότητα αρκετά μικρή σε σύγκριση με άλλες Μεσογειακές χώρες.

Ορισμένοι μικρής κλίμακας παραγωγοί πελλετών ή μπρικετών στην Ελλάδα χρησιμοποιούν περιστασιακά βιομάζα από μόνιμες καλλιέργειες, κυρίως κλαδέματα από ελαιόδεντρα. Το συνολικό επίπεδο κατανάλωσης αυτών των ειδών βιομάζας δεν είναι γνωστό, ενώ δεν είναι σαφές εάν αυτή η δραστηριότητα είναι συχνή ή πραγματοποιείται μόνο σποραδικά. Αυτό διερευνάται περαιτέρω από το ΕΚΕΤΑ στα πλαίσια των δραστηριοτήτων του uP_running και των αναζητήσεων νέων αλυσίδων αξίας και πιθανών «ναυαρχίδων» αξιοποίησης βιομάζας από μόνιμες καλλιέργειες. Μέχρι τώρα έχουν εντοπιστεί οι ακόλουθες περιπτώσεις επιχειρήσεων που παράγουν στερεά βιοκαύσιμα από μόνιμες καλλιέργειες:

- Η **Βιομάζα Αιγαίου** (<http://www.aegean-biomass.gr>), στο Πλωμάρι Λέσβου, παρήγαγε στο παρελθόν πελλέτες από κλαδέματα ελιάς. Αυτόν τον καιρό είναι σε φάση αναβάθμισης της γραμμής παραγωγής πελλετών. Επιπλέον, η εταιρεία διερευνά τις δυνατότητες παραγωγής ηλεκτρικής ενέργειας από κλαδέματα ελιάς. Για την αρχική επεξεργασία κλαδεμάτων στα αγροτεμάχια, η εταιρεία χρησιμοποίησε ένα φορητό τεμαχιστή.
- Η **Aenaon Bioenergies** (<http://aenaon-bioenergies.gr>), που βρίσκεται στη Βιομηχανική Περιοχή (ΒΙ.ΠΕ.) Πάτρας, είναι μια εταιρεία παραγωγής πελλετών και μπρικετών που διαθέτει τροποποιημένο καταστροφέα⁶ για συλλογή κλαδεμάτων. Η εταιρεία παράγει περιστασιακά πελλέτες από κλαδέματα για τη βιομηχανική αγορά.
- Η **Εταιρεία Ανάκτησης Μεταποίησης Εμπορίας Βιομάζας (Ε.Α.Μ.Ε.Β.)** (<http://eameb.gr>) εδρεύει στη Βόρεια Ελλάδα και προσφέρει υπηρεσίες εκρίζωσης σε καλλιεργητές μόνιμων καλλιεργειών. Τα ξεριζωμένα δέντρα μετατρέπονται σε τεμαχισμένο ξύλου (wood chips) και πωλούνται σε βιομηχανικούς καταναλωτές.

Εμπόδια για την ανάπτυξη της χρήσης βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα

Τα κύρια εμπόδια για την ανάπτυξη του κλάδου βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα φαίνονται στον ακόλουθο πίνακα. Αρκετά από αυτά είναι σύμφυτα με αυτό το είδος βιομάζας εν γένει, ενώ άλλα αφορούν συγκεκριμένα την Ελλάδα ως χώρα.

⁶ Ο τροποποιημένος καταστροφέας παράγεται από την Ελληνική εταιρεία “Φωτόπουλος Σαράντης & Υιοί” που βρίσκεται στα Καβάσιλα Ημαθίας. Το μηχάνημα εκβάλλει τα επεξεργασμένα κλαδέματα σε μεσάκι (big bag).

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Πίνακας 9: Εμπόδια για τη βιομάζα από μόνιμες καλλιέργειες στην Ελλάδα

Εμπόδια στην Ελλάδα	
Εμπόδια	
Τεχνικά	Τεχνικοί περιορισμοί για τους τελικούς χρήστες, ιδίως όσον αφορά το σύστημα τροφοδοσίας. Η αγορά λεβήτων στην Ελλάδα έχει αναπτυχθεί κυρίως για πελλέτες (ξύλου) και υλικά μικρής κοκκομετρίας (όπως το πυρηνόξυλο) και όχι τεμαχισμένο ξύλο, ιδίως με ανομοιομορφία στην κατανομή μεγέθους
	Μη ώριμα συστήματα διαχείρισης και συλλογής. Δεν υπάρχουν μεγάλοι κατασκευαστές μηχανημάτων συλλογής κλαδεμάτων στην Ελλάδα
	Πολλοί λέβητες και άλλα συστήματα θέρμανσης δεν μπορούν να λειτουργήσουν σωστά λαμβάνοντας υπόψη τα ιδιαίτερα χαρακτηριστικά της βιομάζας από μόνιμες καλλιέργειες (π.χ. υψηλότερη τέφρα, άζωτο, κτλ.)
	Δεν υπάρχει επαρκής γνώση για την παραγωγικότητα βιομάζας από μόνιμες καλλιέργειες ή είναι χαμηλή
Πολιτισμικά	Δυσπιστία απέναντι στις αλλαγές (κυρίως στον αγροτικό τομέα)
	Οι αγρότες προτιμούν εύκολες λύσεις και όχι περιπλοκές
	Οι αγρότες βλέπουν μόνο το κόστος της διαχείρισης των κλαδεμάτων, όχι την εξοικονόμηση που μπορεί να επιτευχθεί από την ενεργειακή τους αξιοποίηση
	Πεποίθηση ότι οι λέβητες βιομάζας είναι δύσκολοι στη λειτουργία (πολλή χειρωνακτική δουλειά, μικρός αυτοματισμός)
	Πεποίθηση ότι η καύση βιομάζας ρυπαίνει, ακόμα και όταν πραγματοποιείται σε σύγχρονες μονάδες, σύνδρομο NIMBY (Not In My Back Yard)
Νομοθετικά	Πεποίθηση ότι οι λύσεις και οι καλές πρακτικές από άλλες Ευρωπαϊκές χώρες δεν μπορούν να μεταφερθούν στις Ελληνικές συνθήκες
	Ο εθνικός ενεργειακός σχεδιασμός δε λαμβάνει υπόψη της τη βιομάζα από μόνιμες καλλιέργειες
	Προς το παρόν, επιτρέπεται η ανοιχτή καύση κλαδεμάτων σε συγκεκριμένες περιόδους του χρόνου
	Ο Κανονισμός Ecodesign της ΕΕ θεωρεί τα κλαδέματα ως «ξυλώδη βιομάζα» και θεσπίζει για αυτά πολύ χαμηλά όρια εκπομπών για λέβητες έως 500 kW
Δομικά	Υπό εξέταση η επιδότηση των αγροτών για την ενσωμάτωση των κλαδεμάτων στο έδαφος, όχι για την ενεργειακή τους αξιοποίηση
	Άγνοια δυνητικών λύσεων
	Απουσία τοπικών / εθνικών επιτυχημένων παραδειγμάτων για αναπαραγωγή / μίμηση
	Η βιομάζα από τις μόνιμες καλλιέργειες είναι «άγνωστο» μέγεθος
	Το μικρό μέγεθος των αγροτικών εκμεταλλεύσεων περιορίζει την ποσότητα της βιομάζας που μπορεί ένας μεμονωμένος αγρότης να φέρει στην αγορά
Αγορά	Η καλλιέργεια μόνιμων καλλιεργειών σε ημιορεινά και ορεινά εδάφη (ιδίως στους ελαιώνες) δυσκολεύει τη μηχανική συλλογή των κλαδεμάτων
	Δυσκολία στην εξεύρεση μεγάλων (δυνητικών) καταναλωτών βιομάζας από μόνιμες καλλιέργειες
	Μικρός μέγεθος της Ελληνικής αγοράς βιομάζας
	Λίγες εταιρείες μπορούν να ενσωματώσουν τη βιομάζα από μόνιμες καλλιέργειες ως νέο είδος καυσίμου
	Υψηλός ΦΠΑ για στερεά βιοκαύσιμα στην Ελλάδα (24 %), υψηλότερος από τις περισσότερες Ευρωπαϊκές χώρες
	Πολλά φθηνά και χαμηλής ποιότητας στερεά βιοκαύσιμα στην Ελληνική αγορά και χαμηλό επίπεδο γνώσης σχετικά με την επίδραση της ποιότητας του καυσίμου (π.χ. τέφρα, άζωτο, χλώριο, κτλ) στη λειτουργία των συστημάτων καύσης και στους αέριους ρύπους
Οργανωτικά	Πολλοί κατασκευαστές (μηχανημάτων συλλογής, λεβήτων) δε δείχνουν ενδιαφέρον για να ξεκινήσουν εργασίες στην Ελληνική αγορά
	Οι εφοδιαστικές αλυσίδες βιομάζας από μόνιμες καλλιέργειες είναι περίπλοκες οργανωτικά

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Εμπόδια στην Ελλάδα	
Εμπόδια	
Οικονομικά και χρηματοδοτικά	Η από κοινού χρήση μηχανημάτων συλλογής δεν είναι πάντα εύκολο να κανονιστεί
	Δυσπιστία των αγροτών σε εξωτερικές εταιρείες που εκτελούν εργασίες στο χωράφι τους
	Δυσκολία στο να υπογραφούν συμβόλαια τροφοδοσίας βιομάζας μεταξύ τελικών καταναλωτών και αγροτών
	Δεν υπάρχουν πολλοί ενδιαμέσοι φορείς που μπορούν να αναλάβουν δράσεις για την οργάνωση εφοδιαστικής βιομάζας
	Αβεβαιότητα στο επενδυτικό κλίμα λόγω της οικονομικής κρίσης
	Δυσκολίες στον τραπεζικό δανεισμό
	Χαμηλές τιμές ορυκτών καυσίμων
	Χαμηλό περιθώριο κέρδους από την αξιοποίηση βιομάζας από μόνιμες καλλιέργειες και αβεβαιότητα για τα κόστη
	Το κόστος μηχανημάτων συλλογής προϋποθέτει την αξιοποίηση σημαντικών ποσοτήτων βιομάζας προκειμένου να γίνουν αποσβέσεις
	Οι λέβητες που είναι προσαρμοσμένοι σε αυτά τα είδη βιομάζας είναι ακριβότεροι
	Δεν υπάρχουν συγκεκριμένες επιδοτήσεις για την αγορά ή τη χρήση βιομάζας από μόνιμες καλλιέργειες

Κινητήριες δυνάμεις για την ανάπτυξη της χρήσης βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα

Οι κινητήριες δυνάμεις που ωθούν την ανάπτυξη του κλάδου βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα παρουσιάζονται στον ακόλουθο πίνακα. Όπως και με τα εμπόδια, κάποια είναι εγγενή σε αυτό το είδος βιομάζας, ενώ αλλά προέρχονται από την ιδιαίτερη κατάσταση στην Ελλάδα.

Πίνακας 10: Κινητήριες δυνάμεις για τη βιομάζα από μόνιμες καλλιέργειες στην Ελλάδα

Κινητήριες δυνάμεις στην Ελλάδα	
Κινητήριες δυνάμεις	
Κατανάλωση	Βιομηχανικό ενδιαφέρον για τη μείωση του ενεργειακού κόστους και στροφή σε καύσιμα βιομάζας
	Πολλές αγροτοβιομηχανίες που συνδέονται με τον αγροτικό τομέα (ελαιουργεία, πυρηνελαιουργεία, κονσερβοποιίες) που μπορούν να γίνουν καταναλωτές ή εφοδιαστικά κέντρα για αυτά τα είδη βιομάζας
	Ορισμένες μονάδες ηλεκτροπαραγωγής από βιομάζα υπό κατασκευή / μελέτη, οι οποίες θα μπορούσαν να είναι δυνητικοί καταναλωτές βιομάζας από μόνιμες καλλιέργειες
Δομικές	Μεγάλες εκτάσεις μόνιμων καλλιεργειών
	Τεράστιο δυναμικό βιομάζας από μόνιμες καλλιέργειες σε εθνικό επίπεδο
	Περιορισμένο δυναμικό βιομάζας από το δασικό τομέα. Δυσκολία στην εξαγωγή των δασικών υπολειμμάτων λόγω μορφολογίας εδάφους, θεσμικού πλαισίου, κτλ.
Νομοθεσία	Πιο αυστηρές πολιτικές ως προς την ανοιχτή καύση υπολειμμάτων και πιθανή απαγόρευση της πρακτικής στην αναθεωρημένη ΚΑΠ
	Δημόσιες δηλώσεις τοπικών / περιφερειακών αρχών υπέρ της ενεργειακής αξιοποίησης βιομάζας από μόνιμες καλλιέργειες
	Προώθηση της έρευνας και της τεχνολογικής ανάπτυξης σε θέματα σχετικά με τη βιο-οικονομία και την κυκλική οικονομία
	Αναθεώρηση της ΚΑΠ και πιθανές συνέργειες της ενεργειακής αξιοποίησης της βιομάζας από μόνιμες καλλιέργειες στο πλαίσιο του δεύτερου πυλώνα
	Το Πρόγραμμα Αγροτικής Ανάπτυξης περιλαμβάνει υπομέτρα που παρουσιάζουν

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Κινητήριες δυνάμεις στην Ελλάδα	
Κινητήριες δυνάμεις	
	ενδιαφέρουν για των προώθηση της χρήσης βιομάζας
Αγορά	Οι μεταβολές στις τιμές των ορυκτών καυσίμων προκαλούν ενδιαφέρον για εναλλακτικές, όπως τα καύσιμα βιομάζας
	Ανάπτυξη υποδομών για τη διαχείριση και αναβάθμιση στερεών βιοκαυσίμων στην Ελλάδα (π.χ. μονάδες παραγωγής πελλετών, μπρικετών)
	Οι αγρότες ενδιαφέρονται για νέες πηγές εισοδήματος ή για εξοικονόμηση εξόδων και ερευνούν τις δυνατότητες που προσφέρει η βιομάζα
	Ανάπτυξη συνεταιριστικών υποδομών (συμπεριλαμβανομένων αγροτικών, ενεργειακών συνεταιρισμών και ΚοινΣΕΠ) οι οποίες μπορούν να εξετάσουν επιχειρηματικά τη διαχείριση και την ενεργειακή αξιοποίηση βιομάζας από μόνιμες καλλιέργειες
	Ενδιαφέρον των επενδυτών στην ηλεκτροπαραγωγή από βιομάζα, καθώς η αγορά αιολικών και φωτοβολταϊκών γίνεται κορεσμένη
Αντίληψη	Αναγνώριση ότι η καύση των υπολειμμάτων στο χωράφι είναι απώλεια ενέργειας και πηγή ρύπανσης
	Αναγνώριση ότι η Ελληνική ύπαιθρος θα έπρεπε να απεξαρτηθεί από τη χρήση πετρελαίου για θέρμανση και να στραφεί σε τοπικές, ανανεώσιμες πρώτες ύλες
	Μεγάλο ενδιαφέρον για πληροφόρηση σχετικά με βέλτιστες πρακτικές (π.χ. «ναυαρχίδες» του έργου uP_running) και το πως μπορούν να αναπαραχθούν στην Ελλάδα

Κύριοι φορείς για τη βιοενέργεια και τη βιομάζα στην Ελλάδα

Οι κύριες οργανώσεις που διαδραματίζουν πρωταγωνιστικό ρόλο σε Εθνικό επίπεδο για τη διαμόρφωση πολιτικών και την ενημέρωση της κοινής γνώμης σχετικά με τη βιομάζα και τη βιοενέργεια είναι οι ακόλουθες:

Κλαδικές οργανώσεις για τη βιομάζα

Ελληνική Εταιρεία Ανάπτυξης Βιομάζας (ΕΛΕΑΒΙΟΜ), <http://www.hellabiom.gr>: η ΕΛΕΑΒΙΟΜ είναι μια μη κερδοσκοπική οργάνωση, μέλος του Ευρωπαϊκού Οργανισμού Βιομάζας (ΑΕΒΙΟΜ). Οι σκοποί της ΕΛΕΑΒΙΟΜ είναι οι ακόλουθοι:

- Η καταγραφή, η προώθηση και ο συντονισμός της επιστημονικής έρευνας που αφορά στην παραγωγή, εμπορία, ενεργειακή (και πάσης φύσεως βιομηχανική) εκμετάλλευση, καθώς και στις αγροτικές εφαρμογές της βιομάζας.
- Η διάδοση και υποστήριξη των χρήσεων της βιομάζας σε εθνικό επίπεδο.
- Η εκπόνηση μελετών στατιστικού και οικονομοτεχνικού χαρακτήρα είτε αυτόνομα είτε σε συνεργασία με άλλους ημεδαπούς και αλλοδαπούς φορείς και οργανισμούς που δραστηριοποιούνται σε τομείς αξιοποίησης βιομάζας, με σκοπό την πληροφόρηση των μελών του Συνδέσμου, των επιχειρήσεων του κλάδου και της επιστημονικής κοινότητας.

Για την επίτευξη των στόχων της, η ΕΛΕΑΒΙΟΜ αναλαμβάνει δράσεις την κατάθεση διαβημάτων, υπομνημάτων, αναφορών, αιτημάτων, προτάσεων, κτλ. προς τους αρμόδιους φορείς και Αρχές και επικοινωνεί, συνδιαλέγεται και συνεργάζεται με άλλα Σωματεία, Συλλόγους ή Οργανισμούς που έχουν όμοιους ή παρεμφερείς σκοπούς.

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Η ΕΛΕΑΒΙΟΜ συνδιοργανώνει – μαζί με ερευνητικούς φορείς όπως το ΕΚΕΤΑ και το ΚΑΠΕ – την εκδήλωση “Biomass Day” κάθε Απρίλιο. Το 2017, συμμετείχε στον εορτασμό της Πανευρωπαϊκής καμπάνιας της ΑΕΒΙΟΜ για την «Ευρωπαϊκή Ημέρα Βιοενέργειας» και συντόνισε τις δραστηριότητες στην Ελλάδα μαζί με το ΕΚΕΤΑ.

Υπουργεία

Υπουργείο Περιβάλλοντος και Ενέργειας (ΥΠΕΝ), <http://www.ypeka.gr>: Βασική αρμοδιότητα του ΥΠΕΝ είναι ο καθορισμός και η υλοποίηση της εθνικής ενεργειακής πολιτικής, ο συντονισμός του ενεργειακού τομέα της χώρας και η προώθηση της χρήσης των ΑΠΕ. Οι σχετικές δραστηριότητες υλοποιούνται από τη Γενική Γραμματεία Ενέργειας & Ορυκτών Πρώτων Υλών, ειδικότερα για τις ΑΠΕ από τη Διεύθυνση Ανανεώσιμων Πηγών Ενέργειας (ΑΠΕ) και Εναλλακτικών Καυσίμων. Το ΥΠΕΝ επιβλέπει διάφορους φορείς, οργανώσεις και επιχειρήσεις που σχετίζονται με την Ελληνικό ενεργειακό τομέα, όπως τη Ρυθμιστική Αρχή Ενέργειας (ΡΑΕ), τη ΔΕΗ Α.Ε. και τη ΔΕΗ Ανανεώσιμες, τον Ανεξάρτητο Διαχειριστή Μεταφοράς Ηλεκτρικής Ενέργειας Α.Ε. (ΑΔΜΗΕ) και το Κέντρο Ανανεώσιμων Πηγών Ενέργειας (ΚΑΠΕ).

Υπουργείο Αγροτικής Ανάπτυξης και Τροφίμων (ΥΠΑΝ), <http://www.minagric.gr>: Το ΥΠΑΝ συνεργάζεται με αγρότες και άλλους εμπλεκόμενους στον πρωτογενή τομέα με στόχο την προώθηση της αειφόρου γεωργίας, της επισιτιστικής ασφάλειας και της ασφάλειας των τροφίμων, τη βιωσιμότητα του πρωτογενή τομέα και την ανάπτυξη των αγροτικών περιοχών της Ελλάδας. Το ΥΠΑΝ είναι υπεύθυνο για την υλοποίηση της Κοινής Αγροτικής Πολιτικής (ΚΑΠ) στην Ελλάδα και διαχειρίζεται το Πρόγραμμα Αγροτικής Ανάπτυξης (ΠΑΑ).

Ερευνητικοί και ακαδημαϊκοί φορείς

Υπάρχουν πολλοί ερευνητικοί οργανισμοί και ακαδημαϊκά τμήματα στην Ελλάδα που δραστηριοποιούνται στο χώρο της ενεργειακής αξιοποίησης της βιομάζας στο πλαίσιο εθνικών, Ευρωπαϊκών ή διεθνών έργων. Το Εθνικό Κέντρο Έρευνας και Τεχνολογικής Ανάπτυξης (ΕΚΕΤΑ) είναι εταίρος του έργου uP_running, ενώ υλοποιεί δραστηριότητες σχετικές με την ενεργειακή αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες και στο πλαίσιο των Ευρωπαϊκών έργων (Ορίζοντας 2020) BIOmasud Plus και AGROinLOG. Άλλοι σχετικοί οργανισμοί είναι το Τμήμα Βιομάζα του **Κέντρου Ανανεώσιμων Πηγών Ενέργειας (ΚΑΠΕ)**, το **Γεωπονικό Πανεπιστήμιο Αθηνών (ΓΠΑ)** και το **Εθνικό Μετσόβιο Πολυτεχνείο (ΕΜΠ)**.

Οργανισμοί από τον αγροτικό, διατροφικό και αγροτοβιομηχανικό τομέα

Οι οργανισμοί από τον αγροτικό, διατροφικό και αγροτοβιομηχανικό τομέα μπορούν να διαδραματίσουν κρίσιμο ρόλο στην προώθηση της χρήσης βιομάζας ως μια ανανεώσιμη πηγή ενέργειας, καθώς μπορούν να αποτελέσουν τον κύριο συνδετικό κρίκο μεταξύ του πρωτογενούς τομέα (αγρότες) και του ενεργειακού κόσμου.

Η Νέα ΠΑΣΕΓΕΣ (<http://www.neapaseges.gr>) είναι η διάδοχος κατάσταση της Πανελλήνιας Συνομοσπονδίας Ενώσεων Αγροτικών Συνεταιρισμών (ΠΑΣΕΓΕΣ). Από το 1935, η ΠΑΣΕΓΕΣ ήταν ο κύριος φορέας που εκφράζει και εκπροσωπεί το Ελληνικό συνεταιριστικό κίνημα. Μέσω του Ινστιτούτου Αγροτικής και Συνεταιριστικής Οικονομίας (ΙΝΑΣΟ-ΠΑΣΕΓΕΣ), συμμετέχει ενεργά στην ανάπτυξη της αγοράς βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα και σε καινοτομικές δράσεις στο πλαίσιο των Ευρωπαϊκών έργων uP_running και AGROinLOG.

Σχετικοί φορείς που εκπροσωπούν συγκεκριμένους αγροτοβιομηχανικούς κλάδους ή συγκεκριμένα διατροφικά προϊόντα είναι: ο **Σύνδεσμος Πυρηνελαιουργών Ελλάδας (ΣΠΕΛ)**, η

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Ένωση Κονσερβοποιών Ελλάδας (ΕΚΕ), η Κεντρική Συνεταιριστική Ένωση Αμπελοοινικών Προϊόντων (ΚΕΟΣΟΕ), η Εθνική Διεπαγγελματική Οργάνωση Αμπέλου και Οίνου (ΕΔΟΑΟ) και η Εθνική Διεπαγγελματική Οργάνωση Ελαιολάδου και Ελιάς (ΕΔΟΕΕ).

Από τους πολλούς αγροτικούς συνεταιρισμούς που δραστηριοποιούνται στην Ελλάδα, αξίζει να αναφερθούν οι πέντε που εξέφρασαν μεγαλύτερο ενδιαφέρον για την ενεργειακή αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες και οι οποίοι συνεργάζονται με το έργο uP_running project για την υλοποίηση επιδεικτικών δράσεων: η **ΕΑΣ Λακωνίας**, το **VAENI – Νάουσα**, ο **Α.Ο.Σ. Κορωπίου**, η **Ένωση Αγρινίου** και ο **Αιχμέας** στη Λιβαδειά. Σημειώνεται επίσης ο κρίσιμος ρόλος του **Αγροτικού Συνεταιρισμού Αγίου Κωνσταντίνου – Λοκρίδος** στην υλοποίηση των μεγάλης κλίμακας επιδεικτικών δράσεων συλλογής κλαδεμάτων ελαιόδεντρων που θα πραγματοποιηθούν στη Φθιώτιδα στο πλαίσιο του έργου AGROinLOG.

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Δ. Εθνικό Σχέδιο για την Ενέργεια και το Κλίμα

Εθνικό Σχέδιο Δράσης για τις Ανανεώσιμες Πηγές Ενέργειας

Η Ελλάδα έχει υιοθετήσει το δικό της Εθνικό Σχέδιο Δράσης για τις ΑΠΕ – ΕΣΔΑ (National Renewable Energy Action Plan – NREAP), όπως όλα τα κράτη μέλη της ΕΕ, προκειμένου να περιγράψει το είδος των δράσεων που πρέπει να πραγματοποιηθούν για την επίτευξη των στόχων για τις ανανεώσιμες πηγές ενέργειας (20-20-20). Σύμφωνα με την οδηγία 2009/28/ΕΚ της ΕΕ, η Ελλάδα πρέπει να επιτύχει στόχο μεικτής κατανάλωσης ενέργειας από ΑΠΕ στα 18 % (4.341 ktoe) μέχρι το 2020, ξεκινώντας από 6.9 % το 2005. Ο στόχος αυτός αυξήθηκε σε 20 % με το Νόμο 3851/2010, ο οποίος έθεσε ειδικούς στόχους για τις ΑΠΕ για την μεικτή κατανάλωση ηλεκτρικής ενέργειας (40 %), την τελική κατανάλωση ενέργειας για θέρμανση και ψύξη (20 %) και την τελική κατανάλωση ενέργειας για τις μεταφορές (10 %) έως το 2020.

Όπως αναφέρεται σε επόμενο τμήμα αυτής της έκθεσης ("Βιομάζα για την παραγωγή ηλεκτρικής ενέργειας"), οι στόχοι του ΕΣΔΑ για τη βιομάζα είναι αρκετά συντηρητικοί. Η μόνη αναφορά στην βιομάζα από μόνιμες καλλιέργειες είναι η χρήση των κλαδεμάτων ως καυσόξυλα από τις τοπικές κοινότητες. Δεν υπάρχει κάποια ποσοτικοποίηση του δυναμικού τους. Το ΕΣΔΑ δίνει μεγαλύτερη έμφαση στην κινητοποίηση νέων πόρων βιομάζας, π.χ. ενεργειακές καλλιέργειες σε οριακές ή εγκαταλελειμμένες εκτάσεις και κάλυψη της ζήτησης βιομάζας για παραγωγή βιοντίζελ.

Με βάση το πακέτο μέτρων για το κλίμα και την ενέργεια για το 2020, το πλαίσιο για το κλίμα και την ενέργεια 2030 εγκρίθηκε από τους ηγέτες της ΕΕ τον Οκτώβριο του 2014 και καθορίζει τους ακόλουθους τρεις στόχους για το έτος 2030:

- Τουλάχιστον 40 % περικοπές στις εκπομπές αερίων θερμοκηπίου (από τα επίπεδα του 1990)
- Τουλάχιστον 27 % το μερίδιο των ανανεώσιμων πηγών ενέργειας
- Τουλάχιστον 27 % βελτίωση της ενεργειακής απόδοσης

Πιο πρόσφατα (Ιανουάριος 2018), το Ευρωπαϊκό Κοινοβούλιο ψήφισε την νέα Οδηγία για τις ΑΠΕ (REDII) και πρότεινε δεσμευτικό στόχο για το μερίδιο των ανανεώσιμων πηγών ενέργειας σε επίπεδο ΕΕ, ύψους 35 %. Τα κράτη μέλη θα πρέπει να καθορίσουν δεσμευτικούς εθνικούς στόχους για την επίτευξη του στόχου της ΕΕ. Δημόσιες δηλώσεις του Πρωθυπουργού της Ελλάδας, Αλέξη Τσίπρα, δείχνουν ότι η σημερινή Ελληνική κυβέρνηση είναι πρόθυμη να ακολουθήσει ακόμα υψηλότερους στόχους, π.χ. 50 % μερίδιο συμμετοχής των ΑΠΕ στο ενεργειακό μείγμα.

Η Εθνική Επιτροπή για την Ενέργεια και το Κλίμα που είναι υπεύθυνη για την εκπόνηση του αντίστοιχου Εθνικού Σχεδίου για την Ελλάδα συστάθηκε μόλις πρόσφατα και πραγματοποίησε την πρώτη της συνεδρίαση την 21^η Φεβρουαρίου 2018. Οι εταίροι του προγράμματος uP_running στην Ελλάδα θα αναζητήσουν ευκαιρίες για να παρουσιάσουν τις δυνατότητες της βιομάζας από μόνιμες καλλιέργειες στις σχετικές υποεπιτροπές, έτσι ώστε να ληφθεί δεόντως υπόψη κατά την ανάπτυξη του νέου πλαισίου Εθνικής πολιτικής.

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Βιοενέργεια για εφαρμογές θέρμανσης

Το σημαντικότερο πρόγραμμα που αφορά την προώθηση των ΑΠΕ και της εξοικονόμησης ενέργειας στον εγχώριο τομέα είναι το «Εξοικονόμηση Κατ' Οίκον», το οποίο συγχρηματοδοτείται από το Ελληνικό Δημόσιο και την Ευρωπαϊκή Ένωση μέσω του Εθνικού Στρατηγικού Πλαισίου Αναφοράς (ΕΣΠΑ). Το πρόγραμμα έχει ως στόχο την προώθηση της ενεργειακής απόδοσης στον οικιακό τομέα παρέχοντας κίνητρα για την εφαρμογή μέτρων εξοικονόμησης ενέργειας.

Το πρόγραμμα στοχεύει κυρίως σε κατοικίες στις χαμηλές ζώνες τιμών και χαμηλής ενεργειακής απόδοσης (κατηγορία μικρότερη ή ίση με D). Ο στόχος εξοικονόμησης από τις παρεμβάσεις του προγράμματος είναι η αύξηση της ενεργειακής κατηγορίας κατά τουλάχιστον μία κατηγορία ή η επίτευξη εξοικονόμησης πρωτογενούς ενέργειας τουλάχιστον κατά 30 % της ενεργειακής κατανάλωσης του κτιρίου αναφοράς.

Μία από τις επιλέξιμες δράσεις στα πλαίσια του Προγράμματος ήταν η αναβάθμιση του συστήματος παραγωγής θέρμανσης και ζεστού νερού μιας επιλέξιμης κατοικίας. Δηλαδή, η εγκατάσταση ενός νέου συστήματος θέρμανσης ΑΠΕ, π.χ. ενός λέβητα βιομάζας, μπορεί να υποστηριχθεί στα πλαίσια αυτής της δράσης.

Το πρόγραμμα ήταν σε αναμονή για αρκετά χρόνια αφού είχε εξαντλήσει όλα τα κονδύλια που του είχαν διατεθεί. Αναμένεται να συνεχιστεί στις αρχές Μαρτίου 2018.

Άλλα προγράμματα που περιλαμβάνονται στο ΕΣΠΑ περιλαμβάνουν την υποστήριξη επιχειρήσεων, δημόσιου τομέα κλπ. για την εγκατάσταση συστημάτων θέρμανσης από βιομάζα. Για παράδειγμα, το Επιχειρησιακό Πρόγραμμα "Περιβάλλον και Αειφόρος Ανάπτυξη" χορήγησε προϋπολογισμό 2 εκατ. ευρώ για την εγκατάσταση συστημάτων βιομάζας σε δημοτικά κτίρια.

Βιομάζα για παραγωγή ηλεκτρικής ενέργειας

Όπως φαίνεται στον Πίνακα 8, η ισχύουσα σήμερα εγκατεστημένη δυναμικότητα βιομάζας (στερεά βιοκαύσιμα + βιοαέριο) στην Ελλάδα ανήλθε σε 61 MW, πολύ κάτω από τους στόχους του έτους 2014 και 2020 των 200 και 350 MW που καθορίστηκαν από την Κοινή Υπουργική Απόφαση 19598. Το Εθνικό Σχέδιο Δράσης για τις Ανανεώσιμες Πηγές Ενέργειας υποδεικνύει επίσης πολύ χαμηλά επίπεδα για τη βιοενέργεια από στερεά βιομάζα: 40 MW έως το 2020, που αντιστοιχεί στο 0.3 % της συνολικής εγκατεστημένης ισχύος ΑΠΕ και 1.3 % της συνολικής παραγωγής ηλεκτρικής ενέργειας από ΑΠΕ.

Λαμβάνοντας υπόψη τους χαμηλούς αυτούς στόχους, δεν αποτελεί έκπληξη το γεγονός ότι οι φορείς χάραξης πολιτικής έχουν δώσει σχετικά μικρή προσοχή στη βιοενέργεια και ότι υπάρχουν ελάχιστα ειδικά μέσα πολιτικής που στοχεύουν στην ανάπτυξη της βιοενέργειας. Παρ' όλα αυτά, έχουν σημειωθεί πρόσφατες κινήσεις στην αγορά, που οφείλονται εν μέρη στο γεγονός ότι η αγορά αιολικής και ηλιακής ενέργειας έχει ωριμάσει και ότι οι επενδυτές εξετάζουν άλλες εναλλακτικές λύσεις.

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Οι προτεινόμενες εγκαταστάσεις νέων σταθμών ηλεκτροπαραγωγής από βιομάζα στην Ελλάδα, ακόμη και εκείνων με σχετικά χαμηλή εγκατεστημένη ισχύ, έχουν συχνά συναντήσει έντονη αντίθεση από τους τοπικούς πληθυσμούς. Προκειμένου να μειωθούν οι εντάσεις, το Υπουργείο Περιβάλλοντος και Ενέργειας πρότεινε πρόσφατα μια τροποποίηση του νόμου που θα απαιτούσε εγκαταστάσεις ηλεκτροπαραγωγής από βιομάζα εγκατεστημένες σε γεωργικές εκτάσεις υψηλής παραγωγικότητας να έχουν ακτίνα προμήθειας, για πρώτες ύλες που προέρχονται από γεωργικές, δασικές ή ζωικές εκμεταλλεύσεις, κατ' ανώτατο όριο 30 χιλιομέτρων. Κίνητρο της τροπολογίας είναι η σύνδεση της ενεργειακής αξιοποίησης της βιομάζας με την τοπική παραγωγή υπολειμμάτων και η αποφυγή της χρήσης της γεωργικής γης για βιομηχανικούς σκοπούς χωρίς να υπάρχει τοπική ανάγκη.

Αγροτική Πολιτική

Η Κοινή Αγροτική Πολιτική (ΚΑΠ) αποτελεί το βασικό νομοθετικό πλαίσιο για τη λειτουργία του αγροτικού τομέα σε όλα τα κράτη μέλη, όπως άλλωστε και στην Ελλάδα. Η ΚΑΠ δεν παρέχει άμεση οικονομική στήριξη στους παραγωγούς για την παραγωγή βιομάζας για ενέργεια. Ωστόσο, η πολιτική αγροτικής ανάπτυξης της ΕΕ περιλαμβάνει μέτρα που αποσκοπούν στην ενθάρρυνση της παραγωγής και χρήσης ΑΠΕ.

Το ισχύον πλαίσιο της ΚΑΠ δεν παρείχε πολλά άμεσα κίνητρα στους παραγωγούς μόνιμων καλλιεργειών ώστε να εξετάσουν την ενεργειακή αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες. Η επικείμενη μεταρρύθμιση της ΚΑΠ μετά το 2020 (οι τελικές αποφάσεις αναμένονται το 2018) θα δημιουργήσει ένα νέο γενικό πλαίσιο· αναμένεται να έχει αντίκτυπο στον τομέα της βιομάζας από μόνιμες καλλιέργειες, αν και η έκτασή του καθώς και το εάν θα είναι θετικό ή αρνητικό είναι ασαφές σε αυτό το σημείο. Ωστόσο, οι συνεχιζόμενες συζητήσεις υπονοούν αυστηρότερες περιβαλλοντικές πολιτικές που ενδέχεται να περιορίσουν σοβαρά την καύση των κλαδεμάτων στην ύπαιθρο και έτσι να προωθήσουν έμμεσα την ενεργειακή τους αξιοποίηση.

Στο εθνικό πλαίσιο, το Πρόγραμμα Αγροτικής Ανάπτυξης 2014-2020 είναι το βασικό εργαλείο για την υποστήριξη της ανάπτυξης του αγροτικού τομέα στην Ελλάδα. Ο συνολικός προϋπολογισμός του προγράμματος ανέρχεται στα 4,7 εκατ. €. Απ' όσο γνωρίζουμε, το Πρόγραμμα δεν περιλαμβάνει δράσεις που στοχεύουν ειδικά στην προώθηση της ενεργειακής αξιοποίησης της βιομάζας από μόνιμες καλλιέργειες⁷, αλλά υπάρχουν δράσεις για την προώθηση των ΑΠΕ στον αγροτικό τομέα. Οι πιο σημαντικές που έχουν προσδιοριστεί μέχρι τώρα είναι οι ακόλουθες:

⁷ Το Υπομέτρο 4.4 του Προγράμματος Αγροτικής Ανάπτυξης προβλέπει επιδότηση 140 ευρώ / εκτάριο στους ελαιοκαλλιεργητές για μια πενταετία. Η επιδότηση προορίζεται για να καλύψει το κόστος αγοράς των τεμαχιστών, των θρυματιστών ή των καταστροφένων για την επεξεργασία των κλαδιών ελιάς που πρόκειται να παραμείνουν στο έδαφος για τουλάχιστον έξι μήνες. Ο σκοπός του υπομέτρου είναι να αποφευχθεί η καύση τους στην ύπαιθρο, μεταυτόχρονη αύξηση του οργανικού άνθρακα του εδάφους. Η αφαίρεση των κλαδεμάτων για ενεργειακή χρήση δεν προβλέπεται από το υπομέτρο. Κατά το χρόνο σύνταξης της παρούσας έκθεσης, αυτό το υπομέτρο δεν είχε ακόμα προκηρυχθεί.

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- **Υπομέτρο 4.1.3**, παροχή στήριξης για επενδύσεις σε ΑΠΕ σε γεωργικές εκμεταλλεύσεις με βάση την κάλυψη των ενεργειακών τους αναγκών, ορθές πρακτικές διαχείρισης των αποβλήτων και υποπροϊόντων και αξιοποίησή τους για την παραγωγή ενέργειας.
- **Μέτρο 16** είναι μια νέα δράση που αποσκοπεί στην προώθηση της καινοτομίας στους τομείς της γεωργίας και των γεωργικών προϊόντων διατροφής. Το Μέτρο προορίζεται για μέλη "επιχειρησιακών ομάδων"⁸. Περιλαμβάνει τα ακόλουθα Υπομέτρα σχετικά με την βιομάζα από μόνιμες καλλιέργειες.
 - **Υπομέτρο 16.1-16.2** προωθεί τη δημιουργία συνεργασίας σε δράσεις που σχετίζονται με την ανάπτυξη νέων προϊόντων, διαδικασιών και τεχνολογιών στον αγροτικό τομέα για την ενίσχυση της ανταγωνιστικότητας των επιχειρήσεων του πρωτογενούς τομέα (γεωργικές εκμεταλλεύσεις) και των επιχειρήσεων τροφίμων. Ο κατάλογος των δράσεων περιλαμβάνει τη χρησιμοποίηση γεωργικών υποπροϊόντων για την παραγωγή ενέργειας.
 - **Υπομέτρο 16.1-16.5** προωθεί τη δημιουργία συνεργασίας για την ανάπτυξη νέων αγροτικών και παραγωγικών πρακτικών με στόχο την προστασία του περιβάλλοντος και την προσαρμογή στην αλλαγή του κλίματος. Ο κατάλογος των ενεργειών περιλαμβάνει τη χρήση ΑΠΕ για τη μείωση χρήσης των ορυκτών καυσίμων.
- **Υπομέτρα 4.2.1, 4.2.2 και 4.2.3** στήριξη επενδύσεων που σχετίζονται με τη μεταποίηση, το εμπόριο ή / και την ανάπτυξη γεωργικών προϊόντων. Οι επενδύσεις σε ΑΠΕ δεν υποστηρίζονται ως αυτόνομες δράσεις, αλλά ως μέρη ενός ολοκληρωμένου επενδυτικού σχεδίου.

Βιοενέργεια και αέριοι ρύποι

Η ποιότητα του αέρα και η επίδραση της χρήσης βιομάζας σε αυτή είναι ένα θέμα που συζητείται συχνά στην Ελλάδα. Κατά τα τελευταία χρόνια και λόγω της οικονομικής κρίσης και της αυξημένης φορολογίας του πετρελαίου θέρμανσης, τα επίπεδα χρήσης βιομάζας για οικιακή θέρμανση έχουν αυξηθεί. Ωστόσο, η αύξηση αυτή οφείλεται σε μεγάλο βαθμό στη χρήση ακατάλληλων συστημάτων θέρμανσης (π.χ. μη σωστά σχεδιασμένα ανοικτά τζάκια και ανεπαρκείς καμινάδες, μη πιστοποιημένοι λέβητες) και καυσίμων χαμηλής ποιότητας (συμπεριλαμβανομένου κλασμάτων απόβλητης ξυλείας). Αυτό οδήγησε στην επανεμφάνιση της αιθαλομίχλης σε πολλά Ελληνικά αστικά κέντρα κατά τη διάρκεια του χειμώνα.

Προκειμένου να ελεγχθεί η αιθαλομίχλη, οι Ελληνικές αρχές ανέλαβαν τα ακόλουθα μέτρα:

- Εκστρατείες ενημέρωσης για την αποφυγή τέτοιων συσκευών και καυσίμων, την προώθηση κατάλληλων πρακτικών εμπορίας καυσόξυλων και την ενημέρωση σχετικά με τις απαιτήσεις CE για συσκευές θέρμανσης.

⁸ Μια «επιχειρησιακή ομάδα» έχει πολλούς συνεργάτες με κοινό ενδιαφέρον για ένα συγκεκριμένο και πρακτικό σχέδιο καινοτομίας. Τα μέλη μιας ομάδας επιχειρήσεων πρέπει να προέρχονται από διάφορους τομείς, όπως η πρωτογενής παραγωγή (π.χ. αγρότες), οι επιχειρήσεις και η έρευνα (π.χ. επιστήμονες).

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- Μειωμένους λογαριασμούς ηλεκτρικού ρεύματος για οικιακούς καταναλωτές κατά τη διάρκεια των ημερών αιθαλομίχλης για να προωθηθούν λύσεις ηλεκτρικής θέρμανσης
- Καθιέρωση απαιτήσεων για όλους τους τύπους στερεών βιοκαυσίμων για μη βιομηχανική χρήση και δημιουργία μηχανισμών παρακολούθησης της αγοράς.

Επιπλέον, ο νόμος σχετικά με τα συστήματα κεντρικής θέρμανσης απαιτεί οι λέβητες βιομάζας (έως 500 kW) να συμμορφώνονται με τις απαιτήσεις ορίων απόδοσης και εκπομπών της Κλάσης 3 του Ευρωπαϊκού προτύπου EN 303-5. Ωστόσο, η επιβολή ελέγχων είναι σπάνια και πολλοί λέβητες βιομάζας που διατίθενται στην ελληνική αγορά δεν είναι πιστοποιημένοι.

Στην Ελλάδα, όπως και σε όλα τα κράτη μέλη, οι εγκαταστάσεις βιομάζας με ονομαστική θερμική ισχύ από 1 έως 50 MW πρέπει να συμμορφώνονται με τα όρια εκπομπών της Οδηγίας 2015/2193 (ΕΕ) για μονάδες καύσης μεσαίας δυναμικότητας. Για μεγαλύτερες εγκαταστάσεις ισχύουν τα όρια της Οδηγίας για τις βιομηχανικές εκπομπές 2010/75/ΕΕ. Υπάρχει σήμερα ένα κανονιστικό / νομοθετικό κενό - τόσο στην Ελλάδα όσο και σε επίπεδο ΕΕ - για τα όρια εκπομπών των εγκαταστάσεων που κυμαίνονται από 500 kW έως 1 MW· αυτό μπορεί να είναι πολύ σημαντικό για τα συστήματα θέρμανσης που λειτουργούν με βιομάζα από μόνιμες καλλιέργειες.

Βιοενέργεια και έρευνα / καινοτομία

Υπάρχουν αρκετά εθνικά χρηματοδοτούμενα προγράμματα έρευνας και καινοτομίας που θα μπορούσαν να υποστηρίξουν δραστηριότητες που σχετίζονται με τη βιομάζα και τη βιοενέργεια. Για παράδειγμα, το πρόγραμμα "ΕΡΕΥΝΩ-ΔΗΜΙΟΥΡΓΩ-ΚΑΙΝΟΤΟΜΩ" συγχρηματοδοτείται από την Ευρωπαϊκή Ένωση και την Ελληνική κυβέρνηση για την περίοδο 2014-2020. Σκοπός του προγράμματος είναι η σύνδεση της έρευνας και της καινοτομίας με τις Ελληνικές βιομηχανίες. Η διαθέσιμη επιχορήγηση για προτάσεις σχετικά με την ενέργεια και το περιβάλλον και την αειφορία είναι 31 εκατ. € και 40 εκατ. € αντίστοιχα.

Η βιομάζα από μόνιμες καλλιέργειες στην πολιτική ατζέντα

Με βάση τις διαθέσιμες πληροφορίες καθώς και κατά την άποψη του ΕΚΕΤΑ, όπως διαμορφώθηκε μετά από συζητήσεις, συνεντεύξεις και ημερίδες με πολλούς ενδιαφερόμενους και τη μελέτη υλικού διαθέσιμου στο ευρύ κοινό, μπορεί να εξαχθεί το συμπέρασμα ότι η ενεργειακή αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες πρακτικά απουσιάζει από την εθνική πολιτική ατζέντα ως στρατηγικός στόχος. Περιστασιακά, πραγματοποιούνται δημόσιες δηλώσεις που αναφέρουν την αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες, αλλά δεν υποστηρίζονται από συγκεκριμένα μέτρα πολιτικής που στοχεύουν τον τομέα. Επιπλέον, γενικότερα ο τομέας της βιομάζας είναι σε χαμηλό επίπεδο ανάπτυξης και δε λαμβάνει επαρκή πολιτική στήριξη.

Σε περιφερειακό επίπεδο, η βιομάζα από μόνιμες καλλιέργειες τυγχάνει μεγαλύτερης προσοχής και μερικές φορές αναφέρεται σε σχέδια περιφερειακής ανάπτυξης ή σχέδια διαχείρισης αποβλήτων. Και πάλι όμως, πραγματοποιούνται ελάχιστες δράσεις για την υποστήριξη της αξιοποίησής της.

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Οι δραστηριότητες του προγράμματος uP_running στην Ελλάδα αποσκοπούν στην καλύτερη προβολή του τομέα βιομάζας από μόνιμες καλλιέργειες και των δυνατοτήτων του. Ήδη, τον Ιούλιο του 2017 υπογράφηκε κοινό μνημόνιο για την προώθηση της βιομάζας από μόνιμες καλλιέργειες από εκπροσώπους της Περιφέρειας Πελοποννήσου, των Δημοτικών Αρχών στην Περιφερειακή Ενότητα Λακωνίας και πολλούς αγροτικούς συνεταιρισμούς της περιοχής. Πρόκειται για ένα πρώτο βήμα προς την εφαρμογή πιο συγκεκριμένων μέτρων.

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Ε. Σύνοψη μιας βασικής SWOT ανάλυσης

Ο παρακάτω πίνακας συνοψίζει μια βασική SWOT ανάλυση για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις στην Ελλάδα. Ένας διακριτός "τομέας βιομάζας από μόνιμες καλλιέργειες" είναι στην πραγματικότητα ανύπαρκτος, δεδομένου ότι το πραγματικό επίπεδο χρησιμοποίησης αυτού του τύπου βιομάζας είναι πρακτικά μηδενικό, με εξαίρεση τα κλάσματα που χρησιμοποιούνται ως καυσόξυλα. Ως εκ τούτου, οι παράγοντες της SWOT ανάλυσης (δυνατά σημεία, αδυναμίες, ευκαιρίες, απειλές) είναι πιο σχετικοί με τους ακόλουθους βασικούς τομείς:

- Αγροτικός τομέας, συμπεριλαμβανομένων των αγροτών και των γεωργικών ενώσεων, που καλλιεργούν μόνιμες καλλιέργειες.
- Βιομηχανικός τομέας, ιδίως ο αγροτοβιομηχανικός τομέας που χρησιμοποιεί ως πρώτες ύλες φυτικά προϊόντα από μόνιμες καλλιέργειες (π.χ. ελαιοτριβεία, ελαιουργεία, οινοποιεία, κονσερβοποιεία κλπ.).
- Ενεργειακός τομέας (π.χ. επιχειρήσεις κοινής ωφέλειας, μονάδες παραγωγής ηλεκτρικής ενέργειας, ESCO) και τελικούς χρήστες.

Οι Αδυναμίες και τα Δυνατά σημεία είναι όλα εγγενή χαρακτηριστικά στον τομέα που αναλύεται. Από την άλλη πλευρά, οι Απειλές και Ευκαιρίες αποτελούν εξωτερικούς παράγοντες για την ανάπτυξη του κλάδου βιομάζας από αγροτικά κλαδέματα και εκριζώσεις.

ΔΥΝΑΤΑ ΣΗΜΕΙΑ (STRENGTHS – “S”)

- S1. Μεγάλο δυναμικό της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε εθνικό επίπεδο.
- S2. Μεγάλες εκτάσεις καλλιεργούμενες με φυτείες μόνιμων καλλιεργειών σε διάφορες τοποθεσίες στην Ελλάδα.
- S3. Ο γεωργικός τομέας είναι μια βασική οικονομική δραστηριότητα στην Ελλάδα, με μεγάλες δυνατότητες επηρεασμού των κυβερνητικών αποφάσεων.
- S4. Η ενεργειακή αξιοποίηση των κλαδεμάτων μπορεί να βοηθήσει τους αγρότες να εξοικονομήσουν χρόνο και εισόδημα που θα χρησιμοποιούσαν για τη διαχείριση των υπολειμμάτων.
- S5. Τα οφέλη της αξιοποίησης της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις είναι εύκολο να παρατηρηθούν σε τοπικές συνθήκες (π.χ. αποφυγή εκπομπών και ρύπανσης από πυρκαγιές σε ανοικτό πεδίο, εξοικονόμηση κόστους που επιτυγχάνεται στη διαχείριση αγροτικών κλαδεμάτων και εκριζώσεων, εξοικονόμηση ορυκτών καυσίμων κλπ.).
- S6. Αγροτοβιομηχανίες που συνεργάζονται στενά με τους καλλιεργητές μόνιμων καλλιεργειών είναι παρούσες (ελαιοτριβεία, ελαιουργεία, κονσερβοποιεία) και μπορούν να χρησιμεύσουν ως καταναλωτές ή ενδιάμεσα κέντρα εφοδιαστικής για την βιομάζα από κλαδέματα και εκριζώσεις.
- S7. Ύπαρξη τοπικών αλυσίδων αξιών βιομάζας (π.χ. πυρηνόξυλο, κελύφη ξηρών καρπών, καυσόξυλα από μόνιμες καλλιέργειες) που θα μπορούσαν να χρησιμοποιηθούν για την προώθηση της χρήσης της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις.
- S8. Λέβητες βιομάζας και συστήματα καύσης ικανά να χειρίζονται τα αγροτικά κλαδέματα και τις εκριζώσεις είναι επίσης ικανά για την καύση άλλων τύπων βιομάζας, ενισχύοντας έτσι την ασφάλεια του εφοδιασμού.
- S9. Η αντικατάσταση των ορυκτών καυσίμων (π.χ. πετρελαίου θέρμανσης) με βιομάζα για εφαρμογές θέρμανσης μπορεί να έχει σύντομο χρόνο αποπληρωμής.
- S10. Σε σύγκριση με τα ορυκτά καύσιμα, η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις οδηγεί σε μείωση των εκπομπών αερίων του θερμοκηπίου. Η μείωση μπορεί να είναι υψηλότερη από τη χρήση άλλων τύπων βιομάζας.

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S11. Σε σύγκριση με άλλα υπολείμματα του γεωργικού τομέα (π.χ. άχυρο) δεν υπάρχουν πολλές ή ακόμη και καμία ανταγωνιστική χρήση για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις. Η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις είναι επίσης άμεσα διαθέσιμη και όχι μια πιθανή μελλοντική πραγματικότητα (όπως οι ενεργειακές καλλιέργειες).

ΑΔΥΝΑΜΙΕΣ (WEAKNESSES – “W”)

- W1. Οι μικρές εκμεταλλεύσεις περιορίζουν το ποσό της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις που μπορεί να φέρει ένας μεμονωμένος γεωργός στην αγορά.
- W2. Περισσότερες αβεβαιότητες στις πρωτοβουλίες που επικεντρώνονται στην βιομάζα από αγροτικά κλαδέματα και εκριζώσεις σημαίνουν δυσκολίες στην προσέλκυση κεφαλαίων από τράπεζες ή από τον ιδιωτικό τομέα.
- W3. Μηχανήματα για τη συγκομιδή της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις δεν είναι πολύ γνωστά, δίδεται μεγαλύτερη έμφαση σε μηχανήματα που μπορούν να διαχειριστούν γρήγορα τα αγροτικά κλαδέματα και τις εκριζώσεις (π.χ. τεμαχιστές, καταστροφείς)
- W4. Δεν είναι εύκολο να οργανωθεί η συνεταιριστική ιδιοκτησία γεωργικών μηχανημάτων που απαιτούνται για τη συγκομιδή των κλαδεμάτων
- W5. Δυσκολία να πειστούν ορισμένοι αγρότες να δεχτούν εξωτερικές εταιρείες για μηχανοποιημένες εργασίες στα χωράφια τους.
- W6. Λίγοι κατασκευαστές στην Ελλάδα παράγουν μηχανήματα ικανά να συλλέγουν βιομάζα από αγροτικά κλαδέματα και εκριζώσεις.
- W7. Η ανοικτή καύση των αγροτικών κλαδεμάτων και εκριζώσεων είναι μια πρακτική που γίνεται ανεκτή από τις τοπικές και εθνικές αρχές
- W8. Χαμηλότερη ποιότητα καυσίμων της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε σύγκριση με τη δασική βιομάζα ξύλου, η οποία επηρεάζει την λειτουργική και περιβαλλοντική συμπεριφορά των συστημάτων καύσης.
- W9. Η αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις απαιτεί συγκεκριμένες τεχνολογίες καύσης
- W10. Δεν υπάρχει σύστημα τυποποίησης / πιστοποίησης καυσίμων για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις
- W11. Οι φυτοϋγειονομικές πρακτικές μπορεί να επηρεάσουν τις ιδιότητες καυσίμων της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις (π.χ. αυξημένη περιεκτικότητα σε χαλκό λόγω ραντισμάτων)
- W12. Έλλειψη γνώσεων σχετικά με τις δυνατότητες αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων
- W13. Δεν υπάρχουν επιτυχείς περιπτώσεις προς μίμηση στην Ελλάδα
- W14. Η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις δεν εξετάζεται ρητά στο εθνικό σχέδιο δράσης για τις ανανεώσιμες πηγές ενέργειας
- W15. Εκτιμήσεις σχετικά με το δυναμικό βιομάζας από αγροτικά κλαδέματα και εκριζώσεις με βάση τις γενικές τιμές της βιβλιογραφίας, οι οποίες μπορεί να μην έχουν σχέση με τις τοπικές ιδιαιτερότητες
- W16. Η διαχείριση των κλαδεμάτων από αγροτικά κλαδέματα και εκριζώσεις είναι ένα δευτερεύον ζήτημα για τους αγρότες, οι οποίοι επικεντρώνονται στην παραγωγή των κύριων γεωργικών προϊόντων
- W17. Οι γεωργοί ενδιαφέρονται περισσότερο για την ταχεία διάθεση των αγροτικών κλαδεμάτων και εκριζώσεων και έχουν απροθυμία στο να υιοθετήσουν πρακτικές (π.χ. ξήρανση στο χωράφι) που μπορεί να έχουν θετικό αντίκτυπο στην ποιότητα
- W18. Η χαμηλή παραγωγικότητα αγροτικών κλαδεμάτων και εκριζώσεων (σε τόνους / εκτάριο) σε ορισμένες περιπτώσεις μπορεί να επηρεάσει τα οικονομικά της αλυσίδας αξίας
- W19. Το κόστος της αλυσίδας αξίας μπορεί να είναι υψηλό και επομένως η κερδοφορία μιας πρωτοβουλίας αγροτικών κλαδεμάτων και εκριζώσεων μπορεί να είναι περιορισμένη

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W20. Περιορισμένη αγορά μη συμβατικής βιομάζας (όπως η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις) και σχεδόν κανένας μεγάλος καταναλωτής μεγάλης κλίμακας βιομάζας για την "απογείωση" της αγοράς

W21. Οι τομείς της γεωργίας και της ενέργειας δεν είναι καλά συνδεδεμένοι

ΕΥΚΑΙΡΙΕΣ (OPPORTUNITIES – “Ο”)

- O1. Οι αγρότες ενδιαφέρονται να διερευνήσουν νέες πηγές εισοδήματος (ή να μειώσουν το κόστος και να εξετάσουν τις ευκαιρίες που προσφέρει η βιομάζα.
- O2. Η αυξημένη φορολογία και το υψηλό κόστος των ορυκτών καυσίμων για θέρμανση έχουν δημιουργήσει ενδιαφέρον για τα καύσιμα βιομάζας
- O3. Οι βιομηχανίες ενδιαφέρονται για τη μείωση του ενεργειακού κόστους και λαμβάνουν υπ' όψη τα καύσιμα βιομάζας
- O4. Επέκταση του συστήματος πιστοποίησης BIOmasud® από βιομάζα κλαδεμάτων ελαιόδεντρων και αμπελώνων
- O5. Δυνατότητες χρηματοδότησης από τοπικές, εθνικές και κοινοτικές πηγές (π.χ. Πρόγραμμα Αγροτικής Ανάπτυξης, ΕΣΠΑ, κ.λπ.)
- O6. Λόγω της χρηματοπιστωτικής κρίσης, οι καταναλωτές δείχνουν αυξημένο ενδιαφέρον για τοπικές πρώτες ύλες και πόρους.
- O7. Οι αγροτοβιομηχανίες ενδιαφέρονται να αναπτύξουν μια "πράσινη" εικόνα και να αποκτήσουν πιστοποίηση ουδετερότητας CO₂, χρησιμοποιώντας υποπροϊόντα και υπολείμματα.
- O8. Οι γεωργοί, οι τοπικές αρχές και άλλοι ενδιαφερόμενοι φορείς αναγνωρίζουν ότι η καύση υπολειμμάτων σε ανοικτό πεδίο είναι μια πρακτική που θα μπορούσε να τεθεί εκτός νόμου στο μέλλον
- O9. Οι νέοι κανονισμοί και οδηγίες της ΕΕ (π.χ. RED2) ευνοούν έμμεσα τη χρησιμοποίηση τοπικών πόρων, όπως η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις
- O10. Η κυκλική οικονομία και η αγροτική ανάπτυξη εντάσσονται στην πολιτική ατζέντα
- O11. Ύπαρξη μηχανισμού ενίσχυσης της ηλεκτροπαραγωγής από βιομάζα
- O12. Ενδιαφέρον για τη ηλεκτρική ενέργεια από βιομάζα λόγω του κορεσμού των άλλων ανανεώσιμων πηγών ενέργειας (π.χ. ηλιακή ενέργεια, αιολική ενέργεια κ.λπ.)
- O13. Νέες μορφές συλλογικών / συνεργατικών / συνεταιριστικών ενεργειακών έργων σε ανοδική πορεία (π.χ. ενεργειακοί συνεταιρισμοί)

ΑΠΕΙΛΕΣ (THREATS – “Τ”)

- T1. Παράλογες προσδοκίες (πολύ υψηλές αποδόσεις, παραγωγή υψηλής ποιότητας ξύλινων σφαιριδίων από αγροτικά κλαδέματα και εκριζώσεις) μπορεί να οδηγήσουν σε αποτυχίες νέων πρωτοβουλιών λόγω εσφαλμένης εκτίμησης του κόστους ή του δυναμικού της αγοράς.
- T2. Η ανάπτυξη της ελληνικής αγοράς βιομάζας επικεντρώνεται στις πελλέτες και όχι στην τεμαχισμένη βιομάζα.
- T3. Φτηνά, χαμηλής ποιότητας καύσιμα βιομάζας που διατίθενται στην αγορά και περιορισμένος έλεγχος ή γνώση σχετικά με τις επιπτώσεις των ιδιοτήτων των καυσίμων.
- T4. Ο υψηλός ΦΠΑ των στερεών βιοκαυσίμων στην Ελλάδα (24%) δημιουργεί προβλήματα στην ανάπτυξη νέων πρωτοβουλιών.
- T5. Η χρηματοπιστωτική κρίση περιορίζει τις επενδύσεις και καθιστά τις συνθήκες της αγοράς επισφαλείς.

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- T6. Οι βραχυπρόθεσμες μειώσεις της τιμής του πετρελαίου θέρμανσης αποθαρρύνουν τους πιθανούς χρήστες.
- T7. Οι πολιτικές της ΕΕ ενδέχεται να δημιουργήσουν αρνητικές συνθήκες για τη βιομάζα από αγροτικά κλαδέματα και εκριζώσεις (π.χ. μη συμμόρφωση με όρια εκπομπών αν θεωρεί ως ξυλώδης βιομάζα από τον Κανονισμό Ecodesign, απαίτηση για υψηλό ηλεκτρικό βαθμό απόδοσης από την Οδηγία RED2 κ.λπ.)
- T8. Μη ευνοϊκή δημόσια αντίληψη για τη βιομάζα λόγω του καπνού που σχηματίζεται από κακή καύση καυσόξυλων τόσο στις αστικές όσο και στις αγροτικές περιοχές.
- T9. Ανακολουθίες στον πολιτικό σχεδιασμό και καθόλου σαφείς μεσοπρόθεσμοι / μακροπρόθεσμοι στόχοι
- T10. Η εναλλακτική χρησιμοποίηση των αγροτικών κλαδεμάτων και εκριζώσεων (π.χ. η εδαφοκάλυψη) αυξάνεται.

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ΣΤΡΑΤΗΓΙΚΟ ΣΧΕΔΙΟ

SO Στρατηγικές (Στρατηγικές που χρησιμοποιούν τα Δυνατά σημεία, προκειμένου να επωφεληθούν από τις Ευκαιρίες). Αυτές είναι οι στρατηγικές τύπου max-max, με την έννοια ότι συνδυάζουν τα πιο ευνοϊκά στοιχεία για την οικοδόμηση μιας στρατηγικής. Οι SO στρατηγικές χρησιμοποιούν τα δυνατά και ισχυρά στοιχεία προκειμένου να επωφεληθούν από τις εξωτερικές ευκαιρίες. Η στρατηγική γίνεται δυναμική και επιθετική (επίθεση).

① Ενημέρωση και εκπαίδευση των αγροτών για τα οφέλη της ενεργειακής αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων	
Στρατηγική: Δυνατά σημεία + Ευκαιρίες → SO «Επίθεση»	
S4. Η ενεργειακή αξιοποίηση των κλαδεμάτων μπορεί να βοηθήσει τους αγρότες να εξοικονομήσουν χρόνο και εισόδημα που θα χρησιμοποιούσαν για τη διαχείριση των υπολειμμάτων S5. Τα οφέλη της αξιοποίησης της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις είναι εύκολο να παρατηρηθούν σε τοπικές συνθήκες (π.χ. αποφυγή εκπομπών και ρύπανσης από πυρκαγιές σε ανοικτό πεδίο, εξοικονόμηση κόστους που επιτυγχάνεται στη διαχείριση αγροτικών κλαδεμάτων και εκριζώσεων, εξοικονόμηση ορυκτών καυσίμων κλπ.)	O1. Οι αγρότες ενδιαφέρονται να διερευνήσουν νέες πηγές εισοδήματος (ή να μειώσουν το κόστος) και να εξετάσουν τις ευκαιρίες που προσφέρει η βιομάζα O7. Οι αγροτοβιομηχανίες ενδιαφέρονται να αναπτύξουν μια "πράσινη" εικόνα και να αποκτήσουν πιστοποίηση ουδέτερου CO₂, χρησιμοποιώντας υποπροϊόντα και υπολείμματα O8. Οι γεωργοί, οι τοπικές αρχές και άλλοι ενδιαφερόμενοι φορείς αναγνωρίζουν ότι η καύση υπολειμμάτων σε ανοικτό πεδίο είναι μια πρακτική που θα μπορούσε να τεθεί εκτός νόμου στο μέλλον
Αντικείμενα SO1. Να πειστούν αγρότες για τα οφέλη που μπορεί να προσφέρει η ενεργειακή αξιοποίηση των αγροτικών κλαδεμάτων και οι εκριζώσεις	
Ενέργειες/Δραστηριότητες - Ενημέρωση των αγροτών αγρότες για το τα περιορισμένα οφέλη από τη χρήση βιομάζας από αγροτικά κλαδέματα και εκριζώσεις για λίπανση του εδάφους. - Προετοιμασία απλών αλλά πραγματικών μεγεθών σχετικά με τα οφέλη της αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων (π.χ. εξοικονόμηση κόστους / χρόνου, εξοικονόμηση εκπομπών κ.λπ.) - Διοργάνωση συναντήσεων εργασίας, εκδηλώσεων κατάρτισης, κ.λπ. - Δημιουργία μόνιμης υποστήριξης (π.χ. μέσω κατάρτισης συμβούλων) σε αγρότες / συνεταιρισμούς που ενδιαφέρονται για την ανάπτυξη αλυσίδων αξίας από αγροτικά κλαδέματα και εκριζώσεις.	

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② Ανάπτυξη των αγροτικών βιομηχανιών ως καταναλωτές βιομάζας μόνιμων καλλιεργειών και παραγωγούς ενδιάμεσων προϊόντων

Στρατηγική: Δυνατά σημεία + Ευκαιρίες → SO «Επίθεση»

S6. Αγροτοβιομηχανίες που συνεργάζονται στενά με τους καλλιεργητές μόνιμων καλλιεργειών είναι παρούσες (ελαιοτριβεία, ελαιουργεία, κονσερβοποιεία) και μπορούν να χρησιμεύσουν ως καταναλωτές ή ενδιάμεσα κέντρα εφοδιαστικής για την βιομάζα από κλαδέματα και εκριζώσεις S7. Ύπαρξη τοπικών αλυσίδων αξιών βιομάζας (π.χ. πυρηνόξυλο, κελύφη ξηρών καρπών, καυσόξυλα από μόνιμες καλλιέργειες) που θα μπορούσαν να χρησιμοποιηθούν για την προώθηση της χρήσης της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις. S8. Λέβητες βιομάζας και συστήματα καύσης ικανά να χειρίζονται τα αγροτικά κλαδέματα και τις εκριζώσεις είναι επίσης ικανά για την καύση άλλων τύπων βιομάζας, ενισχύοντας έτσι την ασφάλεια του εφοδιασμού. S9. Η αντικατάσταση των ορυκτών καυσίμων (π.χ. πετρελαίου θέρμανσης) με βιομάζα για εφαρμογές θέρμανσης μπορεί να έχει σύντομο χρόνο αποπληρωμής S10. Σε σύγκριση με τα ορυκτά καύσιμα, η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις οδηγεί σε μείωση των εκπομπών αερίων του θερμοκηπίου. Η μείωση μπορεί να είναι υψηλότερη από τη χρήση άλλων τύπων βιομάζας S11. Σε σύγκριση με άλλα υπολείμματα του γεωργικού τομέα (π.χ. άχυρο) δεν υπάρχουν πολλές ή ακόμη και καμία ανταγωνιστική χρήση για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις. Η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις είναι επίσης άμεσα διαθέσιμη και όχι μια πιθανή μελλοντική πραγματικότητα (όπως οι ενεργειακές καλλιέργειες)	O2. Η αυξημένη φορολογία και το υψηλό κόστος των ορυκτών καυσίμων για θέρμανση έχουν δημιουργήσει ενδιαφέρον για τα καύσιμα βιομάζας O3. Οι βιομηχανίες ενδιαφέρονται για τη μείωση του ενεργειακού κόστους και λαμβάνουν υπ' όψη τα καύσιμα βιομάζας O4. Επέκταση του συστήματος πιστοποίησης BIOmasud® από βιομάζα κλαδεμάτων ελαιοδέντρων και αμπελώνων O5. Δυνατότητες χρηματοδότησης από τοπικές, εθνικές και κοινοτικές πηγές (π.χ. Πρόγραμμα Αγροτικής Ανάπτυξης, ΕΣΠΑ, κ.λπ.) O6. Λόγω της χρηματοπιστωτικής κρίσης, οι καταναλωτές δείχνουν αυξημένο ενδιαφέρον για τοπικές πρώτες ύλες και πόρους O7. Οι αγροτοβιομηχανίες ενδιαφέρονται να αναπτύξουν μια "πράσινη" εικόνα και να αποκτήσουν πιστοποίηση ουδέτερου CO₂, χρησιμοποιώντας υποπροϊόντα και υπολείμματα O11. Ύπαρξη μηχανισμού ενίσχυσης της ηλεκτροπαραγωγής από βιομάζα O12. Ενδιαφέρον για τη ηλεκτρική ενέργεια από βιομάζα λόγω του κορεσμού των άλλων ανανεώσιμων πηγών ενέργειας (π.χ. ηλιακή ενέργεια, αιολική ενέργεια κ.λπ.)

Αντικείμενα

- SO1. Να δημιουργηθούν πραγματικές μορφές συνεργασίας μεταξύ της γεωργίας και των αγροτοβιομηχανιών, μετασχηματίζοντας τις αγροτοβιομηχανίες σε μείζονες τελικούς χρήστες και / ή ενδιάμεσα κέντρα εφοδιαστικής για βιομάζα από αγροτικά κλαδέματα και εκριζώσεις.

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② Ανάπτυξη των αγροτικών βιομηχανιών ως καταναλωτές βιομάζας μόνιμων καλλιεργειών και παραγωγούς ενδιάμεσων προϊόντων

Στρατηγική: Δυνατά σημεία + Ευκαιρίες → SO «Επίθεση»

Ενέργειες/Δραστηριότητες

- Διερεύνηση των επιχειρήσεων και των μοντέλων των εφοδιαστικών αλυσίδων που κάνουν χρήση της παρουσίας των αγροτοβιομηχανιών σε γεωργικές εκτάσεις με μόνιμες καλλιέργειες.
- Χρήση ευκαιριών και υπάρχουσών υποδομών των αγροτοβιομηχανιών (π.χ. αποθήκη, στεγνωτήρια, συστήματα μετατροπής ενέργειας) σε αλυσίδες αξίας των κλαδεμάτων και εκριζώσεων
- Υποστήριξη της ανάπτυξης μονάδων ηλεκτροπαραγωγής με χρήση βιομάζας από μόνιμες καλλιέργειες
- Διοργάνωση επιχειρηματικών συναντήσεων (match-making) μεταξύ πιθανών φορέων της αλυσίδας αξίας και προμηθευτών εξοπλισμού

③ Προώθηση άμεσων και έμμεσων ωφελειών αξιοποίησης βιομάζας από μόνιμες καλλιέργειες

Στρατηγική: Δυνατά σημεία + Ευκαιρίες → SO «Επίθεση»

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③ Προώθηση άμεσων και έμμεσων ωφελειών αξιοποίησης βιομάζας από μόνιμες καλλιέργειες Στρατηγική: Δυνατά σημεία + Ευκαιρίες → SO «Επίθεση»	
S1. Μεγάλη δυναμική της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε εθνικό επίπεδο S2. Μεγάλες εκτάσεις καλλιεργούμενες με φυτείες μόνιμων καλλιεργειών σε διάφορες τοποθεσίες στην Ελλάδα. S3. Ο γεωργικός τομέας είναι μια κύρια οικονομική δραστηριότητα στην Ελλάδα, με μεγάλες δυνατότητες επηρεασμού των κυβερνητικών αποφάσεων. S4. Η ενεργειακή αξιοποίηση των κλαδεμάτων μπορεί να βοηθήσει τους αγρότες να εξοικονομήσουν χρόνο και εισόδημα που θα χρησιμοποιούσαν για τη διαχείριση των υπολειμμάτων S5. Τα οφέλη της αξιοποίησης της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις είναι εύκολο να παρατηρηθούν σε τοπικές συνθήκες (π.χ. αποφυγή εκπομπών και ρύπανσης από πυρκαγιές σε ανοικτό πεδίο, εξοικονόμηση κόστους που επιτυγχάνεται στη διαχείριση αγροτικών κλαδεμάτων και εκριζώσεων, εξοικονόμηση ορυκτών καυσίμων κλπ.). S9. Η αντικατάσταση των ορυκτών καυσίμων (π.χ. πετρέλαιο θέρμανσης) με βιομάζα για εφαρμογές θέρμανσης μπορεί να έχει μικρό χρόνο αποπληρωμής. S10. Σε σύγκριση με τα ορυκτά καύσιμα, η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις οδηγεί σε μείωση των εκπομπών αερίων του θερμοκηπίου. Η μείωση μπορεί να είναι υψηλότερη από τη χρήση άλλων τύπων βιομάζας. S11. Σε σύγκριση με άλλα υπολείμματα του γεωργικού τομέα (π.χ. άχυρο) δεν υπάρχουν πολλές ή ακόμη και καμία ανταγωνιστική χρήση για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις. Η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις είναι επίσης άμεσα διαθέσιμη και όχι μια πιθανή μελλοντική πραγματικότητα (όπως οι ενεργειακές καλλιέργειες).	O1. Οι αγρότες ενδιαφέρονται να διερευνήσουν νέες πηγές εισοδήματος (ή να μειώσουν το κόστος) και να εξετάσουν ευκαιρίες βιομάζας. O2. Η αυξημένη φορολογία και το υψηλό κόστος των ορυκτών καυσίμων για θέρμανση έχουν δημιουργήσει ενδιαφέρον για τα καύσιμα βιομάζας O3. Οι βιομηχανίες ενδιαφέρονται για τη μείωση του ενεργειακού κόστους και λαμβάνουν υπ' όψη τα καύσιμα βιομάζας O6. Λόγω της χρηματοπιστωτικής κρίσης, οι καταναλωτές δείχνουν αυξημένο ενδιαφέρον για τοπικές πρώτες ύλες και πόρους O7. Οι αγροτοβιομηχανίες ενδιαφέρονται να αναπτύξουν μια "πράσινη" εικόνα και να αποκτήσουν πιστοποίηση ουδέτερου CO₂, χρησιμοποιώντας υποπροϊόντα και υπολείμματα O8. Οι γεωργοί, οι τοπικές αρχές και άλλοι ενδιαφερόμενοι φορείς αναγνωρίζουν ότι η καύση υπολειμμάτων σε ανοικτό πεδίο είναι μια πρακτική που θα μπορούσε να τεθεί εκτός νόμου στο μέλλον O9. Οι νέοι κανονισμοί και οδηγίες της ΕΕ (π.χ. RED2) ευνοούν έμμεσα τη χρησιμοποίηση τοπικών πόρων, όπως η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις O10. Η κυκλική οικονομία και η αγροτική ανάπτυξη εντάσσονται στην πολιτική ατζέντα
Αντικείμενα SO1. Στρατηγική τοποθέτηση της βιομάζας από μόνιμες καλλιέργειες ως μέσο για την βελτίωση της ανταγωνιστικότητας της Ελληνικής οικονομίας. SO2. Να επισημανθούν έμμεσα, άυλα οφέλη της αξιοποίησης της βιομάζας από μόνιμες καλλιέργειες, όπως η βελτίωση της ποιότητας ζωής και η συμμόρφωση με τους κανονισμούς της ΕΕ.	

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③ Προώθηση άμεσων και έμμεσων ωφελειών αξιοποίησης βιομάζας από μόνιμες καλλιέργειες

Στρατηγική: Δυνατά σημεία + Ευκαιρίες → SO «Επίθεση»

Ενέργειες/Δραστηριότητες

- Αναγνώριση και μετάδοση των πλεονεκτημάτων – άμεσων και έμμεσων - της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις.
- Παρουσίαση και ποσοτικοποίηση της ικανότητας της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις να βελτιώσει την ποιότητα του αέρα τοπικά.
- Συνδυασμός της αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων με την ανάπτυξη μιας «πράσινης» εικόνας για τα Ελληνικά γεωργικά προϊόντα στην Ευρωπαϊκή και την παγκόσμια αγορά.

④ Προώθηση της χρήσης βιομάζας από μόνιμες καλλιέργειες στην ηλεκτροπαραγωγή

Στρατηγική: Δυνατά σημεία + Ευκαιρίες → SO «Επίθεση»

	Έγγραφο:	Ανάλυση Τομέα και Στρατηγικό Σχέδιο για τη βιομάζα από μόνιμες καλλιέργειες στην Ελλάδα		
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	Αναφορά:		Ημερομηνία:	28/02/2018

④ Προώθηση της χρήσης βιομάζας από μόνιμες καλλιέργειες στην ηλεκτροπαραγωγή

Στρατηγική: Δυνατά σημεία + Ευκαιρίες → SO «Επίθεση»

S1. Μεγάλη δυναμική της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε εθνικό επίπεδο. S2. Μεγάλες εκτάσεις καλλιεργούμενες με φυτείες μόνιμων καλλιεργειών σε διάφορες τοποθεσίες στην Ελλάδα. S4. Η ενεργειακή αξιοποίηση των κλαδεμάτων μπορεί να βοηθήσει τους αγρότες να εξοικονομήσουν χρόνο και εισόδημα που θα χρησιμοποιούσαν για τη διαχείριση των υπολειμμάτων S5. Τα οφέλη της αξιοποίησης της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις είναι εύκολο να παρατηρηθούν σε τοπικές συνθήκες (π.χ. αποφυγή εκπομπών και ρύπανσης από πυρκαγιές σε ανοικτό πεδίο, εξοικονόμηση κόστους που επιτυγχάνεται στη διαχείριση αγροτικών κλαδεμάτων και εκριζώσεων, εξοικονόμηση ορυκτών καυσίμων κλπ.). S10. Σε σύγκριση με τα ορυκτά καύσιμα, η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις οδηγεί σε μείωση των εκπομπών αερίων του θερμοκηπίου. Η μείωση μπορεί να είναι υψηλότερη από τη χρήση άλλων τύπων βιομάζας. S11. Σε σύγκριση με άλλα υπολείμματα του γεωργικού τομέα (π.χ. άχυρο) δεν υπάρχουν πολλές ή ακόμη και καμία ανταγωνιστική χρήση για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις. Η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις είναι επίσης άμεσα διαθέσιμη και όχι μια πιθανή μελλοντική πραγματικότητα (όπως οι ενεργειακές καλλιέργειες)	O1. Οι αγρότες ενδιαφέρονται να διερευνήσουν νέες πηγές εισοδήματος (ή να μειώσουν το κόστος) και να εξετάσουν ευκαιρίες βιομάζας. O9. Οι νέοι κανονισμοί και οδηγίες της ΕΕ (π.χ. RED2) ευνοούν έμμεσα τη χρησιμοποίηση τοπικών πόρων, όπως η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις O11. Ύπαρξη μηχανισμού ενίσχυσης της ηλεκτροπαραγωγής από βιομάζα O12. Ενδιαφέρον για τη ηλεκτρική ενέργεια από βιομάζα λόγω του κορεσμού των άλλων ανανεώσιμων πηγών ενέργειας (π.χ. ηλιακή ενέργεια, αιολική ενέργεια κ.λπ.)

Αντικείμενα

SO1. Η εκμετάλλευση των ευνοϊκών ή / και μεταβαλλόμενων συνθηκών για την ενίσχυση της ηλεκτροπαραγωγής από βιομάζα για την εγκατάσταση σταθμών παραγωγής ηλεκτρικής ενέργειας με χρήση βιομάζας από αγροτικά κλαδέματα και εκριζώσεις

Ενέργειες/Δραστηριότητες

- Ενημέρωση των επενδυτών σχετικά με τα οφέλη (δυναμική, ασφάλεια εφοδιασμού, περιβαλλοντική, οικονομική, κανονιστική συμμόρφωση κ.λπ.) για τη χρήση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις ως πηγή καυσίμου σε μονάδα παραγωγής βιομάζας.
- Επισήμανση ότι λόγω των τοπικών ωφελειών που παρατηρούνται, τα έργα αγροτικών κλαδεμάτων και εκριζώσεων σε έργα ηλεκτροπαραγωγής αναμένεται να αντιμετωπίσουν χαμηλότερη δημόσια αντίσταση.

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WO Στρατηγικές (Στρατηγικές που επιδιώκουν να παραμερίσουν την επίδραση των Αδυναμιών με την αξιοποίηση των Ευκαιριών). Πρόκειται για στρατηγικές του min-max τύπου, με την έννοια ότι συνδυάζουν τις εσωτερικές αδυναμίες με τις εξωτερικές ευκαιρίες. Η στρατηγική επιχειρεί να χρησιμοποιήσει τις ευκαιρίες, ώστε να εξαλειφθούν ή να παρεμποδιστούν οι αδυναμίες (επαναπροσανατολισμός).

⑤ Επιδείξεις των αλυσίδων αξίας της βιομάζας από μόνιμες καλλιέργειες Στρατηγική: Αδυναμίες + Ευκαιρίες → WO «Επαναπροσανατολισμός»	
W3. Μηχανήματα για τη συγκομιδή της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις δεν είναι πολύ γνωστές, δίδεται μεγαλύτερη έμφαση σε μηχανήματα που μπορούν να διαχειριστούν γρήγορα τα αγροτικά κλαδέματα και τις εκριζώσεις (π.χ. τεμαχιστές) W12. Έλλειψη γνώσεων σχετικά με τις δυνατότητες αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων W13. Δεν υπήρξαν επιτυχείς περιπτώσεις προς μίμηση στην Ελλάδα	O5. Δυνατότητες χρηματοδότησης από τοπικές, εθνικές και κοινοτικές πηγές (π.χ. Πρόγραμμα Αγροτικής Ανάπτυξης, ΕΣΠΑ, κ.λπ.)
Αντικείμενα WO1. Να καλυφθεί η έλλειψη γνώσης εκτελώντας και προωθώντας “hands-on” παραδείγματα και επιδείξεις.	
Ενέργειες/Δραστηριότητες • Οργάνωση επιδεικτικών δράσεων “open-day” των αλυσίδων αξίας της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις στο πλαίσιο κατάλληλων προγραμμάτων και πρωτοβουλιών. • Οπτικοποίηση και διάδοση των αποτελεσμάτων	

⑥ Μετασχηματισμός των αγροτικών συνεταιρισμών σε ενεργειακούς συνεταιρισμούς βιομάζας από μόνιμες καλλιέργειες	
Στρατηγική: Αδυναμίες + Ευκαιρίες → WO «Επαναπροσανατολισμός»	

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W1. Οι μικρές εκμεταλλεύσεις περιορίζουν το ποσό της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις που μπορεί να φέρει ένας μεμονωμένος γεωργός στην αγορά W4. Δεν είναι εύκολο να οργανωθεί η συνεταιριστική ιδιοκτησία γεωργικών μηχανημάτων που απαιτούνται για τη συγκομιδή των κλαδεμάτων W5. Δυσκολία να πειστούν ορισμένοι αγρότες να δεχτούν εξωτερικές εταιρείες που εργάζονται στους τομείς τους με μηχανήματα. W16. Η διαχείριση των κλαδεμάτων από αγροτικά κλαδέματα και εκριζώσεις είναι ένα δευτερεύον ζήτημα για τους αγρότες, οι οποίοι επικεντρώνονται στην παραγωγή των πρωτογενών γεωργικών προϊόντων W17. Οι γεωργοί ενδιαφέρονται περισσότερο για την ταχεία διάθεση των αγροτικών κλαδεμάτων και εκριζώσεων και έχουν απροθυμία στο να υιοθετήσουν πρακτικές (π.χ. ξήρανση στο χωράφι) που μπορεί να έχουν θετικό αντίκτυπο στην ποιότητα W18. Η χαμηλή παραγωγικότητα αγροτικών κλαδεμάτων και εκριζώσεων (σε τόνους / εκτάριο) σε ορισμένες περιπτώσεις μπορεί να επηρεάσει τα οικονομικά της αλυσίδας αξίας W19. Το κόστος της αλυσίδας αξίας μπορεί να είναι υψηλό και επομένως η κερδοφορία μιας πρωτοβουλίας αγροτικών κλαδεμάτων και εκριζώσεων μπορεί να είναι περιορισμένη W21. Οι τομείς της γεωργίας και της ενέργειας δεν είναι καλά συνδεδεμένοι	O1. Οι αγρότες ενδιαφέρονται να διερευνήσουν νέες πηγές εισοδήματος (ή να μειώσουν το κόστος) και να εξετάσουν τις ευκαιρίες που προσφέρει η βιομάζα O5. Δυνατότητες χρηματοδότησης από τοπικές, εθνικές και κοινοτικές πηγές (π.χ. Πρόγραμμα Αγροτικής Ανάπτυξης, ΕΣΠΑ, κ.λπ.) O13. Νέες μορφές συλλογικών / συνεργατικών / συνεταιριστικών ενεργειακών έργων σε ανοδική πορεία (π.χ. ενεργειακοί συνεταιρισμοί)

Αντικείμενα

- WO1. Να αναπτυχθούν ενεργειακοί συνεταιρισμοί από τους "παραδοσιακούς" αγροτικούς συνεταιρισμούς που είναι σε θέση να κινητοποιήσουν με οικονομικά αποτελεσματικό τρόπο σημαντικούς όγκους βιομάζας από αγροτικά κλαδέματα και εκριζώσεις.
- WO2. Να εξασφαλιστεί η συνεργασία των αγροτών ως ο πρωταρχικός σύνδεσμος σε οποιαδήποτε αλυσίδα αξίας της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις.

Ενέργειες/Δραστηριότητες

- Εκμετάλλευση του νέου νομικού πλαισίου για την ίδρυση ενεργειακών συνεταιρισμών αγροτικών κλαδεμάτων και εκριζώσεων με τη συμμετοχή αγροτικών συνεταιρισμών
- Εκπαίδευση του προσωπικού των συνεταιρισμών ώστε να μπορούν να παρέχουν καθοδήγηση σχετικά με τη δημιουργία αλυσίδων αξίας από αγροτικά κλαδέματα και εκριζώσεις από τα χωράφια.
- Προώθηση της συνεταιριστικής ιδιοκτησίας σχετικών δαπανηρών μηχανημάτων συγκομιδής για την γρηγορότερη απόσβεση των κεφαλαιουχικών δαπανών στην αλυσίδα αξίας
- Χρησιμοποίηση της εμπειρίας των αγροτικών συνεταιρισμών και των ανθρώπινων πόρων τους (π.χ. τοπικούς γεωπόνους) για την ενημέρωση των αγροτών σχετικά με τις κατάλληλες πρακτικές στις αλυσίδες αξίας αγροτικών κλαδεμάτων και εκριζώσεων
- Ανάπτυξη αυτών των συνεταιρισμών ως τον συνδετικό κρίκο μεταξύ του τομέα της ενέργειας και της γεωργίας

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⑦ Ενίσχυση των γεωργών και του γεωργικού τομέα για την αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες	
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W3. Μηχανήματα για τη συγκομιδή της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις δεν είναι πολύ γνωστά, δίδεται μεγαλύτερη έμφαση σε μηχανήματα που μπορούν να διαχειριστούν γρήγορα τα αγροτικά κλαδέματα και τις εκριζώσεις (π.χ. τεμαχιστές) W5. Δυσκολία να πειστούν ορισμένοι αγρότες να δεχτούν εξωτερικές εταιρείες που εργάζονται στους τομείς τους με μηχανήματα. W7. Η ανοικτή καύση των αγροτικών κλαδεμάτων και εκριζώσεων είναι μια πρακτική που γίνεται ανεκτή από τις τοπικές και εθνικές αρχές W12. Έλλειψη γνώσεων σχετικά με τις δυνατότητες αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων W16. Η διαχείριση των κλαδεμάτων από αγροτικά κλαδέματα και εκριζώσεις είναι ένα δευτερεύον ζήτημα για τους αγρότες, οι οποίοι επικεντρώνονται στην παραγωγή των πρωτογενών γεωργικών προϊόντων W17. Οι γεωργοί ενδιαφέρονται περισσότερο για την ταχεία διάθεση των αγροτικών κλαδεμάτων και εκριζώσεων και έχουν απροθυμία στο να υιοθετήσουν πρακτικές (π.χ. ξήρανση στο χωράφι) που μπορεί να έχουν θετικό αντίκτυπο στην ποιότητα	O1. Οι αγρότες ενδιαφέρονται να διερευνήσουν νέες πηγές εισοδήματος (ή να μειώσουν το κόστος) και να εξετάσουν ευκαιρίες βιομάζας. O2. Η αυξημένη φορολογία και το υψηλό κόστος των ορυκτών καυσίμων για θέρμανση έχουν δημιουργήσει ενδιαφέρον για τα καύσιμα βιομάζας O5. Δυνατότητες χρηματοδότησης από τοπικές, εθνικές και κοινοτικές πηγές (π.χ. Πρόγραμμα Αγροτικής Ανάπτυξης, ΕΣΠΑ, κ.λπ.) O6. Λόγω της χρηματοπιστωτικής κρίσης, οι καταναλωτές δείχνουν αυξημένο ενδιαφέρον για τοπικές πρώτες ύλες και πόρους O8. Οι γεωργοί, οι τοπικές αρχές και άλλοι ενδιαφερόμενοι φορείς αναγνωρίζουν ότι η καύση υπολειμμάτων σε ανοικτό πεδίο είναι μια πρακτική που θα μπορούσε να τεθεί εκτός νόμου στο μέλλον O13. Νέες μορφές συλλογικών / συνεργατικών / συνεταιριστικών ενεργειακών έργων σε ανοδική πορεία (π.χ. ενεργειακοί συνεταιρισμοί)
Αντικείμενα WO1. Για να γίνει η ενεργειακή αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις ένα σημαντικό κριτήριο στη νοοτροπία και τις δραστηριότητες των αγροτών	
Ενέργειες/Δραστηριότητες - Ποσοτικοποίηση των άμεσων ωφελειών για τους αγρότες από την αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε σύγκριση με άλλες εναλλακτικές λύσεις - Υπογράμμιση ότι η σημερινή κατάσταση δεν θα διαρκέσει για πάντα και ότι οι νεοεισερχόμενοι θα είναι καλύτερα τοποθετημένοι σε μια μελλοντική αγορά - Επισήμανση ότι οι δυνατότητες των αγροτών να μειώσουν την εξάρτηση από το πετρέλαιο για θέρμανση χρησιμοποιώντας τους δικούς τους τοπικούς πόρους - Να πειστούν οι αγρότες ότι αποτελούν βασικό στοιχείο της ενεργειακής μετάβασης και της ανάπτυξης κοινοτικών ενεργειακών έργων	

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⑧ Τεχνολογική ανάπτυξη μέσω δράσεων Έρευνας και Τεχνολογικής Ανάπτυξης και δράσεων Καινοτομίας

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W6. Λίγοι τοπικοί κατασκευαστές παράγουν μηχανήματα ικανά να συλλέγουν βιομάζα από αγροτικά κλαδέματα και εκριζώσεις. W8. Χαμηλότερη ποιότητα καυσίμων της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε σύγκριση με τη δασική βιομάζα ξύλου, η οποία επηρεάζει την λειτουργική και περιβαλλοντική συμπεριφορά των συστημάτων καύσης. W9. Η αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις απαιτεί συγκεκριμένες τεχνολογίες καύσης. W10. Δεν υπάρχει σύστημα τυποποίησης / πιστοποίησης καυσίμων για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις.	O4. Επέκταση του συστήματος πιστοποίησης BIOmasud® από βιομάζα κλαδεμάτων ελαιόδεντρων και αμπελώνων O5. Δυνατότητες χρηματοδότησης από τοπικές, εθνικές και κοινοτικές πηγές (π.χ. Πρόγραμμα Αγροτικής Ανάπτυξης, ΕΣΠΑ, κ.λπ.) O10. Η κυκλική οικονομία και η αγροτική ανάπτυξη εντάσσονται στην πολιτική ατζέντα

Αντικείμενα

WO1. Χρησιμοποίηση ευκαιριών χρηματοδότησης για τη βελτίωση των τεχνολογικών συνιστωσών των αλυσίδων αξίας της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις και της ποιότητας των καυσίμων

Ενέργειες/Δραστηριότητες

- Να επωφεληθούν από τις συνεχιζόμενες πρωτοβουλίες (π.χ. Biomassud Plus, AGROinLOG) που έχουν δραστηριότητες σχετικές με την κατανόηση και πιστοποίηση των ιδιοτήτων καυσίμου βιομάζας από αγροτικά κλαδέματα και εκριζώσεις.
- Έναρξη έργων Έρευνας και Τεχνολογικής Ανάπτυξης με στόχο την ανάπτυξη τοπικών λύσεων για τη συγκομιδή της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις με καλές ιδιότητες καυσίμων.
- Έναρξη έργων Έρευνας και Τεχνολογικής Ανάπτυξης που αποσκοπούν στην ανάπτυξη κατάλληλων τεχνολογιών για την ορθή καύση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις (π.χ. νέα μοντέλα λέβητα, νέα συστήματα καθαρισμού καυσαερίων κ.λπ.).

⑨ Τοποθέτηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις στην πολιτική ατζέντα

Στρατηγική: Αδυναμίες + Ευκαιρίες → **WO «Επαναπροσανατολισμός»**

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W12. Έλλειψη γνώσεων σχετικά με τις δυνατότητες αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων W14. Η βιομάζα από μόνιμες καλλιέργειες δεν εξετάζεται ρητά στο εθνικό σχέδιο δράσης για τις ανανεώσιμες πηγές ενέργειας	O9. Οι νέοι κανονισμοί και οδηγίες της ΕΕ (π.χ. RED2) ευνοούν έμμεσα τη χρησιμοποίηση τοπικών πόρων, όπως η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις O10. Η κυκλική οικονομία και η αγροτική ανάπτυξη εντάσσονται στην πολιτική ατζέντα

Αντικείμενα

WO1. Αναθεώρηση του εθνικού στρατηγικού πλαισίου υπέρ της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις

Ενέργειες/Δραστηριότητες

- Ενημέρωση των υπεύθυνων χάραξης πολιτικής σχετικά με τις δυνατότητες της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις στο πλαίσιο της κυκλικής οικονομίας και της αγροτικής ανάπτυξης.
- Αναθεώρηση του Εθνικού Σχεδίου Δράσης για τις Ανανεώσιμες Πηγές Ενέργειας το οποίο να θέτει στόχους για την αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις.
- Να επωφεληθεί από την αναθεώρηση των κανονισμών / νόμων για την ενσωμάτωση κατάλληλων μέτρων ευνοϊκών για την βιομάζα από μόνιμες καλλιέργειες.

⑩

Προώθηση της δημιουργίας μιας αγοράς βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε διάφορους τομείς της ενέργειας

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W8. Χαμηλότερη ποιότητα καυσίμων της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε σύγκριση με τη δασική βιομάζα ξύλου, η οποία επηρεάζει την λειτουργική και περιβαλλοντική συμπεριφορά των συστημάτων καύσης. W9. Η αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις απαιτεί συγκεκριμένες τεχνολογίες καύσης W10. Δεν υπάρχει σύστημα τυποποίησης / πιστοποίησης καυσίμων για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις. W17. Οι γεωργοί ενδιαφέρονται περισσότερο για την ταχεία διάθεση των αγροτικών κλαδεμάτων και εκριζώσεων και έχουν απροθυμία στο να υιοθετήσουν πρακτικές (π.χ. ξήρανση στο χωράφι) που μπορεί να έχουν θετικό αντίκτυπο στην ποιότητα W20. Περιορισμένη αγορά μη συμβατικής βιομάζας (όπως η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις) και σχεδόν κανένας μεγάλος καταναλωτής μεγάλης κλίμακας βιομάζας για "απογείωση" στην αγορά	O2. Η αυξημένη φορολογία και το υψηλό κόστος των ορυκτών καυσίμων για θέρμανση έχουν δημιουργήσει ενδιαφέρον για τα καύσιμα βιομάζας O3. Οι βιομηχανίες ενδιαφέρονται για τη μείωση του ενεργειακού κόστους και λαμβάνουν υπ' όψη τα καύσιμα βιομάζας O4. Επέκταση του συστήματος πιστοποίησης BIOmasud® από βιομάζα κλαδεμάτων ελαιόδεντρων και αμπελώνων O11. Ύπαρξη μηχανισμού ενίσχυσης της ηλεκτροπαραγωγής από βιομάζα O12. Ενδιαφέρον για τη ηλεκτρική ενέργεια από βιομάζα λόγω του κορεσμού των άλλων ανανεώσιμων πηγών ενέργειας (π.χ. ηλιακή ενέργεια, αιολική ενέργεια κ.λπ.)

Αντικείμενα

- WO1. Ανάπτυξη κατάλληλων τελικών χρήσεων για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις έτσι ώστε η αγορά να μπορεί να επεκταθεί

Ενέργειες/Δραστηριότητες

- Ενημέρωση για τις πραγματικές δυνατότητες της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις και αποφυγή μη ρεαλιστικών προσδοκιών (π.χ. παραγωγή πελλετών ξύλου υψηλής ποιότητας από κλαδέματα)
- Εντοπισμός συγκεκριμένων τομέων της αγοράς για τους οποίους η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις μπορεί να έχει παρουσία (π.χ. παραγωγή ισχύος / CHP, αγροτοβιομηχανίες, θερμοκήπια κ.λπ.) και επισήμανση στους φορείς εκμετάλλευσης τα οφέλη από τη χρήση τους
- Προώθηση μεταξύ των φορέων της αλυσίδας εφοδιασμού, συμπεριλαμβανομένων των αγροτών, των καλών πρακτικών συγκομιδής και διαχείρισης που εξασφαλίζουν την προμήθεια βιομάζας από αγροτικά κλαδέματα και εκριζώσεις με καλές ιδιότητες και ποιότητα (π.χ. περιεκτικότητα σε τέφρα κ.λπ.)
- Να εμπλακούν οι δυνητικοί μεγάλης κλίμακας καταναλωτές βιομάζας / βιομάζας από αγροτικά κλαδέματα και εκριζώσεις έτσι ώστε να δημιουργηθεί μια ζήτηση για το προϊόν
- Υποστήριξη της τροποποίησης του εξοπλισμού βιομηχανικών εγκαταστάσεων (π.χ. λέβητες, συστήματα τροφοδοσίας) ώστε να μπορούν να δεχθούν την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις ως καύσιμο

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ST Στρατηγικές (οι στρατηγικές που χρησιμοποιούν τα Δυνατά σημεία για την πρόληψη ή την ελαχιστοποίηση των Απειλών). Είναι στρατηγικές του max-min τύπου, με την έννοια ότι χρησιμοποιούν τις δυνάμεις για να αποφευχθούν ή να μειωθούν οι εξωτερικές απειλές (άμυνα)

11 Υιοθέτησης της χρήσης βιομάζας από μόνιμες καλλιέργειες από δημόσιους φορείς	
Στρατηγική: Δυνατά σημεία + Απειλές → ST “Άμυνα”	
S1. Μεγάλη δυναμική της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε εθνικό επίπεδο S2. Μεγάλες εκτάσεις καλλιεργούμενες με φυτείες μόνιμων καλλιεργειών σε διάφορες τοποθεσίες στην Ελλάδα S3. Ο γεωργικός τομέας είναι μια βασική οικονομική δραστηριότητα στην Ελλάδα, με μεγάλες δυνατότητες επηρεασμού των κυβερνητικών αποφάσεων S5. Σύντομες περίοδοι αποπληρωμής για εγκαταστάσεις βιομάζας για θέρμανση (ανάλογα με τις τιμές των ορυκτών καυσίμων). Τα οφέλη από την αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις είναι εύκολο να παρατηρηθούν σε τοπικές συνθήκες (π.χ. αποφυγή εκπομπών και ρύπανσης από πυρκαγιές ανοιχτού χώρου, εξοικονόμηση κόστους που επιτυγχάνεται στη διαχείριση των αγροτικών κλαδεμάτων και εκριζώσεων, εξοικονόμηση ορυκτών καυσίμων κ.λπ.) S8. Οι λέβητες βιομάζας και τα συστήματα καύσης που είναι ικανά να χειρίζονται τα αγροτικά κλαδέματα και τις εκριζώσεις είναι επίσης ικανά για καύση και άλλων τύπων βιομάζας, ενισχύοντας έτσι την ασφάλεια του εφοδιασμού S9. Η αντικατάσταση των ορυκτών καυσίμων (π.χ. πετρέλαιο θέρμανσης) με βιομάζα για εφαρμογές θέρμανσης μπορεί να έχει μικρό χρόνο αποπληρωμής. S10. Σε σύγκριση με τα ορυκτά καύσιμα, η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις οδηγεί σε μείωση των εκπομπών αερίων του θερμοκηπίου. Η μείωση μπορεί να είναι υψηλότερη από τη χρήση άλλων τύπων βιομάζας	T1. Παράλογες προσδοκίες (πολύ υψηλές αποδόσεις, παραγωγή υψηλής ποιότητας ξύλινων σφαιριδίων από αγροτικά κλαδέματα και εκριζώσεις) μπορεί να οδηγήσουν σε αποτυχίες νέων πρωτοβουλιών λόγω εσφαλμένης εκτίμησης του κόστους ή του δυναμικού της αγοράς T5. Η χρηματοπιστωτική κρίση περιορίζει τις επενδύσεις και καθιστά τις συνθήκες της αγοράς επισφαλείς T6. Οι βραχυπρόθεσμες μειώσεις της τιμής του πετρελαίου θέρμανσης αποθαρρύνουν τους πιθανούς χρήστες T8. Μη ευνοϊκή δημόσια αντίληψη για τη βιομάζα λόγω του καπνού που σχηματίζεται από κακή καύση καυσόξυλων τόσο στις αστικές όσο και στις αγροτικές περιοχές
Αντικείμενα	
ST1. Ενθάρρυνση της ανάπτυξης του τομέα των αγροτικών κλαδεμάτων και εκριζώσεων μέσω έγκαιρης υιοθέτησης από τον δημόσιο τομέα.	

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⑪ Υιοθέτησης της χρήσης βιομάζας από μόνιμες καλλιέργειες από δημόσιους φορείς

Στρατηγική: Δυνατά σημεία + Απειλές → ST “Αμυνα”

Ενέργειες/Δραστηριότητες

- Να καταστούν οι δυνητικοί τελικοί χρήστες στον δημόσιο τομέα (π.χ. δημόσια κτίρια) οι πρώτοι χρήστες βιομάζας από μόνιμες καλλιέργειες έτσι ώστε να δημιουργηθεί μια νέα αγορά.
- Ενημέρωση των κατοίκων μέσω δημόσιων καναλιών σχετικά με τα άμεσα και έμμεσα οφέλη της αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων (π.χ. μείωση των δημοτικών φόρων, μείωση των εκπομπών αερίων του θερμοκηπίου κ.λπ.)
- Η ενημέρωση των φορέων για τα υπάρχοντα μοντέλα και παραδείγματα συμβάσεων προμήθειας με προτεραιότητα στη χρήση βιομάζας και γεωργικών αποβλήτων σε περιοχές υψηλού δυναμικού.
- Να συμπεριληφθεί η συλλογή της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις στο πλαίσιο διαχείρισης των αποβλήτων των τοπικών δήμων.
- Περιορισμός του επιχειρηματικού ρίσκου των ιδιωτών επενδυτών μέσω της δημιουργίας ζήτησης στο δημόσιο τομέα.

⑫ Τοποθέτηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις στην αγορά καυσίμων

Στρατηγική: Δυνατά σημεία + Απειλές → ST “Αμυνα”

S1. Μεγάλη δυναμική της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε εθνικό επίπεδο.	T2. Η ανάπτυξη της ελληνικής αγοράς βιομάζας επικεντρώνεται στις πελλέτες και όχι στην τεμαχισμένη βιομάζα
S4. Μεγάλες εκτάσεις καλλιεργούμενες με φυτείες μόνιμων καλλιεργειών σε διάφορες τοποθεσίες στην Ελλάδα	T3. Φθηνά, χαμηλής ποιότητας καύσιμα βιομάζας που διατίθενται στην αγορά και περιορισμένος έλεγχος ή γνώση σχετικά με τις επιπτώσεις των ιδιοτήτων των καυσίμων
S7. Υπάρχουν τοπικές αλυσίδες αξίας βιομάζας (π.χ. πυρηνόξυλο, κελύφη καρπών, καυσόξυλα από μόνιμες καλλιέργειες) που θα μπορούσαν να χρησιμοποιηθούν για την προώθηση της χρήσης βιομάζας από αγροτικά κλαδέματα και εκριζώσεις	T7. Οι πολιτικές της ΕΕ ενδέχεται να δημιουργήσουν αρνητικές συνθήκες για τη βιομάζα από αγροτικά κλαδέματα και εκριζώσεις (π.χ. μη συμμόρφωση με όρια εκπομπών αν θεωρεί ως ξυλώδης βιομάζα από τον Κανονισμό Ecodesign, απαίτηση για υψηλό ηλεκτρικό βαθμό απόδοσης από την Οδηγία RED2 κ.λπ.)
S8. Οι λέβητες βιομάζας και τα συστήματα καύσης που είναι ικανά να χειρίζονται τα αγροτικά κλαδέματα και τις εκριζώσεις είναι επίσης ικανά για καύση και άλλων τύπων βιομάζας, ενισχύοντας έτσι την ασφάλεια του εφοδιασμού	T8. Μη ευνοϊκή δημόσια αντίληψη για τη βιομάζα λόγω του καπνού που σχηματίζεται από κακή καύση καυσόξυλων τόσο στις αστικές όσο και στις αγροτικές περιοχές.
S10. Σε σύγκριση με τα ορυκτά καύσιμα, η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις οδηγεί σε μείωση των εκπομπών αερίων του θερμοκηπίου. Η μείωση μπορεί να είναι υψηλότερη από τη χρήση άλλων τύπων βιομάζας	
S11. Σε σύγκριση με άλλα υπολείμματα του γεωργικού τομέα (π.χ. άχυρο) δεν υπάρχουν πολλές ή ακόμη και καμία ανταγωνιστική χρήση	

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⑫

Τοποθέτηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις στην αγορά καυσίμων

Στρατηγική: Δυνατά σημεία + Απειλές → ST “Άμυνα”

για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις. Η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις είναι επίσης άμεσα διαθέσιμη και όχι μια πιθανή μελλοντική πραγματικότητα (όπως οι ενεργειακές καλλιέργειες).

Αντικείμενα

ST1. Θέση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις στην αγορά καυσίμων με την εξεύρεση κατάλληλων αγορών για αυτό.

Ενέργειες/Δραστηριότητες

- Υποστήριξη της εγκατάστασης λεβήτων πολλαπλών καυσίμων ικανών να χειριστούν βιομάζα από αγροτικά κλαδέματα και εκριζώσεις
- Παρουσίαση τεχνικοοικονομικών και περιβαλλοντικών δεδομένων που υποστηρίζουν το γεγονός ότι η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις είναι κατάλληλη για συγκεκριμένες αγορές της αγοράς που χρησιμοποιούν σήμερα καύσιμα που προκαλούν υπερβολικές εκπομπές
- Επισήμανση ότι η σωστή καύση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις με κατάλληλα τεχνολογικά συστήματα δεν είναι υπεύθυνη για την αιθαλομίχλη
- Επισήμανση των ωφελειών της επιλογής των αγροτικών κλαδεμάτων και εκριζώσεων ως καυσίμου (π.χ. τοπική διαθεσιμότητα, ποσότητες, μη ανταγωνιστικές χρήσεις, χαμηλότερες εκπομπές αερίων του θερμοκηπίου)
- Χρησιμοποίηση υπαρχόντων εμπορικών καναλιών για τη βιομάζα για την προώθηση των αγροτικών κλαδεμάτων και εκριζώσεων

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WT Στρατηγικές (Στρατηγικές που παραμερίζουν τις Αδυναμίες και επιδιώκουν να μειώσουν τις επιπτώσεις των Απειλών). Πρόκειται για στρατηγικές τύπου min-min που επιδιώκουν να ελαχιστοποιήσουν τις αδυναμίες, αν οι εξωτερικές απειλές μπορούν να αποφευχθούν (επιβίωση).

⑬ Χρηματοδοτική υποστήριξη για την ανάπτυξη της αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων Στρατηγική: Αδύνατα σημεία + Απειλές → «Επιβίωση»	
W2. Περισσότερες αβεβαιότητες στις πρωτοβουλίες που επικεντρώνονται στην βιομάζα από αγροτικά κλαδέματα και εκριζώσεις σημαίνουν δυσκολίες στην προσέλκυση κεφαλαίων από τράπεζες ή από τον ιδιωτικό τομέα W18. Η χαμηλή παραγωγικότητα αγροτικών κλαδεμάτων και εκριζώσεων (σε τόνους / εκτάριο) σε ορισμένες περιπτώσεις μπορεί να επηρεάσει τα οικονομικά της αλυσίδας αξίας W19. Το κόστος της αλυσίδας αξίας μπορεί να είναι υψηλό και επομένως η κερδοφορία μιας πρωτοβουλίας αγροτικών κλαδεμάτων και εκριζώσεων μπορεί να είναι περιορισμένη W20. Περιορισμένη αγορά μη συμβατικής βιομάζας (όπως η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις) και σχεδόν κανένας μεγάλος καταναλωτής μεγάλης κλίμακας βιομάζας για "απογείωση" στην αγορά	T1. Παράλογες προσδοκίες (πολύ υψηλές αποδόσεις, παραγωγή υψηλής ποιότητας ξύλινων σφαιριδίων από αγροτικά κλαδέματα και εκριζώσεις) μπορεί να οδηγήσουν σε αποτυχιές νέων πρωτοβουλιών λόγω εσφαλμένης εκτίμησης του κόστους ή του δυναμικού της αγοράς T4. Ο υψηλός ΦΠΑ των στερεών βιοκαυσίμων στην Ελλάδα (24%) δημιουργεί προβλήματα στην ανάπτυξη νέων πρωτοβουλιών T5. Η χρηματοπιστωτική κρίση περιορίζει τις επενδύσεις και καθιστά τις συνθήκες της αγοράς επισφαλείς T6. Οι βραχυπρόθεσμες μειώσεις της τιμής του πετρελαίου θέρμανσης αποθαρρύνουν τους πιθανούς χρήστες
Αντικείμενα WT1. Να δημιουργηθεί ένα ασφαλέστερο και ελκυστικότερο περιβάλλον για τις επενδύσεις βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε ενέργεια μέσω κατάλληλων οικονομικών μέτρων.	
Ενέργειες/Δραστηριότητες • Άμεση / έμμεση υποστήριξη επενδύσεων σε έργα βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε ενεργειακά έργα (π.χ. επιχορηγήσεις, φορολογικές μειώσεις κ.λπ.) • Μείωση ΦΠΑ για βιομάζα από αγροτικά κλαδέματα και εκριζώσεις • Αφαίρεση ή μείωση του ΦΠΑ για την προώθηση της χρήσης βιομάζας. • Φορολογικά οφέλη για τις επιχειρήσεις που χρησιμοποιούν βιομάζα από αγροτικά κλαδέματα και εκριζώσεις (π.χ. φορολογικές μειώσεις, εξαιρέσεις κ.λπ.) • Άλλα μέτρα στήριξης για νέες επενδύσεις που χρησιμοποιούν τη διαχείριση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις.	

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⑭ Ανάπτυξη τεχνολογιών και κανονισμών προσαρμοσμένων στις ιδιότητες καυσίμου από αγροτικά κλαδέματα και εκριζώσεις

Στρατηγική: Αδύνατα σημεία + Απειλές → «Επιβίωση»

W8. Χαμηλότερη ποιότητα καυσίμων της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε σύγκριση με τη δασική βιομάζα ξύλου, η οποία επηρεάζει την λειτουργική και περιβαλλοντική συμπεριφορά των συστημάτων καύσης. W9. Η αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις απαιτεί συγκεκριμένες τεχνολογίες καύσης. W10. Δεν υπάρχει σύστημα τυποποίησης / πιστοποίησης καυσίμων για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις. W11. Οι φυτοϋγειονομικές πρακτικές μπορεί να επηρεάσουν τις ιδιότητες καυσίμων της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις (π.χ. αυξημένη περιεκτικότητα σε χαλκό λόγω ραντισμάτων)	T2. Η ανάπτυξη της ελληνικής αγοράς βιομάζας επικεντρώνεται στις πελλέτες και όχι στην τεμαχισμένη βιομάζα T3. Φτηνά, χαμηλής ποιότητας καύσιμα βιομάζας που διατίθενται στην αγορά και περιορισμένος έλεγχος ή γνώση σχετικά με τις επιπτώσεις των ιδιοτήτων των καυσίμων T7. Οι πολιτικές της ΕΕ ενδέχεται να δημιουργήσουν αρνητικές συνθήκες για τη βιομάζα από αγροτικά κλαδέματα και εκριζώσεις (π.χ. μη συμμόρφωση με όρια εκπομπών αν θεωρεί ως ξυλώδης βιομάζα από τον Κανονισμό Ecodesign, απαίτηση για υψηλό ηλεκτρικό βαθμό απόδοσης από την Οδηγία RED2 κ.λπ.) T8. Μη ευνοϊκή δημόσια αντίληψη για τη βιομάζα λόγω του καπνού που σχηματίζεται από κακή καύση καυσόξυλων τόσο στις αστικές όσο και στις αγροτικές περιοχές.

Αντικείμενα

- WT1. Να επηρεάσει την κοινοτική / εθνική / περιφερειακή νομοθεσία έτσι ώστε η βιομάζα από αγροτικά κλαδέματα και εκριζώσεις να έχει σημαντική παρουσία στην αγορά.
- WT2. Ανάπτυξη τεχνολογιών ικανών να χειρίζονται τα αγροτικά κλαδέματα και τις εκριζώσεις με χαμηλές εκπομπές ρύπων.

Ενέργειες/Δραστηριότητες

- Η αναγνώριση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις ως "αγροβιομάζα" και όχι "βιομάζα ξύλου" στην ΕΕ (π.χ. στον Κανονισμό Ecodesign) και της εθνικής νομοθεσίας, ώστε να μην χρειαστεί να καλύψουν τα ανέφικτα όρια εκπομπών
- Προώθηση των συστημάτων πιστοποίησης καυσίμων για την βιομάζα από αγροτικά κλαδέματα και εκριζώσεις
- Υποστήριξη των παρόχων τεχνολογίας (π.χ. κατασκευαστές λεβήτων) στην ανάπτυξη λύσεων ικανών να χειριστούν βιομάζα από αγροτικά κλαδέματα και εκριζώσεις.
- Ενημέρωση του κοινού και των ενδιαφερόμενων φορέων σχετικά με τα περιβαλλοντικά ζητήματα που συνδέονται με τη χρήση άλλων καυσίμων βιομάζας χαμηλής ποιότητας σε ακατάλληλες εγκαταστάσεις καύσης.

⑮ Αποφυγή του συνδρόμου NIMBY για την ενεργειακή χρήση βιομάζας από μόνιμες καλλιέργειες και συνειδητοποίηση των περιορισμών άλλων πρακτικών διάθεσης

Στρατηγική: Αδύνατα σημεία + Απειλές → «Επιβίωση»

	Έγγραφο:	Ανάλυση Τομέα και Στρατηγικό Σχέδιο για τη βιομάζα από μόνιμες καλλιέργειες στην Ελλάδα		
	Συγγραφέας:	ΕΚΕΤΑ, ΙΝΑΣΟ-ΠΑΣΕΓΕΣ	Έκδοση:	v2
	Αναφορά:		Ημερομηνία:	28/02/2018

⑮

Αποφυγή του συνδρόμου NIMBY για την ενεργειακή χρήση βιομάζας από μόνιμες καλλιέργειες και συνειδητοποίηση των περιορισμών άλλων πρακτικών διάθεσης

Στρατηγική: Αδύνατα σημεία + Απειλές → «Επιβίωση»

W7. Η ανοικτή καύση των αγροτικών κλαδεμάτων και εκριζώσεων είναι μια πρακτική που γίνεται ανεκτή από τις τοπικές και εθνικές αρχές

W17. Οι γεωργοί ενδιαφέρονται περισσότερο για την ταχεία διάθεση των αγροτικών κλαδεμάτων και εκριζώσεων και έχουν απροθυμία στο να υιοθετήσουν πρακτικές (π.χ. ξήρανση στο χωράφι) που μπορεί να έχουν θετικό αντίκτυπο στην ποιότητα

T8. Μη ευνοϊκή δημόσια αντίληψη για τη βιομάζα λόγω του καπνού που σχηματίζεται από κακή καύση καυσόξυλων τόσο στις αστικές όσο και στις αγροτικές περιοχές.

T10. Η εναλλακτική χρησιμοποίηση των αγροτικών κλαδεμάτων και εκριζώσεων (π.χ. η εδαφοκάλυψη) αυξάνεται

Αντικείμενα

WT1. Να πειστεί το ευρύ κοινό και οι άλλοι ενδιαφερόμενοι φορείς (π.χ. ΜΚΟ) ότι η ενεργειακή αξιοποίηση των αγροτικών κλαδεμάτων και εκριζώσεων αποτελεί βιώσιμη και αειφόρος επιλογή προς τις εναλλακτικές λύσεις.

Ενέργειες/Δραστηριότητες

- Ενημέρωση για την τρέχουσα πραγματικότητα της διαχείρισης βιομάζας από αγροτικά κλαδέματα και εκριζώσεις
- Επισήμανση των περιορισμών εναλλακτικών μεθόδων απόρριψης (π.χ. εδαφοκάλυψη)
- Ποσοτικοποίηση και διάδοση των περιβαλλοντικών οφελών από την αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε σύγκριση με εναλλακτικές λύσεις.

Ο παρακάτω πίνακας συνοψίζει τα 15 μέτρα που περιλαμβάνονται στο στρατηγικό σχέδιο για την προώθηση της χρήσης βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα. Οι περισσότερες από τις συγκεκριμένες δράσεις ανήκουν στις ακόλουθες κύριες κατηγορίες, οι περισσότερες από τις οποίες έχουν ήδη αντιμετωπιστεί σε κάποιο βαθμό από το έργο uP_running:

- Διάδοση και κατάρτιση, ειδικά στο γεωργικό τομέα και στους υπεύθυνους για τη χάραξη πολιτικής.
- Επίδειξη της σκοπιμότητας και υποστήριξη της ανάπτυξης των πρώτων χρηστών.
- Ανάπτυξη κατάλληλων τεχνολογιών αξιοποίησης και συγκομιδής.
- Δημιουργία ευνοϊκών συνθηκών, π.χ. νομοθεσία και κατάλληλα συστήματα στήριξης.

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Πίνακας 11: Σύνοψη των στρατηγικών δράσεων για την προώθηση της χρήσης βιομάζας από μόνιμες καλλιέργειες στην Ελλάδα

SO: Στρατηγική Επίθεσης	ST: Στρατηγική Άμυνας
1. Ενημέρωση και εκπαίδευση των αγροτών για τα οφέλη της ενεργειακής αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων 2. Ανάπτυξη των αγροτικών βιομηχανιών ως καταναλωτές βιομάζας μόνιμων καλλιεργειών και παραγωγούς ενδιάμεσων προϊόντων 3. Προώθηση άμεσων και έμμεσων ωφελειών αξιοποίησης βιομάζας από μόνιμες καλλιέργειες 4. Προώθηση της χρήσης βιομάζας από μόνιμες καλλιέργειες στην ηλεκτροπαραγωγή	11. Υιοθέτησης της χρήσης βιομάζας από μόνιμες καλλιέργειες από δημόσιους φορείς 12. Τοποθέτηση της βιομάζας από μόνιμες καλλιέργειες στην αγορά καυσίμων
WO: Στρατηγική Επαναπροσανατολισμού	WT: Στρατηγική «Επιβίωσης»
5. Επιδείξεις των αλυσίδων αξίας της βιομάζας από μόνιμες καλλιέργειες 6. Μετασχηματισμός των αγροτικών συνεταιρισμών σε ενεργειακούς συνεταιρισμούς βιομάζας από μόνιμες καλλιέργειες 7. Ενίσχυση των γεωργών και του γεωργικού τομέα για την αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες 8. Τεχνολογική ανάπτυξη μέσω δράσεων Έρευνας και Τεχνολογικής Ανάπτυξης και δράσεων Καινοτομίας 9. Τοποθέτηση της βιομάζας από μόνιμες καλλιέργειες στην πολιτική ατζέντα 10. Προώθηση της δημιουργίας μιας αγοράς βιομάζας από αγροτικά κλαδέματα και εκριζώσεις σε διάφορους τομείς της ενέργειας	13. Χρηματοδοτική υποστήριξη για την ανάπτυξη της αξιοποίησης των αγροτικών κλαδεμάτων και εκριζώσεων 14. Ανάπτυξη τεχνολογιών και κανονισμών προσαρμοσμένων στις ιδιότητες καυσίμου από αγροτικά κλαδέματα και εκριζώσεις 15. Αποφυγή του συνδρόμου NIMBY για την ενεργειακή χρήση βιομάζας από μόνιμες καλλιέργειες και συνειδητοποίηση των περιορισμών άλλων πρακτικών διάθεσης

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	Αναφορά:		Ημερομηνία:	28/02/2018

ΑΝΑΦΟΡΕΣ

Για τη συγγραφή αυτής της μελέτης χρησιμοποιήθηκε ένα πλήθος πηγών (μελέτες, άρθρα, στατιστικά δεδομένα) προκειμένου να σχηματιστεί μια όσο το δυνατόν πληρέστερη εικόνα για την κατάσταση των μόνιμων καλλιεργειών στην Ελλάδα και το τι αυτή σημαίνει για τη βιομάζα που προέρχεται από αυτές. Οι κύριες πηγές αναφέρονται ονομαστικά στις ακόλουθες ενότητες.

Η τελευταία πρόσβαση στις αναφερόμενες ιστοσελίδες πραγματοποιήθηκε στις 28/02/2018.

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	Αναφορά:		Ημερομηνία:	28/02/2018

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	Συγγραφέας:	ΕΚΕΤΑ, ΙΝΑΣΟ-ΠΑΣΕΓΕΣ	Έκδοση:	v2
	Αναφορά:		Ημερομηνία:	28/02/2018

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ΕΥΧΑΡΙΣΤΙΕΣ

Η μελέτη αυτή συγγράφηκε από το ΕΚΕΤΑ και το ΙΝΑΣΟ-ΠΑΣΕΓΕΣ. Εκτός από τις απόψεις των συγγραφέων, καταβλήθηκε κάθε δυνατή προσπάθεια για την ενσωμάτωση των απόψεων πολλών φορέων της αγοράς και ενδιαφερόμενων όσον αφορά το θεσμικό πλαίσιο, τα εμπόδια, τις κινητήριες δυνάμεις και την γενική κατάσταση των μόνιμων καλλιεργειών και της βιομάζας στην Ελλάδα. Οι γνώμες αυτές εκφράστηκαν κατά τη διάρκεια πολλών διαφορετικών δραστηριοτήτων του έργου **uP_running** (όπως ημερίδες, συνέδρια, συνεντεύξεις, μετρήσεις δυναμικού βιομάζας, προετοιμασία επιδεικτικών δράσεων, κτλ).

Παράλληλα, πρέπει να αναφερθούν οι συνέργειες με τα Ευρωπαϊκά έργα **Biomassud Plus** (www.biomassudplus.eu) και **AGROinLOG** (<http://agroinlog-h2020.eu>), επίσης χρηματοδοτούμενα από το Πρόγραμμα Ορίζοντα 2020. Μέσω των δραστηριοτήτων αυτών των έργων, πραγματοποιήθηκαν επαφές με πολλούς εμπλεκόμενους στον αγροτικό τομέα ή στον τομέα βιομάζας, οι οποίοι εξέφρασαν απόψεις που σχετίζονται άμεσα με το σκοπό αυτής της μελέτης.

Συγκεκριμένα, οι Έλληνες εταίροι του έργου θα ήθελαν να ευχαριστήσουν τους ακόλουθους για την πολύτιμη συνεισφορά τους στην προετοιμασία αυτής της μελέτης:

Ευχαριστίες			
Ονοματεπώνυμο	Θέση / ιδιότητα	Οργανισμός	Είδος οργανισμού

	Έγγραφο:	Ανάλυση Τομέα και Στρατηγικό Σχέδιο για τη βιομάζα από μόνιμες καλλιέργειες στην Ελλάδα		
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Ευχαριστίες			
Ονοματεπώνυμο	Θέση / ιδιότητα	Οργανισμός	Είδος οργανισμού
Γεώργιος Στρατάκος	Γεωπόνος	ΕΑΣ Λακωνίας	Αγροτικός συνεταιρισμός
Νίκος Φουντούλης	Πρόεδρος	Οινοποιητικός Συνεταιρισμός VAENI - Νάουσα	Αγροτικός συνεταιρισμός
Γιάννης Τσαμαλδούπης	Ιδιοκτήτης	Βιομάζα Αιγαίου	Παραγωγός στερεών βιοκαυσίμων από μόνιμες καλλιέργειες
Νίκος Φραγκούλης	Ιδιοκτήτης	Aenaon Bioenergies	Παραγωγός στερεών βιοκαυσίμων από μόνιμες καλλιέργειες
Ιωάννης Ανανιάδης	Ιδιοκτήτης	Ε.Α.Μ.Ε.Β. - Εταιρεία Ανάκτησης Μεταποίησης Εμπορίας Βιομάζας	Παραγωγός στερεών βιοκαυσίμων από μόνιμες καλλιέργειες
Νίκος Δαμάτης	Γραμματέας	ΕΛΕΑΒΙΟΜ – Ελληνική Εταιρεία Ανάπτυξης Βιομάζας	Κλαδικός φορέας
Νίκος Προκοβάκης	Πρόεδρος	ΕΑΣ Λακωνίας	Αγροτικός συνεταιρισμός
Τζανέτος Καραμίχας	Πρόεδρος	ΠΑΣΕΓΕΣ & ΙΝΑΣΟ-ΠΑΣΕΓΕΣ	Αγροτικός τομέας
Γεώργιος Ανέστης	Πρόεδρος	Αγροτικός Συνεταιρισμός Λιβαδειάς «Ο Αιχμέας»	Αγροτικός τομέας
	Αντιπρόεδρος	Νέα ΠΑΣΕΓΕΣ	
Θωμάς Κουτσουπιάς	Πρόεδρος	Ένωση Αργινίου	Αγροτικός συνεταιρισμός
Σταμάτης Γεωργάκης	Πρόεδρος	Αγροτικός Οινοποιητικός Συνεταιρισμός Κορωπίου	Αγροτικός συνεταιρισμός
Μιχάλης Σμύρης	Μηχανολόγος Μηχανικός - Σύμβουλος	ΠΑΣΕΓΕΣ & Νέα ΠΑΣΕΓΕΣ	Αγροτικός τομέας

ANNEX A5

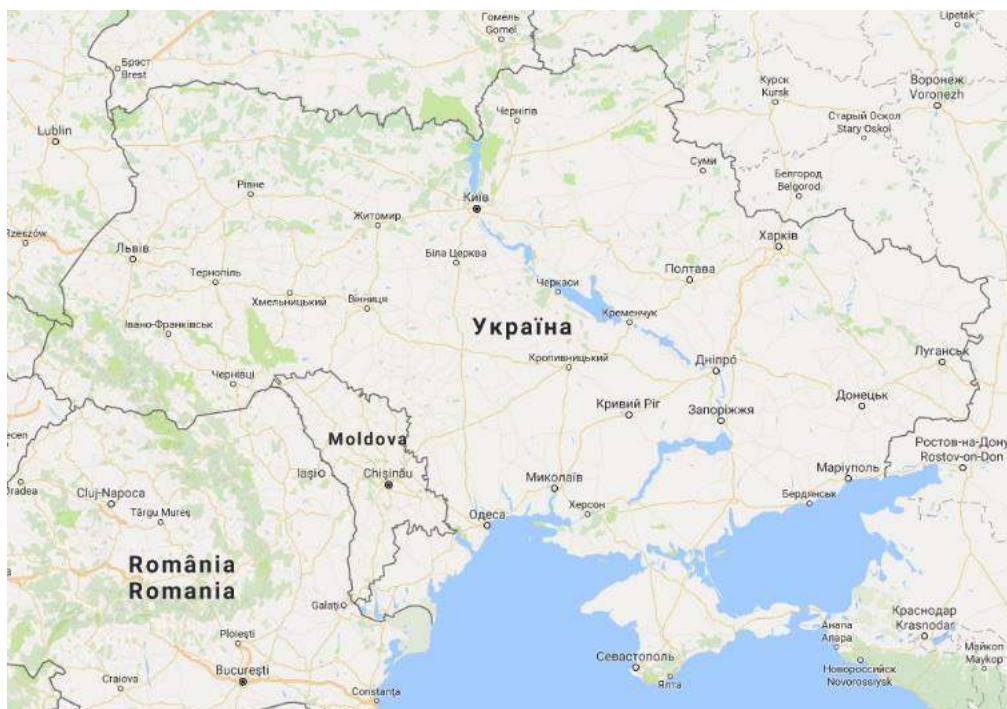
WP2 – Task T2.3

Performing an APPR Sector Analysis and Developing a Strategic Plan at National and EU level Ukraine

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A. Country's features of APPRs production

Ukraine is a state located in Eastern Europe and partially in Central Europe, populated by 42.6 million people (2017). Ukraine borders with Belarus on the North, Poland, Slovakia and Hungary on the West, Romania and Moldova on the South-West, Russia on the East and North. South and South-East of Ukraine borders with the Black Sea and the Sea of Azov (picture 1). Overall area of Ukraine constitutes of 603 628 sq. km. which is 5.7% of European area and 0.44% of World area. Distance from the Southern to the Northern point is 893 km, from West to East – 1316 km.



Picture. 1. Map of Ukraine.

Higher order chain of administrative division consists of Autonomous Republic of Crimea, 24 regions (oblasts) and two cities with extraordinary status – Kyiv and Sevastopol. Middle order chain of Ukraine administrative division consists of cities of sub regional status, towns, villages. In overall, 490 villages' counties build of towns and villages [1].

Ukraine located in temperate continental climate zone, average January temperature differs from region to region: North-East -7°C and 0 °C ... +4 °C in Crimea, average July temperature: +17 °C and +23°C ... +25°C in Crimea. Annual amount of precipitation accounted for 650-600 mm in the West, 450-400 mm in the South and Southern East, out of which 80% fall out in warm season. Due to climate diversification area of Ukraine divided into three zones: Polissya (North belt of forests) and Carpathians, Lisostep (area of mixed forests and steppes) and Steppe (picture 2).

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Fig. 2. Natural and climatic zones of Ukraine

Horticulture and viticulture are vital industries for Ukrainian economy. Horticulture is most developed in Lisostep, Steppe climate regions, L'viv and Zakarpattia administrative regions. Developed viticulture businesses located in South of Ukraine or Steppe climate zone, but also in Zakarpattia administrative region.

In 2016, a share of private holdings in horticulture land areas reached 73%, while vineyards – 29.5%. Role of such orchards and vineyards in the process of deciduous fruits large high quality supplies fulfillments is not vital on internal Ukrainian market. In the same time market experts expect a decrease of private holdings' share in supplies volumes demanded by Ukrainian customers as business supplies expected to increase [2,3].

Pome fruits cultures are major in fruit-bearing orchards. Agricultural businesses have yielded 341.8 thousand tons of fruits from 36.2 thousand hectares (76.2% of overall areas under fruits orchards in productive age) (Table 1) [4]. Considering types of pome fruits cultures, apples' production dominates (91.6 thousand tons in 2016, or 87% of all pome fruits orchards' areas); cherry production is most developed among stone fruits types (19.2 thousand hectares from 60.9 thousand hectares of stone fruits orchards), plum (17.8 thousand hectares), walnut in productive age (13.2 thousand hectares or 99% from general areas of nuts orchards).

Vinnytsia is a leading region in pome fruits production with orchards areas 18.4 thousand hectares in productive stage; in stone fruits orchards areas, the leading region is Dnipro region with 5.9 thousand hectares; in vineyards, Odesa region is the leader with areas 27.4 thousand ha out of overall vineyards area of 42.7 thousand ha).

Comparing with 1990, experts mark a decrease in orchards and vineyards areas, mainly due to ageing of trees and further removals. Nevertheless, an increase of fruits production is noted by the statistics due to much higher yields achieved in orchards planted following recent technologies.

Fruits producing companies operates mostly with orchards planted following intensive technology which allows to get tree productive stage in 2-3 years after an orchard is planted. For such purpose, entrepreneurs use dwarfish and semi-dwarfish wildings possessing high yields and development

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diminutions. Private house holdings practice based on growing separately standing long term productive trees which characterized by higher volume of timber and lower frequency of pruning.

Table 1. Major indicators of orchards & vineyards in Ukraine (statistical data)

	2014	2015	2016
All categories of holdings			
Areas of fruits orchards in productive age, thousand ha, including:	190.4	187.1	178.9
-Pome fruits orchards	113.9	111.2	104.7
-Stone fruits orchards	63.3	62.4	60.9
Area of vineyards in productive stage, thousand ha	44.2	41.8	42.7
Gross yield of fruits, thousand tons, including:	1866.1	2022.7	1879.3
-Pome fruits	1251.3	1360.0	1261.8
-Stone fruits	512.0	547.6	509.8
Grape production, thousand tons	435.6	386.3	377.8
Agricultural commercial holdings			
Areas of fruits orchards in productive age, thousand ha, including:	57.7	54.5	47.5
-Pome fruits	44.9	42.2	36.2
-Stone fruits	12.3	11.5	10.4
Grape production in productive stage, thousand ha	31.6	29.2	30.1
Gross yield of fruits, thousand tons, including:	320.9	399.7	357.9
-Pome fruits	302.9	374.6	341.8
-Stone fruits	17.7	24.6	15.0
Grape production, thousand tons	241.0	206.1	221.0

Reference:

1. Web portal of Supreme Council of Ukraine: Ukraine. Number of administrative units
<http://static.rada.gov.ua/zakon/new/NEWSAIT/ADM/d01.rtf>
2. <http://minagro.gov.ua/node/14018>
3. <http://minagro.gov.ua/node/14024>
4. Statistical bulletin. Areas, gross yields and yields of crops, fruits, berries and grapes in 2016 y. – K., 2017. – 186 page.

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B. APPR's production potential in Ukraine

There is not precise estimation of APPR's production potential originated from pruning and removals of orchards and vineyards in Ukraine. Agricultural businesses and households have not performed any estimations or measures not pursuing such an aim. The only single evaluation has been done by experts of Bioenergy Association of Ukraine: based on information from 2015-2016 years, fruits and vineyards orchards biomass energy potential has been estimated. Results are the following: **105.9** ktoe in 2015, **102.2** ktoe in 2016.

An important issue is that biomass originated from orchards and vineyards removals appeared in official statement on conceptual level in aspects of energy sources diversification. Bioenergy Association of Ukraine, based on detailed evaluation of energy potential of biomass in the country, goals and performance analysis of National Actions Plan on renewable energy – 2020 year, have concluded that additional source of biomass has to be developed, for example – wooden biomass. Afterwards, initiative estimations of wooden biomass potential, derived from orchards and vineyards pruning and removal.

Agricultural producers and individual farmers do not considerate residuals, originated from pruning and removal of agro plantations, as commodity product. Such kind of biomass mainly stored or left on the fields' sides. In rare cases farmers perform grinding or chopping with following scattering on fields, use it for own energy purposes, or hoard residuals for granules production. Till the present time, such type of activities was not common and represent just an exclusion out of common practice (storing or burning). There is a common conviction among farmers that a chain of energy utilization based on such type of residues is complex, additionally harvesting and hording of APPR residues is time and money costly process.

Certain part of plantations in Ukraine require removal due to a decrease in trees productiveness. Timber originated from removed trees is mainly low quality, thus such biomass almost completely applicable for biofuels and energy production.

Availability of plantations subjected for removals increases overall potential in timber biomass. As for current, there is no precise information on orchards areas which require removals activities that is why it's a tough commitment to estimate a volume of timber biomass optional for utilization.

Specific national strategic documents or plans on energetic biomass utilization based on APPR's in Ukraine have not been issued. Biomass industry goals in aspects of its energy purposes are drafted in National actions plan on renewable energy – 2020 (approved by the directive of the Cabinet of Ministers of Ukraine under number 902-p, 01.10.2014¹) and Energy Strategy of Ukraine – 2035 (approved by the directive of the Cabinet of Ministers of Ukraine N 605-p, 18.08.2017²).

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C. Recent developments in energy purposed APPR's residues utilization

During past years, bioenergy industry in Ukraine has been developing rather dynamically replacing more significant volumes of fossil fuels, mainly, natural gas. Based on national energy balance [5], considering biofuel and residuals production in 2015, gas replacement accounted for 3.26 bln cubic meters, but an average pace of growth from 2010 to 2015 reached 38% annually. Considering an indicator of overall primary energy supply in 2015, gas replacement reached 2.63 bln cubic meters, but an average pace of growth from 2010 to 2015 reached 26% annually. Production and supplies difference is an export of biofuels in forms of pellets, chips, firewood and other biofuels types. These exploited resources easily may be utilized on internal market of Ukraine in the case required market framework formed.

Influence of bioenergy in the national balance of Ukraine in 2015 noted as key: "In renewable energy production structure in 2015 most share belongs to biofuel – 81.3%". In 2015, bioenergy input estimated at the level of 2.5% (1283 ktoe) in final energy consumption and 2.3% (2102 kt) of overall primary energy supplies.

Statistical data on bioenergy production for 2016 are not published yet, but due to experts' opinions natural gas replacement by bioenergy may exceed 3 bln cubic meters per annum. Almost half of the volume is natural gas utilization replacement in private holdings via firewood utilization. Second half is natural replacement in the industry via utilization of firewood, timber chips, pellets and sunflower husk. In fact, these are two industries where the state does not regulate tariffs for heating energy and thus it is more favorable for investors to replace natural gas with renewable energy sources considering prices tensions on gas market. It's accepted that investment pay-back period very from 2 to 3 years.

In accordance to annual report of Ukraine state energy efficiency agency¹ prepared for Energy Community, in 2015 Ukraine has reached next results in bioenergy industry development: final biomass consumption for heating production – 1.53 ktoe, including solid biomass - 1.52 ktoe; an installed capacity of electricity producing capacities – 69 MW, including solid biomass – 52 MW); production of electricity based on biomass – 145 GWh, including solid biomass – 80.6 GWh.

Ukraine possesses significant potential for biomass available for energy production, - almost 20 mln tons of oil equivalent as for 2015. Agriculture residues are major constituent of bioenergy potential and energy culture. Timber biomass energy resources (firewood, forest management residues, wood processing residues) is relatively restrained, thus development of additional sources of wooden biomass, such as biomass originated from pruning and removals of fruit orchards or vineyards.

Notable barriers and obstacles for yielding, hoarding and residues utilization for energy purposes are:

Administrative:

- lack of macro targets, strategies and plans of actions devoted to bioenergy production based on APPR.

Informational:

- lack of information in local areas (among farmers, agro producers) devoted to options for bioenergy sector development in Ukraine in general and for APPR in particular,
- lack of information on existing best practices of APPR's utilization for energy purposes.

Technical and organizational:

- demand of farmers for additional technological equipment,
- precise hoarding scheme for residues with accountability of local frameworks in horticulture, for example, orchard plantation dimensions,
- feasible value chain organization complexity in terms of high added value achievement,
- abundance of precise technology in harvesting and hoarding to prevent high ash content,

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- commonly, minor timber residues volumes owned by a single supplier (agriculture producers and farmers),
- lack of expertise in organizational and managerial value chains based on APPR biomass locally,
- underdeveloped infrastructure in local areas (storage, logistical capabilities).

Economics and financials:

- high price on technological equipment for hoarding, harvesting and residues processing,
- farmers' poor third parties' capital engagement capabilities to acquire machineries, equipment and installations,
- relatively high prices for third parties' capital,
- poor margins for final biofuel product on internal market.

Legal:

- administrative barrier for business legalization in APPRs commercialization as fuels,
- lack of APPR open burning prevention and monitoring,
- lack of public standards for solid fuels.

Culture and knowledge:

- lack of market consolidation, high complexity of negotiation procedures,
- low actors' willingness to unite in form of service or other cooperatives due to poor public credit,
- high conservative convictions and poor willingness to take investments risks,
- farmers' poor level or lack of knowledge in timber residues management, technological risk prevention practices,
- informational vacuum problem in local communities in aspects of APPRs' utilization for energy purposes,
- poor perception of economic benefits originated from residues management,
- information's lack information on specifications APPRs' biofuel, resign of clients from timber firewood made of soft types of trees' species based on information about soft trees' worst burning parameters,
- conception that APPRs' residues harvesting is costly due to energy resources (diesel fuel),
- lack of knowledge on market price of own farmers' orchards residues and their volumes.

Structural

- under developing and opacity of biomass market;
- competition with shady timber firewood market causes market failure;
- lack of understanding among potential market actors in local areas, in particulars, poor local areas' development plans,
- lack of service companies providing harvesting, hoarding, storing and processing of APPRs' residues in local areas,
- state monopoly on timber biofuels' supplies to existing customers,
- competition for clients among large producers and state municipal enterprises.

Due to interviews, conducted among varied market actors' categories, vital barriers restraining development of efficient and economically feasible APPRs' value chains, are:

to farmers' opinion, an absence of own capital for investments and high credit rates, an absence or market and biomass consumers, APPRs' value chains' complexity, underdeveloped infrastructure, unfavorable business infrastructure, unfavorable regulatory policy devoted to biofuels' local markets edging and development of APPRs' biomass utilization in energy purposes.

Other categories of market actors (in particular, experts in field of bioenergy) add to the list above a factor of poor macro and municipal level planning and coordination for energy and agro markets development, but also poor expertise community in local areas.

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Major drivers of APPRs' sector development due to market actors' opinions may be:

- replacement of high cost fossil fuels,
- APPRs' residues costs optimization,
- high pay back as in case for own utilization or in case of commercial transactions on biofuel markets,
- stable demand for biofuels, long-term contracts,
- existence of biofuels customers,
- existence of pilot projects and successful cases,
- development of knowledge on APPRs' value chains development among market actors, the same as potential clients,
- active interest of local communities in development of energy systems based on local biofuel resources (energy independence of regions increase national energy stability),
- development policy of regional and national scale,
- attraction of service companies on initial stages of market development,
- development of favorable framework for machineries and equipment acquirement,
- coordination of cooperation of all actors in APPR's utilization for energy purposes value chains,
- creation of new jobs – high priority issues.

Most important factors supporting feasible value chains development, to market actors' opinion, are economic advantages: short-time pay-back period, market stimulus such as high margins, stable prices for biofuels and long-term contracts. Following factors are knowledge diffusion. Experts in field of bioenergy add edging regulatory policy.

There are several optional market actors to participate in new APPRs' residues utilization, such as: agricultural producers, individual farmers, machineries and equipment distributors, boilers on biofuels servicing individual objects (schools, hospitals, kindergartens, individual business), boiler facilities supplying heating power (municipal companies), biomass granules producers, service companies providing orchards removals, hoarding, ingathering, transportation and grinding for utilization in energy purposes. An important basis for market foundation is an increase in a number of such service companies (currently the number of such service companies is negligible. An entity may be organized in form of independent company providing services on diversified basics, but also any another actor in a value chain: agro producers, municipal companies servicing municipal objects of heating supplies or other biofuels consumers.

Due to meager orchards' scales under operations of individual business, successful service company development on the basis of agricultural companies (farmers) is possible in a case of cooperative unification in form of service cooperative, for example, mutual acquires of equipment and machineries.

Some of municipal companies already own required machineries for grinding, biomass transportation and storing facilitates. Such companies, as for current, perform activities on stocking up other types of timber biomass and have capacities to expand activities into APPRs sector. Produced biomass is optional to commercialization as in form of chips, or granules and briquettes.

Suchlike organizational value chains' schemes for APPRs' utilization (development of service companies based on farmers' cooperation or expansion of municipal companies) are most real in short perspective. Due to increased prices for fossil fuels, own APPRs' utilization for energy production is an option optimize business model.

APPR value chain actors' views devoted to initiation of timber residues management listed below:

Farmers:

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- decrease of loading in management procedures, best variant – service company providing whole services range of APPR resources management,

- initiation of business in APPR residues commerce meeting economic feasibility of such activities.

Service companies:

- complete high quality data sets on biomass availability and qualitative based on orchards, vineyards and other sources with biofuel's specifications,

- existence of sufficient biomass volumes originated from orchards and vineyards in regions for provision of economic feasible machineries' exploitation,

- market consolidation,

- existence of pilot projects.

Municipal administrations:

- passing of heating energy production functions to private commercial entities,

- regional economies development and an efficiency increase in energy supplies based on energy resources' diversification, local biofuels sources diversification.

Reference

5. Energy balances of Ukraine - 2015. Ukraine State Statistics Services express bulletin № 455/0/08.4 ВН-16, 20.12.2016.

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D. National plan for Energy and Climate

Fundamental document determining bioenergy industry development in Ukraine is the National Actions Plan on renewable energy – 2020² (adopted in October, 2014) and Ukraine Energy Strategy – 2035³ (adopted in August, 2017).

In accordance to National Actions Plan, priority input of biomass comparing to other renewable energy sources till 2020 in heating power production: 5000 ktoe, including solid biomass – 4850 ktoe, share of biomass in overall heating energy production – 10.6% in 2020. In production of electricity, expected input of biomass among other renewable energy sources is more constrained: installed capacity on biomass – 950 MW (including biomass – 660 MW), electricity production based on biomass – 4220 GWh (including solid biomass – 2950 GWh) in 2020. Meeting defined goals noted in National Actions Plan, heating production capacity defined on the level of 11875 MW, whereas heating energy volume will reach 50000 Gcal/yr.

Positive side of the National Actions Plan is determination ambitious goals for renewable energy resources development considering bioenergy. Weak side is absence of determination of edging and stimulating mechanisms for renewable energy sources and at the same time bioenergy industry.

Major indicators of Ukraine Energy Strategy – 2035 on bioenergy industry are: biomass/biofuels input into overall primary energy supply, mln tons in oil equivalent: 2020 – 4 (4.9), 2025 – 6 (6.9), 2030 – 8 (8.8), 2035 – 11 (11.5).

Analysis and goals comparison in the biomass industry in Ukrainian National Actions Plan – 2020 and Ukraine Energy Strategy – 2035 show that Energy Strategy - 2020 indicators are lower. It may be bounded with a factor that current indicators of bioenergy industry development lower comparing to planned in National Actions Plan and Energy Strategy adopted in August, 2017.

Pros of Ukraine energy strategy – 2035 is consideration current market situations and energy markets' demands, particularly competition and transparency development. Notes from the strategy listed below:

- Supporting development of competitive biomass market;
- Supporting development of project on cogeneration an TPP and biomass;
- Development of logistics' framework and infrastructure for biomass;
- Switching centralized heating systems to operation on renewable energy sources;
- Development of competitive and transparent electricity markets, natural gas, oil, heating power and coal;
- Maintenance of healthy competitive framework, no barriers market access and existing infrastructure (except natural restrictions, and also considering Ukraine energy safety factors rationalization);
- Finalization of transition into market prices. Abandonment of cost based tariff consideration methodology, energy market regulatory laws' base improvement, development of compatibility;
- Electricity exports will grow, particularly due to an increase in utilization biomass and bio gas.

Beneficial side of the Ukraine Energy Strategy is that the document is based on mathematical models, experts' opinions, and also directive indicators which Ukraine plans to reach in accordance to its international obligations devoted to renewable energy development and climate change.

Reasonable precondition for successful bioenergy industry development in accordance to official goals and tasks is an existence of support and stimulus mechanisms. As for today, there two mechanisms in Ukraine: "green tariff" for capacities operating on renewable sources, and stimulus tariff for heating power production based on renewable energy. However, mentioned before stimulus are not enough for

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overcoming existing barriers and restraining institutional factors of market development.

Experts of Bioenergy Association have identified 10 major barriers, directly or indirectly influence bioenergy market's development:

1. Not monetarized public subsidies for households to pay estate maintenance costs,
2. Accounts with certain regime of transactions for heating and electricity payments,
3. Poor biofuels market consolidation in Ukraine,
4. Issues with parcel's assignments for renewable energy objects,
5. Overstated price for non-standard plug-in electricity capacities into electric nets,
6. Complex organizational and technical mechanisms to plug-in into heating production based on renewable energy,
7. Not consolidated heating nets,
8. Restrains with production and utilization of bio methane,
9. Necessity to conduct ecological experiments for small and bioenergy projects,
10. Subsidized price for natural gas for households.

To break mentioned above barriers initiative activities have already began. For instance, Bioenergy Association's experts together with a team of Public Service for energy efficiency work on development and implementation of a competitive market model in Ukraine. Biofuels' commodity exchange planned to be set up in 2019 aiming to support price transparency development. Except of that, a law draft on industry purpose parcel assignment procedure simplification has been submitted to the Supreme Council of Ukraine under N2529a, 26.08.2015¹)

Bioenergy market's aspects mentioned above are devoted also to APPR's biomass. For example, boiler facility operating on APPRs may be granted with stimulating tariff for produced heating energy due to existing energy law¹. Whichever positive actions adopted in bioenergy industry those will influence APPR's subsector and vice-versa. Experts' estimations for bioenergy perspectives in Ukraine are positive in general.

Production and biofuels utilization aspects mentioned in the State Directive Concept for agriculture industry development – 2020 (approved by the Cabinet of Ministers of Ukraine directive N 1437, 30.12.2015)¹. The Concept foresees energy utilization optimization and competition development to avoid energy import's bondage via an expansion of production and use of solid, liquid biofuels and biogas raw in agriculture companies.

Strategy of the State Ecology Policy of Ukraine – 2020 (approved by the Law of Ukraine N 2818-VI, 21.12.2010)¹ contains a goal to increase a use of renewable and alternative energy sources by 25 till 2015 and by 55% till 2020 comparing to the basis point. It's also stated in the Strategy that in the process of innovative and science development programs demand for rationalization and natural resources' use optimization, particularly technological re-equipping via energy saving, renewables and alternatives' development, and also an increase in utilization of energy with low level of CO₂ emission.

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E. Basic SWOT analysis

SWOT analysis

	Strengths	Weaknesses	
Internal factors	Agriculture - Large unexplored potential in APPR's residues across the country; - Existence of own raw base and economic stimulus for APPR's biomass utilization for own energy purposes; - Existence of sufficient demand. Bioenergy - Lack of competition for this kind of raw materials for energy purposes; - Abundant experience in timber's chips utilization for energy purposes; - General positive dynamics in bioenergy industry. Equipment producers - National producers' equipment availability for biomass burning; - Existence of producers and distributors of equipment for hauling, harvesting and grinding of APPR's residues as national and foreign producers. Commerce - Developed infrastructure; - Experience in timber biomass supplies organizations for existing capacities; - Large number of timber biomass granules producers; - Existence of large number of potential suppliers and customers for biomass.	Agriculture - Complexity in logistics organization; - Popular unwillingness of agricultural companies to participate in new value chains; - Lack of experience in residues logistics, required knowledge on value chains organization; - Lack of experience in biomass logistics organization; - Demand for complementary equipment; - Lack of own money for investments; - Exigency in biofuels commerce business legalization. Bioenergy - Underdevelopments of biofuels markets; - Lack of practice in long-term contracts for biofuels supplies; - Lack of approved methodologies for supplied biofuels check; - Lack of equipment for biomass quality check. Equipment producers - High prices for technological equipment for mechanized hauling and APPR's biomass grinding. Commerce - State monopoly for biofuels supplies to existing boilers facilitates; - Lack of knowledge in efficient logistics organization; - Lack of experts' community; - In most of the cases large volumes concentrated on capacities of an individual producer; - Competition with shadow firewood market; - Competition for existing customers.	Internal factors

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External factors	Opportunities Agriculture - Activities' diversification via biofuels commercialization; - Development of service cooperatives; - Hauling residues services; - Residues utilization in own energy purposes and respectively fossil fuels substitution. Bioenergy - Supplies channels diversification; - Competition with other types of timber biofuels via cost optimization. Equipment producers - An increase in a number of machineries and equipment. Commerce - Development of competitive biofuels market; - Development of sub-industries in Ukraine; - Development of new jobs; - Development of biofuels via development of services companies operating in hauling, grinding and logistics of ready biofuels.	Threats Agriculture - Practical ensuring of biofuels supplies; - Poor purchasing power among biofuels consumers. Bioenergy - Instable quality of biofuels originated from APPR's; - Reorientation of biomass suppliers from sales to own utilization or other, more productive activity; - Abrupt change of prices for biofuels from suppliers. Equipment producers - Lack of experience in exploitation of power equipment and equipment for harvesting, hauling and grinding of APPR's residues. Commerce - Unconsolidated and non-transparent biofuels market; - Competition for customers among large state producers and small scale producers; - Lack of biomass resources near power plants.	External factors
	Positive factors	Negative factors	

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STRATEGIC ACTIONS PLAN

The actions plan for fortification of APPR's bioenergy sub-sector development is based on trends' analysis and consultancies with representatives of stakeholders via face to face interviews.

The plan defines a list of concrete technical and non-technical actions which have to be performed (in short, middle and long terms) to increase a level of energy purpose biomass utilization and removal long term agriculture plantations. Despite others, such actions consider demos, knowledge diffusion and actions on potential development, market instruments, funding and economic stimulus, actions devoted to communications development, regulatory framework and other factors which are helpful for sustainable APPR's subindustry. Thus, the actions plan defines a list of actions offered/recommended for accomplishment by general and municipal state administrations, governmental decision makers who defines policy in the industry and takes decisions influencing on ministers and agencies.

Below a list of approaches used for the action plan development (picture 3). SWOT analysis, described in the previous chapter, considered as basis. In accordance to SWOT methodology, key elements of the SWOT are:

Strengths – positive elements to develop further, these elements are reliable for strategic decisions to use it as a leverage.

Weaknesses – elements to be improved, changed or removed.

Opportunities – positive elements for perspective developments. A list of priorities has to be determined, these elements are reliable for strategic decision devoted to perspective developments.

Threats – negative elements for perspectives. Risk avoiding and management strategies and tactics have to be developed.

Via composition of internal and external factors, further strategies may be developed:

SO Strategies (Strengths implication strategy to yield results from opportunities). These strategies, “MAX-MAX” type combining most feasible elements for strategy development. SO strategies exploits powerful elements for successful exploitation of external opportunities. Strategy is dynamic and aggressive (attack strategy).

WO Strategies (Strategies aimed to soften an impact originated from weaknesses via opportunities). These strategies are MIN-MAX type combining internal weaknesses and external opportunities (reorientation).

ST Strategies (Strategies which considering strengths to prevent or to downgrade to minimum threats). These strategies are MAX-MIN type aiming to use strengths to avoid or minimize external threats (protective strategies).

WT Strategies (Strategies which softening weaknesses and aimed to downgrade threats' impact). These strategies are MIN-MIN type and aimed to despise weaknesses in cases when external threats may be avoided (surviving).

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Fig. 3. APPR's industry development strategy approach.

The list of drafted strategies for achievement of sustainable growth in supplies of APPR's timber energy purpose.

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ACTION PLAN

* Time framework for implementation of actions/events (**short-term**: till the end of the project;

middle-term: in the end of the project; **long-term**: in short time after the end of the project).

Strategies/ Goal actions' type	SWOT-analysis components	Aims	Actions / Events	Targeting groups of an interest	Included into project "uP_running" (yes / no)	Time frames*
SO = Strengths + opportunities Development of new chain based on existing companies	S: - Vast experience in timber chips utilization as fuel; - Existing of large number of optional suppliers and biomass' consumers.	Involvement of existing customers and companies which operate in hauling and storing of other types of biofuels into new APPR's chains.	Development of demonstrational chain on APPR's utilization based on existing consumers and state companies which nowadays operate in hauling and storing of other types of biofuels (state forestry companies, municipal companies).	Farmers, boiler facilitates, biofuels suppliers.	yes (in demos' framework)	Short-term
SO = Strengths + opportunities Development of new APPR's supply chain	S: Large unexploited APPR's residues' potential generally in the country. O: Development of biofuels markets via development of service companies supplying full range of services in harvesting, hauling, storing and grinding with further logistics.	Development of successful cooperation cases among agriprenuers and the industry. Support for development of new supply chains. Development of solutions for solving generally known tasks.	Exchange of innovative projects, new business ideas and researches' results via practical implementation. Research for potential partners, best practices, and funding opportunities.	Key actors inside of an interest's network, plus optional allies outside of the APPR's industry + потенційні.	yes	middle-term

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Strategies/ Goal actions' type	SWOT-analysis components	Aims	Actions / Events	Targeting groups of an interest	Included into project "uP_running" (yes / no)	Time frames*
WO = Weaknesses + opportunities Development of new APPR's supply chains	W: - Complexity in organizational logistics chains; - Lack of experience in residues' logistics; O: Diversification of activities via development of business in biofuels commercialization.	Feasible business model identification and its optimization (gathering, primary processing, transportation, biomass storing) from a field to a customer.	Evaluation of technical and economic indicators of new value chain set up. Marketing research of new value chain's development. Development of efficient nets across value chains.	All parties interested in connection to the project. An aim is to develop an idea into successful implication.	yes	Short-term
SO = Strengths + Opportunities Development of enlightenment and transparency	S: - Large number of optional suppliers and consumers. - Overall positive dynamics of bioenergy industry development. O: - Development of competitive biofuels market. - Contiguous industries in regions.	Development of an overall enlightenment and transparency among APPR's value chain actors (agro producers, entrepreneurs, policy makers, others).	Tuning up and consolidation engaged people network, its development devoted to a line of "operative group" intended to work among the group on regional level.	Key actors inside of engaged network	yes (partially)	Middle-term
WO =	W:	Trainings for professionals	Formation of a project's	Professionals and	yes	Short - term

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Strategies/ Goal actions' type	SWOT-analysis components	Aims	Actions / Events	Targeting groups of an interest	Included into project "uP_running" (yes / no)	Time frames*
Weaknesses + Opportunities Development of experts' network	- Lack of experience in logistics, residues supply, required knowledge for added value chains development; - Lack of experts' network; O: - Diversification of farmers' activities and agriculture producers; - Development of biofuel market via foundation of service companies providing full range of services such hauling, grinding and yielding and supplies to energy facilitates of APPR's biomass.	about details in APPR's biomass utilization for energy purposes (technical, economic and organizational aspects). Group of trained individuals has to be active even after finalization of the project.	tech team which will provide support for companies operating in bio residues management industry (projects' development, investors involvement).	consultancies aiming to achieve knowledge and experience in APPR's value chain development.	(only partially)	
ST = Strengths + Threats Farmers trainings	S: Existence of APPR's management equipment & machineries producers and distributors;	Development of knowledge level for most efficient organizational of technological chain in gathering, previous	Development of educational handbook on details in APPR's management for farmers Explanation of	Фермери, с/г підприємства, які бажають розпочати діяльність зі gathering/APPRs'	yes (partially)	Middle - term

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Strategies/ Goal actions' type	SWOT-analysis components	Aims	Actions / Events	Targeting groups of an interest	Included into project "uP_running" (yes / no)	Time frames*
	- Experience in organization of APPR's supply chains for existing of energy capacities; - Energy producers; - Existing of large amount of potential suppliers and biomass consumers; - Existing of large amount of potential suppliers and biomass consumers. T: - High costs of ready biofuels; - Instable quality of biofuel originated from APPRs; - Lack of experience in power machines exploitation, the same as equipment and machines for hauling, grinding of APPR's residues.	processing and preparation of APPR's residues for biofuel production. Stimulation of biofuel production with abundance of technological requirements in a common standard.	advantages in long-term contracts and authorization for biofuels production (technical requirements).	commerce		

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Strategies/ Goal actions' type	SWOT-analysis components	Aims	Actions / Events	Targeting groups of an interest	Included into project "uP_running" (yes / no)	Time frames*
ST = Strengths + Threats Lobbying and informational services	S: - Overall positive dynamics in bioenergy industry development; - Abundant experience in timber chips utilization. T: - Reorientation of biomass suppliers from its commercialization for own purposes or another more profitable activities; - Competition for biofuel customers among small, medium and large municipal companies.	Involvement of governmental, regional, local policy makers influencing decision process in industry policies aimed to develop bioenergy industry. Actions and events have to be directed to break barriers originated from authorization and other bureaucratic procedures.	Public and transparent lobbying aimed to overcome barriers and obstacles which restrains innovational value chains based APPRs. Actions devoted to help receipt and approve from policy makers and opinion leaders: nudging for fossil fuels substitution by APPR's residues, simplification of administrative load on farmers and potential biofuel customers. Defeated timber black market.	Most influential market actors in value chain net, including state, regional and local policy makers.	yes (partially)	Long-term
WO = Stable sides + Opportunities Informational campaign	W: - Unwillingness of agriculture companies to invest into new businesses on APPR's commerce; - State monopoly for	Development of knowledge on potentials energy purposed utilization of APPR's biomass as among farmers, the same among optional customers.	Wide informational distribution of knowledge on the project and generally on opportunities and perspectives of APPR's	Key actors in value chain, all interested individuals and organization	yes	Middle-term

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Strategies/ Goal actions' type	SWOT-analysis components	Aims	Actions / Events	Targeting groups of an interest	Included into project "uP_running" (yes / no)	Time frames*
	biofuels supplies to existing energy capacities. O: - Activities diversification via foundation of business in biofuels commerce; - Development of biofuels market via system of services providing companies. - Opening of new jobs. - Adjacent industries development.		biomass utilization for energy purposes devoted to building up a positive image for all value chain's actors and stakeholders, including locals. Preparation and distribution of information on fuel indicators, volumes of APPRs.			
WO = Weaknesses + Opportunities Financing	W: - Demand for additional equipment; - Widely broadened lack of investment capital among farmers. O: Foundation of service cooperative; - Providing services in hauling of APPR's residues.	Development of opportunities for nudging currently restrained willingness to invest among producers of APPR's residues.	Formation of goal groups with key value chain actors together with experienced consultants' involvement of governmental capital, discounted credits and other financial sources. Information diffusion among entrepreneurs aiming to increase	APPR's value chain key market actors, financial consultants, governmental employees.	No	Lon-term

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Strategies/ Goal actions' type	SWOT-analysis components	Aims	Actions / Events	Targeting groups of an interest	Included into project "uP_running" (yes / no)	Time frames*
			capabilities to get funding for APPR's industry development.			
ST = Сильні сторони + Загрози Biofuels exchange foundation/logistics centers for biofuels commerce	S: - Відсутність конкуренції за даний вид сировини як палива; - Загальна позитивна динаміка розвитку сектору біоенергетики. T: - Нестабільна якість біопалива з відходів ОББН; - Unconsolidated biofuels market.	Development of a net build up based on logistics centers and/or an exchange devoted to biofuels trading guaranteed high quality.	Building up goal groups based on key actors in APPR's residues. Involvement of government representatives devoted to biomass energy industry. Model development of exchange functioning scheme (involving of all interested sides). Foundation of commodities exchange operations.	APPR's value chain key market actors + consultants + governmental employees.	no	Long-term
WT = Weaknesses + threats Alternative production	W: Practice lack in long-term contracts on biofuels supplies. T: - High costs in ready biofuels. - Unconsolidated and nontransparent biomass	Development of new technical opportunities for achievement high economic value of APPR's biomass in case when energy purposed utilization is not feasible or complex for development.	Research of APPR's biomass utilization options for alternative products' production as bio composites, bio filters, compost, others.	All sides interested in participation in project. An aim is to transform an idea into practice.	no	Long-term

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	market.					

ANNEX A6

**АНАЛІЗ СЕКТОРУ ВИКОРИСТАННЯ ВІДХОДІВ ВІД ОБРІЗКИ ТА
ВИДАЛЕННЯ БАГАТОРІЧНИХ СІЛЬСЬКОГОСПОДАРСЬКИХ
НАСАДЖЕНЬ (ОВБН) В ЕНЕРГЕТИЧНИХ ЦІЛЯХ В УКРАЇНІ**

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОБН та розробка стратегічного плану дій для України		
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А. Національні особливості утворення відходів ОБН

Україна — держава у Східній Європі та частково в Центральній Європі з населенням 42,6 млн. осіб (дані 2017 р.). Межує з Білоруссю на півночі, Польщею, Словаччиною та Угорщиною — на заході, Румунією та Молдовою — на південному заході, Росією — на сході і північному сході. На півдні і південному сході омивається Чорним і Азовським морями (**Рис. 1**). Загальна площа України становить 603 628 км², що складає 5,7 % території Європи і 0,44 % території світу. Відстань між крайніми північною та південною точками становить 893 км, а між крайніми західною та східною — 1316 км.

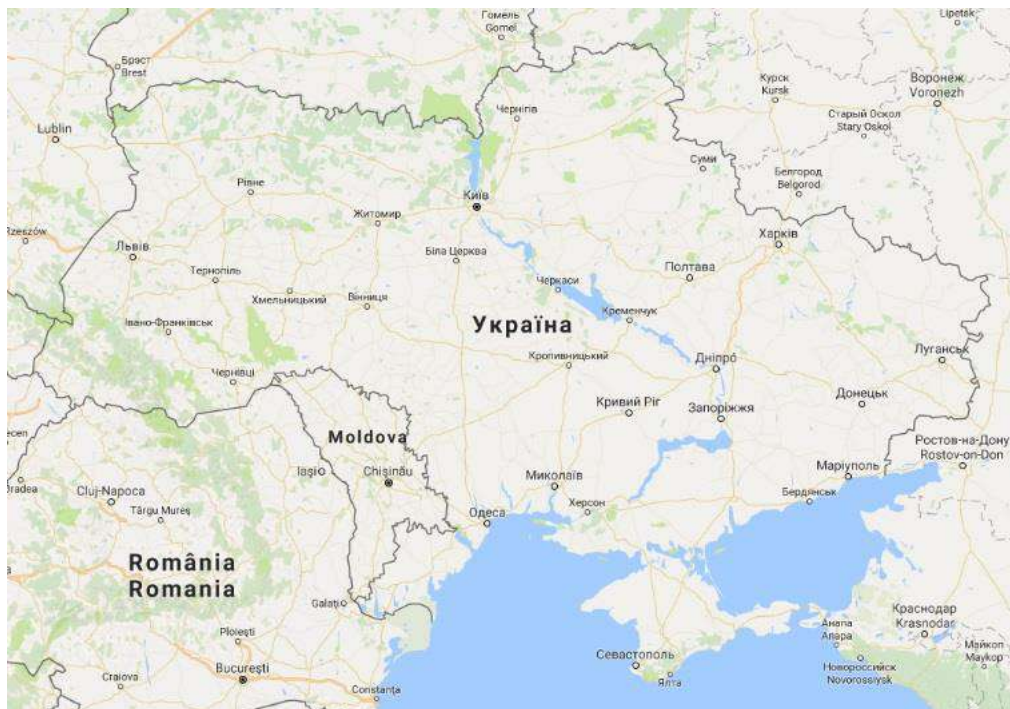


Рис. 1. Карта України.

Одиницями вищої ланки в адміністративно-територіальному поділі України є Автономна Республіка Крим, 24 області та два міста із спеціальним статусом — Київ і Севастополь. Середню ланку в адміністративно-територіальному поділі України складають райони і міста обласного значення. Найнижчою ланкою адміністративно-територіальної системи є міста районного значення, селища міського типу та села. Всього в Україні на 1 вересня 2017 р. нараховується 490 сільських районів [1].

Клімат України переважно помірно-континентальний, середня температура січня: на північному сході -7°C і 0°C ... $+4^{\circ}\text{C}$ у Криму; середня температура липня: на півночі $+17^{\circ}\text{C}$ і $+23^{\circ}\text{C}$... $+25^{\circ}\text{C}$ — у Криму. Річна кількість опадів: від 650–600 мм на заході до 450–400 мм на півдні й південному сході, з них 80% випадають в теплий період року. За природно-кліматичними умовами Україна поділяється на три зони: Полісся і Карпати, Лісостеп та Степ (**рис. 2**).

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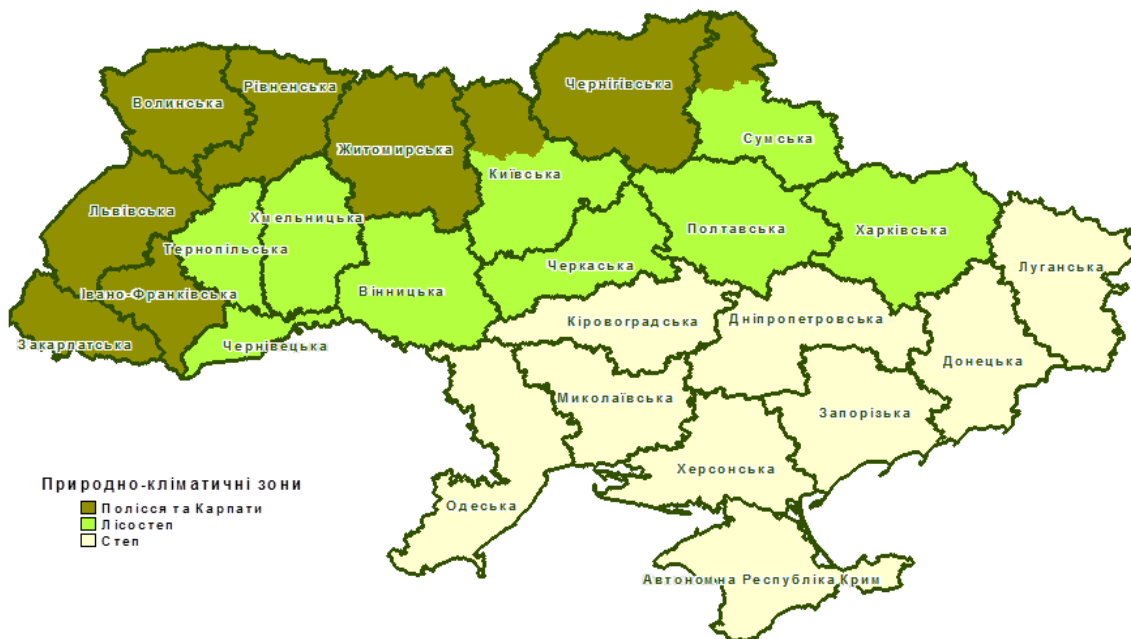


Рис.2. Природно-кліматичні зони України

У сільському господарстві України важлива роль належить садівництву та виноградарству. Садівництво найбільш розвинуто у Лісостепу, Степу, Львівській та Закарпатських областях. Виноградарством займаються на півдні у Степу та в деяких районах Закарпаття.

У 2016 р. частка господарств населення у загальній площі плодкових насаджень становила 73%, у площі виноградників – 29,5%. Роль таких садів і виноградників у формуванні пропозиції високоякісних і великих партій плодів на внутрішньому ринку наразі невелика, і в перспективі очікується її подальше зменшення за рахунок розвитку промислового садівництва та виноградарства [2, 3].

У плодкових насадженнях превалюють зерняткові: сільськогосподарськими підприємствами у 2016 р. з 36,2 тис. га (76,2% загальної площі плодкових насаджень у плодоносному віці у с/г підприємств) було зібрано 341,8 тис. т плодів (Таблиця 1) [4]. У видовій структурі зерняткових насаджень превалює яблуня (загалом 91,6 тис. га у 2016 р., або 87,5% площі всіх зерняткових); у кісточкових найбільше представлені вишня (19,2 тис. га із загальних 60,9 тис. га кісточкових) та слива (17,8 тис. га із загальних 60,9 тис. га кісточкових); у горіхоплідних – волоський горіх (13,2 тис. га, або 99,2% площі всіх горіхоплідних).

За вирощуванням зерняткових насаджень лідирує Вінницька область із площею 18,4 тис. га насаджень у плодоносному віці; за площею кісточкових – Дніпропетровська область (5,9 тис. га); за площею виноградників – Одеська область (27,4 тис. га із загальних 42,7 тис. га).

Порівняно із 1990 р. спостерігається скорочення площ садів і виноградників, у першу чергу, за рахунок старіння насаджень та виведення їх з експлуатації. Хоча в останні роки валовий збір плодів зростає завдяки підвищенню врожайності, що пов'язано із вступом у плодоношення площ, посаджених за сучасними технологіями.

Сільськогосподарські підприємства, переважно, закладають сади за інтенсивними технологіями садівництва, за яких плодові дерева вступають у плодоношення вже на 2-3 рік після закладання саду. Для цього використовуються карликові і напівкарликові підщепи, що добре ростуть і гарно

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плодоносять. Населення переважно використовує сильнорослу технологію садівництва, що характеризується більшим запасом деревини та меншою частотою обрізки дерев.

Таблиця 1. Основні показники садівництва та виноградарства в Україні (статистичні дані)

	2014	2015	2016
Усі категорії господарств			
Площа плодових насаджень у плодоносному віці, тис. га, у тому числі:	190,4	187,1	178,9
зерняткових насаджень	113,9	111,2	104,7
кісточкових насаджень	63,3	62,4	60,9
Площа виноградників у плодоносному віці, тис. га	44,2	41,8	42,7
Валовий збір плодових, тис. т, у тому числі:	1866,1	2022,7	1879,3
зерняткові	1251,3	1360,0	1261,8
кісточкові	512,0	547,6	509,8
Виробництво винограду, тис. т	435,6	386,3	377,8
Сільськогосподарські підприємства			
Площа плодових насаджень у плодоносному віці, тис. га, у тому числі:	57,7	54,5	47,5
зерняткові	44,9	42,2	36,2
кісточкові	12,3	11,5	10,4
Площа виноградників у плодоносному віці, тис. га	31,6	29,2	30,1
Валовий збір плодових, тис. т, у тому числі:	320,9	399,7	357,9
зерняткові	302,9	374,6	341,8
кісточкові	17,7	24,6	15,0
Виробництво винограду, тис. т	241,0	206,1	221,0

Посилання

1. Веб-портал Верховної Ради України: Україна. Число адміністративно-територіальних одиниць <http://static.rada.gov.ua/zakon/new/NEWSAIT/ADM/d01.rtf>
2. <http://minagro.gov.ua/node/14018>
3. <http://minagro.gov.ua/node/14024>
4. Статистичний бюлетень. Площі, валові збори та урожайність сільськогосподарських культур, плодів, ягід та винограду у 2016 р. – К., 2017. – 186 с.

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В. Потенціал утворення відходів ОБН в Україні

На сьогоднішній день не існує точної оцінки потенціалу біомаси, що утворюється від обрізки та викорчовування багаторічних сільськогосподарських насаджень в Україні. Аграрні підприємства та населення не виконували необхідних вимірювань, не маючи такої потреби. Єдина приблизна оцінка виконана експертами Біоенергетичної асоціації України (БАУ)¹: за даними 2015-2016 рр. визначено енергетичний потенціал деревної біомаси, отриманої від обрізки плодкових насаджень та виноградників. Результати оцінки наступні: потенціал деревної біомаси, доступний для енергетики, складає: **105,9** тис. т н.е. у 2015 р., **102,2** тис. т н.е. у 2016 р.

Треба зазначити, що біомаса, що утворюється від обрізки та викорчовування плодкових насаджень та виноградників, на концептуальному рівні стала розглядатися в Україні як додаткове джерело біопалива лише останні кілька років. Біоенергетична асоціація України на основі детальної оцінки енергетичного потенціалу біомаси в країні, аналізу цілей Національного плану дій з відновлюваної енергетики на період до 2020 року та динаміки його виконання дійшла до висновку про необхідність пошуку додаткових джерел енергетичної біомаси, зокрема, деревної. Після цього були зроблені перші оцінки енергетичного потенціалу деревної біомаси, отриманої від обрізки плодкових насаджень та виноградників.

На сьогодні сільськогосподарські підприємства та окремі фермери, у переважній більшості, не розглядають відходи, що утворюються в наслідок обрізки та викорчовування аграрних плантацій, в якості товарного продукту. Даний вид біомаси, переважно, просто зберігається або спалюється на краю поля. Існують поодинокі випадки подрібнення обрізок та розкидання по полю, а також енергетичного використання на власні потреби, збирання та виробництва гранул. Дотепер такого роду діяльність ще не набула помітного поширення і являє собою, скоріше, виключення із правил (зберігання/спалювання). Серед фермерів існує переконання, що ланцюжок енергетичного використання даних видів відходів є дуже складним, а їх збір та переробка дуже затратними з точки зору витрати трудових та енергетичних ресурсів.

Деяка частина насаджень в Україні наразі потребує розкорчовування через зменшення продуктивності рослин. Деревина викорчуваних рослин є, переважно, низькосортною, тому таку біомасу майже повністю можна застосувати для виробництва біопалива та енергії. Наявність насаджень, що підлягають викорчовуванню, потенційно підвищує загальний потенціал деревної біомаси в Україні. Наразі точної інформації щодо площі садів, які потребують викорчовування, немає, тому практично важко оцінити обсяг деревної біомаси, що може бути отримана в результаті цього.

Окремих національних стратегічних документів або планів/цілей щодо енергетичного використання біомаси від обрізки/викорчовування плодкових насаджень в Україні не існує. Цілі по біомасі, як енергетичному ресурсу в цілому, містяться в Національному плану дій з відновлюваної енергетики на період до 2020 року (затверджений Розпорядженням КМУ № 902-р від 01.10.2014²) та Енергетичній стратегії України на період до 2035 року (затверджена Розпорядженням КМУ № 605-р від 18.08.2017³).

¹ <http://uabio.org/>

² <http://zakon3.rada.gov.ua/laws/show/902-2014-%D1%80>

³ <http://www.kmu.gov.ua/control/uk/cardnpd?docid=250250456>

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С. Сучасний стан розвитку сектору енергетичного використання відходів ОБН

Останніми роками сектор біоенергетики в Україні розвивається доволі динамічно, заміщуючи все більші обсяги викопного палива, в першу чергу, природного газу. Згідно енергетичного балансу країни за 2015 р. [5], по показнику "виробництво біопалива та відходів" у 2015 р. заміщення газу біопаливом склало 3,26 млрд. м³, а середній темп зростання з 2010 р. до 2015 р. становив 38%/рік. По показнику "загальне постачання первинної енергії з біопалива та відходів" у 2015 р. заміщення газу біопаливом склало 2,63 млрд м³, а середній темп зростання у період 2010-2015 рр. становив 26%/рік. Різницю між «виробництвом» та «постачанням» складає експорт біопалив за межі України у вигляді пелет, тріски, дров та інших видів біопалив. Ці ресурси, що експортуються, легко можуть бути залучені до використання на внутрішньому ринку України при створенні сприятливих умов для цього.

Роль біоенергетики в енергобалансі 2015 р. відзначена як ключова (цитата): "У структурі виробництва відновлюваних джерел енергії у 2015 р. найбільшу питому вагу мало біопаливо – 81,3%". У 2015 р. внесок енергії з біопалива складав 2,5% (1283 тис. т н.е.) кінцевого споживання енергії та 2,3% (2102 тис. т н.е.) загального постачання первинної енергії в Україні.

Статистичних даних щодо виробництва енергії з біопалива у 2016 році ще немає, але є підстави прогнозувати, що заміщення природного газу біопаливом перевищить 3 млрд м³/рік. Приблизно половину цієї величини складає заміщення газу у приватних домогосподарствах шляхом спалювання, переважно, дров. Друга половина – це заміщення газу в промисловості за рахунок використання дров, деревної тріски, пелет, лушпиння соняшника. Фактично, це два сектори, де держава не регулює встановлення тарифів на тепло, і інвесторам економічно вигідно заміщувати природний газ, враховуючи його суттєве подорожчання протягом останніх років. Терміни окупності відповідних біоенергетичних проектів зазвичай складають 2-3 роки.

Згідно щорічного звіту Державного агентства з енергоефективності та енергозбереження України⁴ перед Енергетичним Співтовариством, членом якого є Україна, у 2015 році досягнуто таких показників розвитку сектору біоенергетики: кінцеве споживання біомаси для виробництва теплової енергії – 1,53 тис. т н.е. (у тому числі твердої біомаси – 1,52 тис. т н.е.); встановлена потужність електрогенеруючого обладнання на біомасі – 69 МВт (у тому числі на твердій біомасі – 52 МВт); виробництво електроенергії з біомаси – 145 ГВт*год (у тому числі з твердої біомаси – 80,6 145 ГВт*год).

Україна має великий потенціал біомаси, доступної для виробництва енергії, – близько 20 млн. т н.е. за даними 2015 року. Основними складовими потенціалу є побічна продукція та відходи сільського господарства, а також енергетичні культури. Енергетичні ресурси деревної біомаси (дрова, порубкові залишки, відходи деревообробки) є відносно обмеженими, тому надзвичайно актуальним є пошук додаткових джерел деревної біомаси, таких як біомаса від обрізки та викорчовування плодкових насаджень та виноградників.

Основними бар'єрами та перешкодами для розвитку діяльності зі збору/продажу/використання відходів від обрізки та видалення багаторічних сільськогосподарських насаджень в енергетичних цілях є наступні:

Регуляторні

- Відсутність національних цілей/стратегій/планів дій з енергетичного використання біомаси ОБН.

Інформаційні

⁴ <http://saee.gov.ua/>

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- Відсутність або нестача інформації на місцях (у фермерів, сільськогосподарських підприємств) щодо можливостей та перспектив розвитку сектору біоенергетики в Україні загалом та сегменту ОВБН, зокрема.
- Відсутність інформації про існуючі кращі приклади енергетичного використання відходів ОВБН.

Технічні та організаційні

- Потреба фермерів у додатковому технологічному обладнанні;
- Необхідність розробки правильної схеми збору відходів з врахуванням місцевих особливостей садівництва, наприклад, довжини рядків;
- Складність в організації правильного логістичного ланцюжка для досягнення високої доданої вартості;
- Необхідність дотримання правильної технології збору обрізків задля забезпечення низької зольності палива;
- Зазвичай невелика кількість деревних відходів у одного постачальника (сільськогосподарського підприємства чи фермера);
- Відсутність експертів з організації та управління логістичного ланцюжку на базі біомаси ОВБН на місцях;
- Нерозвинена інфраструктура в регіонах (складські, транспортні потужності).

Економічні та фінансові

- Висока вартість спеціалізованого обладнання для збору та подальшої обробки відходів;
- Відсутність у фермерів власних коштів для інвестицій та придбання нового обладнання;
- Високі кредитні ставки;
- Висока собівартість готового біопалива.

Нормативні

- Адміністративний бар'єр при легалізації бізнесу з продажу тріски з ОВБН як палива;
- Відсутність відстеження та перешкоджання відкритому спалюванню деревини від ОВБН;
- Відсутність державних стандартів на тверде біопаливо.

Культурні

- Відсутність об'єднання всіх типів зацікавлених сторін, складність узгодження діяльності між всіма учасниками виробничого ланцюга;
- Небажання фермерів об'єднуватись у сервісні кооперативи через недовіру;
- Консервативність фермерів та небажання розпочинати новий бізнес;
- Побожування фермерів щодо складності додаткових операцій із заготівлі деревини ОВБН та можливих накладок, які не дозволяють виконати вчасно та якісно роботи догляду за садами;
- Відсутність інформації у громадах про можливості енергетичного використання деревини ОВБН;
- Нерозуміння фермерами економічних переваг від продажу власних відходів;
- Відсутність інформації щодо паливних характеристик біомаси ОВБН; відмова деяких споживачів від деревини м'яких порід через інформацію про її гірші паливні характеристики;
- Уявлення, що збір відходів є дорогим з точки зору затрачених енергоресурсів (дизельного палива);
- Відсутність у фермерів знань щодо ринкової вартості власних відходів та їх кількості, що утворюється на підприємстві.

Структурні

- Несформований та непрозорий ринок біомаси як палива;
- Конкуренція з тінювим ринком дров, що призводить до неможливості конкурувати по вартості;
- Відсутність розуміння на місцях, зокрема, недостатньо здійснюється планування розвитку місцевої економіки та сільських територій розвитку;
- Відсутність в регіонах сервісних компаній, які надають послуги зі збору, подрібнення та транспортування біомаси;

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- Державна монополія на постачання деревного біопалива існуючим споживачам;
- Конкуренція за споживачів біопалива між невеликими виробниками та державними комунальними підприємствами.

Згідно опитування (інтерв'ю), проведеного поміж різних категорій зацікавлених сторін, найбільш значущими бар'єрами, які заважають побудові ефективних ланцюжків постачання деревини від ОВБН для потреб біоенергетики, є:

На думку фермерів - відсутність власних коштів для інвестицій та високі кредитні ставки; відсутність ринку та споживачів біомаси; складність самого ланцюжка постачання; незадовільна інфраструктура; несприятлива регуляторна політика (по заохоченню використання місцевих видів палива та стимулюванню фермерів до енергетичної утилізації власних відходів).

Інші категорії зацікавлених сторін (зокрема, експерти у сфері біоенергетики) додають до даного переліку фактор недостатнього загальнодержавного та місцевого планування/координування для розвитку енергетичного та агропромислового сектору та відсутність експертного середовища на місцях.

Основними рушійними силами розвитку сектору ОВБН, на думку зацікавлених сторін, можуть бути:

- Заміщення дорогого викопного палива;
- Зменшення собівартості біопалива з відходів ОВБН;
- Високий рівень окупності як при власному споживанні, так і при продажу готового біопалива на ринок;
- Стабільні ціни та попит на біопалива на ринку, довгострокові контракти;
- Наявність споживачів біопалива;
- Наявність пілотних проектів та успішних прикладів;
- Підвищення обізнаності щодо переваг використання ОВБН серед зацікавлених сторін та потенційних споживачів;
- Зацікавленість громад у впровадженні енергетичних систем на місцевому біопаливі (енергетична незалежність регіонів, що підвищує загальнодержавну енергетичну незалежність);
- Стимулююча політика регіонального та національного розвитку;
- Залучення сервісних компаній на початкових етапах становлення ринку;
- Створення пільгових умов для придбання спеціалізованої техніки;
- Узгодження співпраці всіх гравців в ланцюжку енергетичного використання деревини ОВБН (спільне бачення переваг);
- Створення нових робочих місць, що є особливо важливим для сільської місцевості.

Найбільш значущими стимулами, що можуть сприяти побудові ефективних ланцюжків, на думку зацікавлених сторін, є економічні переваги: швидка окупність витрат, ринкові стимули – висока вартість енергетичної біомаси, стабільні ціни на біопалива та довгострокові контракти. На другому, по значущості, місці знаходяться фактори поширення знань та підвищення обізнаності. Експерти в сфері біоенергетики додають стимулюючу регуляторну політику.

В Україні існують наступні типи виробничих організацій, які можуть бути гравцями в ланцюжку енергетичного використання біомаси обрізків та видалення багаторічних сільськогосподарських насаджень: сільськогосподарські підприємства; окремі фермери; виробники та дистриб'ютори обладнання для садівництва та енергетичного обладнання; котельні на біопаливі, які обслуговують один об'єкт (школа, лікарня, дитячий садок, окреме підприємство); котельні централізованого теплопостачання (комунальні підприємства), виробники гранул з біомаси, сервісні компанії, що надають послуги з викорчовування, збору, подрібнення та транспортування відходів від обрізки чи

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викорчовування для використання в якості біопалива. Важливою передумовою започаткування ринку енергетичної утилізації біомаси від ОБН є збільшення кількості таких сервісних компаній (наразі їх число доволі обмежене). Це може бути як нове відокремлене підприємство, що надаватиме послуги на різних умовах, так і будь-хто з існуючих гравців у ланцюжку: аграрні підприємства (фермери), комунальні підприємства, що обслуговують муніципальні об'єкти теплопостачання, чи інші споживачі біопалива.

Через, в основному, невеликі площі садів у користуванні одного господарства, успішне створення сервісної компанії на базі аграрних підприємств (фермерів) можливе за умови їх об'єднання у формі сервісного кооперативу (чи іншої) та закупки спеціалізованого обладнання у спільне користування. Деякі з комунальних підприємств вже зараз володіють необхідною технікою для подрібнення та транспортування біомаси та мають відповідні складські потужності. Такі підприємства наразі здійснюють заготівлю інших видів деревної біомаси та можуть розширити свою діяльність на біомасу ОБН. Вироблена біомаса може бути реалізована як у вигляді тріски так і у вигляді гранул/брикетів.

Саме такі схеми організації вартісного ланцюжка використання біомаси ОБН (створення сервісної компанії на базі об'єднання фермерів або розширення діяльності комунальних підприємств) є найбільш очікуваними у короткостроковій перспективі. Вже зараз (в зв'язку з ростом цін на традиційні енергоресурси) власне споживання деревини ОБН в енергетичних цілях фермерами може бути економічно вигідним та за умови запланованого розвитку сектору виробництва теплової енергії з твердого біопалива будуть створюватися сприятливі умови для організації бізнесу з продажу біопалива з ОБН.

Нижче наведено бачення учасників ланцюжку енергетичного використання відходів ОБН щодо початку діяльності з їх збору/використання:

Фермери:

- Зменшення навантаження при поводженні з відходами. Найкращий варіант: сервісна компанія, яка здійснює весь спектр послуг зі збору/подрібнення та транспортування біомаси з місця утворення;
- Старт бізнесу з продажу власних відходів за умови задовільних економічних показників.

Сервісні компанії:

- Наявність об'єктивних даних щодо кількості біомаси, що утворюється на одиниці площі садів/виноградників та її паливних характеристик;
- Наявність достатнього об'єму енергетичної біомаси з садів/виноградників в регіонах для забезпечення економічно-обґрунтованої роботи техніки;
- Наявність ринку для споживання такого виду біопалива;
- Наявність пілотних проектів.

Місцеві органи влади:

- Передача діяльності з виробництва та постачання теплової енергії приватним енергетичним компаніям;
- Розвиток економіки регіонів та підвищення надійності енергопостачання за рахунок диверсифікації енергоресурсів, використання місцевих видів палива.

Посилання

5. Енергетичний баланс України за 2015 рік. Експрес-випуск Державної служби статистики України № 455/0/08.4 вн-16 від 20.12.2016.

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D. Національний план з Енергетики та Клімату

Основними документами, що визначають розвиток сектору **біоенергетики** в Україні, є Національний план дій з відновлюваної енергетики на період до 2020 року² (прийнятий у жовтні 2014 року) та Енергетична стратегія України на період до 2035 року³ (прийнята у серпні 2017 року).

Згідно Нацпландій, пріоритетний внесок біомаси серед інших відновлюваних джерел енергії (ВДЕ) до 2020 року буде у секторі виробництва теплової енергії: 5000 тис. т н.е., у тому числі тверда біомаса – 4850 тис. т н.е. у 2020 р.; частка біомаси у загальному виробництві теплової енергії – 10,6% у 2020 р. У виробництві електроенергії очікуваний внесок біомаси серед інших ВДЕ є більш обмеженим: встановлена потужність на біомасі – 950 МВт (у т.ч. на твердій біомасі – 660 МВт), виробництво електроенергії з біомаси – 4220 ГВт*год (у т.ч. з твердої біомаси – 2950 ГВт*год) у 2020 році. У відповідності до поставлених цілей, як зазначено у Плані заходів з реалізації Нацпландій, у 2020 році в Україні встановлена потужність теплогенеруючого обладнання на біомасі має складати 11875 МВт, а виробництво теплової енергії становити 50000 Гкал/рік.

Позитивною (сильною) стороною Нацпландій є встановлення достатньо амбітних цілей по розвитку ВДЕ, у т.ч. біоенергетики. Слабкою стороною є відсутність визначення достатніх механізмів стимулювання/підтримки розвитку сектору ВДЕ, у т.ч. біоенергетики.

Основні показники Енергетичної стратегії України на період до 2035 р. щодо сектору біоенергетики наступні. Внесок біомаси/біопалив до загального постачання первинної енергії (ЗПРЕ), млн. т н.е. (% від загального): 2020 р. – 4 (4,9), 2025 р. – 6 (6,9), 2030 р. – 8 (8,8), 2035 р. – 11 (11,5).

Експертний аналіз та порівняння цілей у секторі біоенергетики Національного плану дій з відновлюваної енергетики на період до 2020 року та Енергетичної стратегії України на період до 2035 року показує, що заплановані показники Енергостратегії на 2020 рік є дещо нижчими. Це може бути пов'язане з тим фактом, що поточні показники розвитку біоенергетики дещо відстають від запланованих у Нацпландій, і Енергостратегія, прийнята у серпні 2017 р., враховує цю ситуацію і оперує більш реалістичними цифрами.

Сильною стороною Енергетичної стратегії України на період до 2035 року є врахування сучасних реалій та потреб енергетичних ринків, зокрема, розвиток конкурентності і прозорості. Нижче наведено релевантні цитати з Енергостратегії щодо поставлених нею задач:

- сприяння створенню конкурентних ринків біомаси;
- підтримка реалізації проектів з когенерації на ТЕЦ і когенерації на біопаливі;

створення умов для формування системи з логістичного забезпечення та інфраструктури для збирання біологічної сировини та подальшого її транспортування;

- забезпеченню роботи систем централізованого опалення на енергії з відновлюваних джерел (біопелети, побутове сміття тощо);
- формування конкурентних і прозорих ринків електроенергії, природного газу, нафти, теплової енергії та вугілля;
- створення конкурентних ринків газу, електроенергії, теплової енергії, вугілля, нафти та нафтопродуктів;
- підтримка здорового конкурентного середовища, безперешкодного доступу до ринків та існуючої інфраструктури (окрім природних обмежень, а також виходячи з раціоналізації факторів енергетичної безпеки України);
- завершення процесу переходу на ринкове ціноутворення. Ліквідація «витратної» методології тарифоутворення, вдосконалення нормативно-правової бази регулювання енергетичних ринків, підвищення їх конкурентоспроможності;

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- Зростатиме частка сектору електроенергетичної галузі, який використовує тверду біомасу та біогаз як енергоресурс, що зумовлюватиметься як відносною сталістю виробництва (за наявності ресурсної бази), так і тенденцією до формування локальних генеруючих потужностей.

Сильною стороною Енергетичної Стратегії також є те, що для формування структури ЗППЕ використовувались економіко-математичні моделі, узагальнені експертні оцінки, а також орієнтовні показники, яких Україна має досягнути відповідно до своїх міжнародних зобов'язань у сферах розвитку **ВДЕ** та зміни **клімату**.

Важливою передумовою успішного розвитку сектору біоенергетики у відповідності до офіційно поставлених цілей і задач є наявність дієвих механізмів підтримки і стимулювання. На сьогодні в Україні є два таких механізми: «зелений» тариф на електроенергію з ВДЕ та стимулюючий тариф на виробництво теплової енергії з ВДЕ. Однак наразі їх ще недостатньо, щоби «переважити» існуючі бар'єри та перешкоди.

Експерти Біоенергетичної асоціації України ідентифікували 10 основних бар'єрів, які прямо або опосередковано впливають на розвиток сектору біоенергетики:

1. Немонетизовані державні субсидії для населення на оплату послуг ЖКГ.
2. Рахунки із спеціальним режимом використання для розрахунків за теплову енергію.
3. Недорозвиненість ринку біопалива в Україні.
4. Проблеми відведення землі під об'єкти відновлюваної енергетики.
5. Завищена вартість нестандартного приєднання електроустановок до електричних мереж.
6. Труднощі підключення до теплових мереж незалежних виробників теплової енергії з ВДЕ.
7. Роз'єднаність теплових мереж окремих джерел тепlopостачання.
8. Проблеми виробництва та споживання біометану.
9. Необхідність проведення екологічної експертизи для малих біоенергетичних проектів.
10. Субсидована ціна природного газу для населення.

Для подолання деяких із вказаних бар'єрів вже ведеться активна робота. Наприклад, експерти БАУ разом з Держенергоефективності працюють над розробкою та впровадженням моделі конкурентного ринку біопалив в Україні. Планується, що з 2019 року в країні запрацює біопаливна біржа, що матиме позитивний вплив на подальший розвиток сектору. Крім того, на розгляді Верховної Ради України знаходиться законопроект, спрямований на спрощення процедури відведення землі для будівництва об'єктів відновлюваної енергетики (№ 2529а від 26.08.2015⁵).

Все зазначене вище щодо сектору біоенергетики в тій чи іншій мірі стосується і сегменту ОБН, оскільки біомаса від обрізки та викорчовування плодкових насаджень та виноградників є складовою загального енергетичного потенціалу біомаси в Україні. Наприклад, котельня, що працює на біомасі ОБН, може отримати стимулюючий тариф на вироблену теплову енергію згідно чинного законодавства⁶. Будь-які позитивні кроки у секторі біоенергетики позитивно впливають і на сегмент ОБН і навпаки. Експертні оцінки перспектив розвитку біоенергетики в Україні є, переважно, позитивними. Особливі надії покладаються на створення конкурентного ринку шляхом запровадження роботи біопаливної біржі.

Питання виробництва та використання біопалив відображені також у Концепції Державної цільової

⁵ http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_1?pf3511=56300

⁶ <http://zakon3.rada.gov.ua/laws/show/1959-19>

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програми розвитку **аграрного сектору економіки** на період до 2020 року (затверджена Розпорядженням КМУ № 1437-р від 30.12.2015)⁷. Концепцією передбачено «зменшення енерговитратності та імпортоенергозалежності в результаті створення умов для впровадження проектів з виробництва та/або використання твердих, рідких видів біопалива та біогазу, а також сировини для них підприємствами агропромислового комплексу».

Стратегія державної **екологічної політики** України на період до 2020 року (затверджена Законом України № 2818-VI від 21.12.2010)⁸ містить ціль щодо збільшення обсягу використання відновлюваних і альтернативних джерел енергії на 25 відсотків до 2015 року та на 55 відсотків до 2020 року від базового рівня. Також в Стратегії зазначено, що під час розроблення програм наукового та інноваційного розвитку необхідно враховувати потребу в раціоналізації та оптимізації природокористування, зокрема технологічного переоснащення виробництва шляхом енергозбереження, розвитку відновлюваних та альтернативних джерел енергії, а також збільшення обсягу використання джерел енергії з низьким рівнем викидів двоокису вуглецю.

⁷ <http://zakon3.rada.gov.ua/laws/show/1437-2015-%D1%80>

⁸ <http://zakon3.rada.gov.ua/laws/show/2818-17>

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Е. Базовий SWOT-аналіз

SWOT - аналіз

	Позитивні фактори	Негативні фактори	
Внутрішні фактори	Сильні сторони (для посилення) СІЛЬСЬКЕ ГОСПОДАРСТВО - Великий незадіяний потенціал відходів ОБН в цілому по країні; - Наявність власної сировини та економічних стимулів використання біомаси ОБН на власні енергетичні потреби; - Наявність достатньо великої кількості споживачів біопалива. БІОЕНЕРГЕТИКА - Відсутність конкуренції за даний вид сировини як палива; - Великий досвід використання деревної тріски в якості палива; - Загальна позитивна динаміка розвитку сектору біоенергетики. ВИРОБНИКИ ОБЛАДНАННЯ - Наявність на ринку України вітчизняного обладнання для спалювання деревної біомаси; - Наявність на ринку виробників та дистриб'юторів обладнання для збору та подрібнення відходів ОБН як українського так і закордонного виробництва. КОМЕРЦІЯ - Розвинена інфраструктура; - Досвід організації постачання деревної біомаси на існуючі енергетичні об'єкти; - Велика кількість виробників гранул з деревини та інших видів біомаси. - Наявність великої кількості потенційних постачальників та споживачів біомаси.	Слабкі сторони (для вирішення та подолання) СІЛЬСЬКЕ ГОСПОДАРСТВО - Складність в організації логістичного ланцюжка; - Переважає неготовність аграрних підприємств до початку нового бізнесу з продажу відходів ОБН; - Відсутність досвіду з логістики постачання відходів, необхідних знань з організації ланцюжка доданої вартості; - Потреба в додатковому обладнанні; - Переважає відсутність власних коштів для інвестицій; - Потреба в легалізації бізнесу з продажу відходів як біопалива. БІОЕНЕРГЕТИКА - Недорозвиненість ринку біомаси як палива; - Відсутність практики довгострокових контрактів на постачання біопалив; - Відсутність затверджених методик перевірки якості поставленого біопалива; - Відсутність обладнання для моніторингу якості сировини. ВИРОБНИКИ ОБЛАДНАННЯ - Висока вартість технологічного обладнання для механізованого збору та подрібнення відходів ОБН. КОМЕРЦІЯ - Державна монополія на постачання біопалива на існуючі котельні комунального господарства; - Відсутність знань з правильної організації логістичного ланцюжка; - Відсутність експертного середовища; - Зазвичай невеликі об'єми сировини у одного постачальника; - Конкуренція з тіньовим ринком дров; - Конкуренція за існуючих споживачів.	Внутрішні фактори

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
	Автор:	НТЦ «Біомаса»	Версія:	1
	Посилання:		Дата:	05/10/2017

Зовнішні фактори	Можливості (для використання) СІЛЬСЬКЕ ГОСПОДАРСТВО - Диверсифікація діяльності за рахунок започаткування бізнесу з продажу біопалива; - Створення сервісних кооперативів; - Надання послуг із заготівлі відходів; - Використання відходів у власних енергетичних цілях й, відповідно, заміщення дорогих викопних палив. БІОЕНЕРГЕТИКА - Диверсифікація шляхів постачання біопалива; - Конкурування з іншими видами деревного біопалива за рахунок зменшення собівартості. ВИРОБНИКИ ОБЛАДНАННЯ - Розширення парку та обсягу обладнання, що виробляється та поступає на продаж на ринку України. КОМЕРЦІЯ - Розвиток конкурентного ринку біопалива; - Розвиток суміжних галузей в регіонах; - Створення нових робочих місць; - Становлення ринку біопалива за рахунок створення сервісних компаній, що надають повний спектр послуг зі збору, подрібнення та перевезення готового біопалива на енергетичний об'єкт.	Загрози (для нейтралізації) СІЛЬСЬКЕ ГОСПОДАРСТВО - Практичне забезпечення стабільності поставок біопалива; - Висока собівартість готового біопалива. БІОЕНЕРГЕТИКА - Нестабільна якість біопалива з відходів ОВБН; - Переорієнтація постачальників біомаси з її продажу на власне споживання або на іншу, більш прибуткову діяльність; - Різка зміна ціни на біопаливо від постачальника. ВИРОБНИКИ ОБЛАДНАННЯ - Відсутність досвіду експлуатації як енергетичного обладнання так і обладнання для збору/подрібнення з відходами ОВБН. КОМЕРЦІЯ - Несформований та непрозорий ринок біомаси як палива; - Конкуренція за споживачів біопалива між невеликими виробниками та державними комунальними підприємствами; - Нестача ресурсів біомаси поблизу енергетичного об'єкту.	Зовнішні фактори
	Позитивні фактори	Негативні фактори	

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОБН та розробка стратегічного плану дій для України		
	Автор:	НТЦ «Біомаса»	Версія:	1
	Посилання:		Дата:	05/10/2017

СТРАТЕГІЧНИЙ ПЛАН ДІЙ

Підготовка плану дій для прискорення розвитку сектору енергетичного використання деревини ОБН є результатом аналізу ситуації в країні та консультування з представниками зацікавлених сторін шляхом проведення інтерв'ю та зустрічей.

У Плані дій визначено перелік конкретних технічних та нетехнічних заходів, які повинні бути реалізовані (в коротко- середньо- та довгостроковій перспективі) для підвищення рівня енергетичної утилізації відходів обрізки та викорчовування багаторічних сільськогосподарських насаджень. Серед іншого, такі заходи включають: демонстрації, передачу знань і заходи з нарощування потенціалу, ринкові інструменти, фінансування і економічні стимули, дії в області комунікації, законодавче регулювання і всі інші фактори, які є корисними для становлення успішного та сталого сектору ОБН. Таким чином, план дій визначає комплекс заходів, які пропонуються/рекомендуються для реалізації загальнодержавним та місцевим органам влади, посадовим особам, що визначають політику у секторі та приймають рішення, відповідним міністерствам та агентствам.

Нижче наведено підходи, що використані при підготовці Плану дій (Рис. 3). За основу взято SWOT-аналіз, що наведений в попередньому розділі. Згідно методики SWOT-аналізу, під основними його елементами розуміють наступні зовнішні та внутрішні фактори:

Strengths (Сильні сторони) – те, що наразі є позитивним. Потрібно підтримувати їх, спиратися на них і використовувати в якості важеля.

Weaknesses (Слабкі сторони) – те, що наразі є негативним та потребує виправлення, зміни чи зупинки.

Opportunities (Можливості) – Те, що є позитивним для майбутнього розвитку. Потрібно визначити пріоритетність можливостей, спиратися на них і оптимізувати.

Threats (Загрози) – Те, що є негативним для майбутнього. Потрібно спланувати управління чи боротьбу із загрозами.

Шляхом поєднання внутрішніх та зовнішніх факторів, наступні стратегії можуть бути отримані:

SO Стратегії (Стратегії застосування СИЛЬНИХ СТОРІН з метою отримання вигоди від МОЖЛИВОСТЕЙ). Ці стратегії типу Мах-Мах в тому сенсі, що вони поєднують в собі найбільш сприятливі елементи для побудови стратегії. SO стратегії використовують сильні і потужні елементи для того, щоб отримати користь від зовнішніх можливостей. Стратегія є динамічною та агресивною (*атакуюча*).

WO Стратегії (Стратегії, що прагнуть пом'якшити вплив СЛАБКИХ СТОРІН, користуючись МОЖЛИВОСТЯМИ). Це стратегії типу Мін-Мах в тому сенсі, що вони поєднують в собі внутрішні слабкі сторони з зовнішніми можливостями. Стратегія намагається скористатися наявними можливостями для того, щоб усунути або пом'якшити слабкі сторони (*переорієнтація*).

ST Стратегії (Стратегії, які використовують СИЛЬНІ СТОРОНИ, щоб запобігти або звести до мінімуму ЗАГРОЗИ). Вони є стратегіями типу Мах-Мін в тому сенсі, що вони використовують сильні сторони для того, щоб уникнути або зменшити зовнішні загрози (*захист*).

WT Стратегії (Стратегії, які пом'якшують СЛАБКІ СТОРОНИ і прагнуть зменшити вплив ЗАГРОЗ). Вони являють собою стратегії типу Мін-Мін, тобто прагнуть звести до мінімуму слабкі сторони, якщо зовнішні загрози можна уникнути (*виживання*).

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
	Автор:	НТЦ «Біомаса»	Версія:	1
	Посилання:		Дата:	05/10/2017



Рис. 3. Підхід до побудови стратегії розвитку сектору ОВБН.

Нижче у таблиці наведено перелік запропонованих стратегій для досягнення підвищення сталого постачання деревини ОВБН в енергетичних цілях.

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
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	Посилання:		Дата:	05/10/2017

ТАБЛИЦЯ ПЛАНУ ДІЙ

* Часові рамки для впровадження дій/заходів (**короткострокові**: до кінця проекту; **середньострокові**: в кінці проекту; **довгострокові**: скоро після закінчення проекту)

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту “uP_running” (так / ні)	Часові рамки*
SO = Сильні сторони + Можливості Організація нового ланцюжку на базі існуючих компаній	S: - Великий досвід використання деревної тріски в якості палива; - Наявність великої кількості потенційних постачальників та споживачів біомаси. O: Диверсифікація шляхів постачання біопалива.	Залучення існуючих споживачів та компаній, що наразі виконують заготівлю інших видів деревного біопалива до нового ланцюжку постачання деревини ОВБН	Побудова демонстраційного ланцюжку використання деревини ОВБН на базі існуючих споживачів біопалива та державних підприємств, які наразі здійснюють заготівлю інших видів деревного біопалива (державні лісові господарства, комунальні підприємства).	Фермери, котельні на біопаливі, постачальники біопалива	так (в рамках реалізації демо-проекту)	Коротко- строкова
SO = Сильні сторони + Можливості Організація нового ланцюжку постачання біопалива з ОВБН	S: Великий незадіяний потенціал відходів ОВБН в цілому по країні. O: Становлення ринку біопалива за рахунок створення сервісних компаній, що надають повний спектр послуг зі збору, подрібнення та	Створення прикладів реальної співпраці між аграріями та промисловістю. Підтримка впровадження повного ланцюжка постачання. Пошук нових рішень для вирішення загальновідомих проблем.	Обмін інноваційними проектами, новими бізнес ідеями, та результатами досліджень через практичну реалізацію. Пошук потенційних партнерів проекту, кращих практик	Ключові гравці всередині мережі зацікавлених сторін + потенційні союзники за межами сектору ОВБН (пошук та долучення)	так	Середньо- строкова

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
	Автор:	НТЦ «Біомаса»	Версія:	1
	Посилання:		Дата:	05/10/2017

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту "uP_running" (так / ні)	Часові рамки*
	перевезення готового біопалива на енергетичний об'єкт.		наслідування, і можливостей фінансування.			
WO = Слабкі сторони + Можливості Організація нового ланцюжку постачання біопалива з ОВБН	W: - Складність в організації логістичного ланцюжка; - Відсутність досвіду з логістики постачання відходів. O: Диверсифікація діяльності за рахунок започаткування бізнесу з продажу біопалива.	Визначення найкращої бізнес-моделі та оптимізація її функціонування (збір, попередня обробка, транспортування, зберігання біомаси) від поля до споживача.	Оцінка техніко-економічних показників впровадження нового ланцюжка. Маркетингове дослідження запровадження нового бізнесу. Створення ефективних зв'язків уздовж ланцюжка доданої вартості.	Всі сторони зацікавлені в приєднанні до проекту. Метою є перетворення ідеї в успішне застосування	так	Коротко-строкова
SO = Сильні сторони + Можливості Підвищення інформованості та довіри	S: - Наявність великої кількості потенційних постачальників та споживачів біомаси. - Загальна позитивна динаміка розвитку сектору біоенергетики. O: - Розвиток	Підвищення загального розуміння та довіри між гравцями ланцюжка постачання біомаси ОВБН (аграрії, підприємці, особи, що визначають політику та приймають рішення, ін.)	Налагодження та об'єднання «мережі зацікавлених сторін» та її розвиток в напрямку до ряду "оперативних груп", які будуть співпрацювати між собою на регіональному рівні.	Ключові гравці всередині мережі зацікавлених сторін	так (але лише частково)	Середньо-строкова

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
	Автор:	НТЦ «Біомаса»	Версія:	1
	Посилання:		Дата:	05/10/2017

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту “uP_running” (так / ні)	Часові рамки*
	конкурентного ринку біопалива; • Розвиток суміжних галузей в регіонах.					
WO = Слабкі сторони + Можливості Підготовка експертного середовища	W: • Відсутність досвіду з логістики постачання відходів, необхідних знань з організації ланцюжка доданої вартості; • Відсутність експертного середовища. O: • Диверсифікація діяльності фермерів та аграрних підприємств; • Становлення ринку біопалива за рахунок створення сервісних компаній, що надають повний спектр послуг зі збору, подрібнення та перевезення готового біопалива на	Тренування професіоналів щодо особливостей сектору використання деревини ОВБН (технічні, економічні та організаційні питання). Група підготовлених осіб повинна залишитись активною навіть після закінчення проекту.	Формування технічної команди проекту, що буде надавати підтримку компаніям, які працюють в сфері управління відходами ОВБН (розробка проектів, пошук інвесторів та ін.)	Професіонали та консультанти, які прагнуть здобувати знання і досвід по підвищенню цінності ОВБН	так (але лише частково)	Коротко-строкова

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
	Автор:	НТЦ «Біомаса»	Версія:	1
	Посилання:		Дата:	05/10/2017

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту “uP_running” (так / ні)	Часові рамки*
	енергетичний об'єкт.					
ST = Сильні сторони + Загрози Навчання фермерів	S: - Наявність на ринку України виробників та дистриб'юторів обладнання для збору та подрібнення відходів ОВБН як українського так і закордонного виробництва; - Досвід організації постачання деревної біомаси на існуючі енергетичні об'єкти; - Наявність великої кількості потенційних постачальників та споживачів біомаси. T: - Висока собівартість готового біопалива. - Нестабільна якість біопалива з відходів ОВБН; - Відсутність досвіду	Підвищення рівня знань щодо правильної організації технологічного ланцюжка зі збору, попередньої обробки та підготовки відходів ОВБН для виробництва біопалива. Стимулювання виробництва біопалива з дотриманням технологічних вимог.	Розробка навчального посібника для фермерів щодо особливостей організації збору, попередньої обробки та підготовки деревини що утворюється від ОВБН. Пояснення переваг заключення довгострокових контрактів та схеми отримання дозволів на виробництво біопалива (технічні вимоги).	Фермери, с/г підприємства, які бажають розпочати діяльність зі збору/реалізації відходів ОВБН	так (частково)	Середньо- строкова

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
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	експлуатації як енергетичного обладнання так і обладнання для збору/подрібнення з відходами ОВБН.					
ST = Сильні сторони + Загрози Лобіювання та інформаційна підтримка	S: - Загальна позитивна динаміка розвитку сектору біоенергетики; - Великий досвід використання деревної тріски як палива. T: - Переорієнтація постачальників біомаси з її продажу на власне споживання, або на іншу, більш прибуткову діяльність; - Конкуренція за споживачів біопалива між невеликими виробниками та державними	Залучення державних/ обласних/ регіональних/ місцевих посадових осіб, що впливають на прийняття рішень та визначення політики сектору для сприяння заходам з пропагування та захисту сектору енергетичного використання ОВБН. Заходи мають бути спрямовані на подолання бар'єрів, пов'язаних з отриманням дозволів, бюрократичними адміністративними процедурами,	Публічне та прозоре лобіювання з метою подолання бар'єрів і перешкод, що заважають створенню інноваційних ланцюжків доданої вартості на базі ОВБН. Дії спрямовані на отримання допомоги та схвалення від політиків і лідерів громадської думки: сприяння заміщення викопних видів палива в місцях концентрації відходів ОВБН, полегшення адміністративного	Найбільш впливові гравці в мережі зацікавлених сторін з допомогою державних/ регіональних/ місцевих релевантних посадових осіб.	так (частково)	Довго- строкова

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
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Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту "uP_running" (так / ні)	Часові рамки*
	комунальними підприємствами.	гарантуванням стабільності постачання/споживання.	навантаження на фермерів та потенційних споживачів біопалива. Боротьба з тіньовим ринком деревини.			
WO = Слабкі сторони + Можливості Інформаційна компанія	W: - Неготовність аграрних підприємств до початку нового бізнесу з продажу відходів ОВБН; - Державна монополія на постачання біопалива на існуючі котельні комунального господарства. O: - Диверсифікація діяльності за рахунок започаткування бізнесу з продажу біопалива; - Становлення ринку біопалива за рахунок створення сервісних	Підвищення поінформованості щодо потенційних переваг енергетичного використання біомаси ОВБН як серед фермерів/аграрних підприємств, так і серед потенційних споживачів, компаній, що можуть розширити свою діяльність на заготівлю/постачання біопалива ОВБН, місцевих громад.	Широке розповсюдження інформації щодо проекту та загалом про можливості та перспективи енергетичного використання біомаси, зокрема ОВБН, задля створення позитивного іміджу серед всіх зацікавлених сторін, потенційних гравців в ланцюжку постачання та членів місцевих громад. Підготовка та розповсюдження в рамках проекту	Ключові гравці всередині мережі зацікавлених сторін	так	Середньо-строкова

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
	Автор:	НТЦ «Біомаса»	Версія:	1
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Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту "uP_running" (так / ні)	Часові рамки*
	компаній, що надають повний спектр послуг зі збору, подрібнення та перевезення готового біопалива на енергетичний об'єкт. - Створення нових робочих місць. - Розвиток суміжних галузей в регіонах.		інформації щодо паливних характеристик, об'ємів та кількості відходів ОВБН.			
WO = Слабкі сторони + Можливості Фінансування	W: - Потреба в додатковому обладнанні; - Переважає відсутність власних коштів для інвестицій. O: - Створення сервісних кооперативів; - Надання послуг із заготівлі відходів.	Пошук можливостей для стимулювання наразі обмеженої готовності інвестувати, що виявлена в цілому серед підприємців, що працюють в секторі ОВБН	Формування "цільових груп" з ключових учасників сектора ОВБН разом з консультантами, які мають досвід в залученні "державного фінансування", пільгових кредитів та інших фінансових джерел. Ознайомлення підприємців з додатковими можливостями	Ключові гравці сектору ОВБН + фінансові консультанти + співробітники державних адміністрацій.	ні	Довго-строкова

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
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Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту "uP_running" (так / ні)	Часові рамки*
			фінансування дозволить підвищити шанси підприємців до інвестування, щонайменше, за рахунок часткової підтримки таких пільгових механізмів.			
ST = Сильні сторони + Загрози Створення біопаливної біржі/ логістичних центрів з продажу біопалива	S: - Відсутність конкуренції за даний вид сировини як палива; - Загальна позитивна динаміка розвитку сектору біоенергетики. T: - Нестабільна якість біопалива з відходів ОВБН; - Несформований та непрозорий ринок біомаси як палива.	Створення мережі логістичних центрів та/або біржі з продажу біопалива різних видів з моніторингом якості та гарантією надійності постачання.	Формування "цільових груп" з ключових учасників сектору ОВБН. Залучення державних органів, що здійснюють регулювання в сфері виробництва енергії з біомаси. Розробка моделі та схеми функціонування біржі (за участю всіх зацікавлених сторін). Започаткування роботи біржі.	Ключові гравці сектору ОВБН + консультанти + співробітники відповідних державних органів.	ні	Довго-строкова
WT = Слабкі сторони +	W: Відсутність практики довгострокових контрактів	Розробка нових технічних можливостей для	Вивчення можливості використання біомаси	Всі сторони зацікавлені в	ні	Довго-строкова

	Документ:	Завдання 2.3. Виконання аналізу сектору використання відходів ОВБН та розробка стратегічного плану дій для України		
	Автор:	НТЦ «Біомаса»	Версія:	1
	Посилання:		Дата:	05/10/2017

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту “uP_running” (так / ні)	Часові рамки*
Загрози Альтернативне виробництво	на постачання біопалив. Т: - Висока собівартість готового біопалива. - Несформований та непрозорий ринок біомаси як палива.	досягнення економічної цінності сировини ОВБН у випадку, коли енергетичне використання є економічно недоцільним або важким у практичній реалізації з об’єктивних причин.	ОВБН для виробництва альтернативних продуктів, таких як біокомпозити, біофільтри, компост і т.п.	приєднанні до такого проекту. Метою є перетворення ідеї в успішну практику.		

ANNEX A7

WP2 – Task T2.3

Performing an APPR Sector Analysis and Developing a Strategic Plan at National and EU level Italy

	Document:	Task 2.3. Performing a bioenergy sector analysis and developing a strategies plan at national and EU level: ITALY		
	Author:	UFG	Version:	
	Reference:		Date:	28/07/2017

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Sector Analysis

A. National framework on APPR sources

Italy highlights very favourable pedoclimatic conditions for many of the fruit tree crops typical of the Mediterranean environment. These fruit species represent a peculiar characteristics of the Italian agriculture, and a relevant factor in determining the composition of the country's agricultural landscape, predominantly characterized by the presence of olive groves and of the vineyards, together with other fruit trees such as citrus, apple and stone fruits (such as peach, apricot, plum, cherry, etc.). Hazelnut, walnut, almond, fig, carob and countless other minor fruits complete the wide range of fruit plantations both in the coastal and internal agricultural areas.

Following is the diffusion of the main tree crops in Italy, with particular emphasis on the most widespread species which, better than others, can be a useful reference for the start of energy supply chains focused on the energy use of crop residues obtained by pruning.

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Table 1. Surfaces addressed to the cultivation of fruit trees in the Member States of the European Union, according to the 2015 EuroStat surveys [1].
The data shown are expressed in thousands of hectares.

	Total	Citrus	Grapes	Olives	Apples	Pears	Peaches	Nectarines	Apricots	Cherries	Plums	Walnuts	Hazelnuts	Almonds	Chestnuts
Spain	4.701	299	941	2.527	31	23	51	35	19	26	16	9	13	549	36
Italy	2.337	149	679	1.134	52	31	46	21	17	29	12	=	69	57	=
Greece	1.268	47	114	970	12	4	36	8	7	14	2	11	=	11	8
France	929	4	752	17	50	5	5	5	12	8	15	20	5	1	8
Portugal	751	20	179	351	14	12	3	1	=	6	2	3	=	30	36
Poland	338	=	1	=	180	9	2	=	1	39	14	3	4	=	=
Romania	315	=	176	=	56	3	2	=	3	6	66	2	=	=	=
Serbia	185	=	21	=	24	7	8	1	5	18	78	5	2	=	=
Germany	154	=	100	=	32	2	=	=	=	7	4	=	=	=	=
Hungary	153	=	72	=	33	3	5	=	5	16	7	5	=	=	=
Bulgaria	74	=	39	=	5	1	4	=	2	9	7	5	1	1	=
Croatia	70	2	26	19	5	1	1	=	=	3	5	4	3	=	=
Austria	54	=	44	=	7	=	=	=	1	=	=	=	=	=	=
EU-28	11.331	524	3.174	5.029	538	117	158	71	69	173	154	63	96	652	175

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	Author:	UFG	Version:	
	Reference:		Date:	28/07/2017

Table 2. Breakdown (%) of the cultivation areas of fruit species in the Italian regions, according to the 2010 ISTA census survey [2].

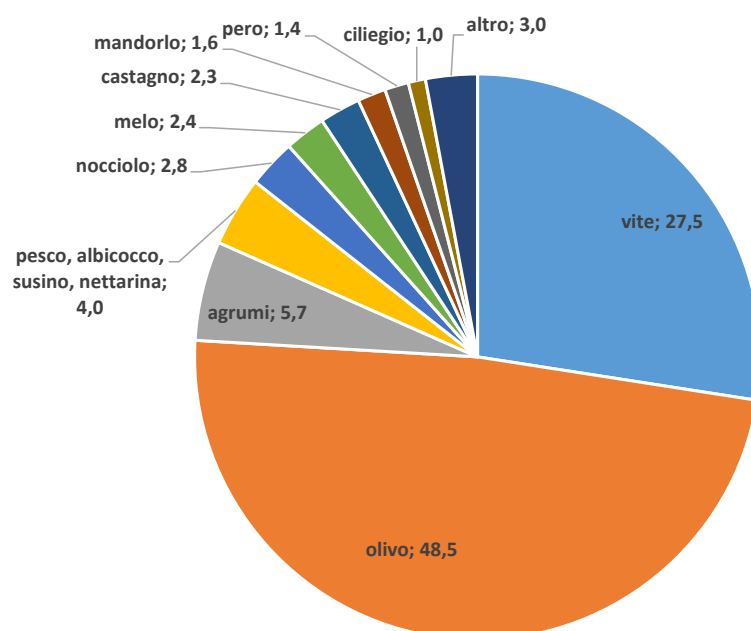
	Totale	Olivo	Vite	Agrumi	Melo	Pero	Drupacee	Nocciolo	Noce	Ciliegio	Fico	Kiwi	Mandorlo	Castagno
Piemonte	3,9	0,1	7,5	0,0	8,9	3,7	8,7	22,5	5,8	1,4	0,8	23,8	0,1	12,3
Valle d'Aosta	0,0	0,0	0,1	0,0	0,3	0,0	0,0	0,0	0,2	0,0	0,0	0,0	0,0	0,1
Liguria	0,6	1,0	0,2	0,0	0,1	0,1	0,2	0,1	0,1	0,2	0,4	0,0	0,0	1,4
Lombardia	1,4	0,2	3,7	0,0	3,3	3,1	0,8	0,1	1,2	0,5	0,7	2,2	0,1	1,2
Trentino Alto Adige	2,1	0,0	2,5	0,0	54,5	0,3	0,2	0,0	0,2	1,3	0,0	0,4	0,0	0,6
Veneto	4,0	0,4	10,4	0,0	10,1	11,7	4,9	0,1	6,0	10,8	0,8	14,8	0,0	0,7
Friuli-Venezia Giulia	1,0	0,0	3,0	0,0	2,8	0,6	0,3	0,0	0,9	0,2	0,2	2,8	0,0	0,1
Emilia-Romagna	5,4	0,3	8,8	0,0	7,9	67,8	29,4	0,1	5,6	10,7	0,9	16,6	0,0	5,4
Toscana	6,5	7,4	8,0	0,0	1,7	1,6	2,0	0,2	6,1	1,2	1,7	0,4	0,1	20,0
Umbria	2,0	2,7	2,0	0,0	0,5	0,2	0,4	0,2	5,2	0,6	0,3	0,0	0,0	1,0
Marche	1,3	1,0	2,2	0,0	0,7	0,4	1,8	0,1	6,6	1,1	2,3	0,2	0,1	1,6
Lazio	5,3	6,1	2,7	0,5	0,8	0,8	2,7	30,4	7,5	3,7	4,2	28,6	0,2	7,3
Abruzzo	3,6	4,0	5,3	0,0	0,5	0,2	1,7	0,1	8,1	1,5	3,5	0,6	0,1	0,6
Molise	0,9	1,3	0,7	0,0	0,3	0,1	0,8	0,0	3,4	0,3	0,3	0,0	0,0	0,0
Campania	6,9	6,6	3,8	1,4	4,2	1,6	18,5	27,5	24,4	7,6	25,1	2,9	0,1	26,6
Puglia	22,2	33,0	15,5	7,1	0,4	0,6	6,0	0,1	1,2	52,5	18,9	0,5	39,0	0,2
Basilicata	2,3	2,6	0,9	4,9	0,7	0,7	8,4	0,1	2,3	0,9	2,2	1,6	0,3	2,2
Calabria	11,2	17,1	1,6	27,6	0,9	0,8	4,5	0,5	7,6	1,9	32,4	4,3	0,6	16,6
Sicilia	16,8	12,9	18,2	55,1	1,0	4,7	7,4	17,7	6,7	2,7	3,4	0,1	55,6	0,9
Sardegna	2,8	3,2	3,0	3,1	0,5	0,9	1,5	0,2	0,8	0,7	2,0	0,0	3,5	1,1

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With reference to the 2015 statistics reported by Eurostat [1], Italy is second only after Spain in terms of agricultural area dedicated to fruit tree plantations (*Table 1*), roughly 2.3 against 4.7 million hectares, followed by Greece (with $1.7 \cdot 10^3$ ha), France ($0.9 \cdot 10^3$ ha) and Portugal ($0.75 \cdot 10^3$ ha).

Selecting among the different species, it is possible to see that Italy is systematically second behind Spain with regard to the agricultural land used for the cultivation of olives, citrus, peach, apricot and nectarines. It offers to consider the most extensive areas in the cultivation of pear trees (followed by Spain), while it is the second largest area in apple cultivation (after Poland and with Romania); finally, it is the second largest country in the cultivation of cherries (still after Romania). *Table 1* provides a more comprehensive figure of the data just commented.

Analysing in detail the data on the Italian tree plantations, as obtained from the 2010 ISTAT census [2], from *Figure 1* it can be observed that olive trees and grapevines largely occupy the most extensive surfaces (48-49% the former, and 27 -28% the latter). Citrus fruit (5-6%), stone fruit (4%) and all other species follow from very far.



We are not mistaken, therefore, when, referring to Italy, the energy supply chains focused on pruning are thought primarily related to the use of olive and grape pruning. This does not mean that, with reference to specific local conditions, other potentially promising fruit trees are also involved. In consideration of their high cultivation density (as expressed by their fraction of AUA – Agriculture Utilized Area - or ATA – Agriculture Total Area). It is quite evident, indeed, that the mechanization of pruning harvesting and the logistical improvement of all operations connected to pruning management are justified only if a "critical mass" of residual biomass is present in the land.

Figure 1. Breakdown (%) of the areas dedicated to the cultivation of fruit tree species in Italy as per ISTAT census data of 2010 [2].

By disaggregating the surfaces destined to fruit tree plantations on a regional basis (*Table 2*) and considering their total, Puglia, Sicily and Calabria are the regions with the largest areas. This blindly reflects the surfaces dedicated to the cultivation of the olive groves, which is largely present in southern Italy. The areas cultivated with vineyards are prevalent in the South (Puglia and Sicily), but also relevant in the North of Italy (Veneto and Emilia Romagna) and in the Centre (Tuscany). Citrus, as expected, is present in Sicily and Calabria almost exclusively. Differently, apple is mainly observed in Trentino Alto Adige and in Veneto (North of Italy). The pear, another pomaceae, is mainly observed in Emilia Romagna, but also in Veneto (still in the North of Italy). Stone fruits (with the exception of the cherry tree) are mostly present in Emilia Romagna, in the North, and in Campania, in the South. Hazelnut is peculiar in the internal, mountainous areas of Apennine in Lazio and Campania; as well as walnut is largely present present in Campania while chestnut is present in Campania, Tuscany and Calabria. As for the cherry, it is particularly extensive in Puglia, but also in Veneto and Emilia Romagna, although for much lower surface values. Almond in Puglia

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and Sicily; fig in Campania, Calabria and Puglia; kiwi (or actinide) especially in Lazio, but also in Veneto and Emilia Romagna.

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B. National potential of the APPR availability

From the agricultural sector, large quantities of biomass to be used for energy use can be obtained, particularly benefitting from those crop residues that, otherwise, represent a burden to farmer for their treatment and management. This feedstock is made up of that amount of biomass not only qualitatively available but also technically collectable [3].

Following the methodology set out in the document prepared by the ENAMA working group [3], after having determined the values of the cultivated areas for each of the examined crops, coefficients of annual unitary residue availability (t / ha in dry matter) are applied, thus arriving at an estimate of the amount of the **potentially obtainable residue**. Although quite approximated, these coefficients show significant variations according to geopedological and climatic features, as well as with respect to the cultivated species and cultivation techniques adopted [3].

This potential residue availability is subsequently reduced by considering the amount of biomass that could actually be collected and used. These values take into account logistical and economic features, such as the farm and field fractionation, biomass concentration in certain areas, current alternative uses of the same residues; all factors that, together, reduce the potential availability of residues. For fruit trees pruning this effective availability varies between 45 - 50% [3].

The tree crop species taken into consideration by the ENAMA study [3] are olive, vine, apple, pear, peach, nectarine, plum, apricot, citrus, hazel, almond and actinide.

Table 3. Potential fruit tree crop residues availability in Italy at regional (NUTS 2) and macro-regional levels.

Region	Biomass amount (t s.s./anno)	Breakdown (%)
Piemonte	124.710	3,7
Val d'Aosta	1.512	0,0
Lombardia	44.213	1,3
Trentino Alto Adige	66.718	2,0
Veneto	147.703	4,4
Friuli Venezia Giulia	32.129	1,0
Liguria	2.751	0,1
Emilia Romagna	194.635	5,8
Nord Italia	614.371	18,3
Toscana	225.781	6,7
Umbria	59.324	1,8
Marche	43.796	1,3
Lazio	206.165	6,1
Centro Italia	535.066	16,0
Abruzzo	112.785	3,4
Molise	33.245	1,0
Campania	229.984	6,9
Puglia	775.809	23,1
Calabria	323.506	9,6
Sicilia	600.724	17,9
Sardegna	128.115	3,8
Sud Italia	2.204.168	65,7
Italia (totale)	3.353.605	100,0

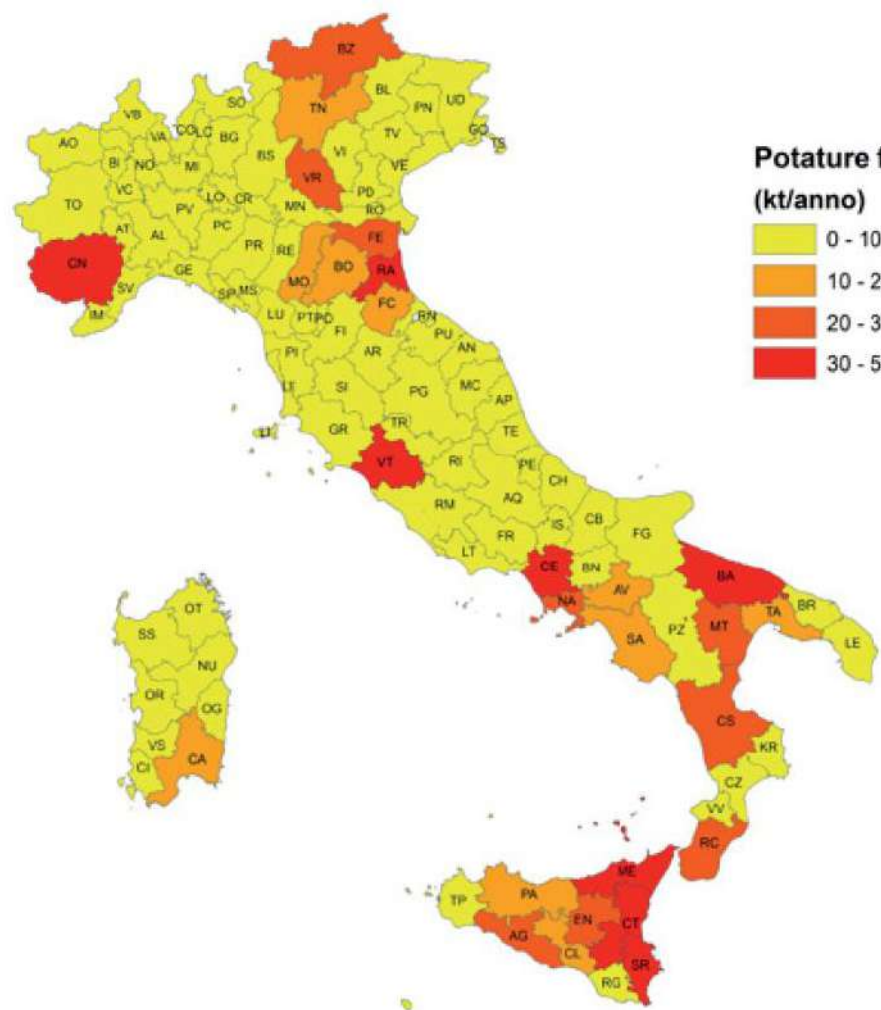


Figure 3. Distribution of olive grove pruning according to the estimated potential at provincial level (kt / year s.s.)

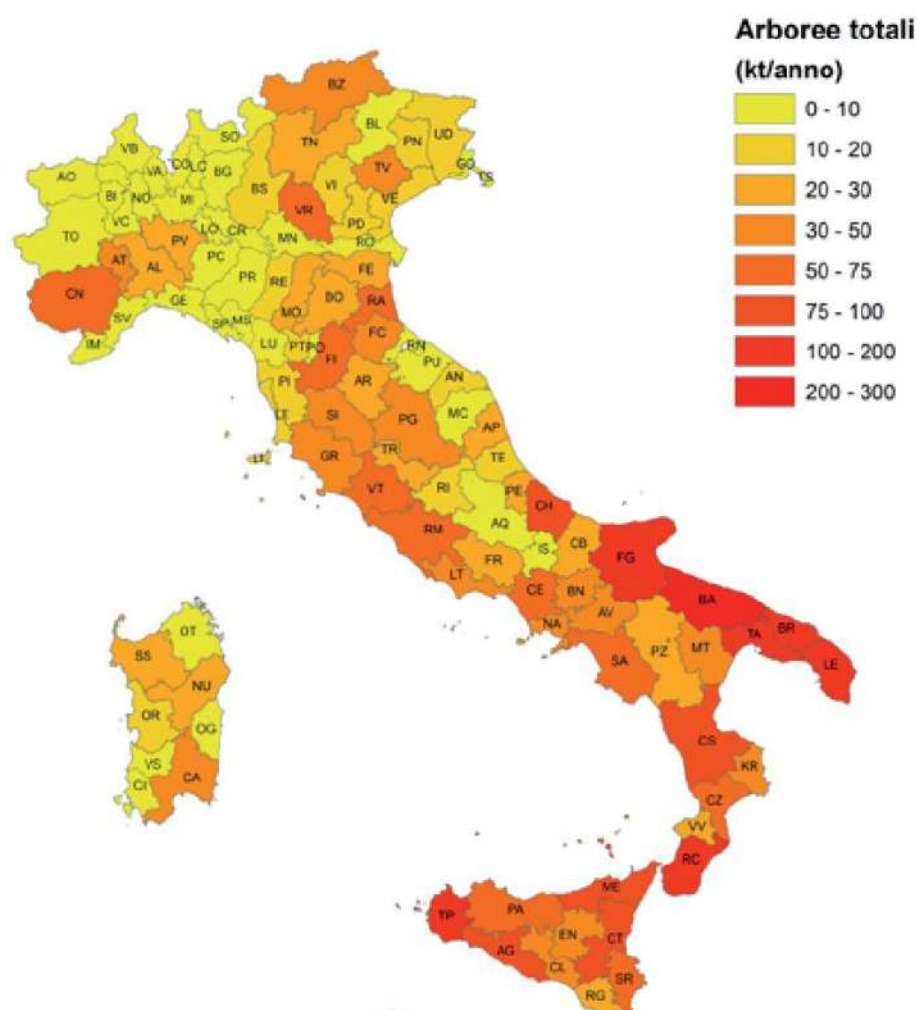


Figure 4. Distribution of vineyard pruning according to the estimated potential at the provincial level (kt / year s.s.)

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The overall potential availability at national level is estimated in the order of 3.3 Mt (*Table 3*). It seems clear that the greater availability is located in the South that, by itself, shows a potential availability equal to 2/3 of the total. Only considering Puglia and Sicily, together, their residual availability is equal to the sum of all the pruning originating from the North and Central Italy. This indicates how important this biomass resource could be for the rural economies of the two southern regions.

In the South, therefore, Puglia stands out (about 776,000 t / year); Tuscany in the Centre (about 226,000 t / year); Emilia Romagna in the North (around 197,000 t / year). *Figures 3, 4 and 5* show the potential amount of pruning annually obtainable from olive groves, vineyards and all the other fruit crops considered in the study (according to a provincial disaggregation); finally, *Figure 6* shows the amount of these residues as a whole.

Table 4. Actual availability of fruit crop pruning in Italy at regional (NUTS 2) and macro-regional levels.

Region	Biomass amount (t s.s./anno)	Breakdown (%)
Piemonte	59.861	3,6
Val d'Aosta	726	0,0
Lombardia	21.222	1,3
Trentino Alto Adige	32.025	1,9
Veneto	70.897	4,3
Friuli Venezia Giulia	15.422	0,9
Liguria	0	0,0
Emilia Romagna	94.745	5,7
Nord Italia	294.897	17,8
Toscana	108.375	6,6
Umbria	28.476	1,7
Marche	21.022	1,3
Lazio	98.959	6,0
Centro Italia	256.832	15,5
Abruzzo	54.137	3,3
Molise	15.958	1,0
Campania	110.392	6,7
Puglia	372.389	22,5
Basilicata	0	0,0
Calabria	155.283	9,4
Sicilia	288.347	17,4
Sardegna	61.495	3,7
Sud Italia	1.058.000	64,0
Italia (totale)	1.654.182	100,0

With reference to pruning for energy use, the conversion from the estimate of **potential availability** to the **actual availability** requires a series of assessments about the biomass losses due to logistical operations in the field, in the hauling process and during storage. Losses have to be faced during collection, transport and storage that affect the economic costs of the process and, therefore, its operability.

It follows that the national actual availability of pruning (i.e. those reduced amount of biomass due to technical difficulties or to alternative uses) amounts to an estimated value of about 1.7 Mt / year (*Table 4*). The regional and macro-geographical distribution of these quantities follow the same comment carried out previously in reference to the potential pruning quantities.

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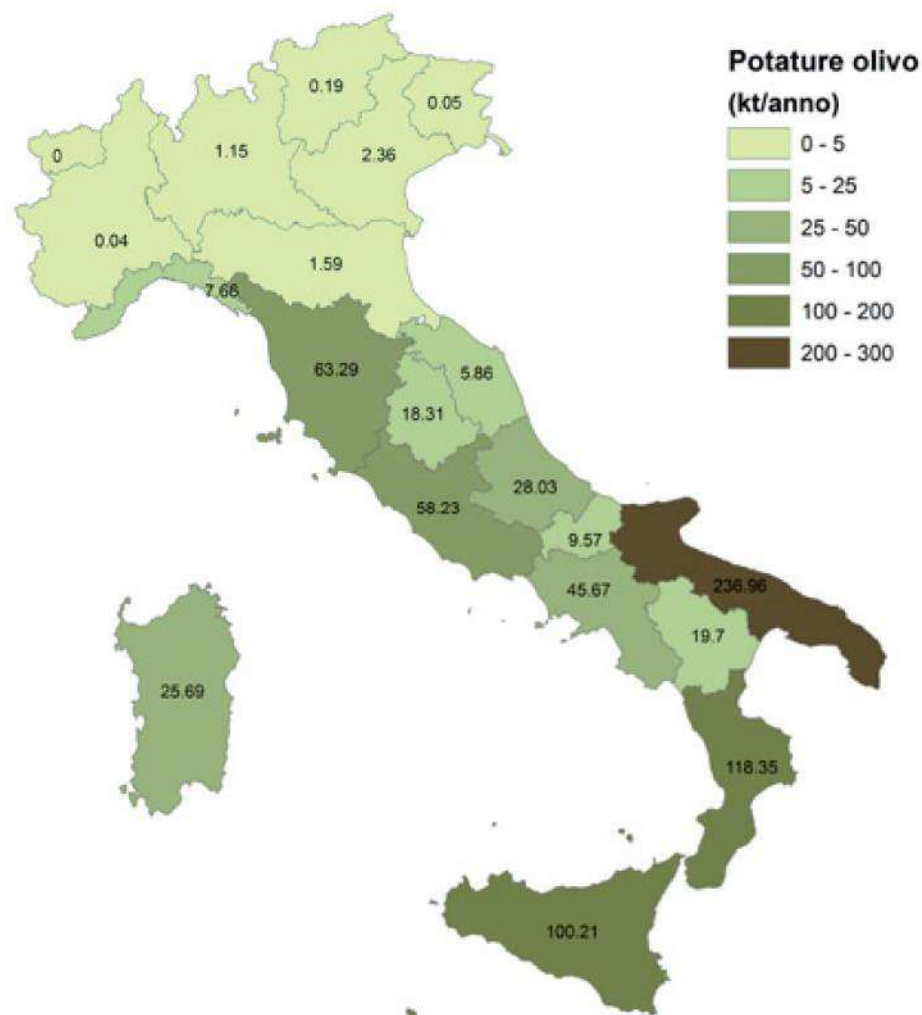


Figure 7. Distribution of pruning from olive groves according to their actual availability estimated at provincial level (kt / year s.s.)

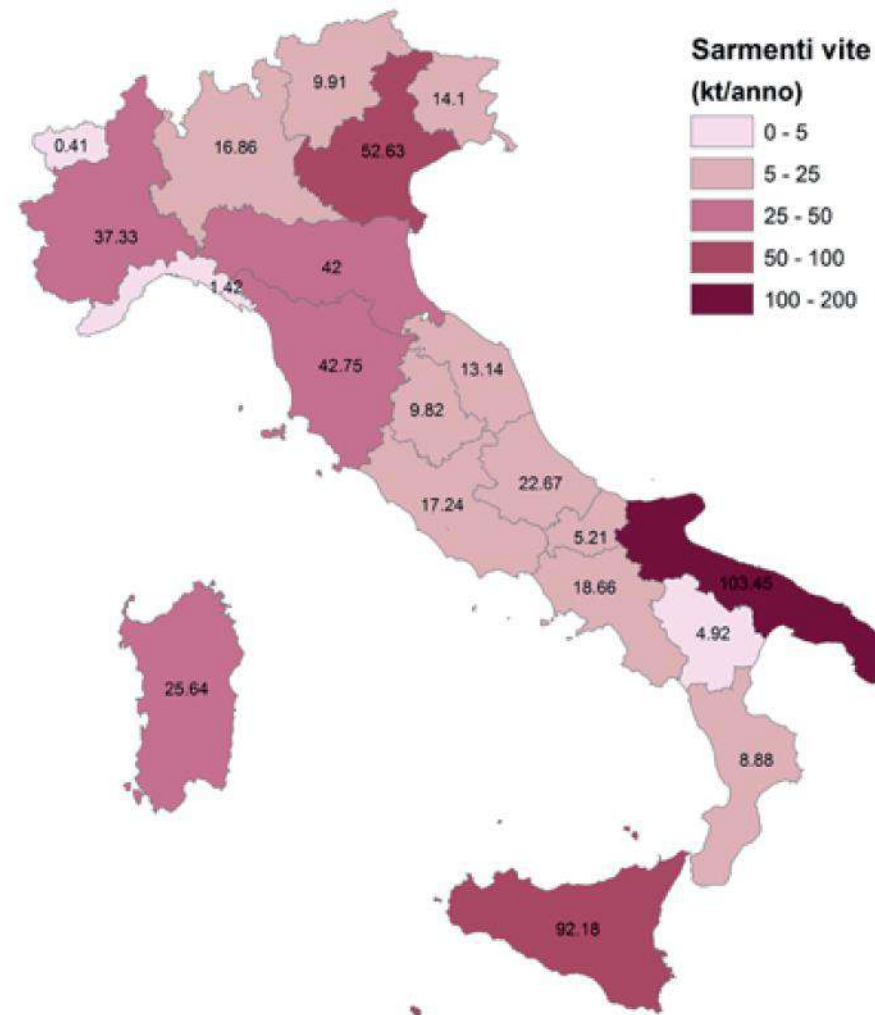


Figure 8. Distribution of pruning from vineyards according to their actual availability estimated at provincial level (kt / year s.s.)

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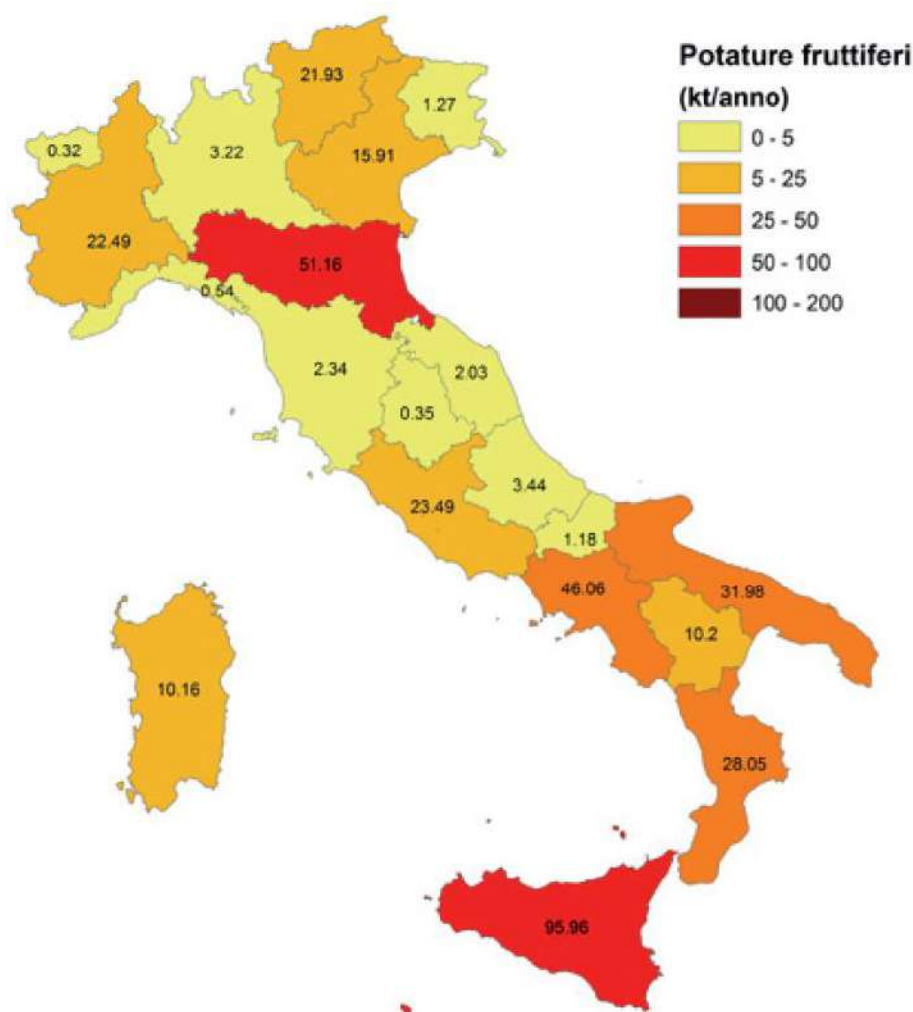


Figure 9. Distribution of pruning residues from all other kind of fruit trees considered in the study (excluding olive groves and vineyards) according to their actual estimated availability at regional level (kt / year s.s.).

In the ENAMA study [3], it was argued that, given the particularly broad level of approximation in the estimated figures, the cartographic restitution of the actual availability data (*Figures 7, 8 and 9*) are not reported with reference to the provincial territories (as done for estimates of potential availability). Instead, it was considered that a cartographic return of the data estimated at the regional (NUTS 2) level was realistically more reliable than to the provincial detail (NUTS 3).

C. Possible energy contribution of APPR

Based on the estimates obtained concerning the actual availability of pruning, projections can be made regarding the advantages that, at economic and environmental level, could be obtained by their correct use.

The energy production possibilities are, basically, of two kinds: electricity or/and heat production. Both energy sources could then be destined for domestic or industrial consumption, the difference is essentially reflected in the purchase price of energy, lower for industrial purposes, higher considering domestic use.

First hypothesis. We consider an amount of biomass equal to its actual availability. We also assume an operation of the plant equal to 8,000 hours per year, as well as a lower calorific value of 4.16 MWh per tonne of biomass and an electric conversion efficiency of 30%. Under these assumptions, the resulting total estimate is an electrical installation capacity of 258 MW, corresponding to an electrical production of approximately 2 million MW (2 TWh).

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Assuming that in Italy the average electricity consumption per capita is equal, approximately, to 1.1 MWh per year, it follows that the electricity production theoretically generated by pruning use would be able to fully meet the electricity consumption of about 1 million and 900 thousand people.

Second hypothesis. Alternatively, but under the same specified conditions, if we want to consider the thermal production for household, we should assume a conversion efficiency of 80% and an annual functioning of about 3,000 hours. Under these assumptions, the resulting total estimate is a thermal installation capacity of approximately 1,800 MW, corresponding to a thermal production of about 5.5 million MW (5.5 TWh).

Assuming that in Italy the average household consumption of natural gas per capita is equal, approximately, to 12 MWh per year, it can be deduced that the thermal production theoretically generated by pruning would be able to fully meet the heating consumption of about 460 thousand people.

D. Possible economic contribution of APPR

With regard to the economic impact that the energy supply chains based on pruning could potentially generate, a rough estimate should consider three main market sectors [3], namely:

- sale of biomass,
- energy sales,
- sale of technologies.

We will obviously refer to gross estimates, i.e. the total value of the gross saleable production.

With reference to the sale of biomass, it is possible to use a reference price roughly corresponding to 60 Euro per tonne (on dry basis). This means a total value slightly below 100 million euros.

With regard to the sale of energy, one must again discriminate between the sale of electricity or thermal energy. Considering that the unit cost of electricity for household consumption is equal, in Italy, to 0.234 Euro / kWh [4], it is possible to estimate a total economic value corresponding to slightly above 480 million Euro per year. Alternatively, considering that the unit cost of natural gas for household consumption is equal, in Italy, to 0.073 Euro / kWh [5], it is possible to estimate a total economic value corresponding to approximately 400 million Euro per year.

Lastly, the business volume due to the sale of biomass plants should be evaluated, at least roughly, whether a thermal or electric biomass plant. With reference to electricity production, it is possible to estimate a unit cost per MW installed of approximately 4 million Euro. [3]. This would mean a total investment capital of approximately 1 billion Euro, spread over a period of 20 years (amortization), which determine an annual investment flow of approximately 52 million Euro.

Far less capital intensive is the purchase of and construction of a thermal plant. It is possible to estimate a unit cost of 300 thousand eurEuroos per MW installed. This determines a total investment capital of approximately 550 million Euro and an annual depreciation of approximately 28 million Euro.

Based on what has already been analysed in the ENAMA [3] study, but referring exclusively to the energy resources represented by pruning, *Table 5*, reported below, summarizes the economic items involved and estimates their overall value. The bioenergy sector referable to pruning is able, every year, to activate a business volume between 530 and 630 million Euro, depending on whether thermal or electrical is the final energy consumption, respectively. If we capitalize this gross benefit ever a 20-year period, i.e. the predicted duration of the investment, then the total capital at stake is between 10.6 and 12.7 billion Euro.

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Table 5. Gross annual economic benefits related to the potential activation of energy supply chains based on the actual availability of pruning with reference to the entire national sector.

Sector	Biomass market		Energy market		Inlant market		Total
	Unit value (Euro/ton)	Total value (MEuro)	Unit value Euro/MWh)	Total value (MEuro)	Unit value Euro/ton)	Total value (MEuro)	
Electrical	60,00	99,25	234,00	483,07	4,00	51,61	633,93
Thermal	60,00	99,25	73,00	401,87	0,300	27,53	528,65

E. Possible environmental contribution of APPR

By using the actual available biomass to produce electricity, it is possible to calculate the amount of CO₂ emissions saved (or avoided) in the atmosphere because of the replacement of fossil fuels. With reference to solid biomass, it is assumed that the emission savings achieved can reach 90% compared to fossils. Moreover, with reference to the currently more efficient fossil-based electrical conversion technologies, i.e. combined-cycle gas turbines (CCGT), it is possible to achieve an emission intensity of 0.39 tonnes of CO₂ emitted per MWh of electricity produced. With this data available, the annual emission savings would amount to approximately 725 thousand tonnes of CO₂.

If we consider that the average annual growth of a forest in a temperate climate implies the capture of about 15 tons of CO₂ per hectare of wooded area, it follows that the amount of CO₂ no longer emitted due to fossil substitution with renewable energy sources would correspond to about 50 thousand hectares of forest.

F. National state of art of the APPR sector

Bioenergy is a continuous and programmable renewable source relying on a wide range of raw materials (not only residual biomass but also dedicated crops) and on the availability of ready and sound technologies. In fact, it is possible to obtain different of final energy forms of use:

- Heat from solid biomass (household and industrial uses);
- Electricity from solid biomass, biogas and bioliquids;
- Liquid biofuels (biodiesel, ethanol / ETBE) from dedicated crops
- Biomethane from fermentable biomass.

In this document, we will focus particularly on the production of heat, considering the easiest and most direct use of solid biomasses resulting from thermochemical conversion processes (combustion, pyrolysis, gasification).

First, however, is useful a brief overview of the entire bioenergy sector which, by far, is the renewable energy sector that, among renewables, contributes the most to the energy final consumption, as shown in *Figure 10*.

Compared to a total gross final consumption of energy, at national level, equal to 121.7 Mtoe, the contribution of all renewables is equal to 21.3 Mtoe, while that of bioenergy corresponds to 10.7 Mtoe. As a result, renewables account for 17.5 % to the final energy consumption, while bioenergy accounts for 8.7 %.

Therefore, it is possible to conclude that, in Italy, thermal bioenergy is the first among the renewable energy sources for quantity of energy consumed [7], as shown in *Figure 10*. In particular, thermal bioenergy amount to about one third of all energy consumption from renewable sources (with reference to 2015).

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Just to give a reference term, it is possible to state that the wood biomass boilers and stoves produce three times more energy (Mtep) than all the photovoltaic (thermal and electric) installed in Italy (*Figure 10*).

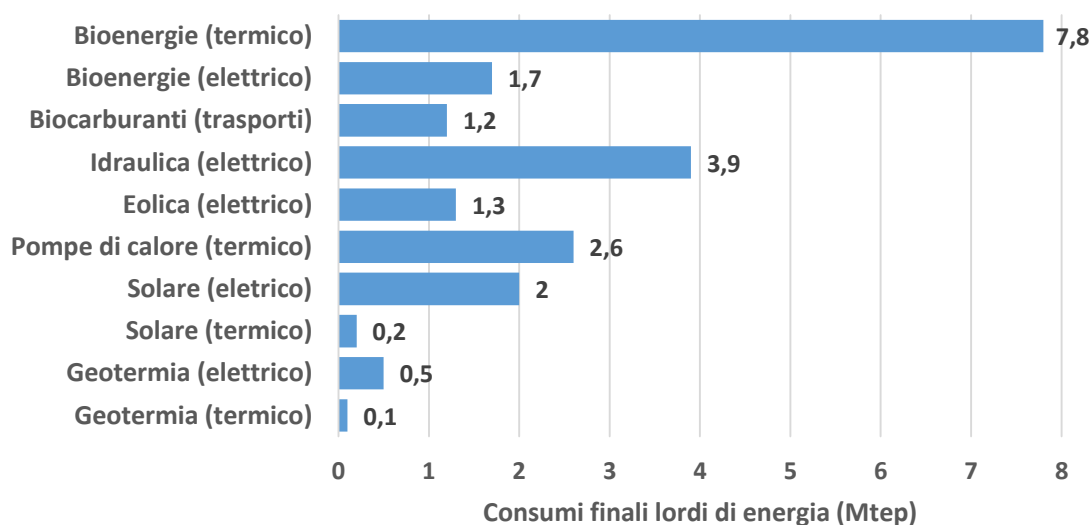


Figure 10. Gross final energy consumption in Italy broken down by technology sector [7].

Sector drivers

As seen in the previous section, solid biomass and, among these, pruning residues of fruit trees, can contribute substantially to the achievement of the objectives set for RES in the European and world context.

The main driving factors considering pruning as energy source lie in the almost ubiquitous presence of these residues. Each cultivation environment, in consideration of both climate and soil characteristics, offers some peculiar fruit tree species interpreting some best fitting features. This implies that in every macro-and micro-geographic area some tree crops can be identified for the setting up of energy supply chains based on pruning.

Agro-energy supply chains must necessarily develop from a systemic point of view, which cannot be separated from a careful assessment of environmental aspects as well as from an adequate support policy. The peculiar aspect that distinguishes these forms of renewable energy is the unavoidable need to give rise to a complex supply/production chain that needs the involvement of a plurality of actors, each of them performing a specific function regarding the sequential phases of biomass collection, conditioning, transport, and storage until its final use in an energy conversion system.

From the economic point of view, the farmer offering the availability of crop residues has the opportunity to save part of the costs related to the management of crop residues, partly also obtaining additional revenues in relation to the value recognized to pruning by the company that collects it (usually a sub-contractors mechanization company).

This careful residue management allows the adoption of the best agronomic techniques deemed effective in order to protect the orchard soil quality, mitigate soil erosion, favouring the build-up of soil organic mater.

All this should be done in compliance with criteria of environmental sustainability, both with regard to the biomass supply phase and to the feedstock into energy conversion phase. First, it should be noted that the biomass we are dealing with is a feedstock of residual nature. This is a considerable advantage because

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their availability is concurrent and parallel to the availability of food products, of which they constitute a by-product.

Therefore, this biomass can be obtained exclusively through the recovery of residues of fruit tree crop pruning operations, without detracting from conventional agricultural production. This offers sufficient guarantees that there is no deleterious competition between *food and non-food* agriculture. Is well known, in recent years, the fear of a conflict between *food vs energy* has generated concerns and controversy for the negative repercussions on the cost of food, especially in “weak” countries from an economic point of view [3].

A driving factor, able to encourage the development of APPR chains, is represented by the possibility that these initiatives can favour the development of economic activities related to the rural land. In fact, bioenergy must be considered as an effective leverage able to promote the productive integration and diversification in agriculture, the so called “**multifunctional**” feature of agriculture. These new productive activities, like bioenergy and many others, are considered as **business activity "connected" to agriculture** (although not prevalent), producing additional agricultural income.

Bioenergy (and APPR biomasses in particular) represent a very profitable way to support the energy self-consumption of the agricultural sector but, above all, to reduce the energy cost of agro-food processing. This, in particular, may concern olive mill cooperatives or social cellars. In this type of reality, in fact, a large number of associated farmers could not only confer the product (the olives to be crushed or the grapes to be pressed), but at the same time also the by-product (the pruning) from which obtain energy to meet the energy needs related to the transformation process into food or drink products. Any energy surplus produced could be fed into the grid (if electricity), or transferred to neighbouring centres (in the case of heat).

What should be promoted, in other words, is an **agro-industrial model**, focused on the use of residual agricultural biomass. This model is integrating, in a complementary way, the **agro-food model** characterizing large part of our rural territories. It is therefore not the competition between food and energy, but their mutual support, the goal to which we should aim. Indeed, through these strategies, full meaning is given to the concept of “circular economy” and of “bioeconomy”, fully supported in the EU context.

Sector barriers and obstacles

A crucial aspect, strongly influencing the development of APPR supply chains, is given by the limited spatial density of the available biomasses (unlike what happens considering the dedicated cultivations or forest coppicing). Moreover, the low unitary value of feedstock, which compels adopting highly optimized technological processes in order to reduce the incidence of unit costs to a minimum.

Another limiting feature is represented by the relatively lower quality characteristics of the fuel obtained from residual biomass (pruning) as compared to that obtained from forestry. In fact, it is generally expected that pruning, compared to forestry wood, shows a higher ash content as a result of a greater cortex fraction.

A further limiting aspect is represented by the physical structure of the biomass fuel that is routinely shredded rather than chipped. Shredding, in fact, generates rather heterogeneous pieces of fuel product with the presence of oversized pieces that could also compromise the mechanical feeding parts of a biomass plant (augers) with consequent interruption of its ordinary operation. This implies, at least in general, the need from the end user to purchase energy systems that are properly calibrated and protected from these technical problems.

Another limiting feature, particularly felt and debated in recent years, lies in the generic accusation that thermal energy plants fed by biomass would be responsible for serious atmospheric pollution by flue gases.

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In particular, PM10, PM2.5 and NOx are the most considered polluting molecules. If this condition is certainly true with reference to the old and technologically outdated installations, this is not true if we consider the modern generation biomass plants, whose environmental performance (and particularly the standards of atmospheric emissions) are very efficient and the pollution levels attributable to these energy plants are very limited. This puts in place the need for a urgent and rapid replacement of old biomass energy plants with new ones, so that a substantial technological turn-over is promoted, which would correspond to a significant reduction in air pollution levels.

From an environmental point of view, it is useful to consider the current use of crop residues and evaluating the pros and cons consequent to the energy destination of pruning. The tree crop residues are currently only minimally recovered for use as "firewood", mainly with regard to the greater size residues, while they are mostly shredded and buried or mulched on the field or, in some cases, removed from cultivation and burned in order to prevent sources of pathogen inoculation. The practice of burning residues is still widespread, unfortunately, mostly because of the indications given in past years about the preventing effect of fire in spreading plant diseases. Overall, it can be stated that pruning energy use represents a benefit, considering both agronomic soil conditions and the opportunity to obtain renewable energy. Sometimes and under specific climatic and soil conditions, crop residues represent an important contribution in soil organic matter and their removal can be a risk. Soil organic matter establishes good soil properties and contribute to climate change mitigation to the extent that carbon sink and sequestration is performed meanwhile the soil organic matter is increasing. The correct management of pruning for the greatest environmental benefit must therefore be well assessed from case to case [3].

In general, the recovery of fruit tree pruning is mostly constrained by the high **pulverization of farm properties**, with very small cultivated fields, which often prevents the economic convenience of a systematic biomass collection, carried out with appropriate operating machines and with well-optimized logistic handling systems. In this sense, it is desirable to create a market organized according to the same model used for food, and therefore with many collection points and storage sites that are well distributed throughout the land.

Considering harvesting, the main difficulty is given by the organization of the collecting site that is very different from that in forestry where biomass is concentrated (50-100 t ss / ha) compared to crop residues (1-3 t ss) / ha) and where biomass harvest takes place on a twenty-year round, and not on annual basis. This considered, a new supply chain actor may be desirable, such as a contractor or a mechanical service company offering a very good operating capacity in biomass harvesting and hauling [3].

Finally, it is worth pointing out a decisive issue in the list of figures that may hinder the setting up of APPR value chains and investments in the biomass sector; it concerns the currently low level of **social acceptance** regarding this type of productive settlements. In fact, it has been recorded that the level of public awareness regarding renewable sources, in general, and biomass for energy, in particular, is very limited, often distorted, in some cases extremely prevented. Far from considering the positive aspects and the environmental, economic and social benefits that could be associated with bioenergy and solid biomass, today very negative opinions prevail, fears, prejudices and mind closures. The lack of knowledge about technical issues reveals, most of the time, fears that the combustion process is dangerous and polluting in itself. Other factors are insecurities about the biomass quality actually used at the plant, suspicions about the fragile border between solid fuels biomass and waste, mistrust about potential investors, etc. Benefits can result only through a very well organized biomass offering. This can be done by applying a strategy of farmer associations, the establishment of farmer cooperatives, consortia, productive organizations that can handle significant amounts of such residual biomass.

As reported in the Sector Plan for Bioenergy [8], the VIII report of the NIMBY Permanent Observatory (*Not In My BackYard*), shows that in Italy, in 2012, the contested projects reached a total of 354. A good part of these concerns the construction of plants for the production of energy from renewable sources (172 out of 354), and 108 complaints are directed to biomass plants (including biogas), followed by hydroelectric plants (32) and wind farms (32). This classification, rather than giving a picture of the "questionability" or the

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"danger" of bioenergy, reflects an increasing trend of cases. Bioenergy, even more than other renewables, can arouse fears and resistance on the side of the population because of the confusion that is generated by the wide variety of systems (resources, processes and technologies) that characterize this kind of energy system.

For these reasons, the biomass to energy projects, in addition to being effectively sustainable, must also provide for an accurate action of social involvement and participation. The numerous "rejection" to bioenergy unfortunately affect transversally any kind of project, small or large, integrated within the territory or not. This is due to the lack of awareness of how these plants are conceived, if they are implemented following the necessary sustainability criteria, and in compliance with the provisions in force, the national guidelines and the related regional regulation. Most of all, the question is if these projects are actually contributing in climate change mitigation and if they are contributing to the social development of the region, strengthening its economic, productive and social fabric [8].

As it can be understood, a long and tiring work of dissemination and progressive involvement of farmers is still necessary. In this respect, "demonstrative" activities should be in first place among those essential to change the orientation of farmers as well as of citizens more in general.

G. National Plan for Energy and Climate

Current status of the energy sector

As stated in the fourth report on the Italy's progress under Directive 2009/28 / EC [11], published on December 2017, to date Italy has already achieved the 2020 targets for renewable sources, with a quota of 17.5 % on total consumption in 2015 compared to the target of 17 %. (*Table 6 and 7*).

In the electricity sector (*Table 8 and 9*), renewable sources were protagonists of a very strong growth in the last 10 years, achieving a share of final consumption of 33.5 % in 2015 (*Table 7*), corresponding to 109.7 TWh, 16 % of which coming from bioenergy.

Considering the heating and cooling sector (*Table 10*), in 2015, Italy achieved a penetration of renewables of 19.2 % (*Table 7*) of which biomass accounts for 73 %.

Table 6. Gross renewable energy consumption per sector (ktep)

	2009	2010	2011	2012	2013	2014	2015	2016
Heating & cooling	10.178	10.018	8.101	10.226	10.603	9.934	10.687	10.538
Electricity	5.244	5.768	6.837	7.840	8.665	9.001	9.142	9.183
Transport	1.290	1.575	1.577	1.552	1.468	1.310	1.456	1.360
Total	16.712	17.362	16.515	19.618	20.737	20.245	21.286	21.081

Table 7. Contribution (%) in renewable energy per sector with respect to final energy consumption

	2009	2010	2011	2012	2013	2014	2015	2016
Heating & cooling	16,43	15,64	13,82	16,98	18,09	18,89	19,17	18,73
Electricity	18,81	20,09	23,55	27,42	31,30	33,42	33,46	34,01
Transport	3,93	4,84	4,98	6,04	5,39	4,99	6,42	7,24
Total	12,78	13,02	12,88	15,44	16,74	17,07	17,49	17,35

Table 8. Net installed power for each technology using renewable energy in Italy (MW)

	2009	2010	2011	2012	2013	2014	2015	2016

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Solid biomass	438	406	421	538	606	620	616	685
Biogas	359	480	732	1.274	1.317	1.336	1.336	1.352
Bioliquld	371	581	736	989	1.003	990	1.000	993
Urban waste	703	716	742	754	836	826	852	841
Total	1.871	2.183	2.631	3.555	3.762	3.772	3.804	3.871

Table 9. Gross electricity production for each technology using renewable energy in Italy (GWh)

	2009	2010	2011	2012	2013	2014	2015	2016
Solid biomass	2.828	2.261	2.522	2.582	3.679	3.823	3.947	4.125
Biogas	1.665	2.054	3.405	4.620	7.448	8.198	8.212	8.259
Bioliquld	1.448	3.078	2.698	2.977	3.628	4.290	4.865	4.627
Urban waste	1.616	2.047	2.208	2.163	2.206	2.370	2.343	2.415
Total	7.557	9.440	10.832	12.342	16.960	18.681	19.366	19.425

Table 10. Gross final energy consumption for each technology using renewable energy in Italy in the heating and cooling sector (ktep)

	2009	2010	2011	2012	2013	2014	2015	2016
Solid biomass	7.848	7.540	5.114	7.247	7.431	6.646	7.380	7.175
Biogas	19	26	330	183	246	283	250	252
Bioliquld	28	25	22	21	21	31	42	42
Urban waste	56	62	86	71	83	85	108	117
Total	7.952	7.652	5.551	7.522	7.781	7.045	7.780	7.586

National Action Plan in favour of the RES (Renewable Energy Sources)

The following are the main measures implemented in line with the National Action Plan guidelines [11].

- Energy Efficiency Certificates (EEC or White Certificates) - Legislative Decree 28/2011 art. 29 and 30 and D.M. 28/12/2012, Legislative Decree 102/2014, Ministerial Decree 11/01/2017). Starting from 2005.
- Tax deduction for building renovations - starting in 1998.
- Tax deduction for energy redevelopment - starting from 2007.
- Thermal Account - Contributions for the production of thermal energy from renewable sources and for small-scale energy efficiency measures (Legislative Decree 28/2011, Article 28, Ministerial Decree 28/12/2012, Ministerial Decree 16/02/2016).
- Obligation to integrate renewable sources in new buildings and existing buildings undergoing major renovations (Legislative Decree 28/2011, Article 11)
- New incentive mechanisms (Legislative Decree 28/2011, article 24 and D.M. 06/07/2012 and D.M. 23/6/2016).

With reference to this last point, in Italy, the incentive mechanisms accessible for new plants producing electricity from RES were the following:

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- Ministerial Decree of 6 July 2012, to support renewable non-photovoltaic plants, which, starting in January 2013, replaced the Green Certificates (hereinafter also the CV) and the All-Inclusive Tariffs (hereinafter also TO).

- Ministerial Decree of 23 June 2016, which updated the mechanisms already introduced by the M.D. 6 July 2012 for the incentive of electricity production from plants powered by renewable sources other than photovoltaic.

In general terms, it is possible to point out that, over time, the guidelines of the national energy policy regarding the conditions of use of biomass for energy purposes have progressively changed, as well as the consequent regulatory framework that has undergone a significant evolution. In fact, the Decree of the Ministry of the Environment of 6 July 2012 introduces a strong sign of rupture with respect to the addresses hitherto taken with regard to renewable energy, thus closing a renewable development season mainly focused on financial incentives, to open a new season, based primarily on the concept of greater competitiveness and environmental sustainability.

Great attention is given today to the "residual" nature of biomasses used for energy purposes; in particular, the legislator intended to mitigate any potential competition between agricultural land invested in biomasses for energy purpose compared to traditional crops for food production. This is achieved by discouraging the use of agricultural crops expressly dedicated to the production of energy and, vice versa, favouring the energy use of crop residues and agro-industrial waste, livestock sewage and manure. This led to the identification of two distinct categories of biomass for energy purposes, respectively "products" and "by-products".

Therefore, biomasses for energy purposes must primarily take into account the recovery and valorisation of waste and residues ("by-products"). In the second instance only, dedicated crops can be used, in any case trying to avoid the negative interfere with food production [8].

Objectives and tools of the SEN 2017

At national level, the recent proposal for a new SEN - National Energy Strategy [10] sets the ambitious objectives of increasing the country's competitiveness by aligning the energy prices with the European ones, improving security of supply, decarbonising the energy system online with the long-term objectives of the Paris Agreement. The achievement of these objectives is expected to take place through the following priorities of actions:

1. Development of renewables
2. Energy efficiency
3. Energy security
4. Competitiveness of the energy markets
5. Acceleration in decarbonizing the energy system: the phasing out from coal
6. Technology, research and innovation.

In 2030, the SEN 2017 proposal considers a 27 % renewable energy target on final energy consumption to be pursued, as follows:

- Electric renewables at 48 – 50 % in 2030 compared to 33.5 % in 2015
- Thermal renewables at 28 – 30 % up to 2030 compared to 19.2 % in 2015
- Renewable transport at 17-19 % to 2030 compared to 6.4 % in 2015

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Compared to these specific targets, the European Parliament proposal, on last January 2018, shifted to a far more ambitious target, equivalent to 35 % of the total renewables as final energy consumption. If this target will be confirmed, it would require **a new overall calibration of all the national commitments**.

As reported in the "position paper" elaborated by MIPAF [9], regarding the contribution of biomass, the SEN 2017 highlights the following relevant traits:

1) Regarding **electric renewables**.

Biomass plants will not be able to reduce costs due to the non-compressibility of fuel purchase costs and other fixed costs in relation to other technologies (photovoltaic and wind). Furthermore, the production cost of small plants remains considerably higher than that of larger plants. In order to reduce the burden of system costs in the electrical bill of citizens and to stimulate solutions that can reach the market parity, SEN2017 proposes to **reduce the incentives for the existing bioenergy projects**.

In order not to lose the current production quota, to promote fair competition on the feedstock market, to ensure compliance with the principle of "cascading" use of biomass and to favour the less impacting chains not in competition with agriculture for the use of cultivated land, the SEN 2017 proposes the following:

- Incentivise only bioenergy projects from **crop residues, agricultural by-products and urban waste**, or, possibly, from second-harvest crop products.
- To allow, preferably, the **promotion and authorization of energy self-consumption**, and to **limit the new forms of tariff incentives to very small size plants** (with a limit of 70 kW).

2) Regarding **thermal renewables**.

- The environmental / health problem deriving from the emissive atmospheric impacts of solid biomass plants is recalled and, therefore, the need to favour plants with high environmental quality and efficiency is clearly highlighted.
- The most promising considered technology is the electric gas heat pumps.

Critical considerations about the SEN 2017

The following are a series of observations made with regard to the SEN 2017 proposal by institutional bodies, as well as associations of producers and farmer and industrial organizations [9, 12, 13, 14, 15, 16, 17, and 18].

- An approach **exceedingly based on economic sustainability** in the short-term is at risk of underestimating the environmental outcomes in the long term [9, 13].
- A greater **integration of energy policy with agricultural policies, climate and the environment** would help to increase certainty for investors by reducing the risk of choosing plant sites and technological paths that may lead to opposition at the local level jeopardizing the trust in renewable energy [9].
- The lack of a long-term perspective and the consideration of a short-range scenario, considering the coming decades as part of the commitments made with the Energy Roadmap 2050 and the Paris agreement of COP21. It is also highlighted the opportunity to set targets much more ambitious than those reported in the SEN 2017 [12, 16, 17]. It is therefore necessary to provide a double scenario for 2013 and 2015, respectively, integrating the European Package to 2030 with a plan in line with the most challenging commitments undertaken with the Paris Agreement [14, 15, and 17].
- A general criticism concerns the **extensive underestimation of the strategic role of agro-forest biomass** for the generation of heat and electricity, not only for its clear contribution to the energy

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balance in the share of renewables, but above all for its decisive role in contrasting climate change [12, 13, 14, 15, and 16].

- Solid biomass is a fundamental and irreplaceable component in the national and European process of energy transition, a decisive factor for phasing out from fossil [12]. Therefore, within the framework of the national energy policies, the SEN should provide for a more significant contribution from biomass in achieving the renewable energy production targets foreseen in 2030, also in consideration of its positive environmental and occupational effects on the territory [12, 13].
- The concept of "**energy democracy**" through an energy system widespread in the territory and fuelled by biomass locally available resources should find greater definition in the strategy [16]. In particular, it refers to the possibilities of **energy self-production** and the creation of **closed distribution systems** (SDC) that should be activated as soon as possible [16, 17]. In this regard, the SEN does not fully consider the new scenario of distributed generation and the advantages it can bring to the energy system [17].
- A contrast with the EU objectives and with the Paris Agreement is detected considered the proposed **reduction in the incentives for existing bioenergy** is foreseen. Conversely, an important role for the achievement of climate goals should be recognized to the agricultural and forestry sector [9, 12, 13,].
- On existing plants **the risk of retroactive action on the level of incentives must be avoided** in order to protect companies that have invested a lot of capital resources over the years, also creating important opportunities in terms of new employees in the sector [9, 13].
- The **positive effects of an environmental, economic** (in particular as regards the level of employment) **and social factors** are not properly taken into account [9, 13, 16].
- Regarding the maximum power threshold to get subsidies, the SEN should refer to the capacity of single or associated farmers to obtain satisfactory amounts of biomass (and not to the size of the "typical agricultural structure"). Moreover, considering the need to valorise increasingly the residual biomasses, it is essential to promote the incentives also for energy plants that aggregate several agricultural and forestry enterprises. In this regard, it is considered essential to provide incentives for energy plants of at least up to 500 kW, being the proposed threshold of 70 kW too much low [9].
- With reference to the observations of the SEN regarding the emissions produced by the combustion of biomass in household thermal appliances, it is believed [9] that this topic could be successfully dealt with through a joint strategy consisting of:
 - o promotion of a **technological turnover** consisting in the **replacement of the old and obsolete biomass appliances** with newly developed ones, realized in compliance with the requirements of the decree implementing the art. 290 of the Italian Environmental Law 152/2006;
 - o dissemination through specific **information campaigns about the incentive systems provided for by the Thermal Account** which aims to support the scrapping of old household appliances with new generation ones;
 - o promotion of wood fuels certified and in compliance with ISO 17225 quality standard;
 - o dissemination of good practices to promote wood biomass use in safety, respecting the environment and air quality through specific **information campaigns aimed at potential final user citizens**.
- Regarding thermal energy, **renewable technologies for heating and cooling** should be considered as real and feasible solutions. A **balanced energy mix for renewable heating** should be ensured

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with efficient solutions, such as modern technology in energy conversion powered by biomass, solar geothermal and thermal energy, the most performing heat pumps, etc. [12, 16]. In fact, it is believed that to entrust the energy turnaround in the heating sector largely to a single technology, although promising such as heat pumps, represents a risk with respect to the objectives that the SEN itself is proposing. Conversely, an **interconnection between all renewables should be pursued**, whether they are addressed to electricity, heat generation or transport [16].

- It is necessary to assess adequately the contribution and benefits for the national energy system that can be given by **programmable energy plants from renewable sources** (biogas, biomass, geothermal, etc.) and those capable of producing electricity and heat according to a self-production criterion and framework of locally distributed energy [17].
- The need for a sustainable electricity generation from biomass is underlined, through an appropriate incentive policy **promoting combined heat and power (CHP) technologies** for energy plants up to 300 or 500 kWe and **assigning a specific recognition to certified biomasses** [12, 13, 16].
- Introducing a **carbon tax** is considered essential to mitigate part of the environmental, climatic and health impacts related to the use of fossil fuels [12]. It should be appropriately quantified based on specific environmental considerations and through approaches such as emission balance.
- A very critical point, in the SEN, is dedicated to the atmospheric emissive impacts of solid biomass plants. In fact [12], in the last 15 years considerable progress has been made by the industries pertaining to the solid biomass sector, thanks to huge investments in research and development. Manufacturers of solid biomass plants are making a major effort to implement low-impact technology solutions on air quality. The **voluntary certification** of the plants can constitute, at least in the start-up phase, a useful tool to guarantee better performance of household heating and cooling appliances. The biomass plants should however have, as soon as possible, a clear **certification regarding the emission performance** provided by the manufacturer. At the same time, **technological turnover** must be promoted in the domestic heating sector; this can be achieved thanks to the diffusion of the incentives provided by the **Thermal Account**, whose opportunities are, even today, little exploited [12, 16].
- The establishment of **district heating networks** fuelled by solid biomass and agricultural by-products of local origin (short supply chain) offering energy services to local communities should be strongly encouraged.
- With regard to electricity generation, it is considered appropriate that the incentive scheme, in the future, should be almost exclusively assigned to **energy plants operating under cogeneration** (CHP systems), in order to increase the energy conversion efficiency of biomass.
- With regard to the very restrictive indication of very **limited power sizes** (70 kW), it is widely believed that this limit is unrealistic and not technically and economically feasible. Therefore, a threshold of at least 300 or even 500 kW power size is proposed; the latter could be a more appropriate threshold [12, 13, and 16].
- To biomass classified as “by-products”, according to current legislation, should be recognized a **specific incentive bonus**. In any case, they must be traced and should come from a properly defined territorial area, as well as be obtained according to agreed criteria of environmental and ecological sustainability [12, 16].
- More attention should be paid to the authorization procedures of the energy plants. The **legal and regulatory uncertainty** is, still today, one of the main barriers in Italy to the diffusion of energy plants from renewable sources. The Legambiente document [17] states that the difficulties in approving energy plants concern both small and large projects, citizens as well as companies. In many Italian regions, in fact, is forbidden to start new projects for renewables, given the chaotic

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crossroads of bureaucracy, constraints put in place by the implementation of national guidelines and prohibitions by Superintendence. This is why a **revision of the guidelines for landscape integration is required, and the introduction of guidelines for environmental impact assessment is recommended**. Priority should be assigned to the definition of **transparent criteria** for environmental assessment procedures for different kind of installations [17].

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SWOT Analysis

The SWOT analysis worked out in the frame of the Bioenergy Sector Plan [8] is presented below. Strengths, Weaknesses, Threats and Opportunities characterizing the national bioenergy system have been outlined with specific reference to solid biomass supply chains.

	Strengths	Weaknesses	
Internal Factors	- Wide availability and range of biomass feedstock (in particular as fruit tree residues, i.e. pruning). - Mature and reliable technologies, both for electrical production and for thermal uses. - Strong presence of the national industry in the production and marketing of plants and plant components and machinery. - Existence of a large number of "success cases" to be used as possible models along the entire supply chain. - GHG emission savings. - European and national strategies sustaining the sector development according to guidelines and supporting a steady growth in line with the objectives of the National Action Plan (NREAP) for 2020 and beyond. - Energy from solid biomass is a continuous, steady and programmable form of electricity production.	- Poor development of biomass supply chains and biomass to energy conversion systems at regional and national scale; considerable use of energy imports. - Low conversion efficiency in electrical generation and limited use of CHP systems (combined heat and power). - Capital costs per unit of installed power capacity still high and construction of district heating systems still expensive. - The availability and reliability of technologies (gasification and pyrolysis) is still limited with respect to the production of electricity with high efficiency in small plants. - Devices for the abatement of Particulate Matter (PM10, PM2.5) in the flue gas emissions are still very expensive. - The costs for the biomass supply are still quite high but also "incompressible", thus affecting the economic affordability of the whole value chain. - Lack of a unique regulation at national level for the treatment of ashes obtained by the energy plants. - Poor attention to communication and information of public opinion on the bioenergy sustainability and benefits. - Poor attention to professional training both in terms of design, construction and maintenance of biomass energy systems. - Need for a better management of skills between the Ministries and the bodies involved.	Internal Factors

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	Opportunities	Threats	
Internal Factors	- Drive a change towards more sustainable agricultural practices, also providing alternatives to the current pruning management as waste and not resources. - Development, productive innovation and internationalization of the national industry in all segments related to the biomass supply chain (agricultural mechanization, plant engineering and components). - Recovery and valorisation of crop residues (pruning) with savings on management costs and supplemental farm income. - Modernization and strengthening of agro-mechanical service companies, with an increase in employment, profitability and the creation of new professionals. - Technological improvement of the existing set of energy plants powered by solid biomass, with specific reference to energy conversion efficiency, GHG savings and environmental standard of atmospheric emissions. - Improvement of the quality standards of solid biomass (e.g. solid biofuel certification). - Supporting the creation of a national biomass supply chains with positive impacts on reducing the dependency from imports to feed biomass-heating systems. - Opportunity to enhance solid biomass in the thermal sector (heating & cooling).	- Increasing quantities of imported biomasses are mobilized because easier to find, preventing positive effects on the territory. - A continuous update of the policy strategy, especially over the long term, is required in order to pursue programmatic objectives that go beyond 2020. Rearrange the targets and stress the national energy system in their accomplishment. - Decrease in the market price of fossil fuels because of "dumping" strategies. - Popular opposition to the construction of new plants (NIMBY syndrome). - Changes in the economic framework of incentives and subsidies, which can invalidate the business plans of large part of biomass energy projects. - Potential conflicts between a widespread and diffused small size bioenergy systems and large size bioenergy plants for the supply of biomass.	Internal Factors

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Strategic Plan

Target ① AIMING AT AN EFFICIENT AND INTEGRATED REGIONAL AGRO-ENERGY SYSTEM ACCORDING TO THE BIOECONOMY MODEL.	
Strategy: Strengths + Opportunities → SO “Attack”	
S1. Agriculture is a strong local productive sector, together with agro-food processing. S2. Large potential biomass availability at regional scale and very high local biomass spatial density. S3 Good level of potential employment offered by the APPR sector. S4. Local operation of some real business cases and successful examples.	O1. Agro-industrial integration towards a "bioeconomy" productive model. O2. Proceed in “greening” the economy, increase the use of renewables in industry, and decarbonize industrial activities, save fossil energy and GHG emissions significantly. O3. Adoption of rules consistent with the development of circular economy according to the EU framework. O4. A potential level of cross-sector innovation. O5. Rules encouraging inter-professional agreements along the biomass supply chain. O6. Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines).
Objectives SO1. Full deployment of a “low carbon economy” based on biomass resources, with particular reference to APPR. SO2. Sustaining entrepreneurs in the development of new APPR energy projects. SO3. Expanding the influencing action of representatives of the APPR sector in the regional milieu.	
Actions / Activities • Projects and investments should promote the development of integrated value chains, connecting regional players, and enabling companies to take advantage of the policies implemented at regional level. • Stimulating the regional establishment of companies manufacturing biomass or energy plant components and equipment to be used by the companies in the APPR sector. Technical and functional integration along the supply chain is particularly relevant, seeking to promote a distributed energy generation model. • Promoting pioneering initiatives and proposing systemic design projects to encourage the emergence of a new, shared and consolidated "vision" about the energy sector development. • Supporting pilot projects and the development of new energy products from APPR biomass, conversion processes and technologies in the bioenergy sector. • Looking after flagship projects to be taken as representative models in the region. • Promoting linking actions with the regional administrative agencies who are in charge of the	

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wide range of authorizations of bioenergy projects and APPR investments according to specific procedures. A “coordinating table” should be established where sharing opinions and suggestions.

- Agreements within the trade (or “Inter-professional agreement”). Considering the large-size energy plants, the equilibrium of rights and obligations between farmers and bioenergy undertakings can be achieved by means of collective negotiations. Key elements contained in the contracts are related to the conditions of APPR delivery and purchase. This concerns mainly the management of APPR delivery/reception, includes elements such as delivery date, quality conditions, bonuses and rules on adapting prices in plurennial contracts, etc..

Target ② SUSTAINABLE APPR ENERGY GENERATION AS A PATH TO RURAL DEVELOPMENT.	
Strategy: Strengths + Opportunities → SO “Attack”	
S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass). S6. Using locally available resources is considered a priority. S7. Observed trend in deepening the agricultural activity along the value chain. S8. Observed trend in applying a set of agricultural diversified activities. S3. Good level of potential employment offered by the APPR sector. S4. Local operation of some real business cases and successful examples. S9. Farmers have a strong imitation attitude. Positive examples are considered as a model. S10. Cohesion is considered a social responsibility among farmers; this should promotes cooperation.	O3. Adoption of rules consistent with the development of circular economy according to the EU framework. O7. The “multifunctional” asset of current agriculture according to the vision of “rural development”. O8. Application of the EU “cross-compliance” with respect to farmers’ commitments. O9. Valorisation and reuse of agricultural residues for bioenergy production. O10. Adaptation measures to climate change. O11. Ensure biodiversity conservation and the supply of ecosystem services. O12. Young and skilled farmers entering in the sector thanks to new incomes opportunities. O13. Funding schemes favouring the APPR sector in agriculture. O14. Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example).
Objectives SO4. Energy self-supply and consumption in the rural areas, distributed bioenergy generation, diversified productive activities, increase of farmer income. SO5. Ecologically sustainable and “close loop” agricultural model based on “circular” economy.	
Actions / Activities • Sustaining farmers in the development of new APPR projects in terms of both increasing the amount of available APPR biomass to be addressed to the energy market and promoting the direct and internal energy exploitation of this feedstock.	

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- Suggesting the insertion of well-defined (national and regional) measures of “good agricultural and environmental conditions” (GAEC) within the “Single Payment” scheme and “Cross Compliance” mechanism (CAP first pillar) with respect to the management of crop residues and fruit tree pruning.
- Promoting the application of well-defined agro-environmental measures (CAP second pillar) within the Rural Development Plan, at national and regional level, aiming at encouraging the energy use of pruning (APPR feedstock) and sustainable energy conversion processes.
- Promoting a large participation of farmers and farmer organizations, together with other stakeholder associations, in the establishment of operational groups (OPs) within the EIP (European Innovation Partnerships), specifically tailoring projects and investments in the APPR energy use and the valorisation of solid energy carriers from APPR feedstock.
- Motivating cooperation and partnership among small landowners, farmers and operators in organising APPR energy value chains, sharing facilities and resources, sustaining horizontal and vertical integration among the actors of the supply chain and for the development of short supply chains and local energy markets.
- Defining “best management practices” in the agricultural sector with reference to the APPR feedstock. Providing comprehensive information and advices on several issues about pruning removal, including handling, logistics and economy. Advising farmers about possible impacts on soil carbon contents. Assessing when and where soil carbon contents are critical to preserve appropriate soil chemical and physical properties.

Target ③ A MARKET ORIENTED APPR ENERGY SECTOR TO INTERCEPT AND SATISFY SOCIETY NEEDS.	
Strategy: Strengths + Opportunities → SO “Attack”	
S1. Agriculture is a strong local productive sector, together with agro-food processing. S2. Large potential biomass availability at regional scale and very high local biomass spatial density. S4. Local operation of some real business cases and successful examples. S6. Using locally available resources is considered a priority. S11. Potential cost savings in field pruning management.	O15. Steady economic affordability of biomass energy carriers as compared to fossil fuels. O16. A prospective increase in the market price of biomass. O17. A prospective increase in the market price of fossil fuels. O18. Label and standards of biomass quality assurance and traceability. O19. Subsidies and incentives promoting fossil displacement. O20. Public support on the demand side of APPR feedstock for energy use (“green public procurement”).
Objectives	
SO6. A large and stable availability of APPR feedstock through an extensive involvement of farmers and an efficient logistic organization of the APPR supply chain (harvesting, transporting and storing). SO7. A large and stable market supply of renewable energy products (energy carriers) obtained from APPR biomass. SO8. Effectiveness of the APPR supply chain and good economic affordability of the whole	

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SO9.	value chain. Strong political leadership with clear market targets to support bioenergy and the APPR sector.
Actions / Activities • Reinforcing the final use of biomass energy carriers. Disseminating knowledge about the large set of potential bioenergy final products and confidence on their possible use in energy conversion processes at both household and industrial application levels. • Informing the large public and potential customers about the economic advantages in switching from conventional fossil fuels to alternative solid wood fuels. • Strengthening stability in biomass fuel prices. High price for biomass energy carriers and its possible sharp variability are parts of the reasons why household end-users show hesitation and could prefer to maintain their conventional oil or gas boiler. Reliable and regular feedstock SUPPLY sources and an efficient supply chain organization allow avoiding irregularities and strong market imbalances. • Strengthening the demand side of the APPR energy market. Maintain subsidies to reduce investment costs for solid biomass heating equipment. High investment costs for wood heating systems are still a main barrier. To overcome this point, governments have to reinforce their supporting policy. For example, individual house-owner can obtain subsidies that correspond a reimbursement (50 % of equipment costs) on taxes for a wood heating equipment. • Developing a local/regional system of feedstock quality control, system of biomass traceability, environmental management assurance, criteria of product eco-labelling, etc. Local criteria should be harmonized with national / international criteria. • Prospective consumers need to buy not only a fuel that is competitive in terms of price (and this is generally the immediate factor), but also conforming to quality standards according to the use, together with excellent service and procurement conditions.	

Target ④ SUPPORTING AN INNOVATION TREND IN BIOENERGY TECHNOLOGY AND A SHIFT TO MORE EFFICIENT ENERGY USE FROM APPR BIOMASS.	
Strategy: Weaknesses + Opportunities → WO “Reorientation”	
W1. Energy conversion from pruning is still considered an overall risky operation. W2. APPR is largely spatially dispersed and need to be collected over a wide land area. Strong seasonality in harvesting. W3. Complexity of biomass supply chains. Lack of well-organized logistics operations. W4. Low degree of mechanization. Lack of knowledge on field mechanization. W5. Harvesting and chipping machines need technological improvements. W6. Inadequate or insufficient technical reliability of biomass plant.	O1. Agro-industrial integration towards a "bioeconomy" productive model. O2. Proceed in “greening” the economy, increase the use of renewables in industry, and decarbonize industrial activities, save fossil energy and GHG emissions significantly. O4. A potential level of cross-sector innovation. O6. Local availability of agro-mechanical service companies as well as builders of processing facilities. O9. Valorisation and reuse of agricultural residues for bioenergy production.

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W7. Agro-industrial integration is hard to be achieved.	O21. Notable "learning curve" on the technological maturity of energy conversion processes.
W8. Energy products that do not comply with international standards and labelling.	O22. Commercial availability of small size power plants.
W9. Lack of integration of knowledge and efforts across sectors	O23. Possible combination of biomass mobilization with information technologies and product traceability.
	O24. Ensure proper conditions for the adoption of knowledge and innovations.
	O25. Possible availability of public financial funding to promote investments.
	O30. More restrictive atmospheric emission thresholds.

Objectives

- WO1. A well-developed technological readiness in order to offer good performing technologies, lower investment costs, reliability and duration of the APPR facilities.
- WO2. Competitive market positioning of APPR energy carriers and reasonable affordability of investment and maintenance costs of the bioenergy projects.
- WO3. Better environmental performance with special reference to GHGs savings and atmospheric emissions (PM10 and PM2.5) from APPR energy conversion (significantly lower than from fossil fuels and even from other types of biomass sources).

Actions / Activities

- Improving the overall technological performance of the equipment and machinery used along the supply chains and in the energy conversion.
- Applying well-targeted research and innovation activities, directly conducted by the companies involved in the engineering development.
- Promoting R&D initiatives and innovative pre-commercial procurements from public funding aiming at the development of sound thermochemical technologies (combustion, gasification, and pyrolysis) in strict connection with well-defined and performing business models of APPR exploitation.
- Identifying the main technological constraints affecting the available equipment and correspondingly improving the current technologies in their reliability, robustness, working capacity, total lifetime, precision and accuracy of the work performed.
- Improving some significant technological components representing the main critical segments along the biomass-to-energy thermochemical conversion process, such as the flue gas cleaning system, the biomass feeding system, the overall system energy efficiency, etc.
- Expanding the capacity of biomass combustion installations to be fed with different types of solid fuels, thus becoming more flexible in their potential applications and in satisfying a wide range of possible uses.
- Systematically checking the outcomes of the energy balance and the GHG saving rates, confirming the ecological standards of the applied technologies and their effective performance on "fossil displacement" and climate change "neutrality".
- Systematically checking the atmospheric emissions due to thermochemical energy conversion processes (mostly considering the particulate matter "PM 10" and "PM 2.5"),

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demonstrating that the updated technology has greater advantages compared to the former one and that is not worse than the conventional technology based on fossil fuels.

- Improve the capacity of apply or submit energy projects to EU funding scheme (such as “SME Instruments” or “Fast Track to Innovation”) by local entrepreneurs (single farmer, cooperatives, or producer association) supporting them in the preliminary project assessment and the subsequent designing phases.

Target ⑤ TRIGGERING SOCIAL AND POLICY INNOVATION IN THE APPR SECTOR.

Strategy: Weaknesses + Opportunities → **WO “Reorientation”**

W9. Lack of integration of knowledge and efforts across sectors.	O1. Agro-industrial integration towards a "bioeconomy" productive model.
W10. Mind-set of farmers, their reluctance to change and their low attitude in cooperating and innovating.	O2. Proceed in “greening” the economy, increase the use of renewables in industry, and decarbonize industrial activities, save fossil energy and GHG emissions significantly.
W11. It does not always exist the culture of sharing machineries and equipment, or organizing jointly the agronomic operations (as would be required for harvesting and mobilising pruning residues more efficiently).	O3. Adoption of rules consistent with the development of circular economy according to the EU framework.
W12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source.	O4. A potential level of cross-sector innovation.
W13. Lack of exemplary business cases.	O5. Rules encouraging inter-professional agreements along the biomass supply chain.
W14. Distrust that farmers may be reliable in biomass supply.	O14. Interest by municipalities and local councils to promote community investments on bioenergy (i.e. district heating systems).
	O19. Subsidies and incentives promoting fossil displacement.
	O20. Public support on the demand side of APPR feedstock for energy use (“green public procurement”).
	O26. Possible application of the “Carbon emission trading” and CO2 taxation.
	O27. Segmenting incentives to renewable energy sources to favour the equitable sharing of benefits and social impact.

Objectives

- WO4. Promoting a strong bottom-up participation approach oriented to a community-based problem solving.
- WO5. Enforcing a strong regional policy on bioenergy and a coherent and consequent regulation framework.
- WO6. Enhancing public understanding (from both citizens and government representatives) about bioenergy role and value.

Actions / Activities

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- Setting up a regional “operational group” (OP) on bioenergy and APPR value chains. OPs consist of several partners with a common interest in a specific, practical innovation project. The people involved in the OP should be from a diverse combination of practical and scientific backgrounds (farmers, scientists, agri-business and others). They work together on concrete, practical solutions to a problem or innovative opportunity. OP are action and result-oriented groups, where all the actors involved need to work together. All partners in OP should have an active role in carrying out the innovative project.
- Deploying regional networking activities. Reinforcing the partnership around a network of individuals, companies, organizations, etc. The aim of the partnership primarily consists of sharing knowledge and includes a vast number of different contributing stakeholders sharing a common vision. They will become the key actors of further initiatives promoting the APPR sector development.
- Generating consensus and social support on (properly tailored, community oriented and environmental friendly) agro-energy projects based on the use of APPR feedstock and targeted to rural development or municipality energy supply.
- Region-specific social innovation and community energy approaches, such as promoting experiences similar to the “energy villages”.
- Promoting engagement through communicative participatory processes can significantly raise awareness and public trust, which can thereafter lead to attracting investments for bioenergy community projects.
- Promotional activities, raising awareness and engagement. For example, “bioenergy-tours” through excursions to existing successful bioenergy projects, which act as “reference models” for future projects, bioenergy exhibition, local information events and articles in the press, conferences and workshops.
- Civic participation and engagement in the region should be significantly increased to get local population aware of the beneficial effects of bioenergy communities (e.g. community energy self-sufficiency, increased job opportunities, empowered re-investments), thus promoting a sense of social responsibility. Key factors for the success of a bioenergy project are based on communication and participation.
- A community-based project could be a public project or, alternatively, a local investments which empower community members to become shareholders of their local project.
- Cross-sector partnership and synergetic actions (i.e. learning from each other at a local, regional, and national scale) can stimulate successful social innovative community energy projects. Stimulating communities in setting up energy supply chains, achieving energy self-sufficiency, and becoming shareholders of a local community energy venture, as well as increase the joint profitability.
- Rules and regulations from regional government and administration should follow accordingly, preventing speculations and aggressive energy projects but favouring community-based energy initiatives.
- Commitment of local government should be clear and effective in increasing the deployment of renewable energy by APPR biomass through promotional activities, incentives, innovative forms of financing, tax-relief, targets, etc.
- A dedicated legal framework should offer financial incentives for entering into partnerships. Better tariffs, FITs and RHIs, tax reliefs and subsidies as well as simpler licensing procedures

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greatly improve the ability to launch new investment initiatives.

- Government incentives and funding. Given the amount of capital investment associated with most bioenergy facilities, the development of new projects require some form of external finance. Private finance is available but could be difficult to obtain. To help to bridge this gap, and until the market develops, governments are providing targeted financial support to the APPR bioenergy sector.

Target ⑥ CONSOLIDATING THE ECONOMIC AFFORDABILITY OF BIOMASS USE AND THE ECONOMIC RETURN ALONG THE VALUE CHAIN.	
Strategy: Weaknesses + Opportunities → WO “Reorientation”	
W15. Pruning is considered a feedstock of too low economic value. W16. APPR harvesting and transport operations are generally considered too costly. W17. Little info on funding opportunities for farmers and entrepreneurs in the bioenergy sector. W18. A long and subdivided supply chain could be not economically efficient for every actors. W19. Industrial investors are expecting very high profits and a fast payback time in the renewable sectors. W20. Limited economic affordability in utilizing services offered by specialized agro-mechanical pruning companies or techno-logistic companies.	O5. Rules encouraging inter-professional agreements along the biomass supply chain. O15. Steady economic affordability of biomass energy carriers as compared to fossil fuels. O19. Subsidies and incentives promoting fossil displacement. O25. Possible availability of public financial funding to promote investments. O27. Segmenting incentives to renewable energy sources to favour the equitable sharing of benefits and social impact. O28. Long-term stability of economic return on bioenergy investment. O29. Significant reduction trend in the capital costs of new investment in the bioenergy sector.
Objectives WO7. Consolidating the economic affordability of biomass use and the economic return along the value chain.	
Actions / Activities • Promoting partners’ aggregation in designing and launching energy projects based on the complementary functions they can offer along the value chains. Give particular importance to inter- and intra-sectorial relationships, promoting the establishment of agro-industrial regulations, contractual agreements, cooperation arrangements, reciprocal constraints and exploitation opportunities. • Offering financial counselling and advising or releasing economic and financial guidelines in order to inform potential entrepreneurs about the economic feasibility of energy projects based on APPR biomass. • Compiling templates of “business plan” also adjusting the economic exercise to the specific conditions of companies participating in the bioenergy project. • Filling out tables comparing the economic and financial aspects of the different business models in the APPR energy sector, in order to outline the pros and cons and provide an overall judgment of profitability.	

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- Giving clear and complete instructions about the availability of public funding in agriculture dedicated to bioenergy projects or funding promoting rural development through biomass mobilization and energy use. Produce a list of options and organize a programme and a timeframe in order to schedule the possible participation of farming cooperatives or agro-food companies in public competitions or tenders.
- The same as the previous bullet, but with the difference that, in this case, industrial companies are involved and public funding opportunities or financial facilities are specifically dedicated to promote industrial investments.
- Establish preferential relationships with some of the banks or credit institutions operating in the region and, through advocacy actions, promoting favoured credit or financing conditions.

Target ⑦ BOOSTING APPR BIOMASS SOURCES AND SETTING UP CONDITIONS TO STRENGTHEN THE APPR SUPPLY CHAIN.	
Strategy: Weaknesses + Opportunities → WO “Reorientation”	
W2. APPR is largely spatially dispersed and need to be collected over a wide land area. Strong seasonality in the harvesting operations. W4. Low degree of mechanization. Lack of knowledge on field mechanization. W12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source. W14. Distrust that farmers may be reliable in biomass supply. W21. Structure of farms and farm size too small to allow a profitable pruning collection and use. W22. Pruning is supposed to be not a by-product but a waste without any economic value. W23. Farmers generally consider pruning residue as an obstacle to ordinary field management and usually their target is to dispose it in the most simple and economic way. W24. Pruning burning in open field is still considered an agronomic operation W25. Competitive agricultural use of pruning as soil amendment.	O6. Local availability of agro-mechanical service companies as well as builders of processing facilities. O7. The “multifunctional” asset of current agriculture according to the most recent vision of “rural development”. O8. Application of the EU “cross-compliance” with respect to farmers’ commitments. O9. Valorisation and reuse of agricultural residues for bioenergy production. O11. Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example). O13. Funding schemes favouring the APPR sector in agriculture
Objectives WO8. Significantly increasing the availability of biomass from APPR farming management and preventing pruning misuse or waste. WO9. Mobilizing large amount of APPR feedstock and effectively use a large proportion of biomass potentially available.	

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Actions / Activities

- Advising, raising awareness and preventing improper treatments with respect to APPR management through information campaigns, news releases and publications, technical reports, etc.
- Involvement and commitment of the regional farmers associations in disseminating the alternative concept of pruning energy use, the know-how about the technical pruning management to supply the energy market, the usefulness of the biomass-to-energy conversion to satisfy the energy community needs.
- Carrying out analysis on regional and local APPR availability and, consequently, proceed to the realization of technical maps of APPR availability. This is a preliminary knowledge to properly plan the APPR energy use and identify agro-energy districts within the region particularly suited to the setting up of supply chains and the installation of energy systems.
- Under no circumstances allow the APPR biomass can be considered a “waste” under the regional or national regulation and, if this happens, make a strong pressure to re-orient the decisions.
- Promoting the constitution of farmers’ cooperatives in order to significantly increase the “critical mass” of companies operating on the market and the total amount of APPR feedstock supplied to the market.
- Stimulating aggregation among farmers and the forming of “agro-energy clustering” or “agro-energy district” within specific regional areas. The advantage of “aggregation” is in the economy of services, in the sharing of common costs, in the decreasing costs of transports, in the stimulating milieu that increase the general level of entrepreneurship.

Target ⑧ PROVING THE FEASIBILITY OF THE APPR VALUE CHAINS AND ITS VALUE IN MICROGENERATION PROJECTS.

Strategy: Strengths + Threats → ST “Defence”

S1. Agriculture is a strong local productive sector, together with agro-food processing.	T1. Actual low degree of pruning valorisation.
S2. Large potential biomass availability at regional scale and very high local biomass spatial density.	T2. Biomass plant and energy facilities are still capital intensive.
S4. Local operation of some real business cases and successful examples.	T3. Still large-scale economy are influencing the sector.
S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass).	T4. Competitive energy use from forest wood, crop residues or food-processing by-products as alternatives to pruning.
S6. Using locally available resources is considered a priority.	T5. APPR biomass use is less competitive than other forms of renewable energies
	T6. Renewable energy more emphasized as power than heat generation.
	T7. Atmospheric emissions due to biomass thermochemical conversion are generally considered an environmental problem.
	T8. District heating is still an uncommon solution in municipalities (with

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	exceptions).
Objectives ST1. Training activities through continuing professional development (CPD) and regional “task force” of technicians and consultants.	
Actions / Activities • Triggering a very attractive information activities made up of workshops, technical meetings, open field demonstrations, practical and applicative handbooks or guidelines having the aim to intensify the know-how and expertise about the APPR sector and its capacity to solve relevant needs concerning energy supply for households, farms, industries, commercial activities, etc. • Demonstrations (permanent installations or during fairs and exhibitions) aimed at showing best case studies or exemplary applications about the use of APPR biomass or APPR energy generation systems, able to highlight the correct, convenient and useful application of such technological solutions. Demonstrations are finalized to increase the opportunities and possibilities to replicate the proposed examples, specifying the “key factors to success”. • Technical assistance, testing on existing and innovative technologies, establishing connections between experts, operators, technical installers, stakeholders and community. • Technical training allowing the acquisition of new competences and expertise in the bioenergy sector, with particular regard to new technologies and distributed model of energy generation. • Forming a regional “task force” made up of properly trained technicians and selected consultants or experts to provide technical support to those entrepreneurs determined in developing new APPR projects.	

Target ⑨ REACTING TO AN IMPROPER AND MISLEADING INFORMATION BY PROMOTING FULL AWARENESS AND SOCIAL ACCEPTANCE.	
Strategy: Strengths + Threats → ST “Defence”	
S1. Agriculture is a strong local productive sector, together with agro-food processing. S2. Large potential biomass availability at regional scale and very high local biomass spatial density. S3. Good level of potential employment offered by the APPR sector. S4. Local operation of some real business cases and successful examples. S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass). S6. Using locally available resources is considered a priority. S11. Potential cost savings in field pruning management.	T7. Atmospheric emissions due to biomass thermochemical conversion are generally considered an environmental problem. T8. District heating is still an uncommon solution in municipalities (with exceptions). T9. Limited communication with civil society/public opinion and lack of promotional activities. T10. No coherent policy, no strategic view on the APPR sector from local governments. T11. NIMBY syndrome (“Not In My Back Yard”). T12. Risk of large fossils energy consumptions and GHGs emissions along the supply value chain and lack of

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	environmental guidelines.
Objectives ST2. Filling the gap of knowledge by the public about the opportunities and potential offered by the development of the APPR sector in the region. ST3. To increase awareness about the value and societal benefits of developing the bioenergy sector in the region.	
Actions / Activities • Overcome lack of information for domestic end-users on available technologies and wood-fuels. • Spreading awareness about the APPR value chains and bioenergy projects. • Communication: presentation of the benefits of bioenergy based on APPR feedstock (both socio-economic and environmental) through workshops, community events, focus groups and forums, training activities, social media, on-line platforms, press releases, well-known and trusted opinion leaders, etc. • Dissemination: presenting successful cases, investing on an increase sense of responsibility of each person in front of his/her community, offering new opportunities of job, creating close-loop economies and energy self-sufficiency within the region. • Promoting a “domino effect” and creating a systemic change: attracting new affiliations, engaging new “franchisees”, generating an opinion movement. • Pressing for the achievement of law changes or transformations and the development of new forms of rules, closer to the community needs. • Communications among citizens and/or different communities facing common problems across different geographies can enable farmers and the general public to inform each other. Local networking and face-to-face communications has been proved to be very effective. This information may include data on the local financial and economic benefits of the bioenergy project, best practices, school presentations, exhibitions, workshops and press releases. In such events, local core competencies can be presented to the communities and publicly discussed.	

Target ⑩ MITIGATING THE ENVIRONMENTAL BURDENS ALONG THE BIOENERGY VALUE CHAIN, FROM FARMING OPERATIONS TO ENERGY CONVERSION.	
Strategy: Weaknesses + Threats → WT “Surviving”	
W24. Pruning burning in open field is still considered an agronomic operation W25. Competitive agricultural use of pruning as soil amendment. W26. Agronomic guidelines on soil and pruning management are still lacking. W27. Risk of soil depletion if APPR biomasses are not properly managed at field scale.	T7. Atmospheric emissions due to biomass thermochemical conversion are generally considered an environmental problem. T12. Risk of large fossil energy consumptions and GHGs emissions along the supply value chain and lack of environmental guidelines. T13. Pruning burning is not roundly forbidden by national/regional regulation. T14. The energy use from pruning is not

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	adequately supported by the CAP.
Objectives WT1. Ensuring that bioenergy projects and APPR market developments do not adversely impact the environment and its ecological resources	
Actions / Activities - Many of the ecological and environmental impacts of bioenergy are associated with land use and land use change in connection to biomass production. In this respect, addressing crop residues (such as the APPR feedstock) to energy conversion has no implications in terms of “land use change” (LUC) and could be considered perfectly in tune with an ecological management of agro-systems. This sound ecological perspective should be clear and well known by farmers, APPR sector operators and public at large as well. Information campaign and technical dissemination on this issues should be organized in the shortest possible time. - The biomass “extraction rate” of biomass from the fields (i.e. the amount of biomass removed and addressed to energy conversion) should be defined according to soil conditions, climate main characters, and farming management. A set of guidelines should be targeted to find the best balance ("trade off") between preserving soil organic matter (through biomass remaining in the soil) and displace fossil fuels (through biomass addressed to energy conversion). - Working out innovative and ecologically sustainable management techniques of the fruit-tree plantations and orchards aimed to significantly reduce carbon (and carbon equivalent) emissions and preserve soil organic matter through a set of operations such as cover crops, soil amendments, minimum tillage, etc. A conservative approach to fruit growing should be defined and disseminated among farmers. This better soil conditions will allow a higher extraction rate of pruning residues from the field. - Burning wood biomass implies emitting gases into the atmosphere. Public opinion is mainly alarmed by particulate matter (PM 10, for example) emissions, together with NOx, CO, OGC and PAH. Especially in the small and medium-scale heating sector, increased biomass utilisation should accompanied by further technology development towards low emission combustion systems. Significant improvement should be made on both biomass quality and technological advancement of boilers and energy plants.	

Target ⑪ WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE.	
Strategy: Weaknesses + Threats → WT “Surviving”	
W12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source.	T4. Competitive energy use from forest wood, crop residues or food-processing by-products as alternatives to pruning.
W15. Pruning is considered a feedstock of too low economic value.	T5. APPR biomass use is less competitive than other forms of renewable energies
W22. Pruning is supposed to be not a by-product but a waste without any economic value.	T15. APPR market still underdeveloped.
W25. Competitive agricultural use of pruning	T16. Imports of cheap biomass feedstock

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as soil amendment. W28. Woodchip from pruning is of lower quality than from forestry. W29. A scarce number of ESCOs are operating in the regional bioenergy sector.	from outside the EU. T17. Price of oil and fossil fuels still quite low to promote competitiveness from bioenergy. T18. Lack of the right market driven incentives and subsidises. T19. APPR biomasses are still not included as potential biomass sources in some regional energy plan. T20. Market driven incentives and subsidises are progressively decreasing.

Objectives

- WT2. Trying to smooth and facilitating the biomass treatment and conditioning processes along the whole supply chain (from field to market) and obtain the best quality energy carriers as possible having in mind the starting feedstock conditions.
- WT3. Trying to promote the development of the APPR market by mitigating the effects of alternative and competing energy products and best attracting the final energy consumers.

Actions / Activities

- An overall market strategy should be launched and an effective connection between market supply and demand should be favoured. This could be achieved by the sector as a whole (considering the network of its key actors) with the support of public authorities and local governments. New consumers should be attracted in order to increase the use of APPR biomass as an ordinary energy feedstock. An affordable price and high quality standards are the key factors to be targeted.
- Reviewing regulations and technical norms at regional level in order to relief some excessively stringent standards or rules, technically not justified, in the utilization of APPR biomass.
- Providing evidences (with sound technical reports) about the fuel quality of energy carriers obtained from APPR biomass, even in comparison with well-known and already appreciated wood-fuels from forestry.
- Proving the relevant benefit of a very high quality/price ratio of energy carriers obtained from APPR biomass with respect to other kinds of wood-fuels.
- Conducting the elaboration of business plans to demonstrate the competitiveness or, at least, the substantial similarity of APPR energy carriers with respect to other kinds of wood-fuels from forestry or biofuels obtained from agro-food processing.
- Encouraging the demand of APPR energy carriers on the market through an increased awareness and a direct commitment by retailers of domestic heating systems as well as by the technical staff in charge of their installation and assistance.
- Carrying out information campaigns aiming at promoting the APPR energy products on the market and disseminating the message that they can properly meet the customers' needs.
- Preserving the APPR quality and the consequent quality of the APPR energy carriers with respect to the biomass composition, heating value, contamination risks, standard compliance, etc.
- Promoting the ordinary monitoring of the biomass quality (through analytical tests on

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samples) offering quality assurance and certifications to the consumer according to international quality standards.

- Adopting a traceability system linking each commercialized biomass lot to the original feedstock and to the field it was extracted.
- Investigating the potential role of chip-fed domestic boilers in promoting a local high-value market from APPR wood chips.
- Promoting the preparation of a regional energy plan on biomass sources specifically addressing the valorisation of APPR feedstock.
- Producing detailed GIS maps about local potential and technical APPR biomass availability, specifically indicating the areas where the spatial densities of APPR feedstock is higher. Those areas could be the focus of “agro-energy district” where investments on APPR conversion facilities should be favoured and sustained, especially by public municipalities.

Target ⑫ RESISTING THE COMPLEXITY OF THE REGULATION SYSTEM ON BIOENERGY AND THE LACKING OF A FARSIGHTED VISION ABOUT THE SECTOR.

Strategy: Weaknesses + Threats → **WT “Surviving”**

W1. Energy conversion from pruning is still considered an overall risky operation.	T10. No coherent policy, no strategic view on the APPR sector from local governments.
W7. Agro-industrial integration is hard to be achieved.	T21. High rate of law changes and great instability in energy policy decisions.
W9. Lack of integration of knowledge and efforts across sectors.	T22. Electricity more economically sustained than heat.
W19. Industrial investors are expecting very high profits and a fast payback time in the renewable energy sectors.	T6. Renewable energy more emphasized as power than heat generation.
W22. Pruning is supposed to be not a by-product but a waste without any economic value.	
W24. Pruning burning in open field is still considered an agronomic operation	

Objectives

- WT4. Promoting a strong simplification of administrative procedures but on condition that few and simple rules are clearly expressed as well as severely applied.
- WT5. A farsighted and coherent energy policy should be worked out by regional administration (even if the national and EU framework is highly influential).

Actions / Activities

- Promoting linking actions with the regional administrative agencies who are in charge of the wide range of authorizations procedures, in order to clarify the correct understanding and interpretations about the required compliance with the law.
- Significantly increasing the level of competences and knowledge in the public administration, specifically with respect to local and regional public entities, supporting the technical public committee in charge of discussing and evaluating bioenergy projects or initiatives.
- Encouraging “bottom-up” participatory processes in order to overcome local opposition to

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bioenergy projects, favouring a good level of knowledge and deep awareness on “pros” and “cons” about the project itself.

- Sustaining private investments with public funding, only if and where technological risks still exists, badly affecting the decision to invest.
- Create a secure and stable financial environment that does not create investment uncertainty. Local banks, credit funds and local chambers of commerce could play a role in this respect.
- Mitigate bureaucracy making things easier and encouraging local stakeholders in engaging new bioenergy initiatives.

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ANNEX A8

WP2 – Task T2.3

Performing an APPR Sector Analysis and Developing a Strategic Plan at National and EU level Italy

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Sector Analysis

A. National framework on APPR sources

L'Italia evidenzia condizioni pedoclimatiche assai favorevoli per alcune delle colture arboree da frutto tipiche dell'ambiente mediterraneo, per cui esse rappresentano una delle peculiari caratterizzazioni dell'agricoltura italiana, fattore rilevante nel determinare la composizione del paesaggio agrario del Paese, in prevalenza contraddistinto dalla presenza dell'olivo e della vite, unitamente ad altri fruttiferi quali gli agrumi, le pomacee e le drupacee (quali il pesco, l'albicocco, il susino, il ciliegio, ecc.). Il nocciolo, il noce, il mandorlo, il fico, il carrubo ed innumerevoli altri frutti minori completano l'ampia gamma di disponibilità che contraddistingue le aree agricole costiere ed interne.

Di seguito, si riporta la diffusione delle principali colture arboree in Italia, con particolare enfasi alle specie più diffuse le quali, meglio di altre, possono costituire un riferimento utile ai fini dell'avvio di filiere energetiche incentrate sulla valorizzazione dei residui colturali ottenuti dalla potatura dei fruttiferi.

Con riferimento alle statistiche del 2015 riportate da Eurostat [1], l'Italia è seconda solo alla Spagna in termini di superficie agricola dedicata ai fruttiferi (*Tabella 1*), grosso modo 2,3 milioni di ettari contro 4,7, seguita dalla Grecia (con $1,7 \cdot 10^3$ ha), dalla Francia ($0,9 \cdot 10^3$ ha) e dal Portogallo ($0,75 \cdot 10^3$ ha).

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Tabella 1. Superfici destinate alla coltivazione di alberi da frutto negli Stati-Membro dell'Unione Europea, secondo le rilevazioni EuroStat del 2015 [1]. I dati riportati sono espressi in migliaia di ettari.

	Total	Citrus	Grapes	Olives	Apples	Pears	Peaches	Nectarines	Apricots	Cherries	Plums	Walnuts	Hazelnuts	Almonds	Chestnuts
Spain	4.701	299	941	2.527	31	23	51	35	19	26	16	9	13	549	36
Italy	2.337	149	679	1.134	52	31	46	21	17	29	12	=	69	57	=
Greece	1.268	47	114	970	12	4	36	8	7	14	2	11	=	11	8
France	929	4	752	17	50	5	5	5	12	8	15	20	5	1	8
Portugal	751	20	179	351	14	12	3	1	=	6	2	3	=	30	36
Poland	338	=	1	=	180	9	2	=	1	39	14	3	4	=	=
Romania	315	=	176	=	56	3	2	=	3	6	66	2	=	=	=
Serbia	185	=	21	=	24	7	8	1	5	18	78	5	2	=	=
Germany	154	=	100	=	32	2	=	=	=	7	4	=	=	=	=
Hungary	153	=	72	=	33	3	5	=	5	16	7	5	=	=	=
Bulgaria	74	=	39	=	5	1	4	=	2	9	7	5	1	1	=
Croatia	70	2	26	19	5	1	1	=	=	3	5	4	3	=	=
Austria	54	=	44	=	7	=	=	=	1	=	=	=	=	=	=
EU-28	11.331	524	3.174	5.029	538	117	158	71	69	173	154	63	96	652	175

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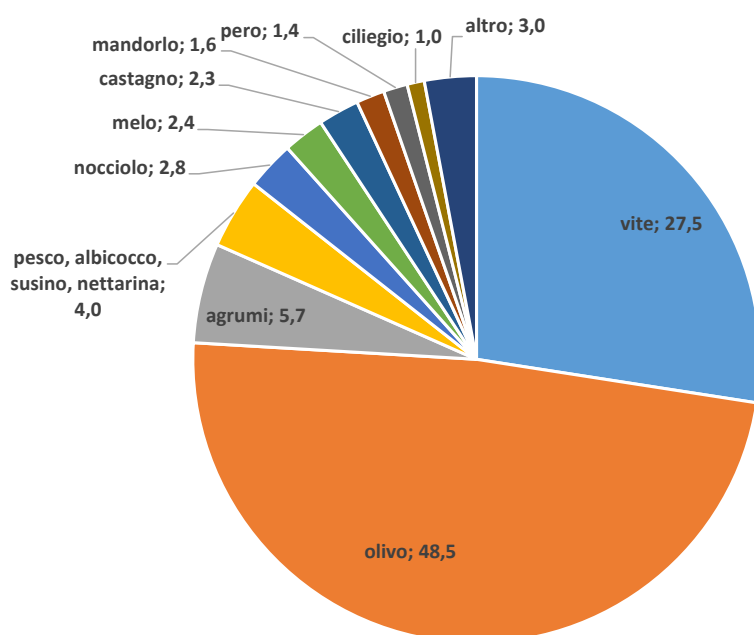
Tabella 2. Ripartizione (%) delle superfici di coltivazione delle specie da frutto nelle regioni italiana, secondo le rilevazioni censuarie ISTA del 2010 [2].

	Totale	Olivo	Vite	Agrumi	Melo	Pero	Drupacee	Nocciolo	Noce	Ciliegio	Fico	Kiwi	Mandorlo	Castagno
Piemonte	3,9	0,1	7,5	0,0	8,9	3,7	8,7	22,5	5,8	1,4	0,8	23,8	0,1	12,3
Valle d'Aosta	0,0	0,0	0,1	0,0	0,3	0,0	0,0	0,0	0,2	0,0	0,0	0,0	0,0	0,1
Liguria	0,6	1,0	0,2	0,0	0,1	0,1	0,2	0,1	0,1	0,2	0,4	0,0	0,0	1,4
Lombardia	1,4	0,2	3,7	0,0	3,3	3,1	0,8	0,1	1,2	0,5	0,7	2,2	0,1	1,2
Trentino Alto Adige	2,1	0,0	2,5	0,0	54,5	0,3	0,2	0,0	0,2	1,3	0,0	0,4	0,0	0,6
Veneto	4,0	0,4	10,4	0,0	10,1	11,7	4,9	0,1	6,0	10,8	0,8	14,8	0,0	0,7
Friuli-Venezia Giulia	1,0	0,0	3,0	0,0	2,8	0,6	0,3	0,0	0,9	0,2	0,2	2,8	0,0	0,1
Emilia-Romagna	5,4	0,3	8,8	0,0	7,9	67,8	29,4	0,1	5,6	10,7	0,9	16,6	0,0	5,4
Toscana	6,5	7,4	8,0	0,0	1,7	1,6	2,0	0,2	6,1	1,2	1,7	0,4	0,1	20,0
Umbria	2,0	2,7	2,0	0,0	0,5	0,2	0,4	0,2	5,2	0,6	0,3	0,0	0,0	1,0
Marche	1,3	1,0	2,2	0,0	0,7	0,4	1,8	0,1	6,6	1,1	2,3	0,2	0,1	1,6
Lazio	5,3	6,1	2,7	0,5	0,8	0,8	2,7	30,4	7,5	3,7	4,2	28,6	0,2	7,3
Abruzzo	3,6	4,0	5,3	0,0	0,5	0,2	1,7	0,1	8,1	1,5	3,5	0,6	0,1	0,6
Molise	0,9	1,3	0,7	0,0	0,3	0,1	0,8	0,0	3,4	0,3	0,3	0,0	0,0	0,0
Campania	6,9	6,6	3,8	1,4	4,2	1,6	18,5	27,5	24,4	7,6	25,1	2,9	0,1	26,6
Puglia	22,2	33,0	15,5	7,1	0,4	0,6	6,0	0,1	1,2	52,5	18,9	0,5	39,0	0,2
Basilicata	2,3	2,6	0,9	4,9	0,7	0,7	8,4	0,1	2,3	0,9	2,2	1,6	0,3	2,2
Calabria	11,2	17,1	1,6	27,6	0,9	0,8	4,5	0,5	7,6	1,9	32,4	4,3	0,6	16,6
Sicilia	16,8	12,9	18,2	55,1	1,0	4,7	7,4	17,7	6,7	2,7	3,4	0,1	55,6	0,9
Sardegna	2,8	3,2	3,0	3,1	0,5	0,9	1,5	0,2	0,8	0,7	2,0	0,0	3,5	1,1

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Selezionando fra le diverse specie, è possibile constatare che l'Italia è sistematicamente seconda alla Spagna riguardo alle superfici agrarie destinate alla coltivazione dell'olivo, degli agrumi, del pesco, albicocco e nettarine. Offre a considerare le superfici più estese nella coltivazione del pero (seguita dalla Spagna), mentre è seconda per superficie nella coltivazione del melo (dopo la Polonia ed insieme alla Romania); infine, è seconda per superficie nella coltivazione delle ciliegie (ancora dopo la Romania). La *Tabella 1* fornisce una disamina più sistematica e completa dei dati appena forniti.

Analizzando nel dettaglio i dati sul patrimonio arboreo italiano ottenuti dal censimento ISTAT del 2010 [2], così come riportato in *Figura 1*, si nota che olivo e vite occupano largamente le superfici più estese (il 48-49 % l'uno ed il 27-28 % l'altra). Seguono, molto a distanza, gli agrumi (5-6 %), le drupacee (4 %) e via via tutte le altre specie.



Non ci si sbaglia, quindi, allorché, riferendosi all'Italia, le filiere energetiche incentrate sulle patate siano pensate prioritariamente come connesse alla valorizzazione delle *frasche* (potature dell'olivo) e dei *sarmenti* (potature della vite). Ciò non toglie che, con riferimento a specifici e circoscritti contesti locali, è anche possibile identificare altri fruttiferi potenzialmente assai promettenti, in considerazione della loro elevata densità di coltivazione (così come espressa dalla loro frazione di SAU o SAT). E' del tutto evidente, infatti, che la meccanizzazione della raccolta ed il perfezionamento logistico di tutte le operazioni ad essa connessa si giustificano solo se una "massa critica" di biomasse residuali è

presente sul territorio.

Figura 1. Ripartizione (%) delle superfici dedicate alla coltivazione delle specie arboree da frutto in Italia come da dati censuari ISTAT del 2010 [2].

Disaggregando le superfici destinate ai fruttiferi su base regionale (*Tabella 2*) e considerandone il totale, Puglia, Sicilia e Calabria risultano essere le regioni con le superfici più estese. Ciò riflette pedissequamente le superfici dedicate alla coltivazione dell'olivo, in larga parte presente nel meridione d'Italia. Le superfici coltivate a vite sono prevalenti al Sud (Puglia e Sicilia), ma rilevanti anche nel Nord d'Italia (Veneto ed Emilia Romagna) ed al Centro (Toscana). Gli agrumi, come atteso, sono quasi esclusivamente presenti in Sicilia ed in Calabria. Diversamente dal melo che si osserva prevalentemente in Trentino Alto Adige ed in Veneto. Il pero, altra pomacea, si osserva prevalentemente in Emilia Romagna, ma anche in Veneto. Le drupacee (con l'eccezione del ciliegio) sono massimamente presenti in Emilia Romagna, al Nord, ed in Campania, al Sud. Il nocciolo contraddistingue le aree interne, sub-appenniniche, del Lazio e della Campania; così come il noce (quello coltivato in impianti arborei), massimamente presente in Campania ed il castagno, presente in Campania, Toscana e Calabria. Per quanto riguarda il ciliegio, la sua presenza è particolarmente estesa in Puglia, ma anche in Veneto ed Emilia Romagna, sebbene per valori di superficie assai più bassi. Il mandorlo in Puglia e Sicilia. Il Fico in Campania, Calabria e Puglia. Il kiwi (od actinidia) soprattutto in Lazio, ma anche in Veneto ed in Emilia Romagna.

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B. National potential of the APPR availability

Dal settore agricolo possono derivare grandi quantitativi di biomasse destinabili ad uso energetico, valorizzando determinati residui colturali che altrimenti costituirebbero solamente un onere per il loro trattamento e gestione. Tali biomasse sono costituite da quella quota di residui colturali qualitativamente idonei e tecnicamente raccogliibili [3].

Seguendo la metodologia esposta nel documento predisposto dal gruppo di lavoro ENAMA [3], dopo aver determinato per ciascuna delle colture indagate i valori delle *superfici coltivate*, a queste sono stati applicati dei coefficienti di *disponibilità unitaria annua* del residuo (t/ha in sostanza secca), giungendo in tal modo ad una stima dei quantitativi di residuo *potenzialmente* ottenibile. Nella loro inevitabile approssimazione, questi coefficienti mostrano delle sensibili variazioni secondo aspetti geopedologici e climatici, rispetto alle specie coltivate ed tecniche di coltivazione adottate [3].

A tali disponibilità potenziali sono state in seguito portate delle correzioni riduttive per definire i quantitativi che potrebbero essere effettivamente raccolti ed utilizzati. Questi valori tengono conto di elementi di tipo logistico ed economico, come il frazionamento delle aziende, la loro concentrazione in determinate aree, l'attuale impiego alternativo dei medesimi residui; tutti fattori che, nel loro insieme, riducono la potenziale disponibilità di scarti convenientemente reperibili. Per le potature dei fruttiferi questa disponibilità effettiva varia tra il 45%- 50% [3].

Le colture arboree prese in considerazione dallo studio ENAMA [3] sono: ulivo, vite, melo, pero, pesco, nettarina, susino, albicocca, agrumi, nocciolo, mandorlo e actinidia.

Tabella 3. Disponibilità potenziale dei residui delle colture arboree in Italia a livello regionale (NUTS 2) e macro-regionale.

Regioni	Quantitativo (t s.s./anno)	Ripartizione (%)
Piemonte	124.710	3,7
Val d'Aosta	1.512	0,0
Lombardia	44.213	1,3
Trentino Alto Adige	66.718	2,0
Veneto	147.703	4,4
Friuli Venezia Giulia	32.129	1,0
Liguria	2.751	0,1
Emilia Romagna	194.635	5,8
Nord Italia	614.371	18,3
Toscana	225.781	6,7
Umbria	59.324	1,8
Marche	43.796	1,3
Lazio	206.165	6,1
Centro Italia	535.066	16,0
Abruzzo	112.785	3,4
Molise	33.245	1,0
Campania	229.984	6,9
Puglia	775.809	23,1
Calabria	323.506	9,6
Sicilia	600.724	17,9
Sardegna	128.115	3,8
Sud Italia	2.204.168	65,7
Italia (totale)	3.353.605	100,0

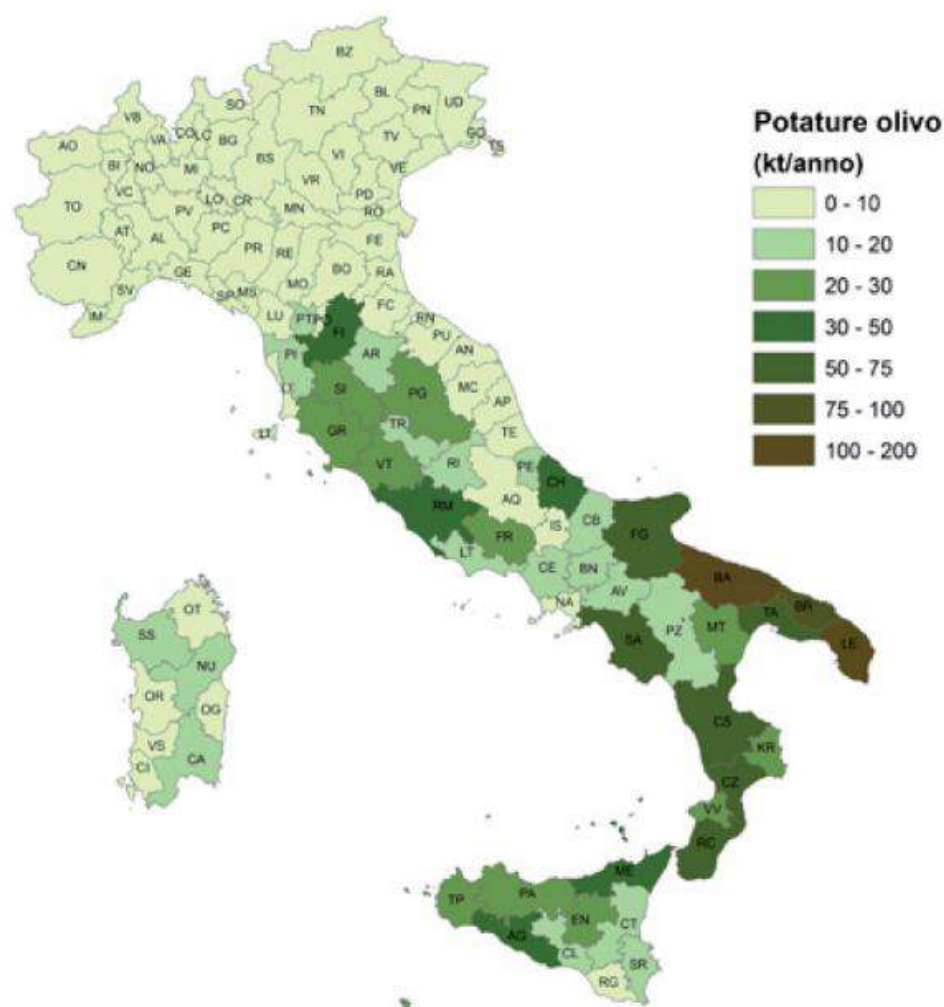


Figura 3. Distribuzione dei residui di potatura degli olivi secondo il potenziale di produzione stimato a livello provinciale (kt/anno s.s.)

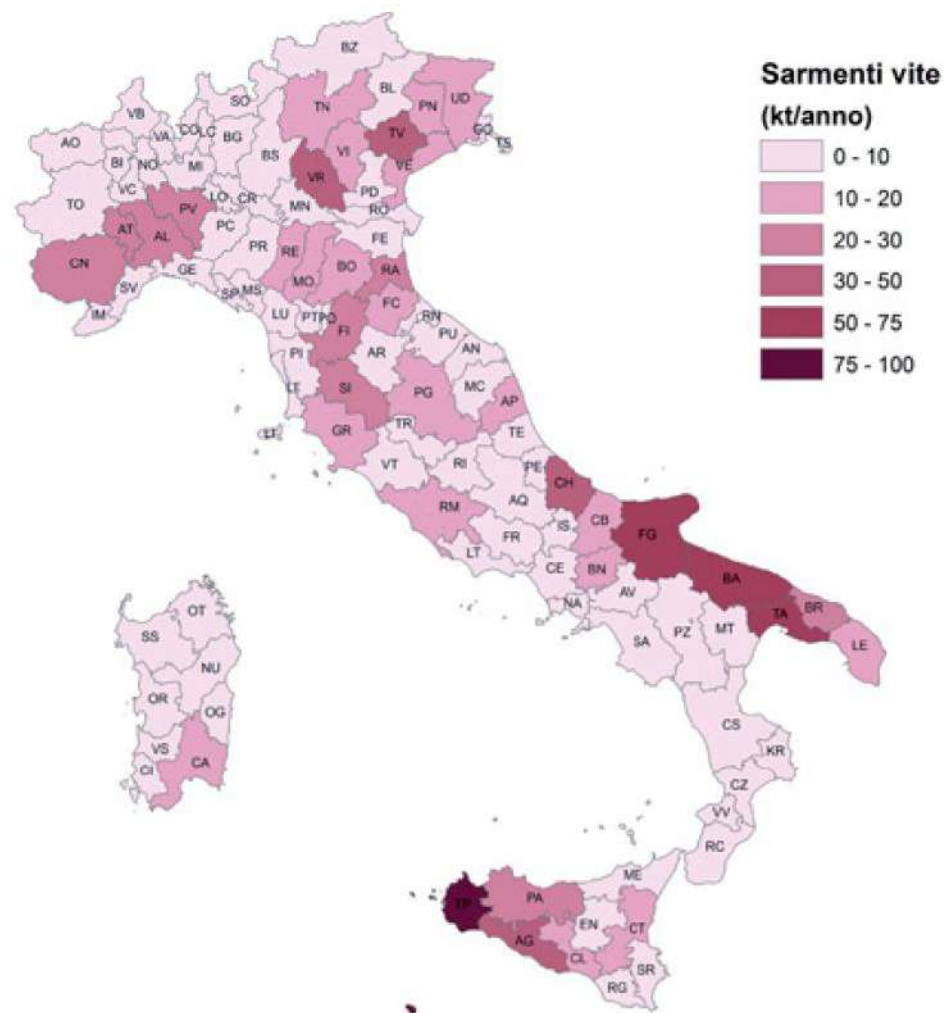
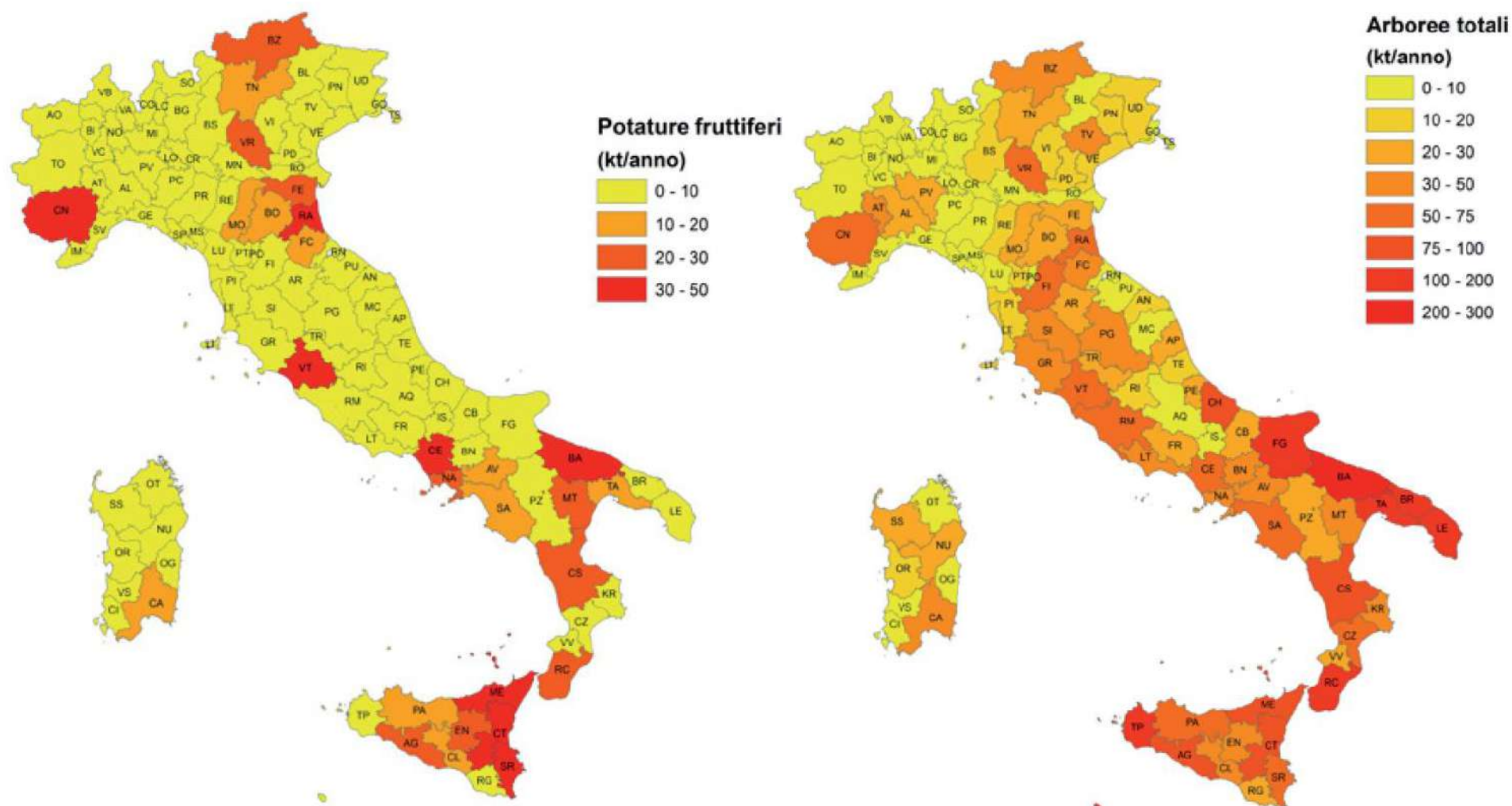


Figura 4. Distribuzione dei residui di potatura delle viti secondo il potenziale di produzione stimato a livello provinciale (kt/anno s.s.)



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Le disponibilità potenziali complessive a scala nazionale sono stimate nell'ordine delle 3,3 Mt (*Tabella 3*). Appare evidente che la maggiore disponibilità è localizzata nel Meridione che, da solo, manifesta una potenzialità pari ai 2/3 del totale. Solo la Puglia e la Sicilia, insieme, assommano una disponibilità di residui pari alla somma di quelle che si possono originare dal Nord e dal Centro Italia. Ciò indica quanto importante questa risorsa potrebbe essere per le economie rurali delle due regioni meridionali.

Al Sud, dunque, primeggia la Puglia (circa 776.000 t/anno); al Centro la Toscana (circa 226.000 t/anno); al Nord l'Emilia Romagna (circa 197.000 t/anno). Le *Figure 3, 4 e 5* mostrano il quantitativo potenziale dei residui di potatura ottenuti annualmente dalla cura di oliveti, vigneti e dall'insieme delle altre colture da frutto considerate nello studio (secondo una disaggregazione provinciale); nella *Figura 6*, infine, si riportano le produzioni di tali residui nel loro complesso.

Tabella 4. Disponibilità effettiva dei residui delle colture arboree in Italia a livello regionale (NUTS 2) e macro-regionale.

Regioni	Quantitativo (t s.s./anno)	Ripartizione (%)
Piemonte	59.861	3,6
Val d'Aosta	726	0,0
Lombardia	21.222	1,3
Trentino Alto Adige	32.025	1,9
Veneto	70.897	4,3
Friuli Venezia Giulia	15.422	0,9
Liguria	0	0,0
Emilia Romagna	94.745	5,7
Nord Italia	294.897	17,8
Toscana	108.375	6,6
Umbria	28.476	1,7
Marche	21.022	1,3
Lazio	98.959	6,0
Centro Italia	256.832	15,5
Abruzzo	54.137	3,3
Molise	15.958	1,0
Campania	110.392	6,7
Puglia	372.389	22,5
Basilicata	0	0,0
Calabria	155.283	9,4
Sicilia	288.347	17,4
Sardegna	61.495	3,7
Sud Italia	1.058.000	64,0
Italia (totale)	1.654.182	100,0

Con riferimento ai residui di potatura destinabili ad uso energetico, il passaggio dalla stima della **disponibilità potenziale** alla valutazione del quantitativo di fatto accessibile, definito come **disponibilità effettiva**, necessita di una serie di valutazioni circa le difficoltà logistiche ed organizzative da affrontare in fase di raccolta e trasporto e che condizionano i costi economici del processo e, dunque, la sua operabilità.

Ne consegue che le disponibilità effettive (ovvero quelle decurtate dei quantitativi tecnicamente di difficile raccolta o destinati ad altri impieghi) ammontano ad un valore stimato pari a circa 1,7 Mt/anno di potature (*Tabella 4*). La ripartizione regionale e macrogeografica di tali quantitativi offre a considerare le stesse analisi svolte precedentemente in riferimento ai quantitativi potenziali, per cui non ci si sofferma ulteriormente.

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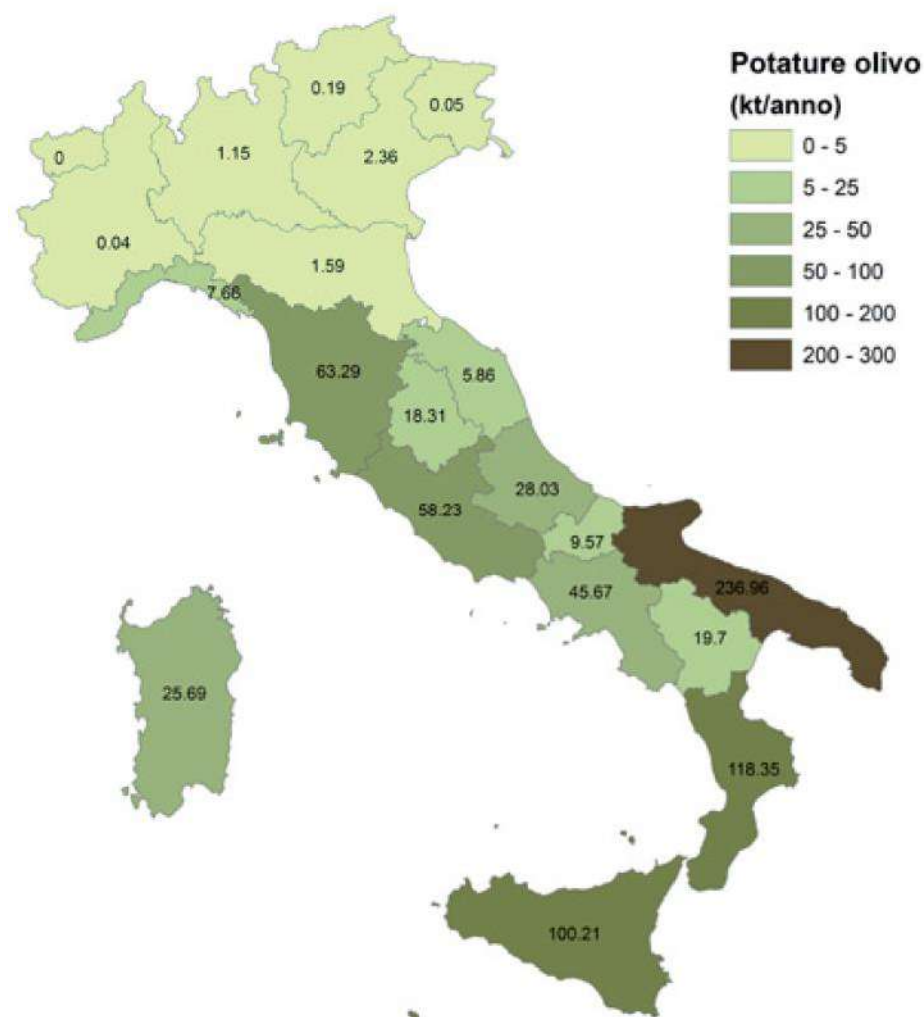


Figura 7. Distribuzione dei residui di potatura degli olivi secondo la disponibilità effettiva stimata a livello provinciale (kt/anno s.s.)

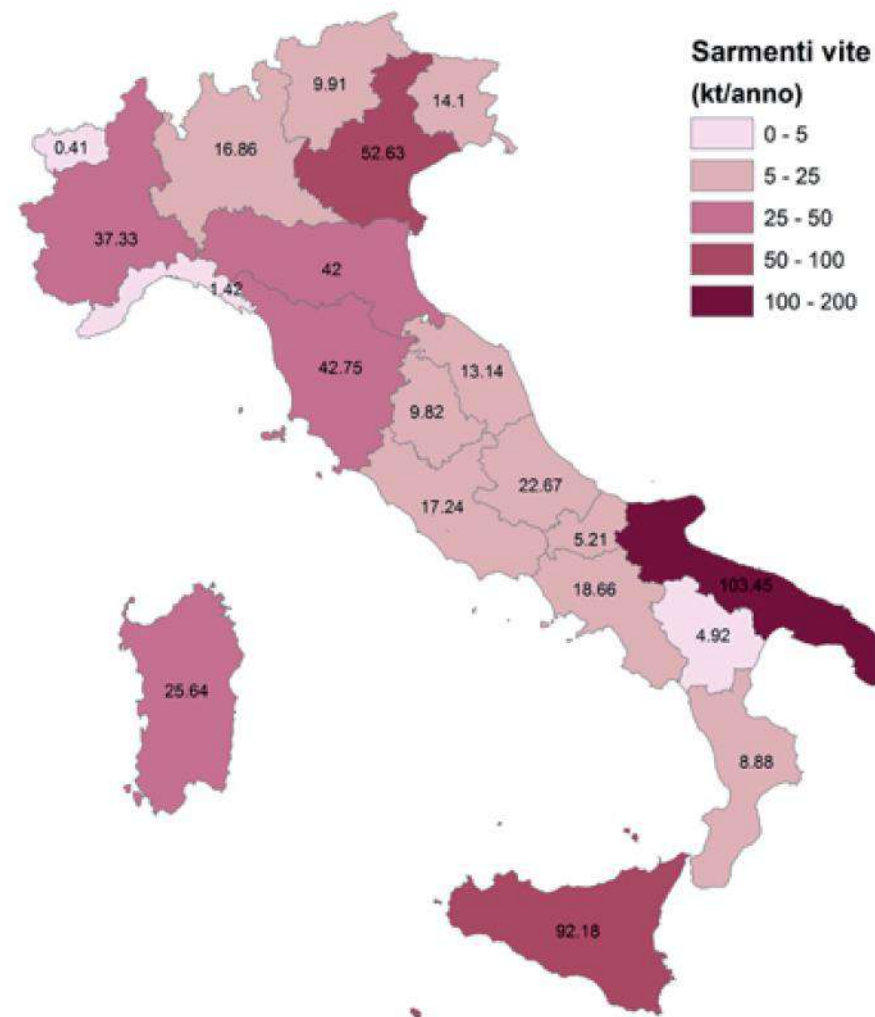


Figura 8. Distribuzione dei residui di potatura delle viti secondo la disponibilità effettiva stimata a livello provinciale (kt/anno s.s.)

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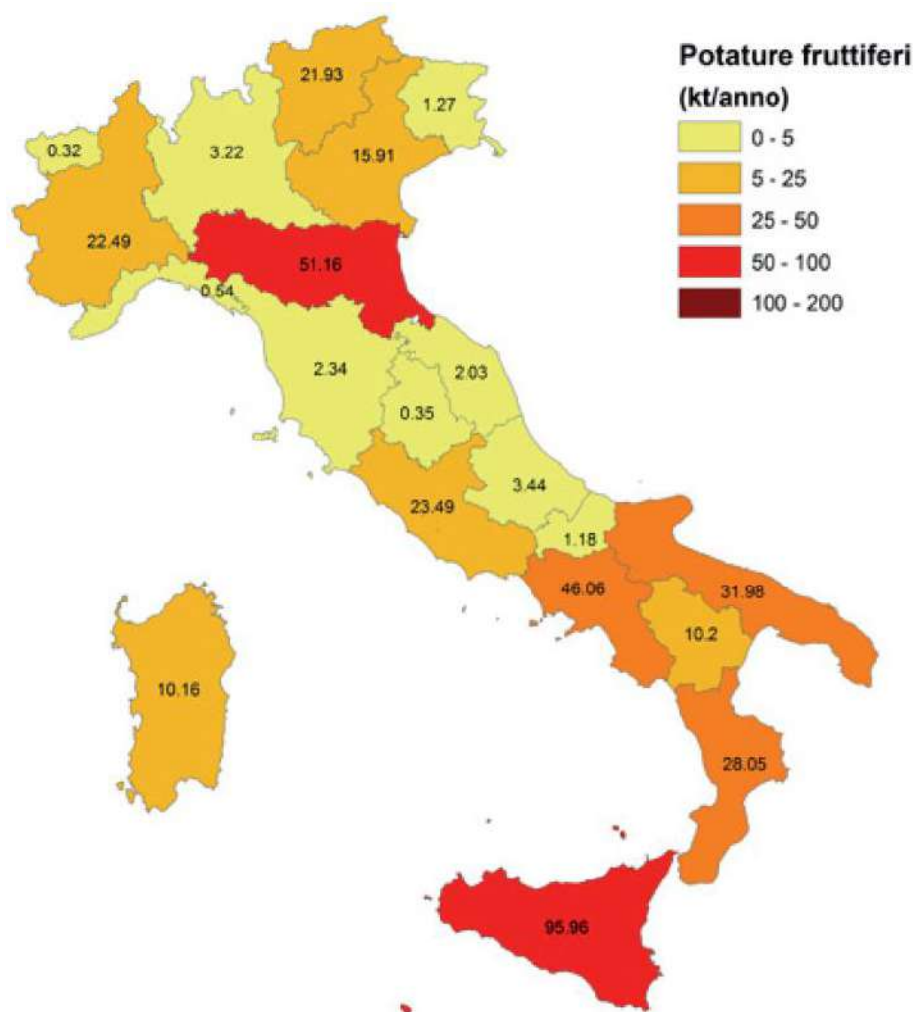


Figura 9. Distribuzione dei residui di potatura dei fruttiferi nel complesso (esclusi olivo e vite) secondo la disponibilità effettiva stimata a livello regionale (kt/anno s.s.).

Nello studio ENAMA [3] giustamente si argomenta che, visto il livello particolarmente ampio di approssimazione della stima, la restituzione cartografica dei dati di disponibilità effettiva (Figure 7, 8 e 9) non sono riportati con riferimento ai territori provinciali (come fatto, invece, per le stime delle disponibilità potenziali). Si è pensato, invece, che una restituzione cartografica dei dati stimati a livello regionale fosse realisticamente più attendibile di una riferibile ad un dettaglio provinciale.

C. Possible energy contribution of APPR

Sulla base delle stime ottenute circa le disponibilità effettive di potature, è possibile effettuare delle proiezioni circa i vantaggi che, a livello economico ed ambientale, potrebbero conseguire da un loro corretto impiego.

Le possibilità produttive sul fronte energetico sono fondamentalmente due: produzione di energia elettrica e produzione di calore. Entrambe le fonti energetiche potrebbero essere poi destinate ai consumi domestici o a quelli industriali, la differenza si ripercuote, essenzialmente, nel prezzo di acquisto dell'energia, più basso ai fini industriali, più elevato considerando i consumi domestici.

Prima ipotesi. Considerando l'ammontare delle biomasse effettivamente disponibili, assumendo un funzionamento dell'impianto pari ad 8.000 ore annue, nonché un potere calorifico inferiore pari a 4,16 MWh per tonnellata di biomassa ed un rendimento di conversione elettrica pari al 30%, si determina una

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potenza elettrica d'installazione pari a 258 MW, corrispondente ad una produzione elettrica di circa 2 milioni di MW (2 TWh).

Assumendo che in Italia il consumo elettrico medio pro-capite è pari, all'incirca, a 1,1 MWh all'anno, se ne deduce che la produzione elettrica teoricamente generata dalle potature sarebbe in grado di soddisfare integralmente i consumi elettrici di circa 1 milione e 900 mila persone.

Seconda ipotesi. In alternativa, e a parità di condizioni non specificate, se si volesse considerare la produzione termica a destinazione domestica dovremmo ipotizzare un rendimento di conversione pari all'80% ed un funzionamento annuo pari a circa 3.000 ore. Ciò assunto, si verrebbe a determinare una potenza termica d'installazione pari a poco più di 1.800 MW, corrispondente ad una produzione termica di circa 5,5 milioni di MW (5,5 TWh).

Assumendo che in Italia il consumo domestico di gas medio pro-capite è pari, all'incirca, a 12 MWh all'anno, se ne deduce che la produzione termica teoricamente generata dalle potature sarebbe in grado di soddisfare integralmente i consumi di riscaldamento di circa 460 mila persone.

D. Possible economic contribution of APPR

Per quanto riguarda le ricadute economiche che le filiere energetiche incentrate sull'impiego delle potature potrebbero potenzialmente generare, una stima di massima dovrebbe considerare tre principali settori di mercato [3], ovvero:

- vendita della biomasse,
- vendita dell'energia,
- vendita delle tecnologie.

Faremo ovviamente riferimento a delle stime lorde, ovvero al valore complessivo della produzione lorda vendibile.

Con riferimento alla vendita di biomasse, è possibile assumere a riferimento un prezzo di vendita grosso modo corrispondente a 60 Euro la tonnellata. Ciò significa un valore complessivo di poco inferiore ai 100 milioni di Euro.

Riguardo alla vendita dell'energia, si deve nuovamente discriminare fra la vendita di energia elettrica ed energia termica. Considerando che il costo unitario dell'energia elettrica destinata al consumo domestico è pari, in Italia, a 0,234 Euro/kWh [4], è possibile stimare un valore economico complessivo corrispondente a poco più di 480 milioni di Euro all'anno. In alternativa, considerando che il costo unitario del gas naturale destinato al consumo domestico è pari, in Italia, a 0,073 Euro/kWh [5], è possibile stimare un valore economico complessivo corrispondente a poco più di 400 milioni di Euro all'anno.

Infine, occorre valutare, in modo orientativo, il volume di affari conseguente alla vendita degli impianti a biomassa, siano essi termici od elettrici. Con riferimento alla produzione elettrica, è possibile stimare un costo unitario per MW installato pari a circa 4 Milioni di Euro. [3]. Ciò significherebbe un capitale d'investimento complessivo pari a circa 1 miliardo di Euro che ripartiti su di un lasso temporale pari a 20 anni (ammortamento) determinano un flusso annuo di investimento pari a circa 52 milioni.

Di gran lunga meno impegnativo è l'impegno di capitali richiesto per la realizzazione di un impianto termico per il quale è possibile stimare un costo unitario pari a 300 mila Euro per MW installato. Ciò determina un capitale totale d'investimento pari a circa 550 milioni di Euro ed un ammortamento annuo di circa 28 milioni di Euro.

Sulla scorta di quanto già analizzato nello studio ENAMA [3] ma facendo riferimento esclusivamente alle risorse energetiche rappresentate dalle potature, la *Tabella 5*, riportata di seguito, riepiloga le voci economiche coinvolte e ne stima il valore complessivo. Il settore bioenergetico riferibile alle potature è in grado, ogni anno, di attivare un volume di affari compreso fra i 530 ed i 630 milioni di Euro, a seconda che

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sia prevalente l'indirizzo termico o quello elettrico nei consumi energetici finali. Se capitalizziamo questo beneficio lordo sui 20 anni di prevedibile durata dell'investimento, allora il capitale complessivo in gioco è compreso fra i 10,6 ed i 12,7 miliardi di Euro.

Tabella 5. Benefici economici lordi ed annui inerenti all'attivazione potenziale di filiere energetiche incentrate sull'impiego delle disponibilità effettive di potature con riferimento all'intero comparto nazionale.

Settore	Mercato Biomasse		Mercato Energetico		Mercato Impiantistico		Totale
	Valore unitario (Euro/ton)	Valore complessivo (MEuro)	Valore unitario (Euro/MWh)	Valore complessivo (MEuro)	Valore unitario (Euro/ton)	Valore complessivo (MEuro)	
Elettrico	60,00	99,25	234,00	483,07	4,00	51,61	633,93
Termico	60,00	99,25	73,00	401,87	0,300	27,53	528,65

E. Possible environmental contribution of APPR

Utilizzando la biomassa disponibile per produrre elettricità è possibile calcolare la quantità di emissioni evitate di CO₂ in atmosfera in seguito alla sostituzione di combustibili fossile. Con riferimento alle biomasse solide si assume che il risparmio emissivo conseguito possa raggiungere il 90%. Inoltre, facendo riferimento alle tecnologie di conversione elettrica attualmente più efficienti a base fossile, ovvero le turbine a gas a ciclo combinato (CCGT = *combined-cycle gas turbine*) è possibile assumere un'intensità emissiva pari a 0,39 tonnellate di CO₂ emessa per MWh di energia elettrica prodotto. Avendo a disposizione questi dati, il risparmio emissivo annuo ammonterebbe a circa 725 mila tonnellate di CO₂.

Se consideriamo che l'accrescimento medio annuo di una foresta in clima temperato implica la cattura di circa 15 tonnellate di CO₂ per ettaro di superficie boscata, ne consegue che l'ammontare di CO₂ che non viene più emessa in virtù della sostituzione delle fonti energetiche fossili con fonti rinnovabili corrisponderebbe a circa 50 mila ettari di bosco.

F. National state of art of the APPR sector

La bioenergia è una fonte rinnovabile continua e programmabile, che può contare su una pluralità di materie prime (non solo biomasse residuali ma anche colture dedicate) e sulla disponibilità di tecnologie mature e affidabili. E' possibile infatti ottenere una pluralità di forme finali d'impiego energetico:

- Calore da biomasse solide (usi civili e industriali)
- Elettricità da biomasse solide, biogas e bioliquidi
- Biocarburanti liquidi (biodiesel, etanolo/ETBE) da colture dedicate
- Biometano da biomasse fermentescibili

In questo documento ci concentreremo particolarmente sulla **produzione di calore**, considerato l'impiego più facile e diretto delle biomasse solide a seguito di processi termochimici di conversione (combustione, pirolisi, gassificazione).

Prima, però, si ritiene utile una piccola panoramica sull'intero settore delle bioenergie che costituisce, di gran lunga, il settore delle rinnovabili che contribuisce maggiormente alla generazione di energia, come risulta evidente dalla *Figura 10*.

Rispetto ad un consumo finale lordo totale di energia, a scala nazionale, pari a 121,7 Mtep, il contributo di tutte le rinnovabili è pari a 21,3 Mtep, mentre quello delle bioenergie corrisponde a 10,7 Mtep. Ne deriva

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che le rinnovabili incidono per il 17,5 % sul livello dei consumi finali di energia, mentre le bioenergie costituiscono l'8,7 % sul medesimo ammontare.

Dunque, è possibile concludere che, in Italia, le bioenergie termiche sono la prima fra le fonti rinnovabili per quantità di energia prodotta [7], così come si evidenzia nella *Figura 10*. In particolare esse ammontano a circa un terzo dei consumi energetici da fonte rinnovabile (con riferimento al 2015).

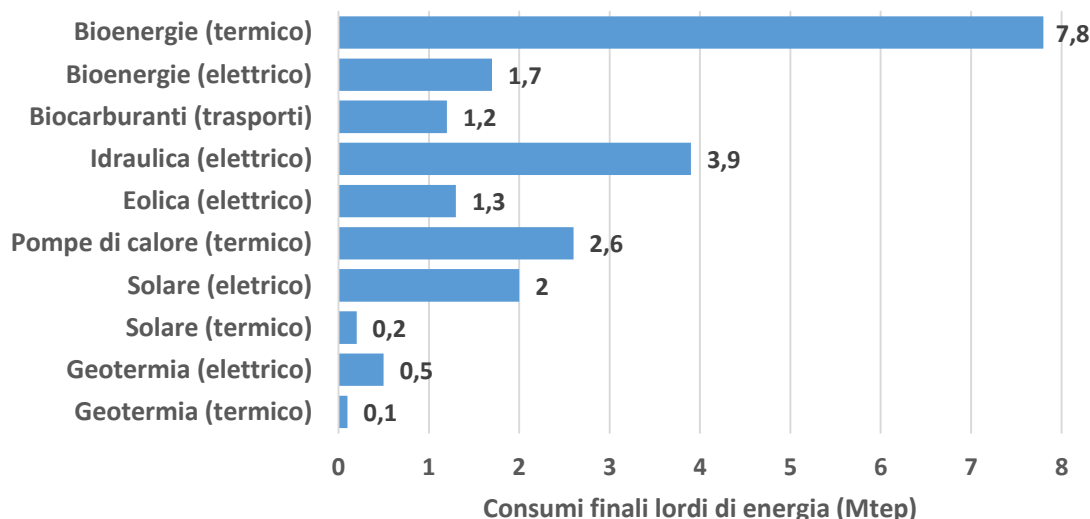


Figura 10. Consumi energetici finali lordi in Italia ripartiti per settore tecnologico (GSE, 2015).

Per dare un termine di riferimento, è possibile affermare che le caldaie e stufe a biomassa legnosa producono tre volte più energia (Mtep) di tutto il fotovoltaico (termico ed elettrico) installato in Italia.

Sector drivers

Come visto nei precedenti paragrafi, le biomasse solide e, fra queste, i residui di potatura delle arboree da frutto, possono contribuire in modo sostanziale al raggiungimento degli obiettivi fissati per le FER in ambito europeo e mondiale.

I principali fattori di forza offerti dal considerare le potature come vettore energetico risiedono nella presenza pressoché ubiquitaria di tali residui. Ogni ambiente di coltivazione, in considerazione del clima e dei caratteri del suolo, offre a considerare alcune peculiari specie arboree da frutto che ne interpretano al meglio i caratteri che vi si adattano egregiamente. Ciò implica che ogni area macro- e micro-geografica potrà identificare le colture arboree su cui incentrare l'avvio di filiere energetiche che valorizzino tale tipologia di residui.

Le filiere agro energetiche debbono necessariamente svilupparsi in un'ottica di sistema, che non può prescindere da un'attenta valutazione degli aspetti ambientali e da adeguate politiche d'indirizzo e di sostegno. L'aspetto peculiare che contraddistingue queste forme di energia rinnovabili è l'imprescindibile necessità di dare luogo ad una articolata filiera produttiva che implichi il coinvolgimento di una pluralità di attori, ciascuno dei quali svolge una specifica funzione riguardo le fasi di raccolta, condizionamento, trasporto, stoccaggio e conservazione fino all'impiego finale nella conversione energetica.

Dal punto di vista economico, l'agricoltore che offre la disponibilità dei residui colturali della propria azienda ha l'opportunità di risparmiare in parte i costi connessi alla gestione dei residui medesimi, ed in parte conseguire dei ricavi aggiuntivi in rapporto al valore riconosciuto alle potature da parte dell'impresa che provvede alla sua raccolta (in genere imprese contoterziste).

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Questa attenta ed oculata gestione dei residui consente di poter adottare le tecniche agronomiche ritenute migliori e più efficaci al fine di proteggere la qualità del suolo del frutteto, mitigare i fenomeni erosivi, conferire maggior portanza al suolo rispetto all'azione compattante dei mezzi meccanici, promuovere la copertura del suolo per mezzo di inerbimento integrale o nell'interfilare, favorire l'apporto di ammendanti organici o misti.

Tutto ciò deve avvenire nel rispetto dei principi di sostenibilità ambientale, sia rispetto alla fase di approvvigionamento che di conversione energetica della materia prima. Occorre in primo luogo rimarcare che le biomasse di cui ci si occupa sono **biomasse di natura residuale**. Ciò costituisce un notevole vantaggio in quanto la loro disponibilità concorre ed è in parallelo alla disponibilità del prodotto alimentare, di cui costituiscono, al limite, un **sottoprodotto**. Pertanto, possono essere ottenuti esclusivamente attraverso il recupero dei residui di colture arboree da frutto, senza nulla sottrarre alla produzione agricola tradizionale, ciò che offre garanzie sufficienti a che non si instauri una deleteria competizione fra *agricoltura food* ed *agricoltura non-food*. Come ben noto il timore di un conflitto fra scelta alimentare o energetica (*food vs energy*) ha generato, negli ultimi anni, preoccupazioni e polemiche per le ripercussioni negative sul costo degli alimenti soprattutto in paesi deboli dal punto di vista economico [3].

Un fattore trainante, in grado d'incoraggiare lo sviluppo di filiere APPR, è rappresentato dalla possibilità che queste iniziative possano favorire un modello di sviluppo di attività economiche afferenti al territorio rurale. Infatti, occorre traguardare le bioenergie come un'efficace leva in grado di promuovere l'integrazione e la diversificazione produttiva in ambito agricolo, venendo così a realizzarsi quel **peculiare tratto multifunzionale** che oggi qualifica in modo significativo l'attività agricola e che, in questo ambito, vedrebbe la produzione di energia come **un'attività aziendale "connessa"** (ma non prevalente), produttrice di reddito agrario integrativo.

Le bioenergie (e le biomasse APPR in particolar modo) rappresentano un modo assai proficuo per sostenere gli autoconsumi energetici delle aziende agrarie ma, soprattutto, per ridurre il costo energetico dei processi di trasformazione agro-alimentare. Ciò, in particolare, può riguardare i frantoi cooperativi, ovvero le cantine sociali. In questo tipo di realtà, infatti, un numero cospicuo di agricoltori associati potrebbe non solo conferire il prodotto (le olive da frangere od le uve da ammostare), ma allo stesso tempo anche il sottoprodotto (le frasche ed i sarmenti) da cui trarre energia per soddisfare le esigenze energetiche connesse al processo di trasformazione. Ogni surplus energetico prodotto potrebbe essere immesso in rete (se trattasi di elettricità), ovvero trasferito presso limitrofi centri d'impiego (se trattasi di calore).

Quello che si vuole promuovere, in altri termini, è un **modello agro-industriale** incentrato sulla valorizzazione delle biomasse residuali agrarie che si integri, in modo assolutamente complementare, al modello produttivo oggi rappresentato dalle eccellenti **filieri agro-alimentari** che contraddistinguono larga parte dei nostri territori rurali. Non è dunque la competizione fra **food** ed **energy**, bensì il loro reciproco sostegno, il traguardo a cui si dovrebbe mirare. Attraverso questa strategie, infatti, si dà senso compiuto al concetto, ormai a rischio d'inflazione, di economia circolare e di bioeconomia, obiettivi fatti propri e pienamente sostenuti nel contesto EU.

Sector barriers and obtacles

Un aspetto cruciale, in grado di condizionare fortemente lo sviluppo delle filiere, è dato dalla limitata densità spaziale delle biomasse disponibili (diversamente da quanto accade considerando le coltivazioni dedicate e la ceduzione forestale). A ciò si aggiunga il basso valore unitario della materia prima, ciò che costringe ad adottare processi tecno-logistici estremamente ottimizzati al fine di ridurre al minimo l'incidenza dei costi unitari.

Un altro aspetto limitante è rappresentato dalle caratteristiche relativamente peggiori del combustibile ottenuto dalle biomasse residuali (potature) rispetto a quello di origine forestale. In genere, infatti, è dato

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attendarsi che le potature rispetto al legno forestale abbiano un più elevato contenuto in ceneri come risultato di una maggiore incidenza ponderale della frazione corticale.

Un ulteriore aspetto limitante è rappresentato dalla costituzione fisica del materiale combustibile che viene ordinariamente trinciato piuttosto che cippato. La trinciatura, infatti, genera una pezzatura del prodotto combustibile piuttosto eterogenea con la presenza di pezzi fuori misura che potrebbero anche compromettere gli organi meccanici di alimentazione di un impianto a biomasse (coclee) con conseguente interruzione del suo ordinario funzionamento. Ciò implica, almeno in genere, la necessità di rivolgersi, da parte dell'utilizzatore finale, verso l'acquisto di impianti che siano opportunamente calibrati e protetti da questi inconvenienti tecnici.

Altro aspetto limitante, particolarmente sentito e dibattuto negli ultimi anni, risiede nella generica accusa che gli impianti termici alimentati a biomassa sarebbero responsabili di un grave inquinamento atmosferico ad opera dei gas di scarico con particolare riferimento ai PM10, PM2,5 ed NOx. Se questa condizione è sicuramente vera con riferimento ai vecchi impianti di remota installazione (tecnologicamente ormai superati), ciò non corrisponde a verità se si considerano gli impianti a biomassa di moderna generazione, le cui prestazioni ambientali (e particolarmente quelle emissive) sono assai efficienti ed i livelli di inquinamento ad essi attribuibili sono estremamente contenuti. Ciò mette in campo la necessità che venga urgentemente favorita una rapida sostituzione dei vecchi impianti con i nuovi, in modo che il parco impianti vada incontro ad un cospicuo *turn-over* a cui corrisponderebbe un significativo abbattimento dei livelli d'inquinamento dell'aria.

Dal punto di vista ambientale è utile considerare l'attuale impiego dei residui prima di valutarne i benefici conseguenti alla destinazione energetica. I residui delle coltivazioni arboree attualmente vengono solo in minima parte recuperati ad uso di **"legna da ardere"** con riguardo ai residui di maggior pezzatura, mentre per lo più sono trinciati ed interrati in loco o in alcuni casi allontanati dalla coltivazione e bruciati al fine di prevenire le fonti di inoculo da parte di patogeni. La pratica della **bruciatura dei residui** è ancora molto diffusa, soprattutto a causa delle indicazioni che sono state date in tal senso negli anni passati al fine di prevenire la diffusione di patologie. Per questa tipologia di biomasse l'utilizzo energetico rappresenta quindi un beneficio, sia agronomico, sia come risorsa energetica rinnovabile. I residui delle colture costituiscono, in certi casi, un importante apporto di sostanza organica al suolo e la loro asportazione può quindi risultare un elemento di criticità agronomica e forse anche climatica per il mancato effetto carbon *sink* che si ha stoccando carbonio organico nel suolo. Il loro corretto impiego per il maggior beneficio ambientale va, quindi, ben valutato di volta in volta [3].

In generale per il recupero dei residui delle coltivazioni arboree il principale limite è attualmente rappresentato dall'elevata **polverizzazione delle proprietà**, che spesso impedisce la convenienza economica di un recupero sistematico, effettuato con appropriate macchine operatrici e con sistemi logistici di movimentazione ben ottimizzati. In tal senso è auspicabile la nascita di un mercato che sia organizzato secondo lo stesso modello utilizzato per le biomasse alimentari, quindi con molti punti di ritiro e siti di stoccaggio delle produzioni ben distribuiti sul territorio.

Dal punto di vista della raccolta, la difficoltà principale è data dall'allestimento del cantiere che è molto differente da quello forestale dove le biomasse sono concentrate (50-100 t ss/ha) rispetto a quelle residuali delle coltivazioni (1-3 t ss/ha) e dove l'utilizzazione avviene a cadenza ventennale e non annuale. In tal senso probabilmente può essere auspicabile la nascita di una figura nuova quale il **contoterzista** che si dedica a questa attività e che ricava parte della marginalità dalla valorizzazione economica del sottoprodotto e parte dal servizio di gestione dei residui reso all'azienda [3].

E' opportuno segnalare un ultimo ma decisivo argomento nel novero degli aspetti che possono ostacolare la costruzione di iniziative e la realizzazione d'investimenti nel settore delle biomasse; esso riguarda il livello attualmente basso di **accettabilità sociale** riguardo questo tipo di insediamenti produttivi. E' dato infatti registrare che il livello di consapevolezza dell'opinione pubblica in merito alle fonti rinnovabili, in genere, ed alle biomasse per l'energia, in particolare sia limitato, spesso distorto, in certi casi oltremodo prevenuto.

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Lungi dal considerare gli aspetti positivi ed i benefici ambientali, economici e sociali che sarebbe possibile associare alla bioenergia ed alle biomasse solide, oggi prevalgono opinioni assai negative, timori, pregiudizi e chiusure assai difficili non tanto da eradicare quanto semplicemente da superare. La scarsa conoscenza delle questioni in chiave tecnica lascia trasparire, il più delle volte, timori che il processo di combustione sia pericoloso ed inquinante in sé, insicurezze in merito alle tipologie di biomasse realmente impiegate presso gli impianti, sospetti in merito al labile confine che si ritiene persista fra biomasse combustibili solide e rifiuti, diffidenti nei riguardi di potenziali investitori che potrebbero afferire non al mondo agricolo ma a quello industriale, incapaci di trarre i vantaggi conseguenti all'organizzazione massiva dell'offerta di biomasse, possibile solo abbracciando con vigore una strategia di associazionismo fra gli agricoltori e la costituzione di cooperative, consorzi, organizzazioni produttive che possano movimentare quantitativi rilevanti di tali biomasse residuali.

Come riferisce il *Piano di Settore per le Bioenergie* [8], l'VIII rapporto dell'Osservatorio Permanente del NIMBY (**Not In My BackYard**), evidenzia che in Italia nel 2012 i progetti contestati hanno raggiunto complessivamente quota 354. Di questi una buona parte riguarda proprio la realizzazione di impianti per la produzione di energia da fonti rinnovabili (172 su 354), e ben 108 contestazioni sono rivolte a impianti a biomasse (incluso il biogas), seguiti dalle centrali idroelettriche (32) e dai parchi eolici (32). Questa classifica, più che fotografare la "discutibilità" o la "pericolosità" della bioenergia, riflette il trend della sua crescita. La bioenergia, ancor più delle altre rinnovabili, può destare timori e resistenze da parte della popolazione a causa della confusione che si genera per l'ampia varietà dei sistemi (risorse, processi e tecnologie) che la caratterizzano.

Per queste ragioni i progetti, oltre ad essere effettivamente sostenibili, devono anche prevedere un'accurata azione di coinvolgimento e partecipazione. I numerosi "no" alle filiere della bioenergia colpiscono purtroppo in maniera trasversale qualsiasi tipo di realizzazione, piccola o grande che sia, integrata con il territorio o meno. Questo proprio perché manca la consapevolezza di come questi impianti, se realizzati seguendo i necessari criteri di sostenibilità, nel rispetto delle disposizioni vigenti e delle linee guida nazionali e delle relative disposizioni regionali di attuazione previste dal D.M. 10 settembre 2010, possano dare un fondamentale contributo non solo a centrare gli obiettivi energetici e di contenimento delle emissioni climalteranti stabiliti a livello nazionale ed europeo, ma anche alla valorizzazione del territorio e al rafforzamento del suo tessuto economico, produttivo e sociale [8].

Come si può comprendere, un lungo e faticoso lavoro di disseminazione e progressivo coinvolgimento degli agricoltori si rende ancora necessario. Ciò deve vedere le attività "dimostrative" al primo posto fra quelle imprescindibili per modificare l'orientamento degli agricoltori così come dei cittadini in genere.

G. National Plan for Energy and Climate

Current status of the energy sector

Come riferito nella quarta relazione dell'Italia in merito ai progressi ai sensi della direttiva 2009/28/CE [11], datata dicembre 2017, ad oggi l'Italia ha già raggiunto gli obiettivi 2020 per le fonti rinnovabili, con una quota del 17,5% sui consumi complessivi al 2015 rispetto ad un target al 2020 del 17%. (*Tabella 6 e 7*).

Nel settore elettrico (*Tabella 9*), le fonti rinnovabili, protagoniste di una fortissima crescita negli ultimi 10 anni, hanno raggiunto una quota sui consumi finali del 33,5 % nel 2015 (*Tabella 5*), corrispondente a 109,7 GWh, di cui il 18 % proveniente da bioenergie.

Nel settore del riscaldamento e del raffrescamento (*Tabella 10*), l'Italia nel 2015 ha raggiunto una penetrazione delle rinnovabili pari a 19,2 % (*Tabella 5*) di cui le biomasse rappresentano il 73 %.

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Tabella 6. Consumo finale lordo di energia rinnovabile relativo a ciascun settore (ktep)

	2009	2010	2011	2012	2013	2014	2015	2016
Riscaldamento e raffrescamento	10.178	10.018	8.101	10.226	10.603	9.934	10.687	10.538
Elettricità	5.244	5.768	6.837	7.840	8.665	9.001	9.142	9.183
Trasporti	1.290	1.575	1.577	1.552	1.468	1.310	1.456	1.360
Totale	16.712	17.362	16.515	19.618	20.737	20.245	21.286	21.081

Tabella 7. Contributo (%) in energia rinnovabile relativo a ciascun settore rispetto ai consumi finali di energia

	2009	2010	2011	2012	2013	2014	2015	2016
Riscaldamento e raffrescamento	16,43	15,64	13,82	16,98	18,09	18,89	19,17	18,73
Elettricità	18,81	20,09	23,55	27,42	31,30	33,42	33,46	34,01
Trasporti	3,93	4,84	4,98	6,04	5,39	4,99	6,42	7,24
Totale	12,78	13,02	12,88	15,44	16,74	17,07	17,49	17,35

Tabella 8. Potenza netta installata per ciascuna tecnologia che utilizza energie rinnovabili in Italia (MW)

	2009	2010	2011	2012	2013	2014	2015	2016
Biomasse solide	438	406	421	538	606	620	616	685
Biogas	359	480	732	1.274	1.317	1.336	1.336	1.352
Bioliquidi	371	581	736	989	1.003	990	1.000	993
Rifiuti urbani	703	716	742	754	836	826	852	841
Totale	1.871	2.183	2.631	3.555	3.762	3.772	3.804	3.871

Tabella 9. Produzione lorda di elettricità per ciascuna tecnologia che utilizza energie rinnovabili in Italia (GWh)

	2009	2010	2011	2012	2013	2014	2015	2016
Biomasse solide	2.828	2.261	2.522	2.582	3.679	3.823	3.947	4.125
Biogas	1.665	2.054	3.405	4.620	7.448	8.198	8.212	8.259
Bioliquidi	1.448	3.078	2.698	2.977	3.628	4.290	4.865	4.627
Rifiuti urbani	1.616	2.047	2.208	2.163	2.206	2.370	2.343	2.415
Totale	7.557	9.440	10.832	12.342	16.960	18.681	19.366	19.425

Tabella 10. Consumo finale lordo di energia per ciascuna tecnologia che utilizza energie rinnovabili in Italia nel settore del riscaldamento e del raffreddamento (ktep)

	2009	2010	2011	2012	2013	2014	2015	2016
Biomasse solide	7.848	7.540	5.114	7.247	7.431	6.646	7.380	7.175
Biogas	19	26	330	183	246	283	250	252
Bioliquidi	28	25	22	21	21	31	42	42
Rifiuti urbani	56	62	86	71	83	85	108	117
Totale	7.952	7.652	5.551	7.522	7.781	7.045	7.780	7.586

National Action Plan in favour of the RES (Renewable Energy Sources)

Di seguito sono riportate le principali misure attuate coerentemente agli indirizzi del Piano di Azione Nazionale [11].

- Titoli di Efficienza Energetica (TEE o Certificati Bianchi) - D.Lgs. 28/2011 art. 29 e 30 e D.M. 28/12/2012, D.Lgs. 102/2014, DM 11/01/2017). A partire dal 2005.
- Detrazione fiscale per ristrutturazioni edilizie - a partire dal 1998.

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- Detrazione fiscale per riqualificazioni energetiche – a partire dal 2007.
- Conto Termico - Contributi per la produzione di energia termica da fonti rinnovabili e per interventi di efficienza energetica di piccole dimensioni (D.Lgs. 28/2011, art. 28, D.M. 28/12/2012, DM 16/02/2016).
- Obbligo di integrazione delle fonti rinnovabili negli edifici di nuova costruzione e negli edifici esistenti sottoposti a ristrutturazioni rilevanti (D.Lgs. 28/2011, art. 11)
- Nuovi meccanismi incentivanti (D. Lgs. 28/2011, art. 24 e D.M. 06/07/2012 e D.M. 23/6/2016).

Con riferimento a questo ultimo punto, in Italia, i meccanismi di incentivazione accessibili per nuovi impianti di produzione di energia elettrica da FER sono stati i seguenti:

- **D.M. 6 luglio 2012**, a supporto degli impianti da fonte rinnovabile non fotovoltaica, che, a partire da gennaio 2013, ha sostituito i Certificati Verdi (di seguito anche CV) e le Tariffe Onnicomprensive (di seguito anche TO).

- **D.M. 23 giugno 2016**, che ha aggiornato i meccanismi già introdotti dal D.M. 6 luglio 2012 per l'incentivazione della produzione di energia elettrica da impianti alimentati da fonti rinnovabili diverse da quella fotovoltaica.

In termini generali, è possibile evidenziare che, nel tempo, gli indirizzi della politica energetica nazionale in merito alle condizioni d'impiego delle biomasse a fini energetici si sono progressivamente modificati, così come il conseguente assetto normativo che ha subito una evoluzione significativa. Infatti, il Decreto del Ministero dell'Ambiente del 6 Luglio 2012 introduce un forte segno di rottura rispetto agli indirizzi sino a quel momento assunti riguardo alle energie rinnovabili, chiudendo una stagione di sviluppo delle rinnovabili principalmente incentrato sull'incentivazione finanziaria, per aprire una stagione nuova, basata innanzitutto su logiche di maggior competitività e sostenibilità ambientale.

Grande attenzione è oggi rivolta alla natura “residuale” delle biomasse impiegate a scopo energetico; in particolare, il legislatore ha inteso mitigare ogni potenziale competizione fra superfici agrarie investite a biomasse aventi scopo energetico rispetto alle colture tradizionali indirizzate alle produzioni agro-alimentari. Ciò si realizza scoraggiando l'impiego di colture agrarie espressamente dedicate alla produzione di energia, viceversa favorendo l'impiego energetico di residui colturali e scarti agro-industriali. Ciò ha determinato l'individuazione di due distinte categorie di biomasse a scopo energetico, rispettivamente i “prodotti” ed i “sottoprodotti”.

Quindi, la produzione di biomasse a destinazione energetica deve guardare prioritariamente, in una condizione come quella italiana, al recupero e alla valorizzazione degli scarti e residui colturali, zootecnici e della lavorazione dei prodotti agroalimentari. In seconda istanza possono essere utilizzate le colture dedicate, evitando in ogni caso di interferire negativamente con le produzioni alimentari [8].

Objectives and tools of the SEN 2017

A livello nazionale la recente proposta per una nuova Strategia Energetica Nazionale [10] si pone gli ambiziosi obiettivi di aumentare la competitività del Paese allineando i prezzi energetici a quelli europei, migliorare la sicurezza dell'approvvigionamento e della fornitura, decarbonizzare il sistema energetico in linea con gli obiettivi di lungo termine dell'Accordo di Parigi. Il raggiungimento di tali obiettivi è previsto avvenga attraverso le seguenti priorità di azione:

1. Sviluppo delle rinnovabili
2. Efficienza energetica
3. Sicurezza energetica
4. Competitività dei mercati energetici

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5. L'accelerazione nella decarbonizzazione del sistema: il phase out dal carbone

6. Tecnologia, ricerca ed innovazione.

Al 2030, la proposta SEN 2017 ritiene perseguibile un obiettivo del 27% di energia rinnovabile sui consumi energetici finali, declinato nel modo seguente:

- Rinnovabili elettriche al 48 – 50 % al 2030 rispetto al 33,5 % del 2015
- Rinnovabili termiche al 28 – 30 % al 2030 rispetto al 19,2 % del 2015
- Rinnovabili trasporti al 17 – 19 % al 2030 rispetto al 6,4 % del 2015

Rispetto a questi specifici targets, la proposta del Parlamento europeo lo scorso gennaio 2018 sposta l'obiettivo verso livelli di gran lunga più ambiziosi, pari al 35 % di energia rinnovabile sui consumi energetici finali. Ciò, se confermato, richiederebbe una **nuova calibrazione complessiva di tutti gli impegni**.

Come riferito nel "position paper" elaborato dal MIPAF [9], in merito al contributo delle biomasse, la SEN 2017 evidenzia quanto segue:

1) Riguardo alle **rinnovabili elettriche**.

Gli impianti a biomassa non riusciranno a ridurre i costi per la non comprimibilità dei costi di acquisto dei combustibili e di altri costi fissi in relazione ad altre tecnologie (fotovoltaico ed eolico). Inoltre, il costo di produzione di impianti piccoli rimane notevolmente superiore a quello degli impianti più grandi. Al fine di ridurre il peso degli oneri di sistema in bolletta e di stimolare soluzioni che possano raggiungere la *market parity* la SEN2017 propone di **ridimensionare le forme di incentivazione per le bioenergie esistenti**.

Per non perdere l'attuale quota di produzione, per promuovere una concorrenza leale sul mercato delle materie prime (oggi alterata dal diverso livello di incentivazione, dipendente dal meccanismo di accesso di cui ha beneficiato ciascun impianto), per assicurare il rispetto del principio dell'impiego a "cascata" delle biomasse e per favorire le filiere a minor impatto e che non sono in competizione con il mondo agricolo per l'uso del suolo agrario, la SEN 2017 propone quanto segue:

- Incentivare solo le **bioenergie da scarti e residui agricoli od urbani**, eventualmente, da prodotti di secondo raccolto.
- Ricorrere, in via preferenziale, alla **promozione ed abilitazione dell'autoconsumo**, di **limitare le nuove forme di incentivazione tariffaria agli impianti di piccolissima taglia** (con il limite di 70kW).

2) Riguardo alle **rinnovabili termiche**.

- Si richiama il problema ambientale/sanitario derivante dagli **impatti emissivi degli impianti a biomasse solide** e, quindi, la necessità di favorire impianti ad alta qualità ambientale ed efficienza.
- Si evidenzia come tecnologia più promettente, le **pompe di calore elettriche a gas**.

Critical considerations about the SEN 2017

Si riportano di seguito una serie di osservazioni mosse nei riguardi della proposta SEN 2017 da parte di enti istituzionali, così come di associazioni di produttori ed organizzazioni di categoria [9, 12, 13, 14, 15, 16, 17, 18].

- Un approccio eccessivamente basato sulla sostenibilità economica nel breve periodo core il rischio di sottovalutare le implicazioni ambientali nel lungo periodo [9, 13].
- Si esorta ad una maggiore **integrazione della politica energetica con le politiche agricole, del clima e dell'ambiente**, contribuirà ad accrescere le certezze per gli investitori riducendo il rischio di scelta di siti e sentieri tecnologici che possono determinare opposizione a livello locale e compromettere la fiducia nelle energie rinnovabili [9].

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- Da più parti si evidenzia la mancanza di una **prospettiva di lungo periodo** e la considerazione di uno **scenario a corto raggio**, in grado di considerare i prossimi decenni nel quadro degli impegni assunti con la *Energy Roadmap 2050* e l'accordo di Parigi di COP21. Si evidenzia, inoltre, l'opportunità di fissare dei target decisamente più ambiziosi rispetto a quelli riportati nella SEN 2017 [12, 16, 17]. Occorre dunque prevedere un duplice scenario al 2013 ed al 2015, integrando il Pacchetto Europeo al 2030 con un piano in linea con gli impegni più sfidanti assunti con l'Accordo di Parigi [14, 15, 17].
- La critica generalmente sollevata riguarda l'ampia **sottovalutazione del ruolo strategico delle biomasse agro-forestali** per la generazione di calore ed energia elettrica, non solo per il loro contributo evidente al bilancio energetico nella quota delle rinnovabili, ma soprattutto per la loro funzione determinante nel contrasto al cambiamento climatico [12, 13, 14, 15, 16].
- Le biomasse solide costituiscono una componente fondamentale ed insostituibile nel processo di transizione energetica nazionale ed europea, fattore decisivo per il *phasing out* dal fossile [12]. Pertanto, nel quadro delle politiche energetiche nazionali, la SEN dovrebbe prevedere un contributo più rilevante delle biomasse al raggiungimento degli obiettivi di produzione di energia rinnovabile al 2030, anche in considerazione delle sue positive ricadute ambientali ed occupazionali sul territorio [12, 13].
- Il concetto di "**democrazia energetica**" mediante un sistema di produzione di energia diffuso sul territorio ed alimentato dalle risorse presenti localmente dovrebbe trovare maggiore definizione nella strategia [16]. In particolare, ci si riferisce alle possibilità di **autoproduzione energetica** ed alla realizzazione di **sistemi di distribuzione chiusi** (SDC) che dovrebbero essere attivati al più presto [16, 17]. A riguardo la SEN non considera appieno il nuovo scenario della **generazione distribuita** ed i vantaggi che essa può apportare al sistema energetico [17].
- Si evidenzia un contrasto con gli obiettivi UE e con l'Accordo di Parigi laddove viene previsto un **ridimensionamento delle forme di incentivazione per le bioenergie esistenti**. Occorre riconoscere al settore agricolo e forestale un ruolo importante per il raggiungimento dei propri obiettivi climatici [9, 12, 13,].
- Sugli impianti esistenti deve essere **scongiurato il rischio di interventi retroattivi** sul livello di incentivazione al fine di tutelare le imprese che in questi anni hanno investito molte risorse creando importanti opportunità in termini di nuovi occupati nel settore [9, 13].
- Non vengono tenute in debito conto le **ricadute positive di carattere ambientale, economico** (in particolare per quanto riguarda il livello di occupazione) **e sociale** legate alla produzione di energia da biomasse agroforestali (in particolare da matrici residuali, sottoprodotti e colture di integrazione o secondo raccolto [9, 13, 16].
- In merito alla **soglia massima di potenza incentivabile**, la SEN dovrebbe fare riferimento alla capacità dell'azienda agricola, singola e associata, di produrre biomasse (e non alle dimensioni della "tipica struttura agricola"). Inoltre, considerata la necessità di valorizzare sempre più le biomasse residuali, considerate le loro caratteristiche, è fondamentale promuovere l'incentivazione anche di impianti che aggregino più imprese agricole e forestali. A riguardo, si ritiene indispensabile prevedere l'incentivazione di impianti almeno fino a 500 kW, essendo la soglia di 70 kW davvero troppo esigua [9].
- In riferimento alle osservazioni della SEN in ordine alle emissioni prodotte dalla combustione di biomasse in apparecchi domestici si è dell'avviso [9] che questo tema potrebbe essere efficacemente affrontato con successo attraverso una strategia congiunta costituita da:
 - o promozione del **turnover tecnologico** e quindi sostituzione dei vecchi ed obsoleti generatori a biomasse con quelli di nuova concezione realizzati nel rispetto dei requisiti previsti dal decreto di applicazione dell'art. 290 del T.U.A. D.lgs. 152/2006;
 - o diffusione attraverso apposite **campagne informative dei sistemi incentivanti previsti dal Conto Termico** che ha lo scopo di sostenere la rottamazione dei vecchi apparecchi domestici con quelli di nuova generazione;

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- promozione dei **combustibili legnosi certificati** e conformi alla norma di **standardizzazione della qualità** ISO 17225;
- diffusione delle buone pratiche per riscaldarsi con le biomasse legnose in sicurezza, nel rispetto dell'ambiente e della qualità dell'aria attraverso specifiche campagne informative rivolte ai cittadini.
- Riguardo all'energia termica, occorre sia considerata l'importanza delle **tecnologie rinnovabili destinate al riscaldamento e al raffrescamento** quali soluzioni reali e praticabili e che sia **assicurato un equilibrato mix energetico per il riscaldamento rinnovabile** con soluzioni efficienti, alle quale concorrano le moderne tecnologie di conversione energetica alimentate a biomasse, l'energia geotermica e termica solare, le pompe di calore più performanti [12, 16]. Si ritiene, infatti, che affidare in larga misura la svolta energetica nel segmento del riscaldamento ad un'unica tecnologia, sebbene promettente come le pompe di calore, rappresenti un rischio rispetto agli obiettivi che la SEN si propone. Diversamente, occorrerebbe perseguire un'interconnessione tra tutte le rinnovabili, siano esse destinate alla generazione elettrica, termica o ai trasporti [16].
- Occorre valutare adeguatamente il contributo ed i benefici per il sistema energetico nazionale che possono portare **gli impianti da fonti rinnovabili programmabili** (biogas, biomasse, geotermia, solare termodinamico, mini idroelettrico, ecc.) e quelli capaci di produrre elettricità e calore in una logica di autoproduzione e distribuzione locale [17].
- Si sottolinea la necessità che la generazione elettrica da biomasse sia sostenuta, tramite un'opportuna **politica incentivante che promuova le tecnologie cogenerative per impianti almeno fino a 300 oppure 500 kW**e e mediante uno specifico riconoscimento alle biomasse certificate [12, 13, 16].
- Si reputa essenziale l'introduzione di una **Carbon Tax** per mitigare parte degli impatti ambientali, climatici e sanitari legati all'impiego dei combustibili fossili [12]. Essa dovrebbe essere opportunamente quantificata in base a specifiche considerazioni ambientali e mediante approcci quali il bilancio delle emissioni.
- Un punto assai critico è quello che, nella SEN, è riservato agli impatti emissivi degli impianti a biomasse solide. In realtà [12], negli ultimi 15 anni sono stati fatti notevoli passi avanti dalle industrie della filiera legno-energia, grazie ad ingenti investimenti in ricerca e sviluppo. I costruttori degli impianti a biomasse legnose stanno compiendo un grande sforzo per implementare soluzioni tecnologiche a basso impatto sulla qualità dell'aria. La **certificazione volontaria** degli impianti può costituire, almeno in fase di avvio, uno strumento utile per garantire migliori prestazioni degli apparecchi domestici di riscaldamento e raffrescamento. Gli impianti a biomasse dovrebbero comunque avere, al più presto, una chiara **certificazione in merito alle prestazioni emissive** fornita da parte del costruttore. Parallelamente, nel settore del riscaldamento domestico occorre **promuovere il turnover tecnologico**; ciò può essere realizzato grazie alla diffusione degli incentivi previsti dal Conto Termico, le cui opportunità sono, ancora oggi, poco sfruttate [12, 16].
- Andrebbe fortemente favorita la realizzazione di **reti di teleriscaldamento** alimentate a biomasse forestali e da sottoprodotti agricoli di origine territoriale (filiera corta) al servizio delle comunità locali.
- Riguardo alla generazione elettrica, si ritiene sia opportuno che il regime d'incentivazione, per il futuro, debba riguardare particolarmente se non esclusivamente gli impianti che operano in regime cogenerativo, al fine di incrementare l'efficienza di conversione energetica della biomassa.
- Riguardo all'indicazione assai restrittiva delle **taglie assai limitate di potenza** (70 kW), si ritiene da più parti che tale limite sia irrealistico e poco sensato sotto il profilo tecnico ed economico. Si propone, pertanto, una soglia di almeno 300 od anche 500 kW di potenza; ciò potrebbe invece rappresentare un riferimento più opportuno [12, 13, 16].
- Si richiama che alle biomasse classificate come **sottoprodotti**, in base alla vigente legislazione in materia, dovrebbe essere riconosciuto un **bonus incentivante specifico**. In ogni caso, devono essere

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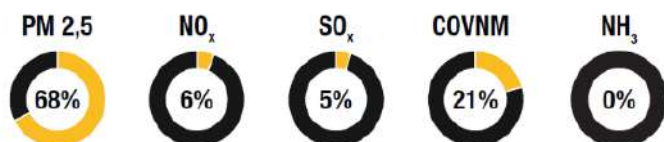
tracciate e provenire da un ambito territoriale definito, nonché essere prodotte secondo criteri condivisi di sostenibilità ambientale ed ecologica [12, 16].

- Da più parti si invoca maggiore attenzione nei riguardi delle **procedure di approvazione degli impianti**. L'incertezza normativa e regolamentare è ancora oggi una delle principali barriere in Italia alla diffusione degli impianti da fonti rinnovabili. Nel documento di Legambiente [17] si afferma che le difficoltà nell'approvazione degli impianti riguardano interventi piccoli e grandi, cittadini e aziende. In molte Regioni italiane è di fatto vietata la realizzazione di nuovi progetti da rinnovabili, visto l'incrocio di burocrazia, limiti posti con il recepimento delle linee guida nazionali e veti dalle soprintendenze (che spesso evidenziano una vera e propria ossessione nei confronti dell'eolico). Per questo **serve una revisione delle linee guida per l'integrazione paesaggistica e l'introduzione di linee guida per la valutazione di impatto ambientale**. La priorità dovrebbe essere la definizione di criteri trasparenti per gli studi e le valutazioni ambientali specifiche per i diversi impianti. Occorre introdurre nuove Linee Guida per fare chiarezza sui temi più delicati d'inserimento degli impianti rispetto alle risorse naturali e al paesaggio, in modo da garantire la tutela ambientale e aiutare l'integrazione nel paesaggio e nel territorio degli impianti da biomasse [17].

Short note about biomass and air quality

Il tema in questione, ovvero i processi termochimici di conversione energetica delle biomasse e l'inquinamento dell'aria, ha avuto grande risalto informativo e costituisce uno dei fattori che maggiormente condizionano (anche con riferimento a quanto riportato nella SEN 2017) lo sviluppo ulteriore delle bioenergie in Italia. Di seguito si riportano i dati e le considerazioni contenute nel report della Fondazione e per lo Sviluppo Sostenibile intitolato "La sfida della qualità dell'aria nelle città italiane" (2017).

Il settore residenziale è responsabile di quasi i due terzi delle emissioni nazionali di PM_{2,5} e di oltre un quinto di quelle dei COVNM. Tra gli altri inquinanti, non inclusi nella presente analisi, da segnalare anche gli



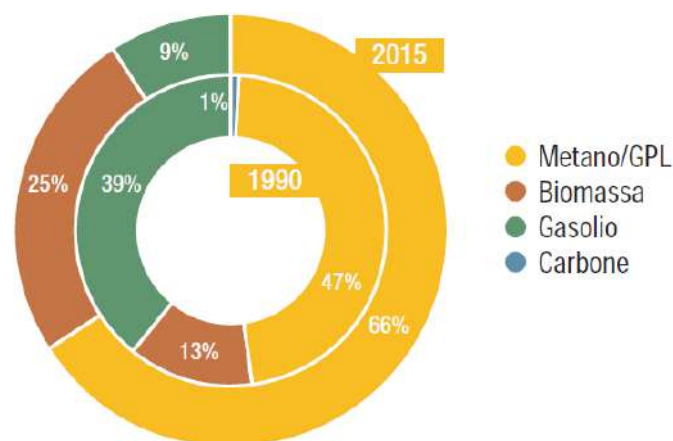
Idrocarburi Policiclici Aromatici (IPA), che per il 71% derivano dal settore residenziale.

L'aumento delle emissioni di particolato nel settore residenziale è dovuto principalmente alla evoluzione del mix energetico per il

riscaldamento domestico e, in particolare, alla crescita del consumo di biomasse legnose (+115% nel periodo considerato).

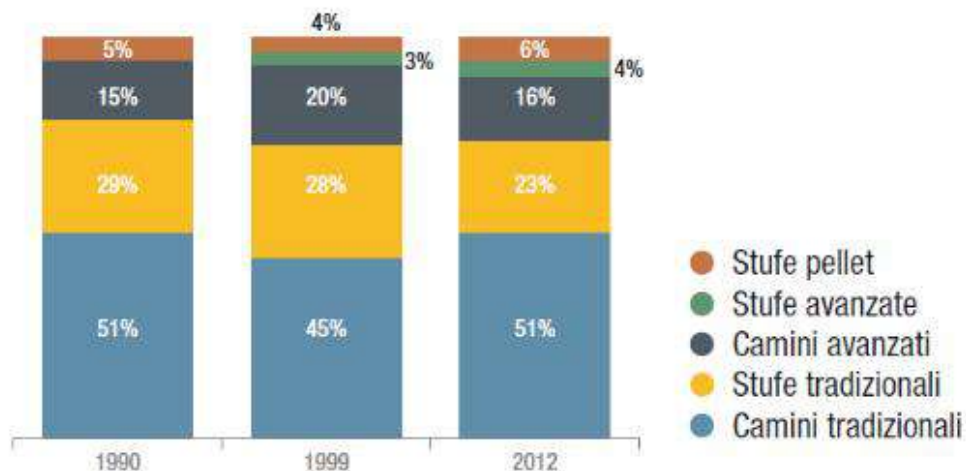
Dall'analisi dei dati di consumo di biomassa, dalla ripartizione tecnologica e dai fattori di emissione emerge che:

- la quasi totalità delle emissioni di particolato in atmosfera riconducibile al settore residenziale è prodotto dalla combustione di biomasse, che rappresentano il 25% dei consumi del settore, contro il 66% dei consumi di combustibili gassosi e il 9% dei combustibili liquidi;
- le tecnologie «tradizionali» (caminetti aperti e stufe tradizionali stand alone a ricarica manuale) rappresentavano il 74% degli impianti in Italia nel 2012 e sono stati responsabili del 90% delle emissioni di particolato, contro il 9% di emissioni imputabili alle tecnologie «avanzate» (stufe a pellet, caminetti chiusi e stufe collegate ad un impianto di riscaldamento con ricarica automatica).

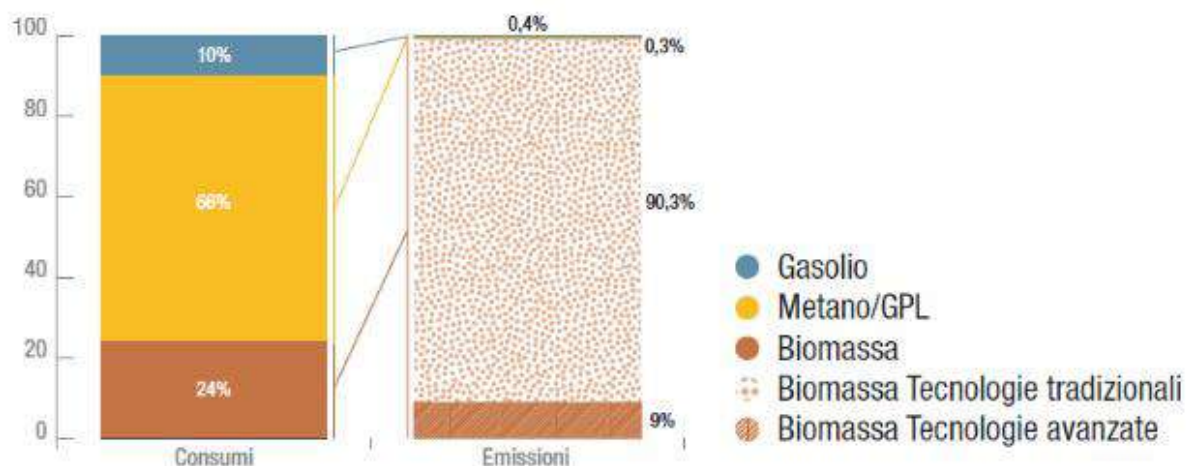


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La distribuzione delle tecnologie per il riscaldamento a biomasse in Italia



Stima del contributo alle emissioni di PM2,5 del settore residenziale nel 2014 dato dalla biomassa ripartito per tecnologie utilizzate



Tratto da: Fondazione per lo Sviluppo Sostenibile, 2017. “La sfida della qualità dell’aria nelle città italiane”. Dieci proposte di Green Economy. https://www.fondazioneviluppосostenibile.org/wp-content/uploads/dlm_uploads/2017/09/Report_La_sfida_della_qualita_dell_aria_nelle_citta_italiane_2017.pdf

Ciò dà conto della estrema necessità di stimolare e favorire la sostituzione dei vecchi apparecchi termici con quelli di nuova concezione, tecnologicamente più avanzati.

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SWOT Analysis

Si ripropone, di seguito, l'analisi SWOT elaborata nel Piano di Settore per le Bioenergie [8]. Vengono delineati i punti di Forza, di Debolezza, le Minacce e le Opportunità che caratterizzano il sistema nazionale delle bioenergie con specifico riferimento alle filiere di biomasse solide.

	Strengths	Weaknesses	
Internal Factors	- Pluralità e ampia disponibilità di materie prime (in particolare da biomasse residuali). - Tecnologie mature ed affidabili, sia per la produzione elettrica che per gli usi termici. - Forte presenza dell'industria nazionale nella produzione e commercializzazione di impianti e componenti impiantistiche. - Presenza di numerosi "casi di successo" riferibili a filiere di approvvigionamento e conversione energetica. - Riduzione delle emissioni di GHGs. - Strategie europee e nazionali che incentivano lo sviluppo del settore, con crescita costante e in linea con gli obiettivi del NREAP (<i>National Renewable Action Plan</i>) al 2020 ed oltre. - Programmabilità, continuità e stabilità delle produzioni di energia.	- Scarso sviluppo delle filiere di approvvigionamento delle biomasse e di conversione energetica a livello territoriale; notevole ricorso all'importazione estera dell'energia. - Bassi rendimenti di conversione in energia elettrica; ancora limitato ricorso alla cogenerazione. - Costi d'impianto elevati per unità di potenza installata e per la realizzazione di reti di teleriscaldamento. - Limitata disponibilità ed affidabilità di tecnologie (gassificazione e pirolisi) per la produzione di elettricità ad elevata efficienza in impianti di piccola taglia. - Costi elevati dei dispositivi di abbattimento delle emissioni (in particolare di PM10 e PM2,5). - Elevati costi di generazione difficilmente comprimibili per il costo di acquisto delle biomasse. - Scarso livello d'informazione pubblica sulla sostenibilità ed i benefici della bioenergia. - Scarsa attenzione alla formazione professionale a livello di progettazione, realizzazione e manutenzione degli impianti termici. - Mancanza di una normativa univoca a livello nazionale ed eterogeneità dei regolamenti regionali. - Necessità di una migliore gestione delle competenze tra i Ministeri e gli Enti coinvolti.	Internal Factors

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	Opportunities	Threats	
Internal Factors	- Corretta gestione e tutela del frutteto, con particolare attenzione all'introduzione di nuove modelli di gestione colturale (inerbimento, minima lavorazione, ecc.) in grado preservare la qualità del suolo e mitigare i fenomeni erosivi. - Sviluppo, diversificazione produttiva ed internazionalizzazione dell'industria nazionale in tutti i segmenti della filiera (meccanizzazione agricole, impiantistica e componenti industriali). - Recupero e valorizzazione dei residui colturali (potature) con risparmio sui costi di gestione ed integrazione del reddito dell'azienda agricola. - Ammodernamento e rafforzamento delle imprese agro-forestali, e di quelle agromeccaniche che operano in contoterzi, con incremento dell'occupazione, della redditività e creazione di nuove figure professionali. - Miglioramento del parco tecnologico degli impianti esistenti, alimentati a biomassa solida, con specifico riferimento all'abbattimento delle emissioni in atmosfera (in particolare PM10 e PM2,5). - Miglioramento degli standard qualitativi delle biomasse solide (tramite ad es. certificazione dei biocombustibili solidi). - Possibilità di creare filiere bioenergetiche nazionali riducendo la dipendenza dalle importazioni di energia (specie nel settore del riscaldamento domestico). - Più efficace valorizzazione delle biomasse solide nel settore termico.	- Ricorso a quantitativi crescenti di biomasse d'importazione, di più facile reperibilità, pregiudicando ricadute positive sul territorio. - Necessità di un aggiornamento (continuo e periodico) della strategia energetica nazionale (NREAP e NECP - National Energy and Climate Plan), in particolare con riferimento al lungo periodo al fine di perseguire obiettivi programmatici che vadano ben oltre il 2020. Non sempre i governi sono celeri e le indicazioni coerenti rispetto agli obiettivi generali e di lungo periodo. - Diminuzione del prezzo di mercato dei combustibili fossili come conseguenza di strategie di "dumping". - Opposizione popolare alla realizzazione di nuovi impianti (<i>sindrome</i> NIMBY). - Modifiche del quadro economico degli incentivi (anche retroattivi), che possono vanificare i <i>business plan</i> degli impianti. - Potenziali conflitti tra generazione diffusa e grandi impianti per l'approvvigionamento di biomassa combustibile.	Internal Factors

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Strategic Plan

Strategie di attacco (Punti di Forza + Opportunità)

1. Puntare alla realizzazione sistema energetico APPR efficiente ed integrato.
2. La generazione energetica incentrata sulle biomasse APPR traccia un percorso favorevole allo sviluppo rurale.
3. Favorire un settore energetico APPR che sia orientato verso il mercato e possa intercettare e soddisfare le esigenze espresse dalla società.

Strategie di riorientamento (Punti di Debolezza + Opportunità)

4. Sostenere l'innovazione delle tecnologie nel settore delle bioenergie ed un passaggio progressivo ad un utilizzo energetico più efficiente delle biomasse APPR.
5. Innescare processi virtuosi d'innovazione sociale e politica nel settore delle biomasse APPR
6. Potenziare la convenienza economica dell'impiego delle biomasse ed il ritorno economico lungo le filiere bioenergetiche.
7. Aumentare le possibilità di mobilitazione delle biomasse APPR e porre in essere le condizioni più favorevoli per il rafforzamento delle filiere bioenergetiche.

Strategie di difesa (Punti di Forza + Minacce)

8. Comprovare la fattibilità delle filiere APPR ed il valore di queste tipologie di biomassa nella realizzazione di progetti di micro-generazione energetica.
9. Reagire in modo opportuno ad una campagna d'informazione spesso deliberatamente fuorviante favorendo, al contrario, un livello adeguato di conoscenza in merito alle bioenergie ed una maggiore consapevolezza riguardo alle effettive ricadute ambientali, economiche e sociali del settore. Promuovere la partecipazione ed il coinvolgimento dei cittadini (e stakeholder in genere) nella definizione dei progetti.

Strategie di sopravvivenza (Punti di Debolezza + Minacce)

10. Mitigare gli impatti ambientali lungo la filiera produttiva, a partire dalle operazioni agricole in campo, fino alla conversione energetica delle biomasse ed al consumo finale dell'energia prodotta.
11. Fronteggiare il rischio di un fallimento di mercato riguardo alle biomasse APPR.
12. Contrastare la complessità del sistema normativo e di regolamentazione vigente nel settore delle biomasse e l'assenza di una visione strategica lungimirante in merito allo sviluppo del settore bioenergetico.

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Target ① AIMING AT AN EFFICIENT AND INTEGRATED REGIONAL AGRO-ENERGY SYSTEM ACCORDING TO THE BIOECONOMY MODEL.	
Strategy: Strengths + Opportunities → SO “Attack”	
S1. Agriculture is a strong local productive sector, together with agro-food processing. S2. Large potential biomass availability at regional scale and very high local biomass spatial density. S3. Good level of potential employment offered by the APPR sector. S4. Local operation of some real business cases and successful examples.	O1. Agro-industrial integration towards a "bioeconomy" productive model. O2. Proceed in “greening” the economy, increase the use of renewables in industry, and decarbonize industrial activities, save fossil energy and GHG emissions significantly. O3. Adoption of rules consistent with the development of circular economy according to the EU framework. O4. A potential level of cross-sector innovation. O5. Rules encouraging inter-professional agreements along the biomass supply chain. O6. Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines).
Objectives SO1. Full deployment of a “low carbon economy” based on biomass resources, with particular reference to APPR. SO2. Sustaining entrepreneurs in the development of new APPR energy projects. SO3. Expanding the influencing action of representatives of the APPR sector in the regional milieu.	
Actions / Activities • Projects and investments should promote the development of integrated value chains, connecting regional players, and enabling companies to take advantage of the policies implemented at regional level. • Stimulating the regional establishment of companies manufacturing biomass or energy plant components and equipment to be used by the companies in the APPR sector. Technical and functional integration along the supply chain is particularly relevant, seeking to promote a distributed energy generation model. • Promoting pioneering initiatives and proposing systemic design projects to encourage the emergence of a new, shared and consolidated "vision" about the energy sector development. • Supporting pilot projects and the development of new energy products from APPR biomass, conversion processes and technologies in the bioenergy sector. • Looking after flagship projects to be taken as representative models in the region. • Promoting linking actions with the regional administrative agencies who are in charge of the wide range of authorizations of bioenergy projects and APPR investments according to specific procedures. A “coordinating table” should be established where sharing opinions and suggestions.	

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- Agreements within the trade (or “Inter-professional agreement”). Considering the large-size energy plants, the equilibrium of rights and obligations between farmers and bioenergy undertakings can be achieved by means of collective negotiations. Key elements contained in the contracts are related to the conditions of APPR delivery and purchase. This concerns mainly the management of APPR delivery/reception, includes elements such as delivery date, quality conditions, bonuses and rules on adapting prices in pluriannual contracts, etc..

Target ② SUSTAINABLE APPR ENERGY GENERATION AS A PATH TO RURAL DEVELOPMENT.

Strategy: Strengths + Opportunities → SO “Attack”

S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass).	O3. Adoption of rules consistent with the development of circular economy according to the EU framework.
S6. Using locally available resources is considered a priority.	O7. The “multifunctional” asset of current agriculture according to the vision of “rural development”.
S7. Observed trend in deepening the agricultural activity along the value chain.	O8. Application of the EU “cross-compliance” with respect to farmers’ commitments.
S8. Observed trend in applying a set of agricultural diversified activities.	O9. Valorisation and reuse of agricultural residues for bioenergy production.
S3. Good level of potential employment offered by the APPR sector.	O10. Adaptation measures to climate change.
S4. Local operation of some real business cases and successful examples.	O11. Ensure biodiversity conservation and the supply of ecosystem services.
S9. Farmers have a strong imitation attitude. Positive examples are considered as a model.	O12. Young and skilled farmers entering in the sector thanks to new incomes opportunities.
S10. Cohesion is considered a social responsibility among farmers; this should promotes cooperation.	O13. Funding schemes favouring the APPR sector in agriculture.
	O14. Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example).

Objectives

- SO4. Energy self-supply and consumption in the rural areas, distributed bioenergy generation, diversified productive activities, increase of farmer income.
- SO5. Ecologically sustainable and “close loop” agricultural model based on “circular” economy.

Actions / Activities

- Sustaining farmers in the development of new APPR projects in terms of both increasing the amount of available APPR biomass to be addressed to the energy market and promoting the direct and internal energy exploitation of this feedstock.
- Suggesting the insertion of well-defined (national and regional) measures of “good agricultural and environmental conditions” (GAEC) within the “Single Payment” scheme and “Cross Compliance” mechanism (CAP first pillar) with respect to the management of crop

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residues and fruit tree pruning.

- Promoting the application of well-defined agro-environmental measures (CAP second pillar) within the Rural Development Plan, at national and regional level, aiming at encouraging the energy use of pruning (APPR feedstock) and sustainable energy conversion processes.
- Promoting a large participation of farmers and farmer organizations, together with other stakeholder associations, in the establishment of operational groups (OPs) within the EIP (European Innovation Partnerships), specifically tailoring projects and investments in the APPR energy use and the valorisation of solid energy carriers from APPR feedstock.
- Motivating cooperation and partnership among small landowners, farmers and operators in organising APPR energy value chains, sharing facilities and resources, sustaining horizontal and vertical integration among the actors of the supply chain and for the development of short supply chains and local energy markets.
- Defining “best management practices” in the agricultural sector with reference to the APPR feedstock. Providing comprehensive information and advices on several issues about pruning removal, including handling, logistics and economy. Advising farmers about possible impacts on soil carbon contents. Assessing when and where soil carbon contents are critical to preserve appropriate soil chemical and physical properties.

Target ③ A MARKET ORIENTED APPR ENERGY SECTOR TO INTERCEPT AND SATISFY SOCIETY NEEDS.

Strategy: Strengths + Opportunities → SO “Attack”

S1. Agriculture is a strong local productive sector, together with agro-food processing.	O15. Steady economic affordability of biomass energy carriers as compared to fossil fuels.
S2. Large potential biomass availability at regional scale and very high local biomass spatial density.	O16. A prospective increase in the market price of biomass.
S4. Local operation of some real business cases and successful examples.	O17. A prospective increase in the market price of fossil fuels.
S6. Using locally available resources is considered a priority.	O18. Label and standards of biomass quality assurance and traceability.
S11. Potential cost savings in field pruning management.	O19. Subsidies and incentives promoting fossil displacement.
	O20. Public support on the demand side of APPR feedstock for energy use (“green public procurement”).

Objectives

- SO6. A large and stable availability of APPR feedstock through an extensive involvement of farmers and an efficient logistic organization of the APPR supply chain (harvesting, transporting and storing).
- SO7. A large and stable market supply of renewable energy products (energy carriers) obtained from APPR biomass.
- SO8. Effectiveness of the APPR supply chain and good economic affordability of the whole value chain.
- SO9. Strong political leadership with clear market targets to support bioenergy and the APPR sector.

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Actions / Activities

- Reinforcing the final use of biomass energy carriers. Disseminating knowledge about the large set of potential bioenergy final products and confidence on their possible use in energy conversion processes at both household and industrial application levels.
- Informing the large public and potential customers about the economic advantages in switching from conventional fossil fuels to alternative solid wood fuels.
- Strengthening stability in biomass fuel prices. High price for biomass energy carriers and its possible sharp variability are parts of the reasons why household end-users show hesitation and could prefer to maintain their conventional oil or gas boiler. Reliable and regular feedstock SUPPLY sources and an efficient supply chain organization allow avoiding irregularities and strong market imbalances.
- Strengthening the demand side of the APPR energy market. Maintain subsidies to reduce investment costs for solid biomass heating equipment. High investment costs for wood heating systems are still a main barrier. To overcome this point, governments have to reinforce their supporting policy. For example, individual house-owner can obtain subsidies that correspond a reimbursement (50 % of equipment costs) on taxes for a wood heating equipment.
- Developing a local/regional system of feedstock quality control, system of biomass traceability, environmental management assurance, criteria of product eco-labelling, etc. Local criteria should be harmonized with national / international criteria.
- Prospective consumers need to buy not only a fuel that is competitive in terms of price (and this is generally the immediate factor), but also conforming to quality standards according to the use, together with excellent service and procurement conditions.

Target ④ SUPPORTING AN INNOVATION TREND IN BIOENERGY TECHNOLOGY AND A SHIFT TO MORE EFFICIENT ENERGY USE FROM APPR BIOMASS.

Strategy: Weaknesses + Opportunities → **WO "Reorientation"**

W1. Energy conversion from pruning is still considered an overall risky operation.	O1. Agro-industrial integration towards a "bioeconomy" productive model.
W2. APPR is largely spatially dispersed and need to be collected over a wide land area. Strong seasonality in harvesting.	O2. Proceed in "greening" the economy, increase the use of renewables in industry, and decarbonize industrial activities, save fossil energy and GHG emissions significantly.
W3. Complexity of biomass supply chains. Lack of well-organized logistics operations.	O4. A potential level of cross-sector innovation.
W4. Low degree of mechanization. Lack of knowledge on field mechanization.	O6. Local availability of agro-mechanical service companies as well as builders of processing facilities.
W5. Harvesting and chipping machines need technological improvements.	O9. Valorisation and reuse of agricultural residues for bioenergy production.
W6. Inadequate or insufficient technical reliability of biomass plant.	O21. Notable "learning curve" on the technological maturity of energy conversion processes.
W7. Agro-industrial integration is hard to be achieved.	O22. Commercial availability of small size
W8. Energy products that do not comply with international standards and labelling.	

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W9. Lack of integration of knowledge and efforts across sectors	power plants. O23. Possible combination of biomass mobilization with information technologies and product traceability. O24. Ensure proper conditions for the adoption of knowledge and innovations. O25. Possible availability of public financial funding to promote investments. O30. More restrictive atmospheric emission thresholds.

Objectives

- WO1. A well-developed technological readiness in order to offer good performing technologies, lower investment costs, reliability and duration of the APPR facilities.
- WO2. Competitive market positioning of APPR energy carriers and reasonable affordability of investment and maintenance costs of the bioenergy projects.
- WO3. Better environmental performance with special reference to GHGs savings and atmospheric emissions (PM10 and PM2.5) from APPR energy conversion (significantly lower than from fossil fuels and even from other types of biomass sources).

Actions / Activities

- Improving the overall technological performance of the equipment and machinery used along the supply chains and in the energy conversion.
- Applying well-targeted research and innovation activities, directly conducted by the companies involved in the engineering development.
- Promoting R&D initiatives and innovative pre-commercial procurements from public funding aiming at the development of sound thermochemical technologies (combustion, gasification, and pyrolysis) in strict connection with well-defined and performing business models of APPR exploitation.
- Identifying the main technological constraints affecting the available equipment and correspondingly improving the current technologies in their reliability, robustness, working capacity, total lifetime, precision and accuracy of the work performed.
- Improving some significant technological components representing the main critical segments along the biomass-to-energy thermochemical conversion process, such as the flue gas cleaning system, the biomass feeding system, the overall system energy efficiency, etc.
- Expanding the capacity of biomass combustion installations to be fed with different types of solid fuels, thus becoming more flexible in their potential applications and in satisfying a wide range of possible uses.
- Systematically checking the outcomes of the energy balance and the GHG saving rates, confirming the ecological standards of the applied technologies and their effective performance on "fossil displacement" and climate change "neutrality".
- Systematically checking the atmospheric emissions due to thermochemical energy conversion processes (mostly considering the particulate matter "PM 10" and "PM 2.5"), demonstrating that the updated technology has greater advantages compared to the former one and that is not worse than the conventional technology based on fossil fuels.
- Improve the capacity of apply or submit energy projects to EU funding scheme (such as "SME Instruments" or "Fast Track to Innovation") by local entrepreneurs (single farmer,

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cooperatives, or producer association) supporting them in the preliminary project assessment and the subsequent designing phases.

Target ⑤ TRIGGERING SOCIAL AND POLICY INNOVATION IN THE APPR SECTOR.	
Strategy: Weaknesses + Opportunities → WO “Reorientation”	
W9. Lack of integration of knowledge and efforts across sectors. W10. Mind-set of farmers, their reluctance to change and their low attitude in cooperating and innovating. W11. It does not always exist the culture of sharing machineries and equipment, or organizing jointly the agronomic operations (as would be required for harvesting and mobilising pruning residues more efficiently). W12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source. W13. Lack of exemplary business cases. W14. Distrust that farmers may be reliable in biomass supply.	O1. Agro-industrial integration towards a "bioeconomy" productive model. O2. Proceed in “greening” the economy, increase the use of renewables in industry, and decarbonize industrial activities, save fossil energy and GHG emissions significantly. O3. Adoption of rules consistent with the development of circular economy according to the EU framework. O4. A potential level of cross-sector innovation. O5. Rules encouraging inter-professional agreements along the biomass supply chain. O14. Interest by municipalities and local councils to promote community investments on bioenergy (i.e. district heating systems). O19. Subsidies and incentives promoting fossil displacement. O20. Public support on the demand side of APPR feedstock for energy use (“green public procurement”). O26. Possible application of the “Carbon emission trading” and CO2 taxation. O27. Segmenting incentives to renewable energy sources to favour the equitable sharing of benefits and social impact.
Objectives WO4. Promoting a strong bottom-up participation approach oriented to a community-based problem solving. WO5. Enforcing a strong regional policy on bioenergy and a coherent and consequent regulation framework. WO6. Enhancing public understanding (from both citizens and government representatives) about bioenergy role and value.	
Actions / Activities Setting up a regional “operational group” (OP) on bioenergy and APPR value chains. OPs consist of several partners with a common interest in a specific, practical innovation project. The people involved in the OP should be from a diverse combination of practical and scientific backgrounds (farmers, scientists, agri-business and others). They work together on	

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concrete, practical solutions to a problem or innovative opportunity. OP are action and result-oriented groups, where all the actors involved need to work together. All partners in OP should have an active role in carrying out the innovative project.

- Deploying regional networking activities. Reinforcing the partnership around a network of individuals, companies, organizations, etc. The aim of the partnership primarily consists of sharing knowledge and includes a vast number of different contributing stakeholders sharing a common vision. They will become the key actors of further initiatives promoting the APPR sector development.
- Generating consensus and social support on (properly tailored, community oriented and environmental friendly) agro-energy projects based on the use of APPR feedstock and targeted to rural development or municipality energy supply.
- Region-specific social innovation and community energy approaches, such as promoting experiences similar to the “energy villages”.
- Promoting engagement through communicative participatory processes can significantly raise awareness and public trust, which can thereafter lead to attracting investments for bioenergy community projects.
- Promotional activities, raising awareness and engagement. For example, “bioenergy-tours” through excursions to existing successful bioenergy projects, which act as “reference models” for future projects, bioenergy exhibition, local information events and articles in the press, conferences and workshops.
- Civic participation and engagement in the region should be significantly increased to get local population aware of the beneficial effects of bioenergy communities (e.g. community energy self-sufficiency, increased job opportunities, empowered re-investments), thus promoting a sense of social responsibility. Key factors for the success of a bioenergy project are based on communication and participation.
- A community-based project could be a public project or, alternatively, a local investments which empower community members to become shareholders of their local project.
- Cross-sector partnership and synergetic actions (i.e. learning from each other at a local, regional, and national scale) can stimulate successful social innovative community energy projects. Stimulating communities in setting up energy supply chains, achieving energy self-sufficiency, and becoming shareholders of a local community energy venture, as well as increase the joint profitability.
- Rules and regulations from regional government and administration should follow accordingly, preventing speculations and aggressive energy projects but favouring community-based energy initiatives.
- Commitment of local government should be clear and effective in increasing the deployment of renewable energy by APPR biomass through promotional activities, incentives, innovative forms of financing, tax-relief, targets, etc.
- A dedicated legal framework should offer financial incentives for entering into partnerships. Better tariffs, FITs and RHIs, tax reliefs and subsidies as well as simpler licensing procedures greatly improve the ability to launch new investment initiatives.
- Government incentives and funding. Given the amount of capital investment associated with most bioenergy facilities, the development of new projects require some form of external finance. Private finance is available but could be difficult to obtain. To help to

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bridge this gap, and until the market develops, governments are providing targeted financial support to the APPR bioenergy sector.

Target ⑥ CONSOLIDATING THE ECONOMIC AFFORDABILITY OF BIOMASS USE AND THE ECONOMIC RETURN ALONG THE VALUE CHAIN.	
Strategy: Weaknesses + Opportunities → WO “Reorientation”	
W15. Pruning is considered a feedstock of too low economic value. W16. APPR harvesting and transport operations are generally considered too costly. W17. Little info on funding opportunities for farmers and entrepreneurs in the bioenergy sector. W18. A long and subdivided supply chain could be not economically efficient for every actors. W19. Industrial investors are expecting very high profits and a fast payback time in the renewable sectors. W20. Limited economic affordability in utilizing services offered by specialized agro-mechanical pruning companies or techno-logistic companies.	O5. Rules encouraging inter-professional agreements along the biomass supply chain. O15. Steady economic affordability of biomass energy carriers as compared to fossil fuels. O19. Subsidies and incentives promoting fossil displacement. O25. Possible availability of public financial funding to promote investments. O27. Segmenting incentives to renewable energy sources to favour the equitable sharing of benefits and social impact. O28. Long-term stability of economic return on bioenergy investment. O29. Significant reduction trend in the capital costs of new investment in the bioenergy sector.
Objectives WO7. Consolidating the economic affordability of biomass use and the economic return along the value chain.	
Actions / Activities - Promoting partners’ aggregation in designing and launching energy projects based on the complementary functions they can offer along the value chains. Give particular importance to inter- and intra-sectorial relationships, promoting the establishment of agro-industrial regulations, contractual agreements, cooperation arrangements, reciprocal constraints and exploitation opportunities. - Offering financial counselling and advising or releasing economic and financial guidelines in order to inform potential entrepreneurs about the economic feasibility of energy projects based on APPR biomass. - Compiling templates of “business plan” also adjusting the economic exercise to the specific conditions of companies participating in the bioenergy project. - Filling out tables comparing the economic and financial aspects of the different business models in the APPR energy sector, in order to outline the pros and cons and provide an overall judgment of profitability. - Giving clear and complete instructions about the availability of public funding in agriculture dedicated to bioenergy projects or funding promoting rural development through biomass mobilization and energy use. Produce a list of options and organize a programme and a timeframe in order to schedule the possible participation of farming cooperatives or agro-	

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food companies in public competitions or tenders.

- The same as the previous bullet, but with the difference that, in this case, industrial companies are involved and public funding opportunities or financial facilities are specifically dedicated to promote industrial investments.
- Establish preferential relationships with some of the banks or credit institutions operating in the region and, through advocacy actions, promoting favoured credit or financing conditions.

Target ⑦ BOOSTING APPR BIOMASS SOURCES AND SETTING UP CONDITIONS TO STRENGTHEN THE APPR SUPPLY CHAIN.

Strategy: Weaknesses + Opportunities → **WO “Reorientation”**

W2. APPR is largely spatially dispersed and need to be collected over a wide land area. Strong seasonality in the harvesting operations.	O6. Local availability of agro-mechanical service companies as well as builders of processing facilities.
W4. Low degree of mechanization. Lack of knowledge on field mechanization.	O7. The “multifunctional” asset of current agriculture according to the most recent vision of “rural development”.
W12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source.	O8. Application of the EU “cross-compliance” with respect to farmers’ commitments.
W14. Distrust that farmers may be reliable in biomass supply.	O9. Valorisation and reuse of agricultural residues for bioenergy production.
W21. Structure of farms and farm size too small to allow a profitable pruning collection and use.	O11. Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example).
W22. Pruning is supposed to be not a by-product but a waste without any economic value.	O13. Funding schemes favouring the APPR sector in agriculture
W23. Farmers generally consider pruning residue as an obstacle to ordinary field management and usually their target is to dispose it in the most simple and economic way.	
W24. Pruning burning in open field is still considered an agronomic operation	
W25. Competitive agricultural use of pruning as soil amendment.	

Objectives

- WO8. Significantly increasing the availability of biomass from APPR farming management and preventing pruning misuse or waste.
- WO9. Mobilizing large amount of APPR feedstock and effectively use a large proportion of biomass potentially available.

Actions / Activities

- Advising, raising awareness and preventing improper treatments with respect to APPR management through information campaigns, news releases and publications, technical reports, etc.

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- Involvement and commitment of the regional farmers associations in disseminating the alternative concept of pruning energy use, the know-how about the technical pruning management to supply the energy market, the usefulness of the biomass-to-energy conversion to satisfy the energy community needs.
- Carrying out analysis on regional and local APPR availability and, consequently, proceed to the realization of technical maps of APPR availability. This is a preliminary knowledge to properly plan the APPR energy use and identify agro-energy districts within the region particularly suited to the setting up of supply chains and the installation of energy systems.
- Under no circumstances allow the APPR biomass can be considered a “waste” under the regional or national regulation and, if this happens, make a strong pressure to re-orient the decisions.
- Promoting the constitution of farmers’ cooperatives in order to significantly increase the “critical mass” of companies operating on the market and the total amount of APPR feedstock supplied to the market.
- Stimulating aggregation among farmers and the forming of “agro-energy clustering” or “agro-energy district” within specific regional areas. The advantage of “aggregation” is in the economy of services, in the sharing of common costs, in the decreasing costs of transports, in the stimulating milieu that increase the general level of entrepreneurship.

Target ⑧ PROVING THE FEASIBILITY OF THE APPR VALUE CHAINS AND ITS VALUE IN MICROGENERATION PROJECTS.	
Strategy: Strengths + Threats → ST “Defence”	
S1. Agriculture is a strong local productive sector, together with agro-food processing. S2. Large potential biomass availability at regional scale and very high local biomass spatial density. S4. Local operation of some real business cases and successful examples. S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass). S6. Using locally available resources is considered a priority.	T1. Actual low degree of pruning valorisation. T2. Biomass plant and energy facilities are still capital intensive. T3. Still large-scale economy are influencing the sector. T4. Competitive energy use from forest wood, crop residues or food-processing by-products as alternatives to pruning. T5. APPR biomass use is less competitive than other forms of renewable energies T6. Renewable energy more emphasized as power than heat generation. T7. Atmospheric emissions due to biomass thermochemical conversion are generally considered an environmental problem. T8. District heating is still an uncommon solution in municipalities (with exceptions).
Objectives ST1. Training activities through continuing professional development (CPD) and regional “task force” of technicians and consultants.	

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Actions / Activities

- Triggering a very attractive information activities made up of workshops, technical meetings, open field demonstrations, practical and applicative handbooks or guidelines having the aim to intensify the know-how and expertise about the APPR sector and its capacity to solve relevant needs concerning energy supply for households, farms, industries, commercial activities, etc.
- Demonstrations (permanent installations or during fairs and exhibitions) aimed at showing best case studies or exemplary applications about the use of APPR biomass or APPR energy generation systems, able to highlight the correct, convenient and useful application of such technological solutions. Demonstrations are finalized to increase the opportunities and possibilities to replicate the proposed examples, specifying the “key factors to success”.
- Technical assistance, testing on existing and innovative technologies, establishing connections between experts, operators, technical installers, stakeholders and community.
- Technical training allowing the acquisition of new competences and expertise in the bioenergy sector, with particular regard to new technologies and distributed model of energy generation.
- Forming a regional “task force” made up of properly trained technicians and selected consultants or experts to provide technical support to those entrepreneurs determined in developing new APPR projects.

Target ⑨ REACTING TO AN IMPROPER AND MISLEADING INFORMATION BY PROMOTING FULL AWARENESS AND SOCIAL ACCEPTANCE.

Strategy: Strengths + Threats → **ST “Defence”**

S1. Agriculture is a strong local productive sector, together with agro-food processing.	T7. Atmospheric emissions due to biomass thermochemical conversion are generally considered an environmental problem.
S2. Large potential biomass availability at regional scale and very high local biomass spatial density.	T8. District heating is still an uncommon solution in municipalities (with exceptions).
S3. Good level of potential employment offered by the APPR sector.	T9. Limited communication with civil society/public opinion and lack of promotional activities.
S4. Local operation of some real business cases and successful examples.	T10. No coherent policy, no strategic view on the APPR sector from local governments.
S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass).	T11. NIMBY syndrome (“Not In My Back Yard”).
S6. Using locally available resources is considered a priority.	T12. Risk of large fossils energy consumptions and GHGs emissions along the supply value chain and lack of environmental guidelines.
S11. Potential cost savings in field pruning management.	

Objectives

ST2. Filling the gap of knowledge by the public about the opportunities and potential offered by the development of the APPR sector in the region.

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ST3.	To increase awareness about the value and societal benefits of developing the bioenergy sector in the region.
Actions / Activities • Overcome lack of information for domestic end-users on available technologies and wood-fuels. • Spreading awareness about the APPR value chains and bioenergy projects. • Communication: presentation of the benefits of bioenergy based on APPR feedstock (both socio-economic and environmental) through workshops, community events, focus groups and forums, training activities, social media, on-line platforms, press releases, well-known and trusted opinion leaders, etc. • Dissemination: presenting successful cases, investing on an increase sense of responsibility of each person in front of his/her community, offering new opportunities of job, creating close-loop economies and energy self-sufficiency within the region. • Promoting a “domino effect” and creating a systemic change: attracting new affiliations, engaging new “franchisees”, generating an opinion movement. • Pressing for the achievement of law changes or transformations and the development of new forms of rules, closer to the community needs. • Communications among citizens and/or different communities facing common problems across different geographies can enable farmers and the general public to inform each other. Local networking and face-to-face communications has been proved to be very effective. This information may include data on the local financial and economic benefits of the bioenergy project, best practices, school presentations, exhibitions, workshops and press releases. In such events, local core competencies can be presented to the communities and publicly discussed.	

Target ⑩ MITIGATING THE ENVIRONMENTAL BURDENS ALONG THE BIOENERGY VALUE CHAIN, FROM FARMING OPERATIONS TO ENERGY CONVERSION.	
Strategy: Weaknesses + Threats → WT “Surviving”	
W24. Pruning burning in open field is still considered an agronomic operation W25. Competitive agricultural use of pruning as soil amendment. W26. Agronomic guidelines on soil and pruning management are still lacking. W27. Risk of soil depletion if APPR biomasses are not properly managed at field scale.	T7. Atmospheric emissions due to biomass thermochemical conversion are generally considered an environmental problem. T12. Risk of large fossils energy consumptions and GHGs emissions along the supply value chain and lack of environmental guidelines. T13. Pruning burning is not roundly forbidden by national/regional regulation. T14. The energy use from pruning is not adequately supported by the CAP.
Objectives WT1. Ensuring that bioenergy projects and APPR market developments do not adversely impact the environment and its ecological resources	

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Actions / Activities

- Many of the ecological and environmental impacts of bioenergy are associated with land use and land use change in connection to biomass production. In this respect, addressing crop residues (such as the APPR feedstock) to energy conversion has no implications in terms of “land use change” (LUC) and could be considered perfectly in tune with an ecological management of agro-systems. This sound ecological perspective should be clear and well known by farmers, APPR sector operators and public at large as well. Information campaign and technical dissemination on this issues should be organized in the shortest possible time.
- The biomass “extraction rate” of biomass from the fields (i.e. the amount of biomass removed and addressed to energy conversion) should be defined according to soil conditions, climate main characters, and farming management. A set of guidelines should be targeted to find the best balance ("trade off") between preserving soil organic matter (through biomass remaining in the soil) and displace fossil fuels (through biomass addressed to energy conversion).
- Working out innovative and ecologically sustainable management techniques of the fruit-tree plantations and orchards aimed to significantly reduce carbon (and carbon equivalent) emissions and preserve soil organic matter through a set of operations such as cover crops, soil amendments, minimum tillage, etc. A conservative approach to fruit growing should be defined and disseminated among farmers. This better soil conditions will allow a higher extraction rate of pruning residues from the field.
- Burning wood biomass implies emitting gases into the atmosphere. Public opinion is mainly alarmed by particulate matter (PM 10, for example) emissions, together with NOx, CO, OGC and PAH. Especially in the small and medium-scale heating sector, increased biomass utilisation should accompanied by further technology development towards low emission combustion systems. Significant improvement should be made on both biomass quality and technological advancement of boilers and energy plants.

Target ⑪ WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE.

Strategy: Weaknesses + Threats → WT “Surviving”

W12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source.	T4. Competitive energy use from forest wood, crop residues or food-processing by-products as alternatives to pruning.
W15. Pruning is considered a feedstock of too low economic value.	T5. APPR biomass use is less competitive than other forms of renewable energies
W22. Pruning is supposed to be not a by-product but a waste without any economic value.	T15. APPR market still underdeveloped.
W25. Competitive agricultural use of pruning as soil amendment.	T16. Imports of cheap biomass feedstock from outside the EU.
W28. Woodchip from pruning is of lower quality than from forestry.	T17. Price of oil and fossil fuels still quite low to promote competitiveness from bioenergy.
W29. A scarce number of ESCOs are operating	

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in the regional bioenergy sector.	T18. Lack of the right market driven incentives and subsidises. T19. APPR biomasses are still not included as potential biomass sources in some regional energy plan. T20. Market driven incentives and subsidises are progressively decreasing.
Objectives WT2. Trying to smooth and facilitating the biomass treatment and conditioning processes along the whole supply chain (from field to market) and obtain the best quality energy carriers as possible having in mind the starting feedstock conditions. WT3. Trying to promote the development of the APPR market by mitigating the effects of alternative and competing energy products and best attracting the final energy consumers.	
Actions / Activities • An overall market strategy should be launched and an effective connection between market supply and demand should be favoured. This could be achieved by the sector as a whole (considering the network of its key actors) with the support of public authorities and local governments. New consumers should be attracted in order to increase the use of APPR biomass as an ordinary energy feedstock. An affordable price and high quality standards are the key factors to be targeted. • Reviewing regulations and technical norms at regional level in order to relief some excessively stringent standards or rules, technically not justified, in the utilization of APPR biomass. • Providing evidences (with sound technical reports) about the fuel quality of energy carriers obtained from APPR biomass, even in comparison with well-known and already appreciated wood-fuels from forestry. • Proving the relevant benefit of a very high quality/price ratio of energy carriers obtained from APPR biomass with respect to other kinds of wood-fuels. • Conducting the elaboration of business plans to demonstrate the competitiveness or, at least, the substantial similarity of APPR energy carriers with respect to other kinds of wood-fuels from forestry or biofuels obtained from agro-food processing. • Encouraging the demand of APPR energy carriers on the market through an increased awareness and a direct commitment by retailers of domestic heating systems as well as by the technical staff in charge of their installation and assistance. • Carrying out information campaigns aiming at promoting the APPR energy products on the market and disseminating the message that they can properly meet the customers' needs. • Preserving the APPR quality and the consequent quality of the APPR energy carriers with respect to the biomass composition, heating value, contamination risks, standard compliance, etc. • Promoting the ordinary monitoring of the biomass quality (through analytical tests on samples) offering quality assurance and certifications to the consumer according to international quality standards. • Adopting a traceability system linking each commercialized biomass lot to the original	

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feedstock and to the field it was extracted.

- Investigating the potential role of chip-fed domestic boilers in promoting a local high-value market from APPR wood chips.
- Promoting the preparation of a regional energy plan on biomass sources specifically addressing the valorisation of APPR feedstock.
- Producing detailed GIS maps about local potential and technical APPR biomass availability, specifically indicating the areas where the spatial densities of APPR feedstock is higher. Those areas could be the focus of “agro-energy district” where investments on APPR conversion facilities should be favoured and sustained, especially by public municipalities.

Target ⑫ RESISTING THE COMPLEXITY OF THE REGULATION SYSTEM ON BIOENERGY AND THE LACKING OF A FARSIGHTED VISION ABOUT THE SECTOR.

Strategy: Weaknesses + Threats → **WT “Surviving”**

W1. Energy conversion from pruning is still considered an overall risky operation.	T10. No coherent policy, no strategic view on the APPR sector from local governments.
W7. Agro-industrial integration is hard to be achieved.	T21. High rate of law changes and great instability in energy policy decisions.
W9. Lack of integration of knowledge and efforts across sectors.	T22. Electricity more economically sustained than heat.
W19. Industrial investors are expecting very high profits and a fast payback time in the renewable energy sectors.	T6. Renewable energy more emphasized as power than heat generation.
W22. Pruning is supposed to be not a by-product but a waste without any economic value.	
W24. Pruning burning in open field is still considered an agronomic operation	

Objectives

- WT4. Promoting a strong simplification of administrative procedures but on condition that few and simple rules are clearly expressed as well as severely applied.
- WT5. A farsighted and coherent energy policy should be worked out by regional administration (even if the national and EU framework is highly influential).

Actions / Activities

- Promoting linking actions with the regional administrative agencies who are in charge of the wide range of authorizations procedures, in order to clarify the correct understanding and interpretations about the required compliance with the law.
- Significantly increasing the level of competences and knowledge in the public administration, specifically with respect to local and regional public entities, supporting the technical public committee in charge of discussing and evaluating bioenergy projects or initiatives.
- Encouraging “bottom-up” participatory processes in order to overcome local opposition to bioenergy projects, favouring a good level of knowledge and deep awareness on “pros” and “cons” about the project itself.
- Sustaining private investments with public funding, only if and where technological risks still

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exists, badly affecting the decision to invest.

- Create a secure and stable financial environment that does not create investment uncertainty. Local banks, credit funds and local chambers of commerce could play a role in this respect.
- Mitigate bureaucracy making things easier and encouraging local stakeholders in engaging new bioenergy initiatives.

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ANNEX A9

WP2 – Task T2.3

Performing an APPR Sector Analysis and Developing a Strategic Plan at National and EU level - Croatia

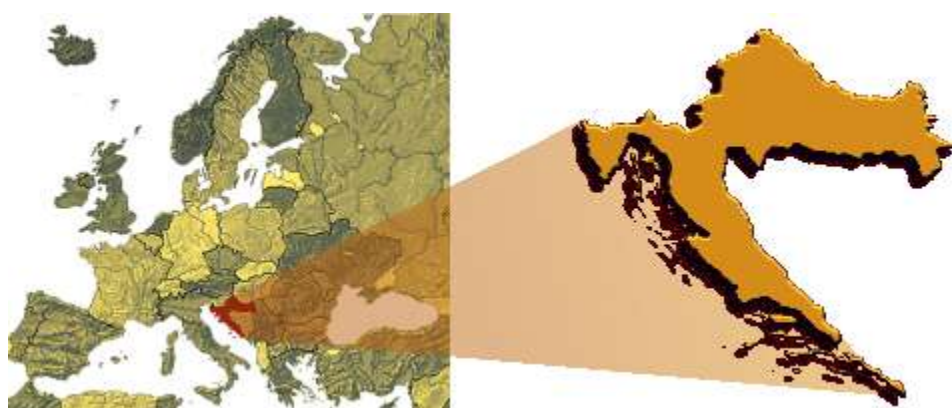
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SECTOR ANALYSIS

A. National framework on APPR sources - Croatia

The Republic of Croatia is located at the crossroads of the routes which connect Central Europe and the Mediterranean and it stretches arch-like from the Danube in the north-east to Istria in the west and along the Adriatic coast to Konavle in the south-east. Croatia is distinguished by natural and climatic diversities which have made it a popular tourist destination but also provided it centuries-old diverse agricultural production.

Figure 1. Map of Croatia



Box 1. Croatia in numbers

Total surface: 87 661 km²

Continental surface: 56 594 km²

Sea surface: 31 067 km²

Sea coast length: 5 835km

Islands, cliffs and reefs: 1 185

Population: 4 284.889 (Census 2011)

Rural population: 47.6%

Population density: 78.5/ km²

Capital: Zagreb

Official language: Croatian

Currency: kuna (100 lipa)

GDP per capita: 10.129 Euro

Forests: 44%

National parks: 8 (107 900 ha)

Nature parks: 10 (428 600 ha)

Sunny hours per year: 2 600

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With a land area of 56 594 km², it is the 19th largest country of the European Union. Due to the terrain and climate is an extremely diverse country. The APPR sector analysis in Croatia focuses on two different geographical regions: Slavonia - territory that covers spacious plains in the continental part between the rivers Drava and Sava (corresponding to a NUTS-2 region HR04: HR04A and HR04B) and Dalmatia - southern part of the long, indented and sunny coastline with more than 1000 islands (corresponding to a NUTS-2 region HR03: HR033).



Figure 2: Location of measurements in Croatia corresponding to NUTS-2 regions¹

Table

1.

	2015.	2016.	2015. = 100 Total production indices
Grapes, total (C 2410)			
Area, '000 ha	26	23	88.5
Production, total, t	154 227	123 651	80.2
Yield per hectare, t	5.9	5.3	89.8
Yield per vine, kg	1.7	1.3	76.5

Production of grapes in Croatia²

¹ Source:

<https://razvoj.gov.hr/UserDocImages/O%20ministarstvu/Regionalni%20razvoj/Nova%20statisti%C4%8Dka%20klasifikacija%20prostornih%20jedinica%20RH%20-%20NUTS%202.pdf>

² Source: Croatian Bureau of Statistics

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Table 2. Area of utilized agricultural land, by categories in ha (2015 and 2016)

	2015	2016	Indices <u>2016</u> 2015
Utilized agricultural area (UAA)	1 537 629	1 546 019	100.5
Arable land	841 939	872 406	103.6
Cereals	490 811	529 388	107.9
Dried pulses	2 254	3 273	145.2
Root and tuber crops	24 802	26 563	107.1
Industrial plants	167 140	178 974	107.1
Fresh vegetables and strawberries	8 837	10 180	115.2
Green fodder from arable land	113 674	107 444	94.5
Fallow land	33 725	15 924	47.2
Flowers and ornamental plants	300	300	100.0
Seed crops and seedlings	396	360	90.9
Kitchen gardens	2 150	1 885	87.7
Permanent grassland	618 070	600 000	97.1
Land under permanent crops	75 470	71 728	95.0
Orchards, vineyards, olive groves	74 799	71 060	95.0
Orchards	30 112	29 476	97.9
Vineyards	25 587	23 400	91.5
Olive groves	19 100	18 184	95.2
Nurseries	310	342	110.3
Osier willows and Christmas trees	361	326	90.3

Source: Croatian Bureau of Statistics

About Dalmatia region

Croatian coast has traditionally been oriented towards agriculture as the most important activity for existence of its inhabitants. Because of geographic position of Croatian coast, its landscape and climatic characteristics, some agricultural branches developed that have up to this day remained important for people's lives and for identification of Dalmatia. They are olive growing, grape growing, sheep breeding, pig breeding, and fruit growing. Olive growing has been traditional activity in this area since ancient times. Thanks to specific soil, climatic conditions and traditional way of processing, autochthonous sorts of wine grape give their maximum in these endemic geographical conditions.

About Slavonia region

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The economy of Slavonia is largely based on processing industry, trade, transport and civil engineering. Agriculture is a significant component of its economy: Slavonia contains 45% of Croatia's agricultural land and accounts for a significant proportion of Croatia's livestock farming and production of permanent crops.

CROATIAN AGRICULTURE IN GENERAL

Croatia has favourable agro-climatic conditions which enable diverse agricultural production. In a relatively narrow agricultural area, due to diverse climatic conditions, relief and soil, a large number of agricultural crops, starting from wheat and industrial crops to wine grapes and Mediterranean fruits and vegetables, are successfully cultivated. The farming structure consists mainly of small family farms which mostly produce for their own needs. Their share in market production is very low.

Detail agricultural statistical data for the period 2005-2016 are presented in Excel file. Source of data is Croatian Bureau of Statistics, FAOstat and Eurostat.

In the total structure of agricultural production in Croatia, arable crop production is the most significant. In the total structure of agricultural production in Croatia, cereal production is the most significant. During the period of 2003-2013, an average of 574,421 hectares was under cereals and 2.9 million tons were produced at the average. Grain maize and wheat are dominant cereals. For several years now, Croatia has been more than self-sufficient in the cereal sector and that mostly because the production of wheat is significantly larger than it is total domestic consumption. Croatia is a net cereal exporter. Oil seed crops (soy, sunflower and oil rape) and sugar beet are important industrial crop.

Fruit production in Croatia is mostly based on production located on agricultural farms and is mostly not market directed. In 2007 the fruit and vegetable sector represented 12% of the Gross Agricultural Output (GAO). Current circumstances of home fruit production do not satisfy even 50% of domestic needs. Apples and mandarins (tangerines) are the most frequent types of fruit.

In the segment of vegetable production, the dominant sorts are cabbage and with an average aggregate production of 30 thousand tons in the same period. Total vegetable production in a year 2013 was 167,429 tons. Self-sufficiency in vegetable production is very low, about 70%.

Livestock farming is present on the entire Croatian territory. The largest share of the production structure belongs to small family farms, whereat the importance of large production units, that is, of specialized farms in the market production has been rising fast in the last few years. Cattle farming is the most important branch of livestock farming, then pig farming follows as well as the significant poultry production and sheep and goat farming.

The farming structure consists mainly of small family farms which mostly produce for their own needs. Their share in a market production is very low. However, the largest share of market production is focused on large farms which are also the ones which have been growing at a fastest rate in the last years. With the application of the latest technologies and extensive investments and knowledge, extraordinary production results have been achieved on some of these farms in global perspective.

In Croatia 181,250 agricultural holdings were recorded in the 2007 FSS. 132,610 (73%) of these holdings had a standard output of over 1,200 €. While the number of holdings that had a Standard Output under 1,200 € represented 27% of the total number of holdings and 20% of the persons working on the holdings, they have share of 2% in terms of total UAA, total LSU, and total SO.

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The 132,610 holdings with a standard output of at least 1200 €, employed around 160,000 AWUs (Annual Working Units), the equivalent of 160,000 people working full time. The average area per farm was 6 ha. These holdings had 0.86 million Livestock Units (LSU) in 2007. On average each farm had 6.5 LSU. Amongst the 132,610 agricultural holdings in 2007:

- 47% made use of less than one AWU, while another 15% made use of two or more AWUs;
- 69% used less than 5 ha, while 1% used 50 ha or more;
- 58% were producing mainly for own consumption,
- 26% were specialists in various crops and livestock combined;
- 14% mixed livestock, mainly grazing livestock specialists;
- 13% specialist dairying;
- 9% were mixed cropping holdings.

Amongst the sole holders:

- 17% were women in 2007;
- 63% were aged 55 or more and 3 % were younger than 35 years (the tendency is towards ageing of the farm holders);
- 30% had another gainful activity in 2007;
- 57% of their agricultural area was owned by farmers.

The family labour force represented 97% of the people working on farms. The number of holdings decreased by 4% and the UAA by 7% since 2003.

Wine

Wine areas in Croatia were divided in two regions: Continental and Adriatic. Each one is characterized by different geographical, geological, agronomy and economy traits. Croatia is actually rare country where one could find such a variety of climate and terroir on such small area. There is also large value in autochthonous varieties that give market identity, significance in tourism, agricultural income and rural employment. Growth of the number of hectares under vineyards have been reached in the second half of the last decade (2005-2010) when Croatian government started with the support program for raising permanent crops (so called Operational plan). About 7,000 hectares of new vineyards has been established. In the Republic of Croatia, in 2011 there were 32,485 ha of vineyard areas, grape production of 204,373 t and wine production of 1,410,000 hl. Annual average wine consumption per household member in Croatia was 10.10 litre. Wine export was on the level of 58,196.26 hl while import in 2012 was on the level of the 148,731.63 hl.

Family farms hold the highest share in of the vineyard areas. Family farms are weak link in the wine sector. They are loaded with the problems of economy of scale, management and marketing knowledge, wine technology, bargaining power toward powerful retail chains, indebtedness and access to the capital. Similar applies to other types of organization involved in wine business (companies and cooperatives).

Olive oil

As regards the number of employed farms (around 40 thousand), olive growing is one of the most evidenced agricultural branch. Just as in wine growing, there is a large number of semi-subsistence farms. The history of production is over two centuries old and the widely-known quality of olive oil from Croatian territory dates back to Roman times. Olive growing and wine growing have another

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common feature, in comparison with the period before the Second World War, the number of olive trees was few times as higher than it is today. The period of destruction of the olive groves and stagnation of their production lasted until some 15 years ago when a recovery ensued owing to, among other, systematic state aid programs. Out of total olive oil production (average 60 thousand hl) direct consumption and direct sale on family farms is still the most important part. The positive trend of production expansion was also influenced by consumer awareness as regards the health and nutritional value of olive oil, especially in the last few years. The largest share of olive production belongs to the indigenous variety of "Oblica" but there are also other domestic and foreign varieties. Although their production volume is modest, Croatian olive oils are included in some of the top world olive oil catalogues.

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- Obrada statističkih podataka o PROUN-u kako bi se upoznao status i potencijal biomase u Hrvatskoj (tj. površina uključena u plantaže voćaka i gruba procjena količine sirovine dobivene iz PROUN ostataka).

During the past few years, the global interest in renewable energy sources, especially energy from biomass, has been growing significantly. The same is in Croatia. There are several reasons for this: biomass is a renewable resource that is largely available and has a good potential as a source of energy products, such as electricity and heat as well as liquid fuels.

In Croatia relevant information on APPR potential availability do not exist. Due to recent uP_running measurements done in fruit tree plantations (olive trees and vineyards) we can give some estimations. Many farmers showed interest in using biomass for their own use. They want to know more and some of them investigate the best possibilities and good practices for their usage.

In some plantations, farmers did more than one pruning per year. Taking into account that some grape, olive or fruit variety are more vigorous than others APPR potential is huge.

The available data on pruning in Croatia is pretty scarce so analysis of national potential of the APPR availability will be based on estimations from the study „*Energy potential of fruit tree pruned biomass in Croatia*“ by N. Bilandzija, N. Voca, T. Kricka, A. Matin and V. Jurisic (2012.) financed by Ministry of Agriculture, Fisheries and Rural Development of the Republic of Croatia. The main aim of this analysis was to establish the quantities of combustible and non-combustible matters in pruned biomass of all significant woody fruit crops in the territory of Croatia and to calculate, based on the obtained data, the energy potential of pruned biomass of the observed crops. Given the fact that norms for energy utilization of pruned biomass from different fruit crops have not been defined yet, the authors of the study state that the analysis results were weighed against the values applicable to broad-leaf wood under the norm ISO CEN/TS 14961 (2005), because this biomass category is most similar to the investigated crops. As this data are showing certain discrepancies they must be used with caution as well as the results obtained in this study. The authors also argue that according to the Croatian energy strategy of 2010, the Croatian energy consumption in all sectors would be around 310.6 PJ and if potential energy from pruned biomass of 4.21 PJ is accounted, it can be calculated that this sector of agriculture contributes to the energy independence of Croatia and to the country's meeting the biofuels targets in total consumption with slightly more than 1%. In the following text, examples will be shown why the estimated value of pruned biomass (Bilandzija et al, 2012) should be taken with consideration.

Table 3. The highest possible amount of pruned biomass from intensive farming areas in Croatia

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Crop	Planting distance (m)	Number of trees or vines	Number of trees or vines ha ⁻¹	Average biomass (kg per tree or vine)	Total biomass (kg ha ⁻¹)
Apple	3.50 × 1.20	15,684.500	2,375	2.34	5,557.5
Pear	3.50 × 1.20	1,149.500	2,375	2.45	5,818.7
Peach and nectarine	5.5 × 4.5	486.325	397	7.23	2,870.3
Apricot	6.5 × 5.5	87.920	280	5.79	1,621.2
Sweet cherry	6.5 × 6.5	281.732	337	5.90	1,988.3
Sour cherry	5.5 × 4.5	981.720	404	5.37	2,169.5
Plum	6.5 × 5.5	1,331.120	280	7.34	2,055.2
Walnut	8.5 × 7.5	1,090.365	157	3.43	538.5
Hazelnut	5.5 × 3	1,137.462	606	3.05	1,848.3
Almond	6.5 × 5.5	127.400	280	5.81	1,626.8
Fig	6.5 × 5.5	110.320	280	4.58	1,282.4
Olive	6 × 6	4,161.938	278	9.08	2,524.2
Grapevine	1.90 × 1.10	162,554.000	4,781	0.89	4,255.1

Source: Bilandzija, N. et.al (2012)

Table 4. Potential amount of useful energy from investigated crops

Crop	MJ tree ⁻¹ / grapevine ⁻¹	MJ ha ⁻¹	Potential of Croatia (TJ)
Apple	39.92	94,814.75	626.13
Pear	41.05	97,498.50	47.17
Peach and nectarine	128.16	50,881.10	62.32
Apricot	89.22	24,981.88	7.84
Sweet cherry	98.86	33,315.82	27.85
Sour cherry	91.99	37,167.19	31.07
Plum	125.33	35,092.40	166.82
Walnut	55.93	8,781.01	60.90
Hazelnut	53.28	32,287.68	60.60
Almond	102.42	28,678.72	13.04
Fig	71.45	20,006.28	7.88
Olive	153.50	42,672.16	638.84
Grapevine	15.17	72,546.89	2,466.59
Total			4,217.05

Source: Bilandzija, N. et.al (2012)

Biomass is still dominant in Croatia in the form of firewood, in the way that our ancestors were doing - in small, energy-inefficient furnaces that are questionable both by economic and health perspective. The Croatian fruit growers in general do not have experience in preparation and use of pruned biomass for producing energy. Positive example of producing modern biofuels in Croatia is production of wood pellets that are, sadly, mainly exported. Pellet consumption depends primarily on the house itself, on the infrastructure (the quality of isolation and carpentry) but for a household that uses a kiln of 8.5 or 10 kW, a maximum of 15 kg of pellets per day is needed, the price of which is 25 HRK including VAT.

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According of the performed measurements in vineyards, olive trees plantation, uP_running researchers concluded that there is significant potential of available agro biomass in Croatia but lack of knowledge, and inappropriate agricultural practices lead to unfavourable behaviour with biomass. Many farmers consider that prunings are surplus waste in their agricultural production. Otherwise, there are positive cases who believe in strong potential of their biomass waste and their implementation in biomass value chains.

Orchards and vineyards require annual pruning, which gives large amounts of biomass that might be available as a source of bioenergy. Obtained amount of vineyard residues shows amount of around 2 tons per hectare. Amount of pruning obtained in olive trees plantations shows estimation of 1.7 – 2.5 tons per hectare (Bilandzija et al.2012)

Another source of information used was the PhD thesis of Biljana Kulišić³. Her work develops concept of agricultural biomass potential assessment by linking the limitations of agricultural production with desirable features needed for energy supply. The concept treats potential as a decision-making problem with several mutually exclusive solutions. Potential is expressed at three levels: theoretical - applying statistical methods; technical - applying fuzzy analytic hierarchal process (FAHP) and economical by attributing referent values.

Table 5. Total technical potential from agricultural biomass in the Croatia

primary energy	PJ/year	GWh/year
Harvest remains/ wheat and maize	7.35	2 041
APPR	1.06	294
Poultry manure	1.77	493
Total	10.17	2 828

Source: Kulišić (2013)

If compared with Bilandzija et al, the APPR potential is reduced to a quarter.

³ Kulišić, B. (2013). Multi Criteria Evaluation of Energy Potential from Agricultural Biomass in Croatia. Doctoral thesis. University of Zagreb Faculty of Agriculture.

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- Istraživanje (ukoliko bude dostupno) kako karakteristike pojedinog nasada te agrotehničke i pomotehničke mjere utječu na količinu raspoložive PROUN biomase. Navesti neke procjene i objasniti razlog nedostatka informacija).
- Pružanje dodatne informacije o neto dostupnosti s obzirom na tehniku berbe i učinkovitost prijevoza, ili uzimajući u obzir posebna gospodarska ograničenja, primjerice zbog dostupnosti i troškova na terenu (ukoliko nema podataka, dati procjene i objasniti nedostatak informacija).

Biomass from pruning is mainly neglected as a source of renewable fuel in Croatia. The common value chains would be disperse from wasting its energy by burning prunings at open field close to the grove to utilizing pruning against frost (wet burning under the tree crowns), ignition wood for barbeque and space heating and/or fuel wood for distilling spirits in home production. Apart of these value chains, pruning is also left aside to rotten at grove. A survey among perennial crop grove owners would be needed to attribute a percentage on common use value chains would be. The use of pruning as well as their availability would reflect local conditions, both in terms of relief and mentality.

According to the Croatian Bureau of Statistic (CBS), land under perennial crops (orchards, vineyards, olive groves) had 71,060 ha or 4.5% share in total utilized agricultural land in 2016, with a 5% drop from 2015.

Table 6. Land under perennial crop related to PROUN sector

Perennial crop land	2015	2016	2015/2016
Orchard	30,112	29,476	97.9
Vineyard	25,587	23,400	91.5
Olive groves	19,100	18,184	95.2

Source: Croatian Bureau of Statistics, www.dzs.hr

Croatia is a little in area (56,594 km²) but diverse country with three main climate zones: continental at norther plains and northwest hills, mountainous in the middle and Mediterranean climate on the coast and numerous islands on the south. Geography and climate determine the size and density of the perennial groves as well as fruit species assortment.

Detail statistics of perennial crops in Croatia (from three different data base) have been added as an Excel file.

Orchards

Orchard pruning residues would vary by fruit species and type of grove (intensive, extensive). The area planted with fruits that are pruned remains steady over the five-year period (Figure below).

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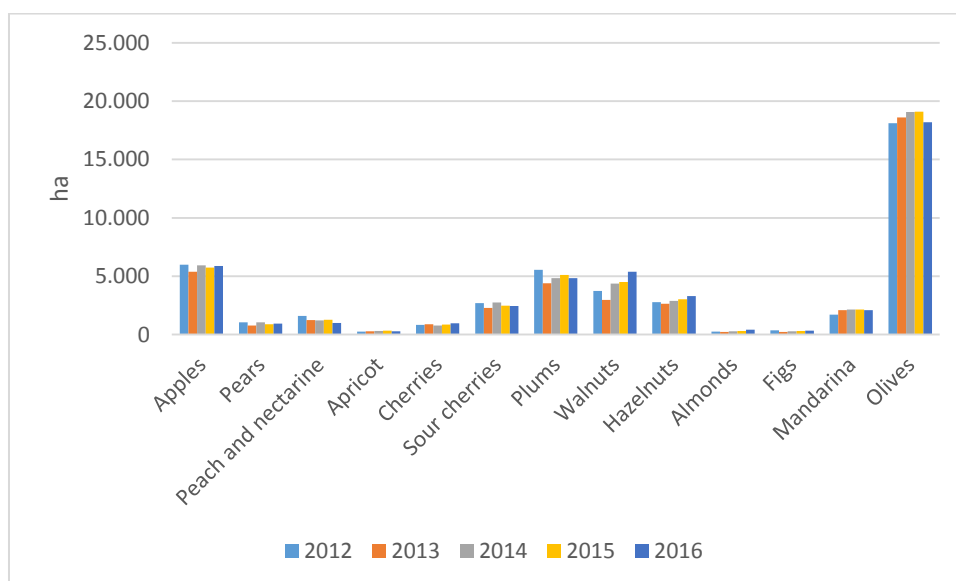


Figure 3 Five year trend of fruit varieties area in Croatia

Source: Croatian Bureau of Statistics, www.dzs.hr

Example 1: Apple Orchards

The following examples of apple grows indicate that approximation of quantity of PROUN per hectare is not a reliable method to estimate biomass potential. The difference between plots in Vrtovi voća d.o.o. and Ivković are in density of planting distances. One has planted 3.50x1.20 distance and the other one 3.20x1.20 distance. The difference between both intensive apple groves records 10% difference in PROUN potential.

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Figure 4 Intensive apple grove (Vrtovi voća d.o.o., 30ha)⁴

⁴ Source of the photos is GoogleSearch if not indicated otherwise.

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Figure 5 Intensive apple grove (Ivković, Pleso 11ha)



Figure 6 Traditional apple grove

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CBS doesn't provide data on orchard sizes which could be relevant to address in terms of own PROUN consumption and placing PROUN on the market.

Vineyards

Vineyards' design on the north is far different than the vineyards on the south. There are some 300 official wine regions divided into coastal and interior wines. The majority (68%) of wine is white and produced in the interior while 31% is red and produced along the coast. A random selection of vineyards in Croatia, figures below, indicate the difficulty to estimate the amount and availability of pruning from vineyards as all differ in density, row distance and slope. To make estimation even more difficult, wine varieties are pruned differently with short, mixed or long cuts. Figures 1-3 depict showcases from continental part of Croatia and the following figures reflect showcases of vineyards from the Mediterranean part of Croatia.



Figure 7 Kutjevo vineyards at north Croatia (Grasevina)



Figure 8 Knezevi vinogradi vineyards at north-east Croatia (Grasevina, Reizling),



Figure 9 Vineyards at Zagorje region



Figure 10. Vineyards at Brod-Posavina County

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Figure 11 Vineyard at Splitsko-Dalmatinska County, southern coast of Adriatic sea (Plavac)



Figure 12 Vineyards at the peninsula Peljesac, southern coast (Dingac and Postup)



Figure 13 Vineyards of Istria, northern coast (Merlot, Terrano, Malvazia)



Figure 14. Vineyards of the island of Krk, north Adriatic (Zlahtina from Vrbnik)



Figure 15. Olive groves in Dalmatia (source: author's collection)

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Table 7. Vineyard structure in Croatia

Vineyard – wine state	Continental Croatia			Mediterranean Croatia		
	Family farms (no.)	Area (ha)	Average size of vineyard (ha)	Family farms (no.)	Area (ha)	Average size of vineyard (ha)
Productive	22,221	9,438.36	2.35	15,843	9,348.78	1.69
Total	28,895	10,590.45	2.73	17,173	9,802.37	1.75

Source: Croatian Bureau of statistics

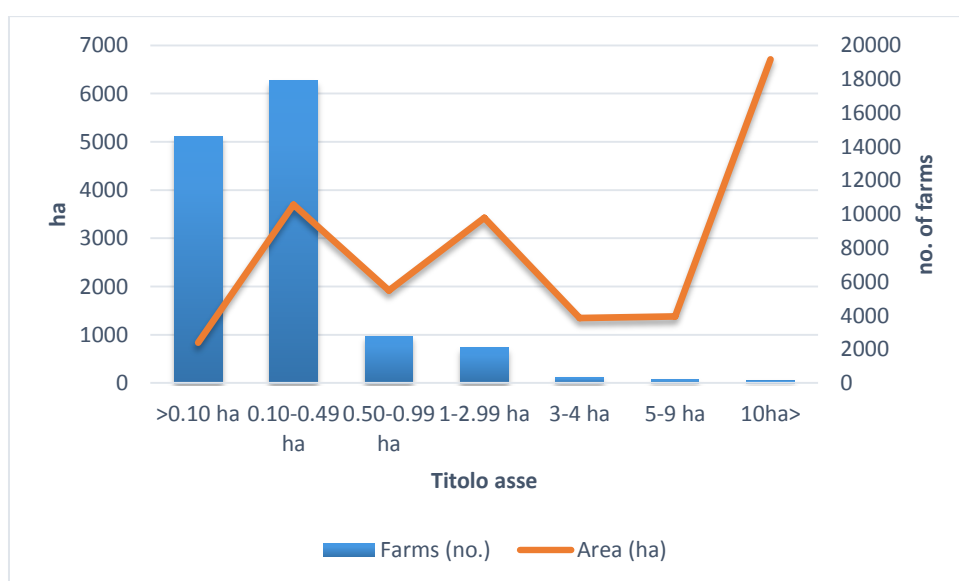


Figure 16 Relationship between area coverage and number of farms under vineyards in Croatia

Source: Croatian Bureau of Statistics, 2015

Assuming a minimum 5 kW stove needed for space heating, with 1800 heating hours per year and 80% efficiency, a household would need 322 kg of vine pruning per year which could be collected from 0.075 ha, if 4,255.1 kg/ha used (Bilandžija et al. 2012). Under that assumption, even parcels less than 0.10 ha would have excess PROUN to place at the market. To be on the safe side, let's assume that all farms under 0.5 ha would have use PROUN for own consumption, whether it is heating, anti-frost measure or barbeque. The remaining farms would have sufficient PROUN quantities to place it on the market for further processing (pellets, chips). The available PROUN potential would be 62.95 t/year at 9.7 MJ/kg energy value, ending up with 0.61 PJ/year.

On the other hand, the example from Kutjevo vineyards reports 1/3 of the PROUN biomass per ha than at research done by Bilandžija et al.2012: 1,508 kg/ha.

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Example2: Vineyards of Kutjevo in Function of Renewable Energy

Pruning obtained on Welsh Riesling grape varieties in vineyards Kutjevo can get about 2052.48 tonnes of biomass (based on the experiment obtained during 2009 and 2010.)

Varieties	Area, ha	No. of trees
<i>Welsh Riesling</i>	930,8228	3947082
Other varieties	430,1731	1979916
Total	1360,9959	5926998

Economic potential (assumptions)

- Without organized buy-out
- Biomass price is about 40 EUR per tonnes
- Additional revenues per ha of vineyard is 600 HRK (
- Kutjevo vine area has a total potential of 3,800 tonnes of biomass
- Fruit growing activities about 3.000 t
- $6800 \text{ t} * 40 \text{ €} = 272.000 \text{ €}$

Sources:

Jakobović, M. and Jakobović, S. (2011) and Jakobović, M. and Kiš, D.

Olive groves

According to the Croatian Bureau of Statistics currently, we have 18,184 hectares of olive groves. After years of growth, areas under olives stagnates in the period from 2012- until today. The statistical methodology was different before Croatian accession to the EU. CBS collected data on the number of olive trees. According to the data, in 2004 there were 3.743.000 olive trees (Statistical yearbook 2005) planted on 16.980 ha from which 16.685 ha own family farms and 295 ha are from legal entity, parts of legal entity and plantations on the state property (source: Project IEE M.O.R. E., Market of Olive Residues for Energy).

A number of hectares and olive trees currently is difficult to estimate. Numerous web sources give different data from different periods (area varies from 5,500 to 28,000 hectares and number of tree is somewhere 5,5 million). To avoid speculations, the estimation of PROUN potential will continue on official statistics.

Annual production of olive oils is about 35.000 hl per year (CBS). Data on pruning availability is collected from secondary sources.

(<https://ec.europa.eu/energy/intelligent/projects/en/projects/more>) differentiate three production systems: 1) traditional groves, 2) more managed traditional plantations and 3) intensive, generally recent, more mechanized. Those systems generate residues like bark wood, wood pellets, branches, olive pomace and vine, pits and other wood production waste).

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Based on the number of hectares and production and data from Cavalaglio G. and Cotana S.(2007)⁵ we could calculate for olives 1.7 tons of residues per hectare or ration between residues and product between 0.5 and 2.6 (wet basis).

Number of hectares (18,184) x 1,7 tones= 30,912.80 tones

Production of olives (31,183 tonnes) (CBS, 2016) x 1.55 (average between 0.5 and 2.6) = 48,333.65 tones

Available data on pruning availability in Croatia is scarce. What is available is several estimations of one (e.g. olive residues) or all (e.g. residential heating biofuels) pruning sources originated within EU funded projects, doctor dissertation and a paper. The sources of estimated pruning potential in Croatia are (organised chronologically):

- IEE M.O.R. E., Market of Olive Residues for Energy
- Bilandžija N. et al. Energy potential of fruit tree pruned biomass in Croatia, 2012
- Kulišić, B.: A multicriteria assessment of biomass from agriculture energy potential in Croatia, doctoral thesis, Univeristy of Zagreb Faculty of Agriculture, 2013.
- FP7 EuroPruning New logistic chain on biomass from pruning <http://www.euopruning.eu/>,
- IEE: Succelog - Triggering the creation of biomass logistic centres by the agro-industry www.succelog.eu
- H2020: BiomasSud Developing the sustainable market of residential Mediterranean solid biofuels. <http://biomasudplus.eu/>
- H2020 up_Running: Take-off for sustainable supply of woody biomass from agrarian pruning and plantation removal; www.up_Running.eu.

Table 8. Estimation of total APPR

orchards	Area*	residues, t/ha**	Total, t	production, t*	residue/product, t (wet basis), lower value**	Total residues, t
Apple	5.890,00	2,40	14.136,00	44.176,00	0,10	4.417,60
Pears	933,00	2,00	1.866,00	3.818,00	0,10	381,80
Peach	1.033,00	2,90	2.995,70	4.619,00	0,20	923,80
Citrus	2.192,00	1,80	3.945,60	52.668,00	0,10	5.266,80
Almonds	430,00	1,70	731,00	154,00	1,90	292,60
Hazelnuts	3.304,00	2,80	9.251,20	1.254,00	1,90	2.382,60
Vineyards	23.400,00	2,90	67.860,00	123.651,00	0,2-0,8	24.730,20
Olives	18.184,00	1,70	30.912,80	31.183,00	0,5-2,6	15.591,50
			131.698,30			53.986,90

*Croatian Bureau of Statistics 2016, ** Cavalaglio G. and Cotana S. 2007

Source: author's calculation based on Kulišić (2013) approach

⁵ Cavalaglio G., Cotana S. (2007) Recovery of Vineyards Pruning Residues in an Agro-Energetic Chain <http://www.crbnet.it/File/Pubblicazioni/pdf/1450.pdf>

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The planting plots stated above are theoretical and would vary between two main regions in Croatia: continental and Mediterranean area, to say the least. It is reasonable to assume that smaller and older groves have less standardised plots while the plots intended for commercial fruit production follow the standards. Yet, the plot distances stated above are more related to extensive agriculture than intensive fruit plots with much denser number of trees per hectare.

In 2017, Croatian Bureau of Statistics (CBS) has expanded the common questionnaire for energy use in households and family farms with biomass use, including data on pruning. The survey is to be implemented in 2018 with results by the end of 2018. In other words, a valid statistical data on pruning material and its use in Croatia would be available in a near future.

It is reasonable to assume that small land plots would opt for short value chains and use PROUN as own heating fuel. In that sense, the only barrier is cultural and relies on manpower willing to cut and transport PROUN from grove to the household. Yet, previously mentioned competing use of PROUN for frost prevention, barbeque and spirit distilling are also valuable use of PROUN. Assuming that owners of larger plots or commercial fruit producers would opt for longer value chains and use PROUN as a raw material to producer either wood chips, wood pellets or agro pellets (a combination of woody and straw, corncob type of biomass), a feasibility study would be needed to raise awareness of this business opportunities.

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uP_running Observatory map of biomass from agrarian pruning and plantation removal- summary of results for Croatia

Table 9. uP_running Observatory map of biomass from agrarian pruning and plantation removal- Continental Croatia

Region	Osijek Baranja County	Osijek Baranja County	Osijek Baranja County	Osijek Baranja County	Brod Posavina county	Brod Posavina county	Brod Posavina county	Brod Posavina county	Brod Posavina county	Brod Posavina county
Municipality	Karanac	Karanac	Karanac	Karanac	Oriovac	Oriovac	Oriovac	Oriovac	Oriovac	Oriovac
Field size	16.43	23.13	7.45	24.28	1.5	1	0.29	1	0.05	1
Crop species	vineyards	vineyards	vineyards	vineyards	vineyards	vineyards	vineyards	vineyards	vineyards	vineyards
Variety of crop	Merlot	Welsh Riesling	Welsh Riesling	Welsh Riesling	Welsh Riesling	Cabernet Sauvignon	Chardonnay	Cabernet Sauvignon	Merlot	Cabernet Sauvignon
Age o crop	13	11	12	12	32	12	9	12	9	12
Tress/ha	4145	4423	4831	4125	7000	4000	4000	4000	4500	4000
Distance	2.8x0.8	2.8x0.9	2.8x0.10	2.8x0.11	2.4x1	2.4x0.8	2.4x0.8	2.4x0.9	2.4x0.8	2.4x0.8
Crop form	Espalier	Espalier	Espalier	Espalier	Vase	one side guyot	Vase	one side guyot	Vase	one side Guyot
Slope. %	6	6	6	6	10	10	16	10	10	8
Soil cover	100% grass cover	100% grass cover	100% grass cover	100% grass cover	Bare	100% grass cover	seasonal occurrence	100% grass cover	Seasonal occurrence	50% grass cover
Yield. t/ha	9.13	10.835	10.07	11.5	7.5	8	5	8	6	8
Crop yield before measurement. t/ha	9	9.772	8.5	11.37		6.5		6.5		6.5
Irrigation	rain fed	rain fed	rain fed	rain fed	rain fed	rain fed	rain fed	rain fed	rain fed	rain fed
Intensification degree	intermediate	intermediate	intermediate	intermediate	intermediate	low	intermediate	low	intermediate	low
Type of pruning	M.S.R	M.S.R	M.S.R	M.S.R	M	M	S	M	S	M



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Pruning method	only manually	only manually	only manually	only manually	only manually	only manually	only manually	only manually	only manually	only manually
Pruning operations	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears
Season of pruning	December. January. February. March	December. January. February. March	December. January. February. March	December. January. February. March	January. February	January. February. March	February. March	January. February. March	February. March	January. February. March
Frequency of pruning	annual	annual	annual	annual	annual	annual	annual	annual	annual	annual
Was this type of pruning as usual	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Describe the amount of pruning produced to the other years	same	same	same	same	same	same	same	same	same	same
Date of measurement	28.02.2017	28.02.2017	28.02.2017	28.02.2017	28.02.2017	27.02.2017	27.02.2017	27.02.2017	27.02.2018	27.02.2017
Amount of pruning obtained. t/ha	1.6	1.3	0.7	1.5	2.15	2.72	1.9	2.26	2.06	2.59
How many days the pruning were on soil before measuring	4	2	3	4	2	4	7	2	2	3
Moisture content. %										

Source: <http://www.up-running-observatory.eu/en/>



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Table 10. uP_running Observatory map of biomass from agrarian pruning and plantation removal- Continental Croatia (cont.)

	Continental Croatia					
Region	Bjelovar Bilogora County	Bjelovar Bilogora County	Bjelovar Bilogora County	Bjelovar Bilogora County	Bjelovar Bilogora County	Bjelovar Bilogora County
Municipality	Daruvar	Daruvar	Daruvar	Daruvar	Daruvar	Daruvar
Field size	6945	836	6.604		314	1877
Crop species	Walnut	cherries	apples	plum	apricot	hazelnuts
Variety of crop						
Age o crop	7	7	7	7	7	7
Tress/ha	157	337	2375	280	280	606
Distance	8.5x7.5	6.5x6.5	3.5x1.2	6.5x5.5	6.5x5.5	5.5x3
Crop form	Vase	Vase	Palm/fan	Vase	Vase	Vase
Slope. %						
Soil cover						
Yield. t/ha						
Crop yield before measurement. t/ha						
Irrigation	rain fed	rain fed	rain fed	rain fed	rain fed	rain fed
Intensification degree						
Type of pruning						
Pruning method	only manually	only manually	only manually	only manually	only manually	only manually
Pruning operations	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears
Season of pruning						
Frequency of pruning	annual	annual	annual	annual	annual	annual
Was this type of pruning as usual						
Describe the amount of pruning produced to the other years						
Date of measurement	2009	2009	2009	2009	2009	2009
Amount of pruning obtained. t/ha	0.54	1.99	5.56	2.06	1.62	1.84

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How many days the pruning were on soil before measuring						
Moisture content. %	45	45	45	45	45	45

Source: <http://www.up-running-observatory.eu/en/>

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Table 11. uP_running Observatory map of biomass from agrarian pruning and plantation removal- Adriatic Croatia

Region	Zadar County	Zadar County	Zadar County	Zadar County	Zadar County	Zadar County	Zadar County	Split Dalmatia county	Split Dalmatia county
Municipality	Zadar	Zadar	Zadar	Zadar	Zadar	Polača	Polača	Marina	Marina
Field size	1.877	34000	394	14971	455	5	10	1	0.1
Crop species	peaches	vineyards	fig	olives	almonds	olives	olives	olives	olives
Variety of crop						oblica. ascolano. carolea. leccino	oblica. ascolano. carolea. leccino	oblica	oblica
Age o crop	7	7	7	7	7	10	10	13	30
Tress/ha	397	4781	280	278	280	260	260	200	180
Distance	5.5x4.5	1.9x1.1	6.5x5.5	6x6	6.5x5.5	6.5x6	6.5x6	8x7.5	9x8
Crop form	Vase	Espalier	Vase	Vase (one stem)	Vase	Vase (one stem)	Vase (one stem). polyconic vase	Vase (2-3 stems from soils)	Ancient olives
Slope. %						5	1	0	0
Soil cover						Bare	stony soil	seasonal occurrence	seasonal occurrence
Yield. t/ha						4.5	2.6	6	3.5
Crop yield before measurement. t/ha								4.5	3.5
Irrigation	rain fed	rain fed	rain fed	rain fed	rain fed	rain fed	partial irrigation	rain fed	rain fed
Intensification degree						organic	organic	organic	organic
Type of pruning						M. S	M.S		M.S. R
Pruning method	only manually	only manually	only manually	only manually	only manually	only manually	only manually	only manually	only manually
Pruning operations	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears	Manually shears

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Season of pruning						February. March. April. August	February. March. April. August	February. march	March
Frequency of pruning	annual	annual	annual	annual	annual	biannual	biannual	annual	annual
Was this type of pruning as usual						yes	yes	yes	yes
Describe the amount of pruning produced to the other years						same	more	same	same
Date of measurement	2009	2009	2009	2009	2009	09.03.2017	10.03.2017	08.03.2017	08.03.2017
Amount of pruning obtained. t/ha	2.87	4.26	1.28	2.52	1.63	2.45	1.26	1.63	2.52
How many days the pruning were on soil before measuring						1	1	1	1
Moisture content. %	45	45	45	45	45				

Source: <http://www.up-running-observatory.eu/en/>

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- Istraživanje nacionalnog energetskog plana (ukoliko postoji) i uloge sektora biomase u istom.

The Croatian Strategy of Energy Development states that the Republic of Croatia belongs to countries with a high potential of biomass. In accordance with the objectives of the Waste Management Strategy, the potential of waste from biological origin for energy production is especially valued.

Croatia's target to increase share of renewable energy by 20% in annual gross energy consumption of the country by 2020 defined in the National Energy Strategy 2009 – 2020. Croatian National Energy Strategy 2009-2020 has three basic objectives: 1) increase security of energy supply, 2) develop competitive energy system and 3) ensure sustainable energy sector development. These objectives are particularly important due to Croatia's dependence on energy imports which results in country's vulnerability to energy prices volatilities. Croatia imports about half of its primary energy demand. Total primary energy production is about 225.66 PJ/year and depending on rainfall.

The Croatian Strategy of Energy Development determined the goal of using around 15 PJ of biomass energy in 2010, and in 2020, about 26 PJ. Part of this biomass will be used in a many powerhouses on biomass of total power of about 85 MW in 2020.

In order for the Republic of Croatia to meet its goals regarding the use of biomass, cooperation between several ministries is inevitable.

Through cooperation of ministries, Croatia should set the preconditions for development into incentive measures of state, industry, agriculture and energy policies such as:

- The development of the Croatian wood processing industry will be encouraged;
- Forest management will be developed and forest exploitation can be exploited;
- Reforestation and breeding of short-range crops will be encouraged on forest land;
- Biomass power plants will be stimulated with cogeneration of electricity and heat;
- The use of biomass for the production of heat energy will be encouraged.

Targets for 2020:

- decrease by 20% greenhouse gas emissions by 2020 taking emissions level of 1990 as a baseline;
- increase share of renewable energy by 20% in annual gross energy consumption of the country by 2020;
- cover 10% of energy consumption in all transport sector with energy derived from renewable sources by 2020;
- decrease final energy consumption by 9% by 2016.

This will allow to meet electricity consumption demand with domestic production.

Targets:

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- **Biomass:**

– Use of 26 PJ of biomass by 2020. Part of this biomass will be used in biomass power plants in 2020 of about 85 MW total power.

- **Biogas:**

– From agricultural production for energy purposes, use an equivalent of at least 20% of total conditional thresholds and thus produce about 2.6 PJ of energy from biogas or about 100 million m³ of biogas in 2020.

- **Wind energy:**

– Install 400 MW in wind power by 2020.

- **Large hydroelectric power plants:**

- Build new or increase power in existing hydro power plants in the amount of 300 MW by 2020.

- **Small hydroelectric power plants:**

– Construction of at least 100 MW of small hydro power plants by 2020.

- **Geothermal energy:**

- Economically justified exploitation of existing geothermal wells and economically advantageous drilling for the use of geothermal energy and exploitation of medium temperature reservoirs for development.

- **Solar Energy:**

- Install 52 MW in photovoltaic systems by 2020

The Energy Development Strategy of the Republic of Croatia has defined the framework objectives for renewable energy sources (RES). Given the economic and financial crisis, economic growth forecasts and direct energy consumption have not been achieved, so the goals set out in the Energy Development Strategy have been adjusted and adapted to the new situation and plans. Concerning the above, the RES targets considered under the revised Action Plan are set so that they are feasible, taking into account technical and financial elements and the ability to connect to the power grid. There was a risk that the project will not be realized due to the inability to connect to the power grid, but the risk is removed so it doesn't limit future projects of any technology if secure network operation is maintained or maintain the same level of security of supply. By adopting the Third Package of Energy Legislation in the national energy legislation, significant changes are being made in planning further affirmation of the RES, while still taking into account the security of supply and security of the power system itself.

The targeted shares of the three sectors heating/ cooling, electricity and transport are shown in table below

Table 12. Croatia's 2020 renewable energy targets

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Sector	Share in gross final consumption per sector
Overall target	20 %
Heating and cooling	19.6 %
Electricity	35 %
Transport	10 %

Source: National Renewable Energy Action Plan

To achieve the RES target, quotas are set for each renewable energy source.

Table 13. Electricity production by renewable energy source in relation to the quota fulfilment

	Eligible producers, operating plants	Project holders; pending plants	Quota left by 2020	Equivalent of installed power
Wind	46%	54%	0%	744
Small hydro	9%	14%	77%	35
Solid biomass*	20%	79%	0%	120
Biogas**	38%	49%	7%	70
Geothermal	0%	33%	67%	30

* there are 51.694 MW under revision ** there are 3.7 MW under revision

Biomass as a resource has been increased its share in household sector as fuel wood to 66% (72 PJ) at the expense of more expensive fuels for heating. In 2015, estimated biomass heat is 515 MW⁶. In September 2017, 41.45 MWe (23.5 GWh) and 34.734 MWe (17.1 GWh) are operating in biogas and solid biomass CHPs⁷. It has been estimated that some 270.000 t of wood pellets or ~5PJ are produced and 95% exported with forecast to expand the production⁸. The quota for biogas and solid biomass CHPs is 70 and 120 MWe by 2020 and it is fully contracted for solid biomass whereas there is some 5 MWe left available for biogas plants. According to CROBIOM, there is an existing demand for 1.5 M t wood chips.

In early 2016, Eurostat has reported that “in Croatia, the share of energy from renewable sources in gross final consumption of energy in 2014 was 27.9%, as against 28.1% in 2013. In that way Croatia exceeded the 2020 target of 20% and reached the EU target for 2030, according to Eurostat's report.”

Table 14. Share (%) of energy from renewable sources in gross final energy consumption

	2011	2012	2013	2014	2020 target
Total RES	25.4	26.8	28.1	27.9	20.0
RES-E	37.6	38.8	42.2	45.3	39.0*
RES-H/C	33.7	36.5	37.2	36.2	19.6*
RES-T	0.4	0.4	2.2	2.1	10.0*

* - targets defined in the framework of the National Renewable Energy Action Plan 2020

Source: National Renewable Energy Action Plan (NREP), draft

⁶ Energy in Croatia 2016, report

⁷ HROTE, 2017 (Croatian Energy Market Operator)

⁸ Crobiom (Biomass Association)

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The explanation lies in the change of national methodology when recording heating energy demand. Namely, the survey has revealed that fuel wood consumption was underestimated 3-4fold in previous methodology based on the heating energy supply. The change in methodology made shift for the base 2005 too. At this point it is unclear how the situation will develop.

In 2016, the national energy balances methodology has changed in recording wood fuel for heating. The outcome of the nation-wide survey on fuel consumption in households applied on census 2011, revealed that 66.5% of Croatian households use solid biomass for space heating (66% belongs to fuel wood) in 2012. In total final energy consumption in households, biomass makes 53% where mere 0.56% is attributed to modern biomass fuels.

The wood fuel demand is the targeted market for PROUN sector.

In November 2017, Croatian Government has created a Working Group to update the existing energy related legislation which is, starting from the Energy Development Strategy (2009) and NREAP (2013, draft), obsolete and does not reflect the current state of energy sector.

Biomass for bioenergy has partially created synergies with industry and economy as expected from the Strategy (2009) as high percentage of bioenergy projects are speculative and rely on abundant feed-in tariff while heat use from the CHP is pending.

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Document	General information	Biomass and Agricultural pruning and plantation removal	reference
Strategy of Smart Specialization 2016-2020 and Action plan for implementation of the strategy	Thematic priority areas: 1. Health and life quality, 2. Transport and mobility, 3. Security, 4. Food and bio economy, 5. Energy and sustainable environment	Under TPA 5., one of subtopics is Ecologically accepted materials, equipment and advanced materials. Under mentioned subtopic focus is on biomass and bio-based products (<i>Knowledge based bio economy</i>) <i>Under TPA 4., subtopics are Sustainable production and procession of food and wood, where biomass have been included as horizontal topic.</i>	http://europski-fondovi.eu/sites/default/files/dokumenti/Strategija_pametne_specijalizacije_RH_2016_2020.pdf Official gazette No. 32/2016
Rural Development Program	Rural Development Program includes 16 measures in the priority areas like Knowledge and innovation, competitiveness, food chain, risk management, ecosystems and climate change.	Under measure 04 Investments in physical assets Sub-measure 4.1 - Support for investments in agricultural holdings Use of renewable sources of energy Construction of facilities for the production of energy from renewable sources (biomass and solar energy) for use on agricultural holdings contributes to the improvement of efficient energy use and the supply and use of energy from by-products. The objective is to increase the independence of farms for energy. The minimum value of public support per project is EUR 5.000. The maximum value of public support per project is EUR 1.000.000. The intensity of the support for investments amounts to 50 % of total eligible expenditures. The maximum rates shall be increased by an	http://ruralnirazvoj.hr/files/documents/Programme_2014HR06RDNP001_4_2_en.pdf



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		additional 20 percentage points in the following cases: • for investments implemented by young farmers or young farmers who have already set up during the five years preceding the application for support; • for integrated projects; • for investments in areas facing natural and other specific constraints; • for investments supported in the framework of the European Innovation Partnership (EIP); • for investments linked to the operations under Articles 28 and 29 of Regulation (EU) No 1305/2013. The maximum combined support shall not exceed 90 % of total eligible expenditures.	
National Plan for renewable energy sources until 2020- Proposal (Ministry of Economy) (2013)	Goals and measures for use of renewable energy sources	Measures for the use of biomass: Mobilization of degraded soils and uncultivated soils. The Program claims that currently (year 2013) no land is devoted to the production of energy crops?	http://europski-fondovi.eu/strateski-dokumenti-republike-hrvatske-2014-2020
Strategy of Energy Development of the Republic of Croatia	Regarding the renewable energy sources (RES), the Strategy sets the following goals: - Increasing the share of RES in gross direct energy consumption to 20% in 2020, Sectoral goals are as follows: - 35% share of RES in	The Republic of Croatia sets the target of using around 26 PJ in 2020. Part of this biomass will be used in a number of biomasses of total power in 2020 of about 85 MW. In order to increase energy efficiency, electricity and heat generation plants in the joint process will have priority. ■ Incentives for Croatian wood processing industry; ■ forest management will be developed and	Official Gazette No 130/2009



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	electricity generation, including large hydro power plants; - 10% share of RES in transport; - 20% share of RES for heating and cooling.	forest biomass exploitation can be exploited; ■ Afforestation and production of fast-growing trees will be encouraged on forest land; ■ Biomass power plants will be stimulated with cogeneration of electricity and heat; ■ The use of biomass for the production of heat energy will be encouraged.	

Other strategic documents:

Strategy of Sustainable Development (Official Gazette No 30/2009)

Materials available on the web page of the Ministry of Environment and Energy (strategies and plans on climate change and low carbon development (<http://www.mzoip.hr/hr/klima/strategije-planovi-i-programi.html>))

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- Identificiranje glavnih čimbenika (tehničkih, kulturnih, regulatornih, strukturnih, organizacijskih, ekonomskih ili financijskih) koji ograničavaju razvoj PROUN sektora.

If PROUN potential is intended for short value chain for domestic use, no special technical, regulatory or organisational barriers are halting the use. Yet, if PROUN potential is intended for a longer value chain for local heat or bio fuel market, post-harvesting, transportation and storage mechanisation and know-how would be needed to implement the potential.

The main barrier for deployment of PROUN potential would be in its economic, and further, financial value. The value of PROUN hasn't been perceived as sufficient enough to make an effort to consider it as a resource.

Cultural barriers of bad habits die hard, supported by economical underestimation are the key barriers for PROUN sector. Those barriers are bounded by economic rationale and would fall eventually if calculations are presented to the perennial crop owners in the manner they understand - a form of official calculations that Agriculture Extension Service is providing for other agricultural products.

It is recommended to make a feasibility study that could demonstrate economic feasibility of utilising PROUN residues to farmers, by plot size, density, variety and type of cultivation. Basic economic milestones should be outlined: BEP and NPV with different PROUN use scenarios: own heating, selling to pellet producer, opportunity cost in short (3 years), middle (5 years) and long (10 years) period.

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Table 15. Summary of barriers detected for the utilisation of APPR in Croatia

Barriers for APPR biomass in Croatia						
Technical	Cultural	Legal	Structural	Market	Value Chain Organization	Economic and Financial
•No technical barriers in the case of short value chains •Postharvest, transportation and storage machinery •Know-how •Harvesting and chipping machines need technological improvements •Inadequate or insufficient technical reliability of biomass plant •Low degree of mechanization. Lack of knowledge on field mechanization	•Reluctance to changes •Energy conversion from pruning is still considered as “not worth of trying” •Farmers are usually not prepared to share machineries and equipment and to organize pruning and harvesting and mobilization collectively •Farmers generally consider pruning as an obstacle to ordinary field management and the goal is simply to get rid of it the sooner as possible	•Energy products that do not comply with international standards and labelling •High rate of law changes and great instability in energy policy decisions	•APPR is largely spatially dispersed and need to be collected over a wide land area. Strong seasonality in harvesting •Lack of integration of knowledge and efforts across sectors •Structure of farms and farm size too small to allow a profitable pruning collection and use	•Small market for biomass •Lack of exemplary business cases •Competitive energy use from forest wood, crop residues or food-processing by-products as alternatives to pruning	•Complexity of biomass supply chains. Lack of well-organized logistics operations •Agro-industrial integration is hard to be achieved	•Value of APPR •APPR harvesting and transport operations are generally considered too costly •Preparedness and appropriate measures financed from Rural Development Program •Availability of loans, leasing guarantees (financial instruments) •Inability to organize and form economy of scales

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- Istraživanje koje su vodeće tvrtke u PROUN sektoru, te koja je glavna poveznica PROUN sektora s drugim proizvodnim sektorima ili sličnim (poljoprivreda, biomasa, agro-prehrana, šumarstvo, proizvodnja strojeva itd.).

During 2014 about 191 thousand farms have been registered in Farm register. The majority (96.55%) were family farms, 1.50% of crafts, 1.43% companies and only 0.32% of cooperatives.

In transition countries small-scale farmers and households are effectively excluded from direct participation in markets. In general, they face pressures from larger processors and retail chains to supply raw materials in required quantities and quality. These demands often pose a great challenge for integration into value chains. At the same time, local, often small and medium-sized processors, challenged by global and regional competition and the need to comply with international regulations, are also experiencing difficulties in establishing their position in the supply of multinational retail chains.⁹

During the transition process in Central and Eastern Europe (CEE), the retail sector was privatized and relationships along the whole food supply chain – from farmers to retailers – collapsed, implying serious supply disruptions. As reforms progressed, including market liberalization and the privatization of formerly state-owned distribution systems, new modes of market coordination mechanisms emerged. In addition, international retailers and processors entered the new markets, introducing their own business models of superior efficiency. Also, international retailers offered products of western quality standards in the supermarkets, thus, strengthening consumers' demand for food of high quality (Hanf and Pieniadz, 2007). Domestic retailers were thus forced to quickly adjust to these new developments to stay in the market. To secure produce of high quality at competitive costs, this required the adoption of higher quality standards and the restructuring of the whole supply chain. Further, to overcome problems of insufficient supply and minor quality, international and domestic retailers, as well as processors, upgraded their vertical coordination mechanisms. Empirical studies provide evidence that due to transition specific development and many market failures, highly diversified modes of vertical coordination exist in CEE countries and Central Asia (Swinnen, 2005; World Bank, 2005).

Contract farming can be defined as a formal or informal contractual agreement between a farmer and a distributor (supermarket) or processor concerning the supply of agricultural products under forward agreements, generally at predetermined prices (Eaton and Shepherd, 2001). An essential element of contract farming is the provision of some degree of assistance to the farmers, with the aim of increasing supply quantity or quality, or reducing seasonality. Contracting with farmers may be implemented within a preferred supplier program or an outgrower scheme. In general, farmers qualifying for a preferred supplier program have a long-standing successful business relationship

⁹ Hanf, J.H. (2014.). Processor driven integration of small-scale farmers into value chains in Eastern Europe and Central Asia. <http://www.fao.org/europe/agrarian-structuresinitiative/en/>

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with a supermarket. These farmers are the suppliers from which a supermarket preferably sources its supply and provides some degree of farm assistance. More comprehensive farm assistance is provided within an outgrower scheme in which the farmer provides the land and labor, whereas the processor or distributor has considerable control over the production process by comprehensively providing inputs and extension services. In general, the aim of farm assistance is to improve farmers' access to basic production factors such as capital and specific inputs, know-how and information (knowledge and experience). In particular, farm assistance may include prepayment to finance the harvest, credit, leasing or rental of farm machinery, bank loan guarantees, quality control and inputs (e.g. seedlings), as well as extension and management advisory services. Farm assistance may be provided within bilateral contracts and complex contract systems. Bilateral contracts are usually agreed upon between the farmer and a processor, or the farmer and an input provider. In contrast, a triangular agreement includes three partners e.g. a farmer, a processor and a bank. Farm assistance is provided within supplier contracting of the supermarkets in the fresh fruit and vegetables (FFV) sector in CEE and Central Asia (World Bank, 2005). Reardon (2003) provides evidence on outgrower schemes in the fresh fruit and vegetables supermarket supply chain in Croatia. Dries et al. (2004) present evidence on complex contract systems: the two largest supermarket chains in Croatia guarantee loans for their outgrowers to acquire greenhouses and irrigation. Further, Dries et al. (2004) report on the acquisition of dedicated wholesalers by large supermarket chains in order to have their own preferred supplier program. The situation in the FFV supermarket supply chain in Croatia is the result of extremely rapid growth in the retail sector, which is among the fastest in the world. Not until 2001, when foreign retailers first entered the market, did supermarkets begin to offer a broad assortment of FFV in their stores; prior to this, FFV had primarily been sold in the street markets (Reardon et al., 2003). Today, FFV is sold to Croatian consumers mainly through the stores of large national and international supermarket chains. However, a large amount of the supply is secured by imported FFV.

Based on the paper: *Gotz, L.; Njavro, M.; Hanf, J.H.; Pieniadz, A.(2009). Vertical coordination with growers in the supermarket fresh fruit and vegetables supply chain in Croatia. Agrarwirtschaft 58 (8): 363-370.*

According to the Cooperatives' registry 1302 cooperatives have been active during 2015. Cooperatives gather about 22 thousand farmers and employ 2.744 persons (About 67% have zero employers!). Most of cooperatives are agricultural cooperatives (531 or 41%).

After significant decrease in the number of cooperative in 2012 (due to harmonisation with the Law on Cooperatives), trend is positive. In 2015 number of newly registered cooperatives was 47 and they gather almost 2000 farmers and employ 14 persons. Total revenue of agricultural cooperative

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in 2015 was about 115 million Euros. The revenue is at the same level as in 2014 and little above revenues in 2012 and 2013.¹⁰

Data show that cooperatives were and are quite irrelevant player in Croatian agribusiness in the number, but also in sales and contribution to gross domestic product (0.5%).

Data indicate a low level of organization of agricultural holdings, primarily family farms, due to the negative historical connotations of former cooperatives and the lack of their inclusion into higher-level organizational forms and other types of cooperation, as well as the high presence of intermediary sales directly affecting their level of competitiveness and poor positioning on the market (Croatian Rural Development Programme).

Although, Government tries to promote cooperation between farmers and promote cooperatives as such via Cooperatives Acts and different programs (education, field visits, and support to cooperative management salaries...) it still hasn't achieved proclaimed goals.

Farmers' inclusion in producers' organizations is also low. Only two POs have been registered in 2014 (milk and fruits and vegetable sector), but positive movement is evident. Thanks to state support and rural development program number of POs is going up. Today about five is ready to start with activities.

Rural development program with its measures 09 and 16 should enhance cooperation between farmers, innovative practices and competitiveness

Measure 09 (Setting-up of producer groups and organizations) has the objective is associating agricultural producers with lower production into producer groups and organizations which will ensure them easier entrance to the market and competitiveness on the market. Due to the lack of information and experience in associations, different levels of professional experience, lack of understanding of common goals and principles of operation farmers have low interest for associating. Producer organizations ensure producers have the ability to use common resources, administrative, bookkeeping and accounting services, as well as equipment for improving and maintaining product quality to facilities for the storage, sorting and packaging of products. In this way better production planning will be achieved that is adjusted to the market needs, price stabilization and ultimately reducing the production costs. Funds available for this measure are 8.8 million euros.

Measure 16 (Cooperation) objectives are to encourage cooperation and the exchange of information on existing and new processes, procedures and technologies in the production and processing of agricultural products, which will achieve improving the economic performance and increasing participation of products with added value on the market.

¹⁰ Annual report on cooperative's entrepreneurship (2015) (Croatian Centre for Cooperative's Entrepreneurship)

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The unfavourable structure of agricultural holdings in the Republic of Croatia is the result of the heritage from the previous system whereby a small number of large industrial agricultural conglomerates operated that no longer exists. The current small number of cooperatives and operational clusters indicates the poor level of cooperation between agricultural producers. Data shows that the fruit and vegetable sectors and livestock sector are the most prone to cooperation. On the other hand, farmers are producing and processing products in a traditional way that has been inherited over decades. Limited contacts between farmers, research sector and food-processing sector results in a lack of awareness of the development and implementation of innovative projects. Joint cooperation between geographically concentrated (local or regional) economic entities and research institutions will result in better exchange of information, knowledge and goods for the production or processing of joint products in agriculture as well as the food processing sector. An added value of the cooperation measure in Croatia is that it will support entities to work together, thereby addressing several of the key challenges and needs for the rural economy, given the dimension of agricultural holdings, dependence on intermediaries for the food and food-processing sectors and the low propensity and high cost barriers to innovation for individual holdings. The knowledge of and access to innovation, including innovative processes, is very low in the agricultural and food-processing sector in Croatia. The setting-up and operation of Operational groups within the European Innovation Partnerships will reduce the gap between agricultural practices and research by promoting innovative solutions and innovations in practice (Croatia RDP)

Strategy of Smart Specialization detects following chain actor in the biomass sector:

Croatian Centre of renewable energy sources (CCRES) formed back in 1988, is one positive example of larger association of companies with main intention to excel applied research and development centre with an international reputation, focusing on the optimal use of the nation's energy resources.

Cluster “Inteligentna Energija”, gathers SMEs investing in RDI

Numerous Croatian companies operate within the waste treatment field. Some of them are global players - e.g. TEHNIX Ltd. is the leader in the production of EKOMUNAL special utility vehicles for collecting, compacting and discharge of municipal and selected waste, high flow rate separators, wastewater treatment and purification plant.

Several companies are utilizing innovative methodologies to further develop their services focusing on the Earth Observation (EO) data, such as; ECOINA Ltd. (air quality monitoring, landfill design, wastewater treatment); EKONERG Ltd. (power plant performance testing, air emission measurements, developing air quality monitoring stations); Geodata Ltd. (geo-information systems, digital terrain modelling, urban planning), Geofoto Ltd. (3D city modelling, LIDAR, UAV); GEOSAT Ltd. (environmental monitoring, CORINE programme, geo-hazard mapping, remote sensing); GISDATA Ltd.; GDI CONVIVO Ltd. (cloud services).

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In addition to major Croatian universities, there are several research institutions in Croatia with significant human resources working in environmental science. A good example of a research institute with a focus on sustainable resources is Energy Institute Hrvoje Požar, Energy Institute Hrvoje Požar (EIHP) contributes significantly to the development of sustainable energy, through analysis of potentials and possibilities of construction and operation capacities for production of energy from renewable sources, analysis related to construction and development photovoltaic systems and solar systems for production of thermal energy and CPS systems, analysis of market models and their impact on business, feasibility studies related to conventional and renewable energy sources in market conditions, development of sustainable market of heating energy from biogas plants, analysis and simulations of electric energy network occurrences related to integration of renewable energy sources, and forecasting production and the uncertainty related to forecast production errors for renewable energy.

In connection to Biotechnology, this field is throughout the whole S3 document presented as one of the most perspective areas. Also, agricultural and biological sciences are second most notable field regarding published scientific papers. Several research groups are led by scientists with over 1.000 citations (Web of Science) and they have achieved good results in obtaining projects and performing international research through pre-accession funds mainly at the, University of Zagreb and the Josip Juraj Strossmayer University of Osijek, as well as at the Agricultural Institute in Osijek. An important boost in the field of Green-Biotechnology is also expected with the soon opening of the BIOCentre. University of Rijeka Numerous national and international projects have been performed by the various research organizations in e.g. the field of agriculture to monitor and analyse effects of fertilization and other chemical treatments in agriculture to pollution of soils and waters (salinization, nitrates, heavy metals, etc.). These projects were conducted in collaboration with industry in the food sector, state companies (Croatian Waters) and public authorities (Croatian Environment Agency), City of Zagreb, etc.) in order to ensure environmental sustainability and improve the health status of food products.

The key feature of PROUN clustering with other sector is the vicinity of supply and demand. On the demand side, family farms organised in associations (Croatian Fruit Producer Association, Vineyard associations, Olive oil associations and similar) or cooperatives or contracted by a processing industry would be the nutshell of the development of PROUN market. Namely, such farms are already involved in some kind of cooperation and it would be less effort to engage in a diversifying business opportunity. Association of some level would also enable formation of machine rings and common storage which would increase profit margin for PROUN suppliers.

PROUN biomass is, in any form – chips, pellets, logs, branches – a fuel for combustion with heating or both heat and power. Useful energy form defines the demand market which is heat consumers or/and biomass CHP plants. At heat market, PROUN biomass has to be contrasted with the local heat

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options (district heating, logs, natural gas, heating oil, wood pellets) and existing habits of the consumers (age of the furnace, household age...). Another niche market for PROUN biomass would be agro-produce drying facilities, assuming that PROUN biomass has better performing features than the existing fuel.

A proactive PROUN biomass market uptake would be to link up with the existing wood pellets production by broadening the feedstock base for wood pellet production. Currently, some 270,000 t/yr wood pellets are made in Croatia, with high demand to increase production. If PROUN biomass toggle along the existing wood pellet market, the efforts of market penetration and positioning could be avoided, which would increase the profit margin for PROUN suppliers.

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- Istraživanje jesu li ove veze relevantne za izbor i strukturiranje preferiranih "poslovnih modela".

Market positioning of PROUN biomass as well a choice of value chain is crucial for choice and structure of business models. As it was suggested before, it would be valuable to develop feasibility study examples to reduce speculative area of placing PROUN biomass at market. The level of feasibility would determine desirable and viable business models from those that are still not matured.

The table below relates stakeholders and business models that need to be evaluated for Croatia once the availability of pruning as well as of economic feasibility are known:

Stakeholders	Business models
APPR producers	<u>Self-consumption</u> : farmers use their own resources in small boilers of adapted to their exploitation. They manage the logistics chain.
Producers, cooperatives, local companies	<u>Marketing</u> : the company is managing the collection and marketing of wood.
Biomass harvesters	<u>APPR management services</u> : the company proposes to carry out the collection work and is paid for the service. <u>Service for the evacuation of APPR</u> : the company proposes a service to manage stocks and for the rehabilitation of the parcel. <u>Equipment rental</u> : the company rents the equipment associated
Logistic operators	<u>Logistics platform</u> : A company organizes the entire logistics chain, from collection to sale. <u>Storage platform</u> : Existing biomass storage or waste management infrastructures are paid to rent available space or store biomass during the drying period.
Consumers: ESCO, municipalities	The company or municipality takes over the operation of the boiler and sells the energy to the heat consumer.

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- Izrada glavnih obilježja PROUN sektora prema sljedećoj SWOT strukturi (SWOT = prednosti, slabosti, mogućnosti i prijetnje).

Following tables of internal strengths and weaknesses and external opportunities and threats are based on the interviews made by researches on the project. Number of people interviewed was nine.

Strengths - Please rank in order of importance (1 extremely important. 5 least important)	average rank	Weaknesses - Please rank in order of importance (1 extremely important. 5 least important)	average rank
1. Agriculture is a strong local productive sector. together with agro-food processing	1.75	1. Energy conversion from pruning is still considered an overall risky operation	3.25
2. Large potential biomass availability at regional scale and very high local biomass spatial density	1.38	2. APPR is largely spatially dispersed and need to be collected over a wide land area. Strong seasonality in harvesting	2.50
3. Good level of potential employment offered by the APPR sector	2.13	3. Complexity of biomass supply chains. Lack of well-organized logistics operations	2.63
4. Local operation of some real business cases and successful examples	3.14	4. Low degree of mechanization. Lack of knowledge on field mechanization	2.50
5. In rural areas. energy needs can be satisfied by local energy sources (such as APPR biomass)	1.38	5. Harvesting and chipping machines need technological improvements	2.00
6. Using locally available resources is considered a priority	2.88	6. Inadequate or insufficient technical reliability of biomass plant	1.75
7. Observed trend in deepening the agricultural activity along the value chain	2.88	7. Agro-industrial integration is hard to be achieved	2.13
8. Observed trend in applying a set of agricultural diversified activities	3.00	8. Energy products that do not comply with international standards and labelling	2.88
9. Farmers have a strong imitation attitude. Positive examples are considered as a model	2.13	9. Lack of integration of knowledge and efforts across sectors	1.75

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10. Cohesion is considered a social responsibility among farmers; this should promotes cooperation	3.25	10. Mind-set of farmers. their reluctance to change and their low attitude in cooperating and innovating	1.50
11. Potential cost savings in field pruning management	1.50	11. Farmers are usually not prepared to share machineries and equipment and to organize pruning harvesting and mobilization collectively	1.25
		12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source	1.50
		13. Lack of exemplary business cases	1.50
		14. Distrust that farmers may be reliable in biomass supply	2.75
		15. Pruning is considered a feedstock of too low economic value	2.38
		16. APPR harvesting and transport operations are generally considered too costly	2.38
		17. Little info on funding opportunities for farmers and entrepreneurs in the bioenergy sector	1.63
		18. A long and subdivided supply chain could be not economically efficient for every actors	2.88
		19. Industrial investors are expecting very high profits and a fast payback time in the renewable energy sectors	2.63
		20. Limited economic affordability in utilizing services offered by specialized agro-mechanical pruning companies or techno-logistic companies	2.50
		21. Structure of farms and farm size too small to allow a profitable pruning collection and use	1.88
		22. Pruning is supposed to be not a by-product but a waste without any economic value	2.00

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	23. Farmers generally consider pruning as an obstacle to ordinary field management and the goal is simply to get rid of it the sooner as possible	1.88
	24. Pruning burning in open field is still considered an agronomic operation	1.75
	25. Competitive agricultural use of pruning as soil amendment	3.14
	26. Agronomic guidelines on soil and pruning management are still lacking	1.75
	27. Risk of soil depletion if APPR biomasses are not properly managed at field scale	2.88
	28. Woodchip from pruning is of lower quality than from forestry	3.50
	29. A scarce number of ESCOs are operating in the regional bioenergy sector	2.88

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Opportunities - Please rank in order of importance (1 extremely important. 5 least important)	Average rank	Threats - Please rank in order of importance (1 extremely important. 5 least important)	average rank
1. Agro-industrial integration towards a "bioeconomy" productive model	1.25	1. Actual low degree of pruning valorisation	2.38
2. Proceed in "greening" the economy. increase the use of renewables in industry. and decarbonize industrial activities. save fossil energy and GHG emissions significantly	1.13	2. Biomass plant and energy facilities are still capital intensive	3.25
3. Adoption of rules consistent with the development of circular economy according to the EU framework	1.38	3. Still large-scale economy are influencing the sector	1.63
4. A potential level of cross-sector innovation	1.38	4. Competitive energy use from forest wood. crop residues or food-processing by-products as alternatives to pruning	2.57
5. Rules encouraging inter-professional agreements along the biomass supply chain	2.00	5. APPR biomass use is less competitive than other forms of renewable energies	2.88
6. Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines)	1.38	6. Renewable energy more emphasized as power than heat generation	2.63
7. The "multifunctional" asset of current agriculture according to the most recent vision of "rural development"	1.63	7. Atmospheric emissions due to biomass thermochemical conversion are generally considered an environmental problem	2.50
8. Application of the EU "cross-compliance" with respect to farmers' commitments	1.50	8. District heating is still an uncommon solution in municipalities (with exceptions).	2.50
9. Valorisation and reuse of agricultural residues for bioenergy production	1.38	9. Limited communication with civil society/public opinion and lack of promotional activities	1.75

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10. Adaptation measures to climate change	1.25	10. No coherent policy. no strategic view on the APPR sector from local governments.	1.00
11. Ensure biodiversity conservation and the supply of ecosystem services	1.13	11. NIMBY syndrome ("Not In My Back Yard")	2.13
12. Young and skilled farmers entering in the sector thanks to new incomes opportunities	1.13	12. Risk of large fossil energy consumptions and GHGs emissions along the supply value chain and lack of environmental guidelines	2.38
13. Funding schemes favouring the APPR sector in agriculture	1.63	13. Pruning burning is not roundly forbidden by national/regional regulation	2.13
14. Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems. for example)	1.25	14. The energy use from pruning is not adequately supported by the CAP	1.75
15. Steady economic affordability of biomass energy carriers as compared to fossil fuels	1.50	15. APPR market still underdeveloped	1.63
16. A prospective increase in the market price of biomass	2.25	16. Imports of cheap biomass feedstock from outside the EU	3.38
17. A prospective increase in the market price of fossil fuels	2.00	17. Price of oil and fossil fuels still quite low to promote competitiveness from bioenergy	2.63
18. Label and standards of biomass quality assurance and traceability	1.50	18. Lack of the right market driven incentives and subsidises	1.88
19. Subsidies and incentives promoting fossil displacement	1.75	19. APPR biomasses are still not included as potential biomass sources in some regional energy plan	1.38
20. Public support on the demand side of APPR feedstock for energy use ("green public procurement")	1.50	20. Market driven incentives and subsidises are progressively decreasing	2.75

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21 Notable "learning curve" on the technological maturity of energy conversion processes.	2.13	21. High rate of law changes and great instability in energy policy decisions	1.88
22 Commercial availability of small size power plants	1.75	22. Electricity more economically sustained than heat	2.63
23 Possible combination of biomass mobilization with information technologies and product traceability	2.25		
24. Ensure proper conditions for the adoption of knowledge and innovations	1.38		
25. Possible availability of public financial funding to promote investments	2.00		
26. Possible application of the "Carbon emission trading" and CO ₂ taxation	2.00		
27. Segmenting incentives to renewable to favour social impact	1.88		
28. Long-term stability of economic return on bioenergy investment	1.50		
29. Significant reduction trend in the capital costs of new investment in the bioenergy sector	2.00		
30. More restrictive atmospheric emission thresholds	2.63		

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Actions and targets

Which are the main targets that the APPR bioenergy sector should achieve in the near future (let's say within the next three-five years)?

Targets - Please rank in order of importance (1 extremely important, 5 least important)	Average rank
1. AGRO-ENERGY INTEGRATION Aiming at an efficient and integrated regional agro-energy system according to the bioeconomy model	1.00
2. RURAL DEVELOPEMENT Sustainable APPR energy generation as a path to rural development	1.00
3. NEW BUSINESS & ENERGY MARKET A market oriented APPR energy sector to intercept and satisfy society needs	1.75
4. RESEARCH & INNOVATION Supporting an innovation trend in bioenergy technology and a shift to more efficient energy use from biomass	1.50
5. BOTTOM-UP PARTICIPATION & NEW FORMS OF POLICY Triggering social and policy innovation in the APPR sector	1.38
6. ECONOMIC AFFORDABILITY Consolidating the economic affordability of biomass use and the economic return along the value chain	1.38
7. RELIABLE BIOMASS SUPPLY SOURCES Boosting APPR biomass sources and setting up conditions to strengthen the APPR supply chain	1.38
Proving the feasibility of the APPR value chains and its value in micro-generation projects	1.38
9. SOCIAL ACCEPTANCE / AWARENESS Reacting to an improper and deliberately misleading information by promoting full awareness and social acceptance	1.75
10. ENVIRONMENTAL STANDARDS & SUSTAINABILITY Mitigating the environmental burdens along the bioenergy value chain, from farming operations to energy conversion	1.13
11. MARKET SECURITY & CONTROLLED ECONOMIC RISK Withstanding the risk of a local APPR market failure	1.88
12. RULES & REGULATIONS Resisting the complexity of the regulation system on bioenergy and the lacking of a farsighted vision about the sector	1.25

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Strategic Plan

In order to obtain a better interpretative framework, the internal SW factors may form together a vertical axis and the external OT factors a horizontal axis. By combining internal and external factors, the following strategic alternatives may be obtained:

SO Strategies (Strategies employing strengths in order to profit by opportunities). These are the *max-max* type of strategies, in the sense that they combine the most favourable elements to building a strategy. SO strategies use strengths and powerful elements in order to make it benefit from external opportunities. The strategy becomes dynamic and aggressive (*attacking*).

WO Strategies (Strategies seeking to alleviate the effect of weaknesses by taking advantage of opportunities). They are strategies of the *min-max* type, in the sense that they combine inside weaknesses with external opportunities. The strategy attempts to use opportunities in order to eliminate or alleviate weaknesses (*reorientation*).

ST Strategies (Strategies that employ strengths in order to prevent or minimize threats). They are strategies of the *max-min* type, in the sense that they use the strengths in order to avoid or reduce external threats (*defense*).

WT Strategies (Strategies that alleviate weaknesses and seek to reduce the impact of threats). They are *min-min* type strategies seeking to minimize weaknesses if external threats can be avoided (*surviving*).

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1. PROMOTING AGRICULTURE AS THE PRIME STEP OF THE BIOENERGY VALUE CHAINS

Strategy: Strengths + Opportunities → **SO strategy**

S1. Agriculture is a strong local productive sector, together with agro-processing
S7. Observed trend in deepening the agricultural activity along the value chain
S8. Observed trend in applying a set of agricultural diversified activities.

O1. Agro-industrial integration towards a bioeconomy productive model
O7. The multifunctional asset of current agriculture according to the most recent vision of rural development sector
O12. Young and skilled farmers entering in the sector thanks to new incomes opportunities
O25. Possible availability of public financial funding to promote investments

Objectives

- SO1. Take advantage of strong agricultural sector to build and develop bioeconomy value chains
- SO2. Prepare clear strategic plan for development of APPR sector

Actions / Activities

- Defining “best management practices” in the agricultural sector with reference to the APPR feedstock. Providing comprehensive information and advices on several issues about pruning removal, including handling, logistics and economy. Advising farmers about possible impacts on soil carbon contents. Assessing when and where soil carbon contents are critical to preserve appropriate soil chemical and physical properties
- Sustaining farmers in the development of new APPR projects in terms of both increasing the amount of available APPR biomass to be addressed to the energy market and promoting the direct and internal energy exploitation of this feedstock
- Promoting a large participation of farmers and farmer organizations, together with other stakeholder associations, in the establishment of operational groups (OPs) within the EIP (European Innovation Partnerships), specifically tailoring projects and investments in the APPR energy use and the valorization of solid energy carriers from APPR feedstock

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2. STRUCTURE OF APPR VALUE CHAINS AND ECONOMIC RETURN

Strategy: Strengths + Threats → **ST strategy**

S2. Large potential biomass availability at regional scale and very high local biomass spatial density
 S11. Potential cost savings in field pruning management
 S3. Good level of potential employment offered by the APPR sector

T4. Competitive energy uses from forest wood, crop residues or food processing by products as alternatives to pruning
 T9. Limited communication with civil society/public opinion and lack of promotional activities
 T12. Risk of large fossils energy consumptions and GHGs emissions along value chain and lack of environmental guidelines

Objectives

- ST1: Develop the sector by highlighting the positive externalities face to economic issues

Actions / Activities

- Comparing the economic and financial aspects of the different business models in the APPR energy sector, in order to outline the pros and cons and provide an overall judgment of profitability
- Selecting the optimal “business model” adjusting the economic exercise to the specific conditions of the companies participating in the bioenergy project as well as to the market and economic conditions (best tailoring)
- Offering financial counselling, advising or economic and financial guidelines in order to inform potential entrepreneurs about the economic feasibility of energy projects based on APPR biomass

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3. TRAINING ACTIVITIES AND CAPACITY BUILDING

Strategy: Opportunities+ Weakness → **WO Strategy**

W4. Lack of knowledge on field machinery	O21. Notable “learning curve” on the technological maturity of energy conversion processes
W9. Lack of integration of knowledge and efforts across sectors	O23. Possible combination of biomass mobilization with information technologies and product traceability
W10. Mind-set of farmers, their reluctance to change and their low attitude in cooperation and innovation	O24. Ensure proper conditions for adoption of knowledge and innovations
W23. Farmers generally consider pruning as an obstacle to ordinary field management and the goal is simply to get rid of it as soon as possible	

Objectives

- WO1 Spreading know-how between actors in the value chain
- WO 2 Increase use of APPR and new investments

Actions / Activities

- Technical training allowing the acquisition of new competences and expertise in the bioenergy sector, with particular regard to new technologies and distributed model of energy generation
- Forming a regional “task force” made up of properly trained technicians and selected consultants or experts to provide technical support to those entrepreneurs determined in developing new APPR projects
- Technical assistance, testing on existing and innovative technologies, establishing connections between experts, operators, technical installers, stakeholders and community

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4. POLICY AND ADVOCACY

Strategy: Weakness+ Threats → **WT Strategy**

W12. Lack of awareness about potential use of APPR W13 Lack of exemplary business cases W17. Little info on funding opportunities for farmers and entrepreneurs in energy sector	T10. No coherent policy, no strategic view on the APPR sector from local governments T14 The energy use from pruning is not adequately supported by the CAP T15. APPR market is still underdeveloped T18.Lack of right market driven incentives and subsidies T19. APPR is still not included as potential biomass source in some regional energy plan T21. High rate of law changes and great instability in energy policy decisions

Objectives

- WO3 Create strategic implementation framework
- WO 2 Create stable legal environment in biomass, namely APPR sector

Actions / Activities

- Harmonizing regional, national and EU strategic plans on APPR bioenergy development
- Promoting a strong simplification of legislative rules
- Suggesting strategic policy guidelines (such as market instruments, taxation regimes, financial incentives, price subsidies, funding opportunities, environmental and agricultural framework, research & innovation, etc.)

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Annex and acknowledgements

ANNEX A10

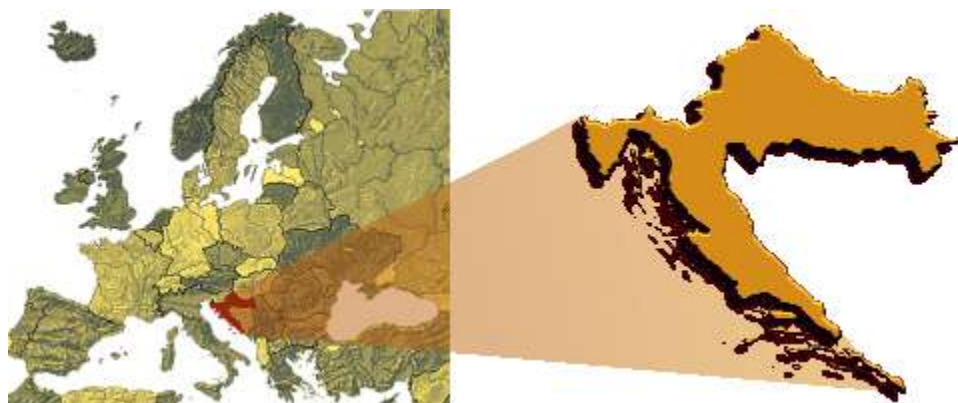
SEKTORSKA ANALIZA

**Nacionalni okvir podataka poljoprivrednih rezidbenih ostataka i
uklonjenih nasada (PROUN) - Hrvatska**

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Republika Hrvatska smještena je na sjecištu putova koji spajaju Srednju Europu sa Mediteranom i rasprostire se od Dunava na sjeveroistoku prema Istri na zapadu, te duž jadranske obale do Konavala na jugoistoku. Hrvatska se odlikuje prirodnim i klimatskim raznolikostima, što ju čini popularnim turističkim odredištem, ali i stoljetnom raznolikom poljoprivrednom proizvodnjom.

Slika 1. Karta Hrvatske



Hrvatska u brojevima

Ukupna površina: 87 661 km²

Površina kopna: 56 594 km²

Površina mora: 31 067 km²

Dužina obale: 5 835 km

Otoci, hridi, grebeni: 1 185

Stanovništvo: 4 284.889 (Census 2011)

Ruralno stanovništvo: 47.6%

Gustoća stanovništva: 78.5/ km²

Glavni grad: Zagreb

Službeni jezik: Hrvatski

Valuta: kuna (100 lipa)

BDP po glavi stanovnika: 10.129 eura

Šume: 44%

Nacionalnih parkova: 8 (107 900 ha)

Parkova prirode: 10 (428 600 ha)

Sunčanih sati godišnje: 2 600

S površinom od 56 594 km² Hrvatska je 19. najveća zemlja Europske unije koja je s obzorom na teren i klimu vrlo raznolika. Sektorska analiza poljoprivrednih rezidbenih ostataka i uklonjenih nasada (PROUN) u Hrvatskoj usredotočena je na dva različita zemljopisna područja: Slavoniju - teritorij koji obuhvaća prostrane ravnice na kontinentalnom dijelu između rijeka Drave i Save (odgovara NUTS-2

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regiji HR04: HR04A i HR04B) i Dalmaciju - južni dio duge, razvedene i sunčane obala s više od 1000 otoka (što odgovara području NUTS-2 HR03: HR033).



Slika 2: Lokacije odrađenih mjerenja u Hrvatskoj; NUTS-2 regije¹

	2015.	2016.	2015. = 100 Indeks ukupne proizvodnje
Grožđe, ukupno (C 2410)			
Površina, '000 ha	26	23	88.5
Proizvodnja, ukupno, t	154 227	123 651	80.2
Prinos po hektaru, t	5.9	5.3	89.8
Prinos po trsu, kg	1.7	1.3	76.5

Tablica 1. Proizvodnja grožđa u Hrvatskoj²

¹ Izvor:

<https://razvoj.gov.hr/UserDocsImages/O%20ministarstvu/Regionalni%20razvoj/Nova%20statisti%C4%8Dka%20klasifikacija%20prostornih%20jedinica%20RH%20-%20NUTS%202.pdf>

² Izvor: Hrvatski zavod za statistiku - Croatian Bureau of Statistics

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Tablica 2. Površina korištenog poljoprivrednog zemljišta, po kategorijama u ha (2015. i 2016.)

	2015	2016	Indeks <u>2016.</u> 2015.
Korištena poljoprivredna površina (UAA)	1 537 629	1 546 019	100.5
Oranice i vrtovi	841 939	872 406	103.6
Žitarice	490 811	529 388	107.9
Mahunarke za suho zrno	2 254	3 273	145.2
Korjenasti i gomoljasti usjevi	24 802	26 563	107.1
Industrijsko bilje	167 140	178 974	107.1
Svježe povrće i jagode	8 837	10 180	115.2
Zelena krma s oranica i vrtova	113 674	107 444	94.5
Ugari	33 725	15 924	47.2
Cvijeće i ukrasno bilje	300	300	100.0
Sjemenski usjevi i presadnice	396	360	90.9
Povrtnjaci	2 150	1 885	87.7
Trajni travnjaci	618 070	600 000	97.1
Trajni nasadi	75 470	71 728	95.0
Voćnjaci, vinogradi, maslinici	74 799	71 060	95.0
Voćnjaci	30 112	29 476	97.9
Vinogradi	25 587	23 400	91.5
Maslinici	19 100	18 184	95.2
Rasadnici	310	342	110.3
Košaračka vrba i božićna drvca	361	326	90.3

Izvor: Hrvatski zavod za statistiku

Dalmacija

Hrvatska obala prema tradiciji usmjerena je na poljoprivredu kao najvažniju aktivnost zaslužnu za opstojnost svojih stanovnika. Zbog geografskog položaja hrvatske obale te njezinih okolišnih i klimatskih karakteristika, razvile su se neke poljoprivredne grane koje su do danas ostale važne za živote ljudi i za prepoznatljivost Dalmacije. To su maslinarstvo, vinogradarstvo, voćarstvo, uzgoj ovaca i svinja. Maslinarstvo je tradicionalno na ovom području od davnih vremena. Zahvaljujući specifičnom tlu, klimatskim uvjetima i tradicionalnom načinu obrade, autohtone sorte vinove loze daju svoj maksimum u ovim endemskim zemljopisnim uvjetima.

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Slavonija

Gospodarstvo Slavonije uglavnom se temelji na prerađivačkoj industriji, trgovini, prometu i građevinarstvu. Poljoprivreda je značajna komponenta gospodarstva: Slavonija sadrži 45% poljoprivrednog zemljišta u Hrvatskoj i čini značajan udio hrvatske stočarske proizvodnje i proizvodnje trajnih nasada.

OPĆENITO O HRVATSKOJ POLJOPRIVREDI

Hrvatska ima povoljne agro-klimatske uvjete koji omogućuju raznoliku poljoprivrednu proizvodnju. U relativno uskom poljoprivrednom području, zbog raznovrsnih klimatskih uvjeta, reljefa i tla, uspješno se uzgaja velik broj poljoprivrednih kultura, počevši od pšenice i industrijskih kultura pa sve do vinove loze i mediteranskog voća i povrća. Poljoprivredna struktura sastoji se uglavnom od malih obiteljskih poljoprivrednih gospodarstava koja uglavnom proizvode za vlastite potrebe. Njihov udio na tržištu je vrlo mali.

U ukupnoj strukturi poljoprivredne proizvodnje u Hrvatskoj najznačajniji udio ima ratarstvo i to proizvodnja žitarica. U razdoblju od 2003. do 2013. prosječno je bilo 574.421 hektara pod žitaricama te je prosječna proizvodnja bila 2,9 milijuna tona. Kukuruz i pšenica dominantne su žitarice. Već nekoliko godina Hrvatska je više nego samodostatna u sektoru žitarica i to uglavnom zato što je proizvodnja pšenice znatno veća od ukupne potrošnje u zemlji. Hrvatska je neto izvoznik žitarica. Uzgoj uljarica (soje, suncokreta i uljane repice) te šećerne repe predstavljaju važne industrijske usjeve.

Voćarska proizvodnja u Hrvatskoj uglavnom se temelji na proizvodnji u poljoprivrednim gospodarstvima i uglavnom nije usmjerena na tržište. U 2007. godini sektor voća i povrća predstavljao je 12% bruto poljoprivredne proizvodnje. Trenutno stanje domaće proizvodnje voća ne zadovoljava ni 50% domaćih potreba. Jabuke i mandarine su najčešće vrste voća.

U segmentu proizvodnje povrća, dominantne sorte su kupus kojemu je ukupna prosječna proizvodnja 30 tisuća tona. Ukupna proizvodnja povrća u 2013. godini iznosila je 167.429 tona. Samodostatnost proizvodnje povrća vrlo je niska i iznosi oko 70%.

Stočarstvo je zastupljeno na cijelom teritoriju zemlje. Najveći dio proizvodne strukture pripada malim obiteljskim poljoprivrednim gospodarstvima. U posljednjih nekoliko godina brzo raste važnost velikih proizvodnih jedinica, odnosno specijaliziranih poljoprivrednih gospodarstava u tržišnoj proizvodnji. Uzgoj stoke najvažnija je grana stočarstva, slijedi uzgoj svinja te proizvodnja peradi i uzgoj ovaca i koza.

Poljoprivredna struktura uglavnom se sastoji od malih obiteljskih poljoprivrednih gospodarstava koja uglavnom proizvode za vlastite potrebe. Njihov udio u tržišnoj proizvodnji je vrlo mali. Međutim, najveći dio tržišne proizvodnje usmjeren je na velike farme, koja su brzorastuće u posljednjih nekoliko godina. Primjenom najnovijih tehnologija i velikih investicija i znanja, na nekim od tih farmi ostvareni su odlični rezultati proizvodnje gledano na globalnoj razini.

U Hrvatskoj je 181.250 poljoprivrednih gospodarstava prema istraživanjima o strukturi poljoprivrednih gospodarstava za 2007. godinu. 132.610 (73%) tih gospodarstava imalo je standardni ekonomski rezultat (standard output SO) preko 1.200 € dok je broj gospodarstava sa standardnim ekonomskim rezultatom ispod 1.200 € zastupalo 27% od ukupnog broja gospodarstava te 20% radnika koji rade na gospodarstvu čine udio od 2% u ukupnom broju korištenog poljoprivrednog zemljišta, ukupnom broju uvjetnih grla i ukupnom standardnom ekonomskom rezultatu.

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132.610 gospodarstava sa standardnim ekonomskim rezultatom od najmanje 1200 €, zapošljavalo je oko 160.000 radnih sati godišnje, što odgovara 160.000 ljudi koji rade puno radno vrijeme. Prosječna površina gospodarstava bila je 6 ha. U 2007. godini, 0,86 milijuna uvjetnih grla (UG) čini prosjek poljoprivrednog gospodarstva. U prosjeku svaka farma imala je 6,5 UG.

Od 132.610 poljoprivrednih gospodarstava u 2007. godini:

- 47% koristilo je manje od jednog radnog sata godišnje dok je 15% koristilo dva ili više radna sata godišnje;
- 69% koristilo je manje od 5 ha, dok je 1% koristilo 50 ha ili više;
- 58% proizvodi uglavnom za vlastitu potrošnju,
- 26% predstavljaju proizvođače raznih usjeva i stočare;
- 14% različita stoka;
- 13% specijalizirano mljekarstvo;
- 9% su bile mješovite grahorice.

Struktura nositelja gospodarstava:

- 17% nositelja u 2007. godini čine žene;
- 63% je 55 i više godina, a 3% mlađe od 35 godina (tendencija je prema starenju vlasnika poljoprivrednih gospodarstava);
- 30% je imalo još jednu dodatnu djelatnost u 2007. godini;
- 57% poljoprivrednog zemljišta u vlasništvu je poljoprivrednika;

Broj gospodarstava se od 2003. godine smanjio za 4% i korištenog poljoprivrednog zemljišta za 7%.

Vino

Vinska područja u Hrvatskoj bila su podijeljena u dvije regije: kontinentalnu i jadransku. Svaka od njih karakterizira različite geografske, geološke, agronomске i gospodarske osobine. Hrvatska je zapravo rijetka zemlja u kojoj se na tako malom području mogu vidjeti raznolikost klime i okoliša. Postoji i velika vrijednost autohtonih sorti koje osiguravaju tržišnu prepoznatljivost, važnost u turizmu, poljoprivredni dohodak i zapošljavanje u ruralnim područjima. Rast broja hektara pod vinogradima postignut je u drugoj polovici prošlog desetljeća (2005.-2010.) kada je Hrvatska Vlada započela s programom potpore za podizanje trajnih usjeva (tzv. operativni plan). Podignuto je oko 7.000 hektara novih vinograda. U Republici Hrvatskoj je u 2011. godini bilo 32.485 ha vinograda, sa proizvodnjom grožđa od 204.373 t i proizvodnjom vina od 1.410.000 hl. Godišnja prosječna potrošnja vina po članu kućanstva u Hrvatskoj iznosila je 10,10 litara. Izvoz vina bio je na razini od 58.196,26 hl dok je uvoz u 2012. bio na razini od 148.731,63 hl.

Obiteljska gospodarstva imaju najveći udio u vinogradima. Obiteljska gospodarstva su slaba karika u sektoru vina. Oni su opterećeni problemima ekonomije razmjera, menadžmentom i marketinškim znanjem, tehnologijom vina, moći pregovaranja prema snažnim maloprodajnim lancima, zaduženosti i pristupu glavnom gradu. Slično se odnosi i na druge vrste organizacija uključene u poslovanje s vinom (tvrtke i zadruge).

Maslinovo ulje

Što se tiče broja poljoprivrednih gospodarstava (oko 40 000), maslinarstvo je jedna od najočuvanijih poljoprivrednih grana. Kao i u vinogradarstvu, postoji velik broj poljoprivrednih farmi. Povijest proizvodnje star je više od dva stoljeća, a poznata kvaliteta maslinovog ulja s hrvatskog područja

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datira iz rimskog doba. Maslinarstvo i vinogradarstvo imaju još jednu zajedničku osobinu, u usporedbi s razdobljem prije Drugog svjetskog rata, broj stabala maslina bio je nekoliko puta veći nego danas. Razdoblje uništavanja maslinika i stagnacija njihove proizvodnje trajala je prije nekih 15 godina, kada je došlo do oporavka zahvaljujući, između ostalog, sustavnim programima državnih potpora. Od ukupne proizvodnje maslinovog ulja (prosječno 60 tisuća hl) i dalje je najvažnija izravna potrošnja i izravna prodaja na obiteljskim gospodarstvima. Na pozitivan trend ekspanzije proizvodnje utjecala je i svijest potrošača o zdravstvenoj i prehrambenoj vrijednosti maslinovog ulja, osobito u posljednjih nekoliko godina. Najveći udio proizvodnje maslina pripada autohtonoj sorti "oblica", ali postoje i domaće i strane sorte. Iako je njihova proizvodnja skromna, hrvatska maslinova ulja uključena su u neke od najboljih svjetskih kataloga maslinovog ulja.

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• **Obrada statističkih podataka o PROUN-u kako bi se upoznao status i potencijal biomase u Hrvatskoj (tj. površina uključena u plantaže voćaka i gruba procjena količine sirovine dobivene iz PROUN ostataka).**

Tijekom proteklih nekoliko godina, globalni interes za obnovljive izvore energije, posebno za energiju iz biomase, značajno raste. Takav je slučaj i u Hrvatskoj. Postoji nekoliko razloga za to: biomasa je obnovljivi izvor koji je u velikoj mjeri dostupan i ima dobar potencijal kao izvor energetske proizvoda, kao što su struja i topline, te tekuća goriva.

U Hrvatskoj ne postoje relevantne informacije o potencijalnoj dostupnosti poljoprivrednih rezidbenih ostataka i uklonjenih nasada (PROUN-a). Zbog nedavno odrađenih terenskih mjerenja u voćnim nasadima (maslina i vinograda) mogu se dati određene procjene. Mnogi poljoprivrednici pokazali su interes za korištenje biomase za vlastitu upotrebu. Žele saznati više, a neki od njih sami istražuju najbolje mogućnosti i dobre prakse za njihovo korištenje.

U nekim nasadima poljoprivrednici su godinama radili više od jednog orezivanja.

Dostupni podaci o orezivanju u Hrvatskoj prilično su slabi pa će se analiza nacionalnog potencijala raspoloživosti PROUN-a temeljiti na procjenama iz studije "Energetski potencijal plodoreda biomase u Hrvatskoj" N. Bilandžija, N. Voca, T. Kricka, A. Matin i V. Jurisic (2012.) koje financira Ministarstvo poljoprivrede, ribarstva i ruralnog razvoja Republike Hrvatske. Glavni cilj ove analize bio je utvrditi količine zapaljivih i nezapaljivih sastojaka u orezanim biomasama svih značajnih drvenastih kultura na području Hrvatske i izračunati, na temelju dobivenih podataka, energetski potencijal usitnjene biomase istraživanog usjeva. S obzirom na činjenicu da još nisu definirane norme za iskorištavanje energije usitnjene biomase iz različitih voćnih usjeva, autori istraživanja navode da su rezultati analize izračunati prema vrijednostima primjenjivima na drvo širokog lista, prema normi ISO CEN / TS 14961 (2005), jer je ova kategorija biomase najslabija istraživanim usjevima. Budući da ti podaci pokazuju određena odstupanja, ona se moraju koristiti s oprezom, kao i rezultati dobiveni u ovoj studiji. Autori također tvrde da bi prema Hrvatskoj energetske strategiji 2010. godine Hrvatska potrošnja energije u svim sektorima iznosila oko 310,6 PJ, a ako se uzme u obzir potencijalna energija iz obrezane biomase od 4,21 PJ, može se izračunati da ovaj sektor poljoprivrede doprinosi energetske neovisnosti Hrvatske i ciljevima o ukupnoj potrošnji biogoriva s nešto više od 1%. U sljedećem tekstu prikazat će se primjeri zašto se procijenjena vrijednost usitnjene biomase (Bilandžija et al, 2012) treba uzeti u razmatranje.

Tablica 3 . Najveća moguća količina orezane biomase iz poljoprivrednih površina intenzivne proizvodnje u Hrvatskoj Izvor: Bilandžija, N. et.al (2012.)

Crop	Planting distance (m)	Number of trees or vines	Number of trees or vines ha ⁻¹	Average biomass (kg per tree or vine)	Total biomass (kg ha ⁻¹)
Apple	3.50 × 1.20	15,684.500	2,375	2.34	5,557.5
Pear	3.50 × 1.20	1,149.500	2,375	2.45	5,818.7
Peach and nectarine	5.5 × 4.5	486.325	397	7.23	2,870.3
Apricot	6.5 × 5.5	87.920	280	5.79	1,621.2
Sweet cherry	6.5 × 6.5	281.732	337	5.90	1,988.3
Sour cherry	5.5 × 4.5	981.720	404	5.37	2,169.5
Plum	6.5 × 5.5	1,331.120	280	7.34	2,055.2
Walnut	8.5 × 7.5	1,090.365	157	3.43	538.5
Hazelnut	5.5 × 3	1,137.462	606	3.05	1,848.3
Almond	6.5 × 5.5	127.400	280	5.81	1,626.8
Fig	6.5 × 5.5	110.320	280	4.58	1,282.4
Olive	6 × 6	4,161.938	278	9.08	2,524.2
Grapevine	1.90 × 1.10	162,554.000	4,781	0.89	4,255.1

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Tablica 4 . Potencijalna količina korisne energije iz ispitivanih usjeva

Crop	MJ tree ⁻¹ / grapevine ⁻¹	MJ ha ⁻¹	Potential of Croatia (TJ)
Apple	39.92	94,814.75	626.13
Pear	41.05	97,498.50	47.17
Peach and nectarine	128.16	50,881.10	62.32
Apricot	89.22	24,981.88	7.84
Sweet cherry	98.86	33,315.82	27.85
Sour cherry	91.99	37,167.19	31.07
Plum	125.33	35,092.40	166.82
Walnut	55.93	8,781.01	60.90
Hazelnut	53.28	32,287.68	60.60
Almond	102.42	28,678.72	13.04
Fig	71.45	20,006.28	7.88
Olive	153.50	42,672.16	638.84
Grapevine	15.17	72,546.89	2,466.59
Total			4,217.05

Izvor: Bilandzija, N. et.al (2012)

Biomasa je još uvijek dominantna u Hrvatskoj u obliku drva za ogrjev, na način na koji su naši preci radili - u malim, neučinkovitim pećima koje su upitne i po ekonomskoj i zdravstvenoj perspektivi. Hrvatski proizvođači voća uopće nemaju iskustva u pripremi i korištenju orezane biomase za proizvodnju energije. Pozitivan primjer proizvodnje suvremenih biogoriva u Hrvatskoj je proizvodnja drvnih peleta koje se, nažalost, uglavnom izvoze. Potrošnja peleta prvenstveno ovisi o samom gospodarstvu, o infrastrukturi (kvaliteti izolacije i stolarije). Za kućanstvo koje koristi peći od 8,5 ili 10 kW potrebno je najviše 15 kilograma peleta dnevno, čija cijena iznosi 25 HRK uključujući PDV.

Prema obavljenim mjerenjima u vinogradima, plantaži maslina, znanstvenici su zaključili da postoji značajan potencijal raspoložive agro biomase u Hrvatskoj, ali nedostatak znanja i neodgovarajuće poljoprivredne prakse dovode do nepovoljnog postupanja s biomasom. Mnogi poljoprivrednici smatraju da orezivanje predstavlja višak u poljoprivrednoj proizvodnji. Inače, postoje pozitivni slučajevi koji vjeruju u snažan potencijal njihove biomase te njene primjenu u vrijednosnim lancima biomase.

Voćnjaci i vinogradi zahtijevaju godišnje orezivanje, što daje velike količine biomase koja bi mogla biti dostupna kao izvor bioenergije. Dobiveni iznosi rezidbenih ostataka iz vinograda pokazuju količine od oko 2 tone po hektaru. Iznos orezivanja u nasadima maslina pokazuje procjenu od 1,7 do 2,5 tona po hektaru (Bilandzija et al.2012).

Još jedan izvor informacija bio je doktorska disertacija Biljane Kulišić [3] . Njezin rad razvija koncept procjene potencijala poljoprivredne biomase povezujući ograničenja poljoprivredne proizvodnje s poželjnim značajkama potrebnim za opskrbu energijom. Potencijal se izražava na tri razine: teorijski - primjenom statističkih metoda; tehničkih - primjenom neizrastog analitičkog hijerarhijskog procesa (FAHP) i ekonomičnim dodavanjem referentnih vrijednosti.

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Tablica 5 . Ukupni tehnički potencijal iz poljoprivredne biomase u Hrvatskoj

Primarna energija	PJ/godišnje	GWh/godišnje
Ostaci žetve/ pšenica i kukuruz	7.35	2 041
PROUN	1.06	294
Peradarski gnoj	1.77	493
Ukupno	10.17	2 828

Izvor: Kulišić (2013)

Uspoređujući s Bilandžijom i suradnicima, PROUN potencijal je smanjen na četvrtinu.

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- Istraživanje (ukoliko bude dostupno) kako karakteristike pojedinog nasada te agrotehničke i pomotehničke mjere utječu na količinu raspoložive PROUN biomase. Navesti neke procjene i objasniti razlog nedostatka informacija).

- Pružanje dodatne informacije o neto dostupnosti s obzirom na tehniku berbe i učinkovitost prijevoza, ili uzimajući u obzir posebna gospodarska ograničenja, primjerice zbog dostupnosti i troškova na terenu (ukoliko nema podataka, dati procjene i objasniti nedostatak informacija).

Biomasa nastala nakon orezivanjem uglavnom se zanemaruje kao obnovljivi izvor goriva u Hrvatskoj. Zajednički vrijednosti lanci raspršili bi se gubitkom energije kroz spaljivanje orezane biomase na otvorenom u blizini nasada, kroz korištenje orezivanja kao zaštite od mraza (mokro spaljivanje pod drvenim krošnjama), paljenjem drva za roštilj i grijanje prostora i / ili kod drva za gorivo tijekom destilacije alkoholnih pića u domaćoj proizvodnji. Osim ovih vrijednosnih lanaca, obrezivanje se također ostavlja na tlu kako bi istrunulo u nasadu. Bit će potrebno provesti istraživanja kod vlasnika ratarskih kultura kako bi se saznao koji bi se postotak zajedničke koristi mogao postići u vrijednosnom lancu. Korištenje orezane biomase, kao i njegova dostupnost, odražavat će lokalne uvjete, kako u smislu reljefa tako i u načina razmišljanja.

Prema podacima Hrvatskog zavoda za statistiku (DZS), u 2016. godini bilo je 71.060 ha pod višegodišnjim nasadima ili 4,5% u udjelu ukupnog korištenog poljoprivrednog zemljišta (voćnjaci, vinogradi, maslinici) s padom od 5% od 2015.

Tablica 6 . Zemljište pod višegodišnjim nasadima vezano za PROUN sektor

Višegodišnji trajni nasadi	2015	2016	2015/2016
Voćnjaci	30,112	29,476	97.9
Vinogradi	25,587	23,400	91.5
Maslinici	19,100	18,184	95.2

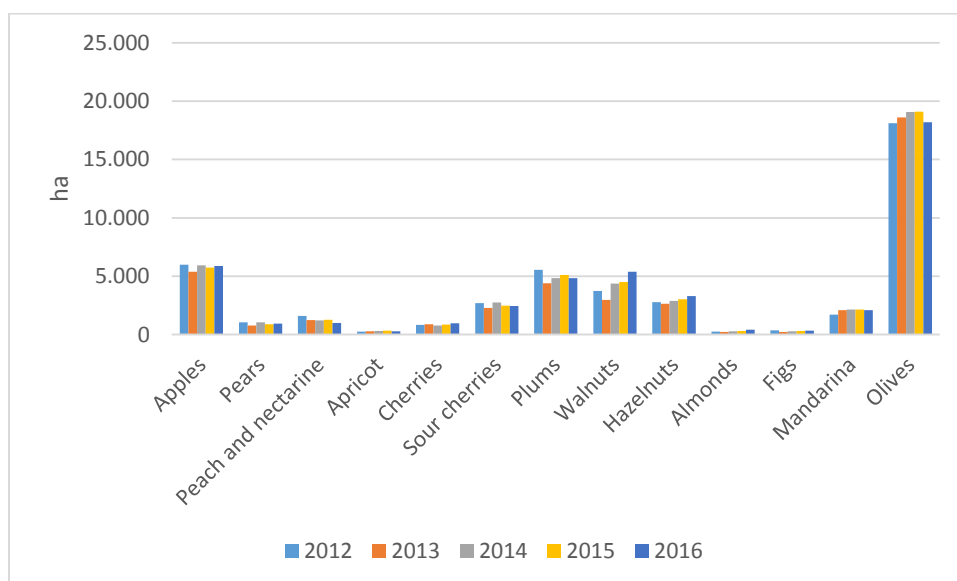
Izvor: Državni zavod za statistiku Croatian Bureau of Statistics, www.dzs.hr

Hrvatska je malo područje (56.594 km²) i s raznolikošću terena s tri glavne klimatske zone: kontinentalna na sjevernim ravnicama i sjeverozapadnim brežuljcima, srednja planinska i mediteranska klima na obali i brojnim otocima na jugu. Geografska i klimatska obilježja određuju veličinu i gustoću višegodišnjih stabala, kao i vrste voća.

Voćnjaci

Rezidbeni ostaci iz voćnjaka razlikuju se po vrstama voća i vrsti grožđa (intenzivno, konvencionalno).

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Slika 3. Petogodišnji trend površina pod voćarskim kulturama u Hrvatskoj

Izvor: Državni zavod za statistiku, www.dzs.hr

Primjer 1: Voćnjaci jabuka

Sljedeći primjeri rasta jabuka pokazuju da prosječna količina poljoprivrednih rezidbenih ostataka (PROUN) po hektaru nije pouzdana metoda procjene potencijalne biomase. Razlika između parcela u Vrtovi voća doo i Ivkovića je u razmaku sadnje. Jedan nasad je na udaljenost od 3,50 x 1,20, a drugi 3,20 x 1,20 udaljenosti. Razlika među oba intenzivna nasada jabuka bilježi 10% razlike u potencijalu PROUN-a.

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Slika 2. Intenzivan uzgoj jabuka (Vrtovi voća d.o.o., 30ha)³

³ Ako nije drugačije navedeno, izvor fotografija je googlesearch

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Slika 3. Intenzivan uzgoj jabuka (Ivković, Pleso 11ha)



Slika 6. Tradicionalni uzgoj jabuka

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Državni zavod za statistiku ne daje podatke o površinama voćnjaka koje bi mogle biti relevantne za određivanje potrošnje PROUN-a i njegovog stavljanja na tržište.

Vinogradi

Oblik vinograda na sjeveru drukčiji je od onoga na jugu. Postoji oko 300 službenih vinarskih regija podijeljenih prema priobalnim i unutrašnjim vinima. Većina (68%) vina su bijela i proizvedena u unutrašnjosti, dok je 31% crvenih, proizvedenih duž obale. Nasumičan odabir vinograda u Hrvatskoj, (niže prikazani) ukazuje na teškoću procjene količine i dostupnosti orezivanja vinograda, jer se svi razlikuju po gustoći, udaljenosti i nagibu. Kako bi procjena bila još teža, sorte vinove loze različito su orezani; kraći, mješiviti i dugi rezi. Slike 7 - 9 prikazuju vinograde u kontinentalnom dijelu Hrvatske, a 10 - 14 prikazuju vinograde sredozemnog dijela Hrvatske.



Slika 4. Kutjevački vinogradi na sjeveru Hrvatske (Graševina)



Slika 5. Kneževi vinogradi u sjeveroistočnoj hrvatskoj (Graševina, Reizling),



Slika 6. Vinogradi u Zagorju



Slika 7. Vinogradi u Brodsko-posavskoj županiji

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Slika 8. Vinogradi u Splitsko-dalmatinskoj županiji, južna obala Jadranskog mora (Plavac)



Slika 9. Vinogradi na poluotoku Pelješcu, južna obala (Dingač and Postup)



Slika 10. Vinogradi u Istri, sjeverna obala (Merlot, Terrano, Malvazia)



Slika 11. Vinogradi na otoku Krku, sjeverni Jadran (Žlahtina from Vrbnik)



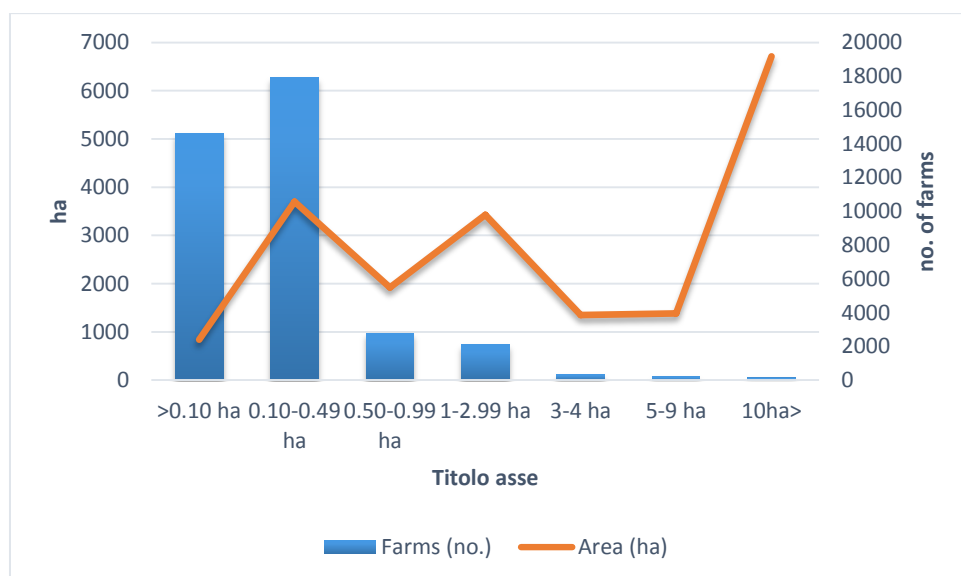
Slika 15. Nasadi maslina u Dalmaciji (izvor: autorova zbirka)

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Tablica 3. Struktura vinograda u Hrvatskoj

Vinogradi	Kontinentalna Hrvatska			Mediteranska Hrvatska		
	Obiteljska poljoprivredna gospodarstva (br.)	Površina (ha)	Prosječna veličina vinograda (ha)	Obiteljska poljoprivredna gospodarstva (br.)	Površina (ha)	Prosječna veličina vinograda (ha)
Proizvodnja	22,221	9,438.36	2.35	15,843	9,348.78	1.69
Ukupno	28,895	10,590.45	2.73	17,173	9,802.37	1.75

Izvor: Državni zavod za statistiku



Slika 16. Odnos između površina i broja vinograda u Hrvatskoj

Izvor: Državni zavod za statistiku, 2015

Uzimajući u obzir da je potrebno minimalno 5 kW da bi se ugriao prostor, uz 1800 sati grijanja godišnje i 80% učinkovitosti, kućanstvo bi trebalo 322 kg rezidbenog ostataka iz vinove loze godišnje, što bi se moglo prikupiti sa 0,075 ha, ako se koristi 4,255.1 kg/ha (Bilandžija et al. 2012). Pod tom pretpostavkom, čak i parcele manje od 0,10 ha bi na tržištu trebale imati višak poljoprivrednih rezidbenih ostataka (PROUN). Da bismo bili sigurni, pretpostavimo da će sva poljoprivredna gospodarstva ispod 0,5 ha koristiti rezidbene ostatke (PROUN) za vlastitu potrošnju, bez obzira radi li se o grijanju, mjerema protiv mraza ili kao materijal za roštilj. Ostala poljoprivredna gospodarstva imala bi dovoljno količina PROUN-a da bi ih stavili na tržište za daljnju preradu (pelete, sječka). Dostupni PROUN potencijal bio bi 62,95 t / god, s 9,7 MJ / kg energetske vrijednosti, s krajnjim 0,61 PJ / god.

S druge strane, primjer iz Kutjevačkih vinograda daje trećinu rezidbene biomase po ha u odnosu na istraživanje Bilandžije i dr. 2012. i to 1,508 kg / ha.

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Primjer 2: Kutjevački vinogradi u funkciji obnovljivih izvora energije

Orezivanje dobiveno sorti Velški Riesling u vinogradima Kutjevo može dati oko 2052,48 tona biomase (temeljeno na pokusu tijekom 2009. i 2010. godine)

Sorte	Površina, ha	Broj trsova
<i>Velški Riesling</i>	930,8228	3947082
Druge sorte	430,1731	1979916
Ukupno	1360,9959	5926998

Ekonomski potencijal (pretpostavke)

- Bez organiziranog otkupa
- Cijena biomase je oko 40 eura po toni
- Dodatni prihodi po ha vinograda iznose 600 kn
- Kutjevačka vinogradarska regija ima ukupni potencijal od 3.800 tona biomase
- Voćarstva oko 3.000 t
- $6800 \text{ t} * 40 \text{ €} = 272.000 \text{ €}$

Izvori:

Jakobović, M. i Jakobović, S. (2011.) i Jakobović, M. i Kiš, D.

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Maslinici

Prema podacima Državnog zavoda za statistiku trenutno imamo 18.184 hektara maslinika. Nakon niza godina u poraste, površine pod maslinama stagniraju u razdoblju od 2012. do danas. Statistička metodologija bila je drugačija prije ulaska Hrvatske u EU. DZS prikuplja podatke o broju maslina. Prema podacima, u 2004. godini bilo je 3.743.000 stabala maslina (Statistički ljetopis iz 2005.) uzgajanih na 16.980 ha, od čega 16.685 ha na obiteljskim poljoprivrednim gospodarstvima i 295 ha kod pravnih subjekata, pravnih osoba i onih na državnom zemljištu (izvor: Projekt IEE VIŠE, tržište ostataka maslina za energiju).

Trenutačno je teško procijeniti broj hektara i broj maslina. Brojni web izvori daju različite podatke iz različitih razdoblja (površina varira od 5.500 do 28.000 hektara, a broj stabala je negdje 5,5 milijuna). Kako bi izbjegli nagađanja, procjena potencijala rezidbenih ostataka i uklonjenih nasada (PROUN) nastaviti će se u službenim statistikama.

Godišnja proizvodnja maslinovog ulja je oko 35.000 hl godišnje (DZS). Podaci o dostupnosti orezivanja prikupljaju se iz sekundarnih izvora. Ti sustavi bilježe ostatke poput kore drveta, drvnih peleta, grana, komine maslina i vinove loze, košćica i drugih drvnih proizvodnih otpada).

Na temelju broja hektara i proizvodnje i podataka iz Cavalaglio G. i Cotana S. (2007.) mogli bismo dobiti količinu od 1,7 tona rezidua po hektaru ili razlika između ostataka i proizvoda od 0,5 i 2,6 (moke baza).

Broj hektara (18.184) x 1,7 tona = 30.912.80 tona

Proizvodnja maslina (31.183 t) (DZS, 2016) x 1.55 (prosjeak između 0.5 i 2.6) = 48.333,65 tona

Podaci o dostupnosti orezivanja u Hrvatskoj su oskudni. Ono što je dostupno je nekoliko procjena jednog (npr. ostataka maslina) ili svih (npr. biogoriva za grijanje stambenih zgrada) rezidbenih izvora koja potječu iz projekata financiranih iz EU, doktorske disertacije i dokumenata. Izvori procjenjenog potencijala u Hrvatskoj su (kronološki nevedno):

- IEE VIŠE, Tržište rezidua maslina u funkciji obnovljivih izvora energije
- Bilandžija N. i sur. Energetski potencijal biomase iz rezidbe voćaka Hrvatskoj, 2012. godine
- Kulišić, B.: Višekriterijska procjena biomase iz poljoprivrednog energetskog potencijala u Hrvatskoj, doktorska disertacija, Sveučilište u Zagrebu Agronomski fakultet, 2013.
- FP7 EuroPruning Novi logistički lanac biomase iz orezivanja <http://www.europruning.eu/>,
- IEE: Succelog - Poticanje stvaranja logističkih centara biomase od strane agroindustrije www.succellog.eu
- H2020: BiomasSud Razvijanje održivog tržišta rezidencijanog sektora sredozemnih krutih biogoriva. <http://biomasudplus.eu/>
- H2020 up_Running: Održivo korištenje drvene biomase iz poljoprivrednih rezidbenih ostataka i uklonjenih nasada; www.up_Running.eu.

Tablica 8. Procjena ukupnog poljoprivrednog rezidbenog ostatka (PROUN)

Voćnjaci	Površina *	Rezidbeni ostaci, t/ha**	Ukupno t	Proizvodnja, t*	Rezidbeni ostaci, t (moko), snižena vrijednost **	Ukupni ostaci, t
Jabuke	5.890,00	2,40	14.136,00	44.176,00	0,10	4.417,60

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Kruške	933,00	2,00	1.866,00		3.818,00	0,10	381,80
Breskve	1.033,00	2,90	2.995,70		4.619,00	0,20	923,80
Limun	2.192,00	1,80	3.945,60		52.668,00	0,10	5.266,80
Badem	430,00	1,70	731,00		154,00	1,90	292,60
Lješnjaci	3.304,00	2,80	9.251,20		1.254,00	1,90	2.382,60
Vinogradi	23.400,00	2,90	67.860,00		123.651,00	0,2-0,8	24.730,20
Masline	18.184,00	1,70	30.912,80		31.183,00	0,5-2,6	15.591,50
			131.698,30				53.986,90

*Državni zavod za statistiku 2016, ** Cavalaglio G. i Cotana S. 2007

Izvor: Izračun autora temeljeno na Kulišić (2013.)

Gore navedeni nasadi su teorijski i razlikuju se prema dvjema glavnima regijama u Hrvatskoj: kontinentalnoj i mediteranskoj. Razumno je pretpostaviti da manji i stariji nasadi daju manje količine, dok nasadi namijenjeni za komercijalnu proizvodnju voća slijede standarde. Ipak, gore navedene razmaci sadnje više se odnose na ekstenzivnu poljoprivredu nego na intenzivne voćne nasade s gušćim sklopom stabala po hektaru.

Državni zavod za statistiku (DZS) je 2017. godine proširio zajednički upitnik o korištenju energije u kućanstvima i obiteljskim gospodarstvima s upotrebom biomase, uključujući podatke o orezivanju. Istraživanje će se provoditi u 2018. godini te će dati rezultate do kraja 2018. Drugim riječima, u bliskoj budućnosti bit će dostupni važeći statistički podaci o orezanoj biomasi i njezinoj uporabi u Hrvatskoj.

Razumno je pretpostaviti da će se male zemljišne parcele koristiti za kratke lance vrijednosti i koristiti rezidbene ostatke za vlastito grijanje. U tom smislu, jedina prepreka je kulturološka i oslanja se na radnu snagu spremnu za orezivanje i transport rezidbenih ostataka iz nasada u kućanstvo. Ipak, prethodno spomenuta konkurentna upotreba rezidbenih ostataka kao prevencija od mraza, material za roštiljanje i destiliranje alkohola vrijedna su upotreba PROUN-a. Pretpostavljajući da se vlasnici većih parcela ili komercijalni proizvođač voća odlučuju za dulje vrijednosne lance i koriste PROUN kao sirovinu za proizvodnju drvne sječke, drvnih peleta ili poljoprivrednih peleta (kombinacija drva i slame, kukuruzovine), bit će potrebna studija izvedivosti podizanja svijesti o ovim poslovnim mogućnostima.

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uP_running Pregledna karta biomase iz poljoprivrednog obrezivanja i uklanjanja plantaža - sažetak rezultata za Hrvatsku

Tablica 9. UP_running pregledna karta biomase iz poljoprivrednog obrezivanja i uklanjanja plantaža - Kontinentalna Hrvatska

Regija	Osiječko-baranjska županija	Osiječko-baranjska županija	Osiječko-baranjska županija	Osiječko-baranjska županija	Brodsko-posavska županija	Brodsko-posavska županija	Brodsko-posavska županija	Brodsko-posavska županija	Brodsko-posavska županija	Brodsko-posavska županija
Općina	Karanac	Karanac	Karanac	Karanac	Oriovac	Oriovac	Oriovac	Oriovac	Oriovac	Oriovac
Veličina polja	16.43	23.13	7.45	24.28	1.5	1	0.29	1	0.05	1
Obročna vrsta	vinogradi	vinogradi	vinogradi	vinogradi	vinogradi	vinogradi	vinogradi	vinogradi	vinogradi	vinogradi
Raznolikost usjeva	Merlot	Velški rizling	Velški rizling	Velški rizling	Velški rizling	Cabernet Sauvignon	Chardonnay	Cabernet Sauvignon	Merlot	Cabernet Sauvignon
Starost usjeva	13	11	12	12	32	12	9	12	9	12
Vitica / ha	4145	4423	4831	4125	7000	4000	4000	4000	4500	4000
Udaljenost	2.8x0.8	2.8x0.9	2.8x0.10	2.8x0.11	2.4x1	2.4x0.8	2.4x0.8	2.4x0.9	2.4x0.8	2.4x0.8
Oblik obrezivanja	špalir	špalir	špalir	špalir	vaza	jedan strani guyot	vaza	jedan strani guyot	vaza	jedna strana Guyot
Nagib. %	6	6	6	6	10	10	16	10	10	8
Pokrivač tla	100% travnjak	100% travnjak	100% travnjak	100% travnjak	Ogoljen	100% travnjak	sezonska pojava	100% travnjak	Sezonska pojava	50% travnjak
Prinos. t / ha	9.13	10,835	10.07	11.5	7.5	8	5	8	6	8
Prinos prinosa prije mjerenja. t / ha	9	9,772	8.5	11.37		6.5		6.5		6.5
Navodnjavanje	oborine	oborine	oborine	oborine	oborine	oborine	oborine	oborine	oborine	oborine
Stupanj intenziviranja	srednji	srednji	srednji	srednji	srednji	nizak	srednji	nizak	srednji	nizak
Vrsta obrezivanja	M.S.R	M.S.R	M.S.R	M.S.R	M	M	S	M	S	M
Metoda čišćenja	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno
Operacije obrezivanja	ručno sa škarama	ručno sa škarama	ručno sa škarama	ručno sa škarama	ručno sa škarama	ručno sa škarama	ručno sa škarama	ručno sa škarama	ručno sa škarama	ručno sa škarama
Obrezivanje vremena	Prosinac. Siječnja. Veljača. ožujak	Prosinac. Siječnja. Veljača. ožujak	Prosinac. Siječnja. Veljača. ožujak	Prosinac. Siječnja. Veljača. ožujak	Siječnja. veljača	Siječnja. Veljača. ožujak	Veljača. ožujak	Siječnja. Veljača. ožujak	Veljača. ožujak	Siječnja. Veljača. ožujak
Učestalost	godišnje	godišnje	godišnje	godišnje	godišnje	godišnje	godišnje	godišnje	godišnje	godišnje

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obrezivanja										
Je li ova vrsta obrezivanja kao i obično	da	da	da	da	da	da	da	da	da	da
Opišite količinu obrezivanja proizvedenu do ostalih godina	isti	isti	isti	isti	isti	isti	isti	Isti	isti	isti
Datum mjerenja	2017/02/28	2017/02/28	2017/02/28	2017/02/28	2017/02/28	2017/02/27	2017/02/27	2017/02/27	2018/02/27	2017/02/27
Količina obrezivanja dobivena. t / ha	1.6	1.3	0,7	1.5	2.15	2.72	1.9	2.26	2.06	2.59
Koliko je dana obrezivanje bilo na tlu prije mjerenja	4	2	3	4	2	4	7	2	2	3
Sadržaj vlage. %										

Izvor: <http://www.up-running-observatory.eu/en/>

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Tablica 4. **UP_running pregledna karta biomase iz poljoprivrednog obrezivanja i uklanjanja plantaža - Kontinentalna Hrvatska**

Regija	Kontinentalna Hrvatska					
Županija	Bjelovarsko bilogorska županija	Bjelovarsko bilogorska županija	Bjelovarsko bilogorska županija	Bjelovarsko bilogorska županija	Bjelovarsko bilogorska županija	Bjelovarsko bilogorska županija
Općina	Daruvar	Daruvar	Daruvar	Daruvar	Daruvar	Daruvar
Veličina polja	6945	836	6,604		314	1877
Obročna vrsta	Orah	trešnje / višnje	jabuke	šljiva	marelica	Lješnjaci
Raznolikost usjeva						
Starost usjeva	7	7	7	7	7	7
Vitica / ha	157	337	2375	280	280	606
Udaljenost	8.5x7.5	6.5x6.5	3.5x1.2	6.5x5.5	6.5x5.5	5.5x3
Oblik obrezivanja	Vaza	Vaza	Palm / ventilator	Vaza	Vaza	Vaza
Nagib. %						
Pokrivač tla						
Prinos. t / ha						
Prinos prinosa prije mjerenja. t / ha						
Navodnjavanje	Oborine	Oborine	Oborine	Oborine	Oborine	Oborine
Stupanj intenziviranja						

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Vrsta obrezivanja						
Metoda čišćenja	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno
Operacije obrezivanja	Ručno sa škarama	Ručno sa škarama	Ručno sa škarama	Ručno sa škarama	Ručno sa škarama	Ručno sa škarama
Obrezivanje vremena						
Učestalost obrezivanja	godišnji	godišnji	godišnji	godišnji	godišnji	godišnji
Je li ova vrsta obrezivanja kao i obično						
Opišite količinu obrezivanja proizvedenu do ostalih godina						
Datum mjerenja	2009	2009	2009	2009	2009	2009
Količina obrezivanja dobivena. t / ha	0,54	1,99	5.56	2.06	1.62	1.84
Koliko je dana obrezivanje bilo na tlu prije mjerenja						
Sadržaj vlage. %	45	45	45	45	45	45
Regija						

Izvor: <http://www.up-running-observatory.eu/en/>

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Tablica 5. UP_running pregledna karta biomase iz poljoprivrednog obrezivanja i uklanjanja plantaža - Kontinentalna Hrvatska

Regija	Kontinentalna Hrvatska								
Županija	Zadarska županija	Zadarska županija	Zadarska županija	Zadarska županija	Zadarska županija	Zadarska županija	Zadarska županija	Zadarska županija	Zadarska županija
Općina	Zadar	Zadar	Zadar	Zadar	Zadar	Polača	Polača	Marina	Marina
Veličina polja	1.877	34000	394	14.971	455	5	10	1	0.1
Obročna vrsta	breskve	vinogradi	smokva	masline	bademi	masline	masline	masline	masline
Raznolikost usjeva						Oblice. ascolano. Carolea. Leccino	Oblice. ascolano. Carolea. Leccino	Oblice	Oblice
Starost usjeva	7	7	7	7	7	10	10	13	30
Vitica / ha	397	4781	280	278	280	260	260	200	180
Udaljenost	5.5x4.5	1.9x1.1	6.5x5.5	6x6	6.5x5.5	6.5x6	6.5x6	8x7.5	9x8
Oblik obrezivanja	Vaza	Špalir	Vaza	Vaza (jedna stabljika)	Vaza	Vaza (jedna stabljika)	Vaza (jedna stabljika). polikonska vaza	Vaza (2-3 proizlazi iz tla)	Drevne masline
Nagib. %						5	1	0	0
Pokrivač tla						Ogoljen	kamenito tlo	sezonska pojava	sezonska pojava
Prinos. t / ha						4.5	2.6	6	3.5

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Prinos prinosa prije mjerenja. t / ha								4.5	3.5
Navodnjavanje	oborine	oborine	oborine	oborine	oborine	oborine	djelomično navodnjavanje	oborine	oborine
Stupanj intenziviranja						organski	organski	organski	organski
Vrsta obrezivanja						M. S	M. S		M. S. R
Metoda čišćenja	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno	samo ručno
Operacije obrezivanja	Ručno škare	Ručno škare	Ručno škare	Ručno škare	Ručno škare	Ručno škare	Ručno škare	Ručno škare	Ručno škare
Obrezivanje vremena						Veljača. Ožujak. Travanj. kolovoz	Veljača. Ožujak. Travanj. kolovoz	Veljača. ožujak	ožujak
Učestalost obrezivanja	godišnje	godišnje	godišnje	godišnje	godišnje	dvogodišnje	dvogodišnje	godišnje	godišnje
Je li ova vrsta obrezivanja kao i obično						Da	Da	Da	Da
Opišite količinu obrezivanja proizvedenu do ostalih godina						isti	više	isti	isti
Datum mjerenja	2009	2009	2009	2009	2009	2017/09/03	2017/10/03	2017/08/03	2017/08/03
Količina obrezivanja dobivena. t / ha	2.87	4.26	1.28	2.52	1.63	2.45	1.26	1.63	2.52
Koliko je dana obrezivanje bilo na tlu prije mjerenja						1	1	1	1

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Sadržaj vlage. %	45	45	45	45	45				

Izvor: <http://www.up-running-observatory.eu/en/>

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- Istraživanje nacionalnog energetskeg plana (ukoliko postoji) i uloge sektora biomase u istom.
- Istraživanje nacionalnog energetskeg plana (ukoliko postoji) i uloga sektora biomase u istom.

Strategija energetskeg razvoja Republike Hrvatske navodi da Republika Hrvatska pripada zemljama s visokim potencijalom biomase. U skladu s ciljevima Strategije gospodarenja otpadom, posebno se ocjenjuje potencijal otpada iz biološkog podrijetla za proizvodnju energije.

Cilj Hrvatske za povećanjem udjela obnovljivih izvora energije za 20% u godišnjoj bruto potrošnji energije u zemlji do 2020. godine definiran Nacionalnom energetskeg strategijom 2009. - 2020. Hrvatska nacionalna energetska strategija 2009.-2020. ima tri osnovna cilja: 1) povećati sigurnost opskrbe energijom, 2) razviti konkurentni energetskeg sustav i 3) osigurati održivi razvoj energetskeg sektora. Ovi su ciljevi osobito važni zbog ovisnosti Hrvatske o uvozu energije, što rezultira ranjivosti zemlje prema promjenama cijena energije. Hrvatska uvozi oko pola primarne potrošnje energije. Ukupna proizvodnja primarne energije iznosi oko 225,66 PJ / god. i ovisno o kišama.

Strategija energetskeg razvoja Republike Hrvatske odredila je cilj korištenja oko 15 PJ energije biomase u 2010., au 2020. godini oko 26 PJ. Dio ove biomase će se koristiti u mnogim elektranama na biomasu ukupne snage od oko 85 MW u 2020.

Da bi Republika Hrvatska ostvarila svoje ciljeve u pogledu korištenja biomase, neizbježna je suradnja između nekoliko ministarstava.

Hrvatska bi suradnjom ministarstava trebala postaviti preduvjete za razvoj u poticajne mjere državne, industrijske, poljoprivredne i energetske politike kao što su:

- Poticat će se razvoj hrvatske industrije drvne industrije;
- Razvija se gospodarenje šumama i iskorištavanje šuma;
- Ponovno šumarstvo i uzgoj usjeva kratkog dometa poticat će se na šumskom zemljištu;
- Elektrane biomase stimulirane su kogeneracijom električne energije i toplinske energije;
- Poticat će se uporaba biomase za proizvodnju toplinske energije.

Ciljevi za 2020 .:

- smanjiti emisije stakleničkih plinova do 20% do 2020. godine uzimanje razine emisija u 1990. godini kao osnovica;
- povećati udio obnovljive energije za 20% u godišnjoj bruto potrošnji energije u zemlji do 2020 .;

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- pokriti 10% potrošnje energije u svim sektorima prometa s energijom iz obnovljivih izvora do 2020.;
- smanjiti potrošnju energije za 9% do 2016. godine.

To će omogućiti da zadovolji potražnju za potrošnjom električne energije s domaćom proizvodnjom.

Ciljevi:

- **biomasa:**

- Korištenje 26 PJ iz biomase do 2020. dio biomase koristiti u elektranama za biomasiu u 2020. godini od oko 85 MW ukupne snage.

- **bioplin:**

- Od poljoprivredne proizvodnje za energetske svrhe, upotrijebiti ekvivalent od najmanje 20% ukupnih uvjetnih grla i time proizvesti oko 2,6 PJ energije iz bioplina ili oko 100 milijuna m³ bioplina u 2020.

- **Energija vjetra:**

- Instalirati 400 MW u vjetroelektranu do 2020.

- **Velike hidroelektrane:**

- Izgraditi nove ili povećati snagu u postojećim hidroelektranama u iznosu od 300 MW do 2020.

- **Male hidroelektrane:**

- Izgradnja najmanje 100 MW malih hidroelektrana do 2020.

- **Geotermalna energija :**

- Ekonomski opravdano iskorištavanje postojećih geotermalnih izvora i ekonomski povoljnih za bušenje te korištenje geotermalne energije i iskorištavanje rezervoara srednje temperature za razvoj.

- **Solarna energija:**

- Ugraditi 52 MW u fotonaponske sustave do 2020.

Strategija energetskog razvoja Republike Hrvatske definirala je okvirne ciljeve za obnovljive izvore energije (OIE). S obzirom na gospodarsku i financijsku krizu, prognoze gospodarskog rasta i izravna potrošnja energije nisu postignuti, pa su ciljevi utvrđeni Strategijom energetskog razvoja Republike Hrvatske prilagođeni novoj situaciji te planovima. Što se tiče gore navedenog, ciljevi obnovljivih izvora energije koji se razmatraju u okviru revidiranog Akcijskog plana postavljaju se tako da su

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izvedivi, uzimajući u obzir tehničke i financijske elemente i sposobnost priključenja na mrežu električne energije. Postoji rizik da projekt ne bude realiziran zbog nemogućnosti spajanja na mrežu električne energije, ali je rizik uklonjen tako da ne ograničava buduće projekte bilo koje tehnologije ako se održava sigurnost mreže ili održava istu razinu sigurnost opskrbe. Donošenjem Trećeg paketa energetskog zakonodavstva u nacionalno energetsko zakonodavstvo, bitno se mijenjaju planovi daljnje afirmacije OIE, uz istodobno uzimanje u obzir sigurnost opskrbe i sigurnost samog elektroenergetskog sustava.

Ciljane dionice triju sektora za grijanje / hlađenje, električnu energiju i transport prikazane su u donjoj tablici

Tablica 12 . Cilj Hrvatske za obnovljive izvore energije 2020

Sektor	Udio u bruto konačnoj potrošnji po sektoru
Ukupni cilj	20%
Grijanje i hlađenje	19 . 6%
Elektricitet	35%
Prijevoz	10%

Izvor: Nacionalni plan djelovanja za obnovljive izvore energije

Kako bi se postigao cilj OIE, određuju se kvote za svaki obnovljivi izvor energije.

Tablica 13 . Proizvodnja električne energije obnovljivim izvorom energije u odnosu na ispunjenje kvota

	Prihvatljivi proizvođači, operativni pogoni	Nositelji projekata; biljke na čekanju	Kvota će ostati do 2020	Ekvivalent instalirane snage
Vjetar	46%	54%	0%	744
Mala hidro	9%	14%	77%	35
Čvrsta biomasa *	20%	79%	0%	120
bioplin **	38%	49%	7%	70
geotermalna	0%	33%	67%	30

* u rebalansu je 51.694 MW, u rebalansu je 3.7 MW

Biomasa kao resurs je povećan udio u sektoru kućanstva kao i drva za gorivo do 66% (72 PJ) na štetu goriva za grijanje. U 2015. godini procijenjena toplina biomase iznosi 515 MW [\[1\]](#) . U rujnu 2017. godine u bioplinima i CHP-ima čvrste biomase djeluje 41,45 MWe (23,5 GWh) i 34,734 MWe (17,1 GWh) [\[2\]](#) . Procjenjuje se da se proizvede oko 270.000 t drvenih kuglica ili ~ 5PJ i izvozi 95% s

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prognozama za proširenje proizvodnje [3]. Kvota za bioplin i CHP za čvrstu biomasu je 70 i 120 MWe do 2020. godine i potpuno je ugovorena za krutu biomasu, dok je za bioplinsku postrojenja dostupno oko 5 MWe. Prema CROBIOM-u postoji postojeća potražnja za 1,5 M t drvene sječke.

Početkom 2016. godine Eurostat je izvijestio da je "u Hrvatskoj udio energije iz obnovljivih izvora u bruto krajnjoj potrošnji energije u 2014. godini iznosio 27,9%, dok je u 2013. godini iznosio 28,1%. Tako je Hrvatska prekoračila cilj do 20% za 2020. godinu te dosegla cilj EU-a za 2030., prema izvještaju Eurostata. "

Tablica 14 . Udio (%) energije iz obnovljivih izvora u bruto krajnjoj potrošnji energije

	2011	2012	2013	2014	Cilj 2020
Ukupno OIE	25.4	26,8	28.1	27,9	20.0
OIE	37,6	38,8	42.2	45,3	39,0 *
RES-H / C	33,7	36,5	37.2	36.2	19,6 *
ODMOR	0.4	0.4	2.2	2.1	10,0 *

* - ciljevi definirani u okviru Nacionalnog akcijskog plana obnovljivih izvora energije 2020

Izvor: Nacionalni akcijski plan obnovljivih izvora energije (NREP), nacrt

Objašnjenje leži u promjeni nacionalne metodologije pri bilježenju potražnje za toplinskom energijom. Naime, istraživanje je pokazalo da je potrošnja drvnog goriva podcijenjena 3-4 puta u ranijoj metodologiji te utemeljena na opskrbi toplinskom energijom. Promjena metodologije učinila je pomak u odnosu na za bazu podataka iz 2005. godine. U ovom trenutku nije jasno kako će se situacija razvijati.

Godine 2016., metodologija nacionalne energetske bilance promijenila se pri snimanju drvnog goriva za grijanje. Rezultati istraživanja o potrošnji goriva u kućanstvima na nacionalnoj razini koji se provode na popisu stanovništva 2011. godine pokazali su da je 66,5% hrvatskih kućanstava u 2012. godini koristilo krutu biomasu za grijanje prostora (66% pripada drvnom gorivu). U ukupnoj potrošnji energije u kućanstvima, biomasa čini 53%, gdje se samo 0,56% pripisuje modernim gorivima za biomasu.

Potrošnja drvnog goriva je ciljano tržište za PROUN sektor.

U studenome 2017. godine Vlada RH je stvorila Radnu skupinu za ažuriranje postojećeg zakonodavstva vezano uz energiju koja je, počevši od Strategija energetskeg razvoja Republike Hrvatske (2009) i NREAP (2013.), zastarjela i ne odražava trenutno stanje energetskeg sektora.

Biomasa za bioenergiju djelomično je stvorila sinergiju s industrijom i gospodarstvom kako se očekuje iz Strategije (2009), budući da je visok postotak bioenergetskih projekata spekulativan i oslanjaju se na bogatu feed-in tarifu dok je korištenje topline iz CHP-a u tijeku.

Dokument	Opće informacije	Uklanjanje biomase i poljoprivrednog obrezivanja i	Linkovi

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		plantaže	
Strategija pametne specijalizacije 2016-2020 i Akcijski plan za provedbu strategije	Tematska prioriteta područja: 1. Zdravstvo i kvaliteta života, 2. Promet i mobilnost, 3. Sigurnost, 4. Hrana i bioekonomija, 5. Energija i održivo okruženje	Pod TPA 5., jedna od podtema je ekološki prihvatljivi materijali, oprema i napredni materijali. Pod spomenutim subtopskim fokusom je na biomasu i bio-based proizvodi (<i>biogoriva temeljena na znanju</i>) <i>Pod TPA 4., subtopics su Održiva proizvodnja i procesiranje hrane i drva, gdje je biomasa uključena kao horizontalna tema.</i>	http://europski-fondovi.eu/sites/default/files/dokumenti/Strategija_pametne_specijalizacije_RH_2016_2020.pdf Narodne novine br. 32/2016
Program ruralnog razvoja	Program ruralnog razvoja uključuje 16 mjera u prioritetnim područjima kao što su znanje i inovacije, konkurentnost, lanac prehrambenih proizvoda, upravljanje rizicima, ekosustavi i klimatske promjene.	Pod mjerom 04 Ulaganja u fizičku imovinu Pod-mjera 4.1 - Potpora za ulaganja u poljoprivredna gospodarstva Korištenje obnovljivih izvora energije Izgradnja postrojenja za proizvodnju energije iz obnovljivih izvora (biomasa i solarna energija) za korištenje na poljoprivrednim gospodarstvima doprinosi poboljšanju učinkovitog korištenja energije i opskrbi i korištenju energije iz nusproizvoda. Cilj je povećati energetska neovisnih poljoprivrednih gospodarstava. Minimalna vrijednost javne potpore po projektu iznosi 5.000 eura. Maksimalna vrijednost javne potpore po projektu iznosi 1.000.000 EUR.Intenzitet potpore za	http://ruralnirazvoj.hr/files/documents/Programme_2014HR06_RDNP001_4_2_en.pdf

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		ulaganja iznosi 50% ukupnih prihvatljivih izdataka. Maksimalne stope će se povećati za dodatnih 20 postotnih bodova u sljedećim slučajevima: 2 za ulaganja koja provode mladi poljoprivrednici ili mladi poljoprivrednici koji su već uspostavili tijekom pet godina prije zahtjeva za potporu; 2 za integriraneprojekte; 2 za ulaganja u područja koja su suočena s prirodnim i drugim specifičnim ograničenjima; 2 za ulaganja koja se financiraju u okviru Europskog inovacijskog partnerstva (EIP); 2 za ulaganja povezana s poslovima iz članaka 28. i 29. Uredbe (EU) br. 1305/2013. Maksimalna kombinirana potpora ne smije prelaziti 90% ukupnih prihvatljivih izdataka.	
Nacionalni plan za obnovljive izvore energije do 2020. - Prijedlog (Ministarstvo gospodarstva) (2013.)	Ciljevi i mjere za korištenje obnovljivih izvora energije	Mjere za korištenje biomase: Mobilizacija degradiranih tala i neobrađenih tala. Program tvrdi da trenutno (2013.) nitko nije posvećen proizvodnji energetske usjeva.	http://europski-fondovi.eu/strateski-dokumenti-republike-hrvatske-2014-2020
Strategija energetskog razvoja Republike Hrvatske	Što se tiče obnovljivih izvora energije (RES), Strategija postavlja sljedeće ciljeve: - Povećanje udjela OIE u bruto izravnoj	Republika Hrvatska postavlja cilj korištenja oko 26 PJ u 2020. Dio ove biomase će se koristiti u brojnim biomasama ukupne snage u 2020. godini oko 85	Narodne novine br. 130/2009

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	potrošnji energije na 20% u 2020. godini, Sektorski ciljevi su sljedeći: - 35% udjela OIE u proizvodnji električne energije, uključujući velike hidroelektrane; - 10% udjela OIE u prometu; - 20% udjela OIE za grijanje i hlađenje.	MW. Kako bi se povećala energetska učinkovitost, postrojenja za proizvodnju električne i toplinske energije u zajedničkom procesu imaju prioritet. ■ Poticati za hrvatsku drvnu industriju; ■ Razviti i gospodarenje šumama i eksploatacija šumske biomase; ■ Poticati pošumljavanje i proizvodnju brzorastućih stabala na šumskom zemljištu; ■ Snage biomase stimulirane su kogeneracijom električne i toplinske energije; ■ Poticati i uporabu biomase za proizvodnju toplinske energije.	

Ostali strateški dokumenti:

Strategija održivog razvoja (Narodne novine br. 30/2009)

Materijali dostupni na web stranici Ministarstva okoliša i energetike (strategije i planovi o klimatskim promjenama i razvoju niskog sadržaja ugljika (<http://www.mzoip.hr/hr/klima/strategije-planovi-i-programi.html>))

- Identificiranje glavnih čimbenika (tehničkih, kulturnih, regulatornih, strukturnih, organizacijskih, ekonomskih ili financijskih) koji ograničavaju razvoj PROUN sektora.

Ako je PROUN potencijal namijenjen za kratki lanac vrijednosti za kućnu uporabu, nikakva posebna tehnička, regulatorna ili organizacijska prepreka ne zaustavlja njegovu upotrebu. Ipak, ako je potencijal PROUN namijenjen za veći vrijednosni lanac za opskrbu lokalnog tržišta

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toplinom ili biogorivima, potreban je transport i skladištenje, mehanizacija te znanje za provedbu potencijala.

Glavna prepreka za implementaciju PROUN potencijala je u ekonomskoj i financijskoj dostupnosti. Vrijednost PROUN-a nije bila dovoljno dostatna da se smatra resursom.

Kulturne prepreke loših navika teško se uklanjaju, uz ekonomsku neisplativost ključne su prepreke sektoru PROUN. Te prepreke osnažene ekonomskim pokazateljima mogle bi se umanjiti ako se izračuni koji se daju vlasnicima višegodišnjih usjeva prikažu na način koji oni razumiju – u obliku službenih izračuna koje bi izrađuje Savjetodavna služba za ostale poljoprivredne proizvode.

Preporuča se napraviti studiju izvedivosti koja bi mogla dokazati ekonomsku isplativost korištenja PROUN-a poljoprivrednih ostataka, prema veličini zemljišta, gustoći, raznolikosti i vrsti uzgoja. Treba naglasiti osnovne ekonomske pokazatelje: BEP i NPV s različitim scenarijima uporabe PROUN: vlastito grijanje, prodaja proizvođaču peleta, kratkoročni (3 godine), srednjoročni (5 godina) i dugoročni (10 godina).

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Tablica 15 . Sažetak otkrivenih barijera za korištenje APPR-a u Hrvatskoj

Prepreke APPR biomasi u Hrvatskoj						
Tehničke	Kulturne	Pravne	Strukturne	Tržište	Organizacija lanca vrijednosti	Ekonomske i financijske
Nema tehničkih prepreka u slučaju kratkih lanaca vrijednosti - Postolje, transport i skladištenje strojeva - Znati kako Strojevi za žetvu i struganje trebaju tehnološka poboljšanja - Nedostatna ili nedovoljna tehnička pouzdanost postrojenja za biomasu - Nizak stupanj mehanizacije. Nedostatak znanja o mehanizaciji na terenu	- Odstupanje od promjena - Pretvorba energije od obrezivanja još uvijek se smatra "ne vrijedi pokušavati" - Poljoprivrednici obično nisu spremni dijeliti strojeve i opremu i organizirati kolektivno sakupljanje i mobilizaciju kolektivno - Poljoprivrednici općenito razmatraju obrezivanje kao zapreku običnom upravljanju poljima, a cilj je jednostavno riješiti se što je prije moguće	- Energetski proizvodi koji nisu u skladu s međunarodnim standardima i označavanjem - Visoka stopa promjene zakona i velika nestabilnost u odlukama o energetske politici	- APPR je u velikoj mjeri prostorno rasprostranjen i potrebno je prikupiti na širokom kopnenom području. Snažna sezonalnost u berbi - Nedostatak integracije znanja i napora diljem sektora - Struktura farmi i veličine farme je premalena kako bi se omogućila isplativost prikupljanja i upotrebe	- Malo tržište za biomasu - Nedostatak primjera poslovnih slučajeva - Konkurentna potrošnja energije iz šumskog drva, ostataka usjeva ili nusproizvoda za preradu hrane kao alternativa obrezivanju	- Složena lanca vrijednosti opskrbenih lanaca biomase. Nedostatak dobro organiziranih logističkih operacija - Agroindustrijska integracija je teško postići	- Vrijednost APPR - APPR žetva i transportni poslovi općenito se smatraju prekomernima - Priprema i odgovarajuće mjere financirane iz Programa ruralnog razvitka - Do stupnost zajmova, leasing garancija (financijski instrumenti) - Nemogućnost organiziranja i oblikovanja ekonomije vage

- Istraživanja onih vodećih tvrtki u PROUN sektoru, koja je glavna poveznica PROUN sektora s drugim proizvodnim sektorima ili sličnim (poljoprivreda, biomasa, agro-prehrana, šumarstvo, proizvodnja strojeva itd.).

Tijekom 2014. godine registrirano je oko 191 tisuće poljoprivrednih gospodarstava. Većina (96,55%) bila su obiteljska poljoprivredna gospodarstva, 1,50% obrta, 1,43% poduzeća i samo 0,32% zadruga.

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U tranzicijskim zemljama poljoprivrednici malih razmjera i kućanstva učinkovito su isključeni iz izravnog sudjelovanja na tržištima. Općenito, suočeni su s pritiscima većih prerađivača i maloprodajnih lanaca za opskrbu sirovina potrebnih količina i kvalitete. Ti zahtjevi često predstavljaju veliki izazov za integraciju u lance vrijednosti. Istodobno, lokalni, često mali i srednji prerađivači, izazvani globalnim i regionalnim konkurencijom i potrebom za usklađivanjem s međunarodnim propisima, također imaju poteškoća u uspostavljanju svoje pozicije u opskrbi multinacionalnih maloprodajnih lanaca. [\[4\]](#)

Tijekom tranzicijskog procesa u Srednjoj i Istočnoj Europi (SIE), sektor maloprodaje je privatiziran, a odnosi na čitavom lancu opskrbe hranom - od poljoprivrednika do trgovaca – narušeni su, što je značilo ozbiljne poremećaje u opskrbi. Kako su reforme napredovale, uključujući liberalizaciju tržišta i privatizaciju bivših sustava distribucije u državnom vlasništvu, pojavili su se novi načini mehanizama koordinacije tržišta. Osim toga, međunarodni trgovci i prerađivači ušli su na nova tržišta, predstavivši svoje poslovne modele vrhunske učinkovitosti. Također, međunarodni trgovci ponudili su proizvode zapadnih standarda kvalitete u supermarketima, čime je jačanje potrošačke potražnje za kvalitetnom hranom (Hanf i Pieniadz, 2007). Domaći trgovci su tako bili prisiljeni da se brzo prilagode tim novim razvojem kako bi ostali na tržištu. Za osiguranje visokokvalitetnih proizvoda uz konkurentne troškove, to je zahtijevalo usvajanje viših standarda kvalitete i restrukturiranje cijelog opskrbnog lanca. Nadalje, kako bi se prevladali problemi nedovoljne opskrbe i manje kvalitete, međunarodni i domaći trgovci, kao i procesori, nadogradili su svoje vertikalne mehanizme koordinacije. Empirijske studije daju dokaze kako u tranzicijskom razvoju i mnogim tržišnim poremećajima postoje vrlo različiti načini vertikalne koordinacije u zemljama srednje i istočne Europe i središnjoj Aziji (Swinen, 2005, World Bank, 2005).

Ugovorna poljoprivreda može se definirati kao formalni ili neformalni ugovorni sporazum između poljoprivrednika i distributera (trgovačkih lanaca) ili prerađivača koji se odnosi na opskrbu poljoprivrednim proizvodima na temelju ugovora, općenito po unaprijed određenim cijenama (Eaton i Shepherd, 2001). Bitan element poljoprivredne proizvodnje ugovora je pružanje određenog stupnja pomoći poljoprivrednicima s ciljem povećanja količine ili kvalitete opskrbe ili smanjenja sezonske razine. Ugovaranje s poljoprivrednicima može se provesti u željenom programu dobavljača ili programu za preradu. Općenito, poljoprivrednici koji ispunjavaju uvjete za željeni program dobavljača imaju dugogodišnji uspješan poslovni odnos s supermarketom. Ovi poljoprivrednici su dobavljači od kojih supermarket preferira izvora opskrbe i pruža određeni stupanj pomoći u poljoprivredi. Sveobuhvatnija pomoć u poljoprivredi osigurava se u sklopu programa prerade u kojem poljoprivrednik osigurava zemljište i rad, dok prerađivač ili distributer ima znatnu kontrolu nad proizvodnim procesom, sveobuhvatno pružanjem inputa i usluga proširenja. Općenito, cilj poljoprivredne pomoći je poboljšati pristup poljoprivrednicima

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osnovnim čimbenicima proizvodnje kao što su kapital i specifični inputi, know-how i informacije (znanje i iskustvo). Posebice, pomoć u poljoprivredi može uključivati plaćanje unaprijed za financiranje žetve, kreditiranja, iznajmljivanja ili iznajmljivanja poljoprivrednih strojeva, bankovnih zajmova, kontrole kvalitete i inputa (npr. sadnica), kao i savjetodavnih usluga za proširenje i upravljanje. Pomoć u poljoprivredi može se osigurati u okviru bilateralnih ugovora i složenih sustava ugovora. Bilateralni ugovori obično se dogovaraju između poljoprivrednika i prerađivača, ili poljoprivrednika i pružatelja usluga. Suprotno tome, trokutni ugovor uključuje tri partnera, npr. Poljoprivrednika, prerađivača i banke. Pomoć u poljoprivredi osigurana je u okviru dobavnog ugovaranja trgovačkih lanaca u sektoru svježeg voća i povrća (FFV) u Srednjoj i Istočnoj Aziji (World Bank, 2005). Reardon (2003) pruža dokaze o programima izlaza u opskrbi trgovačkih lanaca svježeg voća i povrća u Hrvatskoj. Dries i sur. (2004) daju dokaze o složenim ugovornim sustavima: dva najveća trgovačka lanca u Hrvatskoj jamče zajmove za svoje prerađivače za kupnju staklenika i navodnjavanje. Nadalje, Dries i sur. (2004) izvješće o stjecanju namjenskih veletrgovaca velikim trgovačkim lancima kako bi imali svoj vlastiti željeni program dobavljača. Situacija u opskrbnom lancu trgovačkih lanaca voća i povrća u Hrvatskoj rezultat je iznimno brzog rasta maloprodajnog sektora, koji je među najbržim na svijetu. Tek 2001., kada su stranci ušli na tržište, trgovački lanci počinju nuditi široki asortiman svježeg voća i povrća u svojim trgovinama; prije toga, svježe voće i povrće je prvenstveno prodavano na tržnicama (Reardon et al., 2003). Danas se svježe voće i povrće prodaje hrvatskim potrošačima uglavnom putem trgovina velikih domaćih i međunarodnih trgovačkih lanaca. Međutim, veliku količinu ponude osigurava uvezano svježe voće i povrće.

Na temelju rada: Gotz, L.; Njavro, M.; Hanf, JH; Pieniadz, A. (2009). *Vertikalna koordinacija s uzgajivačima u supermarketu lanca opskrbe svježeg voća i povrća u Hrvatskoj. Agrarwirtschaft* 58 (8): 363-370.

Prema registru zadruga, 1302 zadruge su bile aktivne tijekom 2015. godine. Zadruge okupljaju oko 22 tisuće poljoprivrednika i zapošljavaju 2.744 osoba (oko 67% ima nula poslodavaca!). Većina zadruga su poljoprivredne zadruge (531 ili 41%).

Nakon značajnog smanjenja broja zadruga u 2012. godini (zbog usklađivanja sa Zakonom o zadrugama), trend je pozitivan. U 2015. godini broj registriranih zadruga bio je 47 i okupljao je gotovo 2000 poljoprivrednika. Ukupni prihodi poljoprivredne zadruge u 2015. godini iznosili su oko 115 milijuna eura. Prihod je na istoj razini kao i 2014. i malo iznad prihoda u 2012. i 2013. godini. [\[5\]](#)

Podaci pokazuju da su zadruge bile i prilično nevažni igrači u hrvatskom agrobiznisu u broju, ali i u prodaji te doprinosu bruto domaćem proizvodu (0,5%).

Podaci ukazuju na nisku razinu organizacije poljoprivrednih gospodarstava, prvenstveno obiteljskih gospodarstava, zbog negativnih povijesnih konotacija bivših zadruga i nedostatka njihovog uključivanja u višu razinu organizacijskih oblika i drugih oblika suradnje, kao i visoke prisutnosti posrednika prodaje izravno utječu na njihovu razinu konkurentnosti i loše pozicioniranje na tržištu (Hrvatski program ruralnog razvoja).

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Iako Vlada nastoji promicati suradnju između poljoprivrednika i promicati zadruge kao takve putem pravnih akata o zadrugama te različitim programima (obrazovanje, terenski posjeti i podrška plaćama za upravljanje zadrugama ...), još uvijek nije postigla željene ciljeve.

Uključivanje poljoprivrednih proizvođača u organizacije proizvođača je također nizak. U 2014. godini registrirano je samo dvije proizvođačke organizacije (mlijeko i voće i povrće), ali je vidljivo pozitivno kretanje. Zahvaljujući državnoj potpori i ruralnom razvoju, broj PO-a raste. Danas je oko pet spremno za početak aktivnosti.

Program ruralnog razvoja s mjerama 09 i 16 trebao bi unaprijediti suradnju poljoprivrednika, inovativnih praksi i konkurentnosti.

Mjera 09 (osnivanje skupina i organizacija proizvođača) ima za cilj udruživanje poljoprivrednih proizvođača s nižom proizvodnjom u skupine proizvođača i organizacija koje će im omogućiti lakši ulazak na tržište i konkurentnost na tržištu. Zbog nedostatka informacija i iskustava u udruženjima, različite razine stručnog iskustva, nedostatak razumijevanja zajedničkih ciljeva i načela rada poljoprivrednici imaju nizak interes za pridruživanje. Organizacije proizvođača osiguravaju da proizvođači imaju mogućnost korištenja zajedničkih resursa, administrativnih, knjigovodstvenih i računovodstvenih usluga, kao i opreme za poboljšanje i održavanje kvalitete proizvoda u prostorima za skladištenje, sortiranje i pakiranje proizvoda. Na taj će se način postići bolje planiranje proizvodnje koja je prilagođena potrebama tržišta, stabilizaciji cijena i konačno smanjenju troškova proizvodnje. Sredstva dostupna za ovu mjeru iznose 8,8 milijuna eura.

Ciljevi Mjere 16 (Suradnja) su poticanje suradnje i razmjene informacija o postojećim i novim procesima, postupcima i tehnologijama u proizvodnji i preradi poljoprivrednih proizvoda, čime će se poboljšati gospodarski rezultati i povećati sudjelovanje proizvoda s dodanom vrijednošću na tržište.

Nepovoljna struktura poljoprivrednih gospodarstava u Republici Hrvatskoj rezultat je baštine iz prethodnog sustava kojim je djelovao mali broj velikih industrijskih poljoprivrednih konglomerata koji više ne postoje. Trenutni mali broj zadruga i operativnih klastera ukazuje na slabu razinu suradnje poljoprivrednih proizvođača. Podaci pokazuju da su sektori voća i povrća i stočarstva najosjetljiviji na suradnju. S druge strane, poljoprivrednici proizvode i prerađuju proizvode na tradicionalan način koji je naslijeđen više desetljeća. Ograničeni kontakti između poljoprivrednika, istraživačkog sektora i sektora prerade hrane dovode do nedostatka svijesti o razvoju i provedbi inovativnih projekata. Zajednička suradnja između geografski koncentriranih (lokalnih ili regionalnih) gospodarskih subjekata i istraživačkih institucija rezultirat će boljem razmjenom informacija, znanja i dobara za proizvodnju ili preradu zajedničkih proizvoda u poljoprivredi kao i sektoru prerade hrane. Dodana vrijednost mjera suradnje u Hrvatskoj jest da će podržati subjekte da rade zajedno, rješavajući tako nekoliko ključnih izazova i potreba ruralnog gospodarstva. S obzirom na dimenziju poljoprivrednih gospodarstava, ovisnost o posrednicima iz sektora prehrambene industrije i prerade hrane, niskim mogućnostima te visokim troškovima prepreka su za inovacije za pojedine gospodarske subjekte. Znanje i pristup inovacijama, uključujući inovativne procese, vrlo je nizak u sektoru poljoprivrede i prerade hrane u Hrvatskoj. Uspostava i rad Operativnih skupina unutar

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europskih inovacijskih partnerstva smanjit će jaz između poljoprivredne prakse i istraživanja poticanjem inovativnih rješenja i inovacija u praksi (Hrvatska RDP)

Strategija Pametne Specijalizacije otkriva sljedeće lančane aktere u sektoru biomase:

Hrvatski centar obnovljivih izvora energije (CCRES) koji je nastao 1988. godine, jedan je od pozitivnih primjera veće udruge tvrtki s glavnom namjerom da izvrsno primjenjuje istraživački i razvojni centar s međunarodnim ugledom, usredotočujući se na optimalnu uporabu nacionalnih energetske resursa.

Klaster "Inteligentna Energija", okuplja mala i srednja poduzeća koja ulažu u RDI.

Na području gospodarenja otpadom djeluju brojne hrvatske tvrtke. Neki od njih su globalni igrači - npr. TEHNIX d.o.o. je lider u proizvodnji EKOMUNAL posebnih komunalnih vozila za sakupljanje, komprimiranje i pražnjenje komunalnog i odabranog otpada, separatora velike brzine protoka, postrojenja za pročišćavanje i pročišćavanje otpadnih voda.

Nekoliko tvrtki koristi inovativne metodologije za daljnje razvijanje svojih usluga usredotočenih na podatke o Zemlji promatranja (EO), kao što su; ECOINA d.o.o. (praćenje kakvoće zraka, projektiranje odlagališta otpada, pročišćavanje otpadnih voda); EKONERG d.o.o. (ispitivanje performansi elektrana, mjerenja emisija u zrak, razvoj postrojenja za praćenje kakvoće zraka); Geodata d.o.o. (geoinformacijski sustavi, digitalno modeliranje terena, urbanističko planiranje), Geofoto d.o.o. (3D modeliranje grada, LIDAR, UAV); GEOSAT d.o.o. (praćenje stanja okoliša, CORINE program, mapiranje geo-opasnosti, daljinska istraživanja); GISDATA d.o.o.; GDI CONVIVO d.o.o. (usluge oblak).

Pored većih hrvatskih sveučilišta u Hrvatskoj postoji nekoliko istraživačkih institucija s značajnim ljudskim resursima koji rade u znanosti o okolišu. Dobar primjer istraživačkog instituta s naglaskom na održive resurse je Energetski institut Hrvoje Požar. Energetski institut Hrvoje Požar (EIHP) značajno pridonosi razvoju održive energije kroz analizu potencijala i mogućnosti izgradnje i radnih kapaciteta za proizvodnju energije iz obnovljivih izvora, analize vezane za izgradnju i razvoj fotonaponskih sustava i solarnih sustava za proizvodnju toplinske energije i CPS sustava, analize tržišnih modela i njihov utjecaj na poslovanje, studije izvodljivosti vezane uz konvencionalne i obnovljive izvore energije u tržišnim uvjetima, razvoj održivih tržište toplinske energije iz bioplinskog postrojenja, analiza i simulacija pojavljivanja električne energije u vezi s integracijom obnovljivih izvora energije te predviđanje proizvodnje i neizvjesnosti vezane uz prognozu pogreške u proizvodnji za obnovljivu energiju.

U vezi s biotehnologijom ovo je polje u čitavom S3 dokumentu predstavljeno kao jedno od najisplativijih područja. Također, poljoprivredne i biološke znanosti su drugo najznačajnije područje u pogledu objavljenih znanstvenih radova. Nekoliko istraživačkih skupina vode znanstvenici s više od 1.000 citata (Web of Science) te su ostvarili dobre rezultate pri pribavljanju projekata i obavljanju međunarodnih istraživanja kroz pretpristupne fondove uglavnom na Sveučilištu u Zagrebu i Sveučilištu Josipa Jurja Strossmayera u Osijeku, kao i na Poljoprivrednom institutu u Osijeku. Očekuje se i značajan poticaj na području Green-Biotechnology sa skorim otvaranjem BIOCentre, Sveučilište u . Brojni nacionalni i međunarodni projekti provode različite istraživačke organizacije, npr.

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Poljoprivredno područje, kako bi nadgledale i analizirale učinke gnojidbe i drugih kemijskih postupaka u poljoprivredi na onečišćenje tla i vode (salinizacija, nitrati, teški metali itd.), Ti su projekti provedeni u suradnji sa sektorom prehrambene industrije, državnim poduzećima (Hrvatskim vodama) i javnim tijelima (Agencija za zaštitu okoliša), Gradom Zagrebom, itd.) Kako bi se osigurala održivost okoliša i poboljšao zdravstveni status prehrambenih proizvoda.

Ključna značajka klasteriranja PROUN-a s drugim sektorom je blizina ponude i potražnje. Na strani potražnje, obiteljska poljoprivredna gospodarstva organizirana su u udrugama (Hrvatski voćarska zajednica, udruge vinogradara, udruge maslinara i slično) ili zadruge ili ugovorene od strane prerađivačke industrije. Naime, takva se gospodarstva već bave nekom vrstom suradnje i manje bi se trudili da se uključe u različite poslovne prilike. Udruživanje na različitim razinama također bi omogućilo formiranje strojnih prstena i zajedničke pohrane koja bi povećala profitnu maržu za dobavljače PROUN-a.

PROUN biomasa je, u bilo kojem obliku - čipovi, peleti, trupci, grane - gorivo za sagorijevanje s ogrijevnom ili toplinskom snagom. Korisni oblik energije definira tržište potražnje koje koristi potrošač toplinske energije i / ili biomase CHP postrojenja. Na tržištu topline biomasa PROUN mora biti u suprotnosti s trenutnim lokalnim toplinskim opcijama (daljinsko grijanje, trupci, prirodni plin, loživo ulje, pelete) i postojeće navike potrošača (starost peći, starost kućanstva ...). Druga tržišna niša za biomasu PROUN bila bi postrojenja za sušenje u agro-proizvodnji, pod pretpostavkom da biomasa PROUN ima bolje performanse od postojećeg goriva.

Proaktivno prihvaćanje tržišta biomase PROUN bilo bi povezivanje s postojećom proizvodnjom drvenih peleta proširivanjem osnovne sirovine za proizvodnju drvenih peleta. Trenutno, oko 270 , 000 t / god drveni peleti su u Hrvatskoj, s visokim zahtjevima za povećanje proizvodnje. Ako se PROUN biomasa prebaci na postojeće tržište drvenih peleta, moguće je izbjeći nastojanja prodora i pozicioniranja na tržištu što će povećati profitnu maržu za PROUN dobavljače.

[1] Energija u Hrvatskoj 2016., izvješće

[2] HROTE, 2017 (Operator hrvatskog energetskog tržišta)

[3] Crobiom (Udruga biomase)

[4] Hanf, JH (2014.). Procesorska integracija malih poljoprivrednika u lance vrijednosti u istočnoj Europi i središnjoj Aziji. <http://www.fao.org/europe/agrarian-structuresinitiative/en/>

[5] Godišnje izvješće o poduzetništvu zadruga (2015.) (Hrvatski centar za poduzetništvo zadruga)

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- Istraživanje jesu li ove veze relevantne za izbor i strukturiranje preferiranih "poslovnih modela".

Tržišno pozicioniranje PROUN biomase kao i izbor lanca vrijednosti ključno je za izbor i strukturu poslovnih modela. Kao što je prije bilo predloženo, bilo bi vrijedno razviti primjere studija izvedivosti kako bi se smanjio špekulativni prostor stavljanja biomase PROUN na tržište. Razina izvedivosti odredila bi poželjne i održive poslovne modele od onih koji još nisu zreliji.

Tablica u nastavku odnosi se na zainteresirane strane i poslovne modele koji se trebaju vrednovati za Hrvatsku kada su poznata dostupnost obrezivanja kao i ekonomske izvedivosti:

Sudionici	Poslovni modeli
Proizvođači APPR-a	<u>Samo-potrošnja</u> : poljoprivrednici koriste vlastite resurse u malim kotlovima prilagođenim njihovoj eksploataciji. Upravljaču logističkim lancem.
Proizvođači, zadruge, lokalne tvrtke	<u>Marketing</u> : tvrtka upravlja zbirkom i marketingom drva.
Skupljači biomase	<u>Usluge upravljanja APPR-om</u> : tvrtka predlaže izvršavanje radova prikupljanja i plaća se za uslugu. <u>Služba za evakuaciju APPR-a</u> : tvrtka predlaže uslugu za upravljanje zalihama i za rehabilitaciju parcele. <u>Najam opreme</u> : tvrtka iznajmljuje opremu povezanu
Logističke operatore	<u>Logistička platforma</u> : Tvrtka organizira cijeli logistički lanac, od prikupljanja do prodaje. <u>Platforma za pohranu</u> : Postojeće infrastrukture za skladištenje biomase ili za gospodarenje otpadom plaćaju se za najam raspoloživih prostora ili pohranjuju biomasu tijekom perioda sušenja.
Potrošači: ESCO, općine	Tvrtka ili općina preuzima rad kotla i prodaje energiju potrošaču topline.

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- Izrada glavnih obilježja PROUN sektora prema sljedećoj SWOT strukturi (SWOT = prednosti, slabosti, mogućnosti i prijetnje).

Sljedeće tablice unutarnjih snaga i slabosti te vanjske prilike i prijetnje temelje se na intervjuima koje su proveli istraživački radovi na projektu. Broj ispitanih osoba bilo je devet.

Prednosti - Poredajte po važnosti (. 1 izuzetno važno 5 najmanje važno)	Prosječna ocjena	Nedostaci - Poredajte po važnosti (. 1 izuzetno važno 5 najmanje važno)	Prosječna ocjena
1. Poljoprivreda je snažan lokalni proizvodni sektor . zajedno s preradom agro-hrane	1 . 75	1. Energetska pretvorba od obrezivanja se i dalje smatra cjelokupnom rizičnom operacijom	3 . 25
2. Velika potencijalna raspoloživost biomase na regionalnoj razini i vrlo visoka gustoća lokalne biomase	1 . 38	2. APPR je u velikoj mjeri prostorno raspršen i potrebno ga je prikupiti preko širokog područja. Snažna sezonalnost u berbi	2 . 50
3. Dobra razina potencijalnog zapošljavanja koju nudi APPR sektor	2 . 13	3. Složenost opskrbnih lanaca biomase. Nedostatak dobro organiziranih logističkih operacija	2 . 63
4. Lokalni rad nekih stvarnih poslovnih slučajeva i uspješnih primjera	3 . 14	4. Niski stupanj mehanizacije. Nedostatak znanja o mehanizaciji na terenu	2 . 50
5. U ruralnim područjima . energetske potrebe mogu zadovoljiti lokalni izvori energije (kao što je APPR biomasa)	1 . 38	5. Strojevi za žetvu i struganje trebaju tehnološka poboljšanja	2 . 00
6. Korištenje lokalno dostupnih resursa smatra se prioritetom	2 . 88	6. Nedostatna ili nedovoljna tehnička pouzdanost postrojenja za biomasu	1 . 75
7. Promatrani trend u produbljivanju poljoprivredne aktivnosti duž lanca vrijednosti	2 . 88	7. Agroindustrijsku integraciju je teško postići	2 . 13

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8. Promatran trend u primjeni skupa poljoprivrednih raznolikih aktivnosti	3 . 00	8. Energetski proizvodi koji nisu u skladu s međunarodnim standardima i označavanjem	2 . 88
9. Poljoprivrednici imaju snažan stav imitacije. Pozitivni primjeri smatraju se modelom	2 . 13	9. Nedostatak integracije znanja i napora preko sektora	1 . 75
10. Kohezija se smatra društvenom odgovornošću među poljoprivrednicima; to bi trebalo poticati suradnju	3 . 25	10. Um-skup poljoprivrednika . njihovu nevoljkost za promjenu i njihovu nisku povezanost i inovativnost	1 . 50
11. Potencijalne uštede troškova u upravljanju površinskim otjecanjem	1 . 50	11. Poljoprivrednici obično nisu spremni dijeliti strojeve i opremu te zajednički organizirati obrezivanje i mobilizaciju	1 . 25
		12. Nedostatak svijesti o potencijalnoj uporabi APPR biomase kao nosioca / izvora energije	1 . 50
		13. Nedostatak primjera poslovnih slučajeva	1 . 50
		14. Nejasno da poljoprivrednici mogu biti pouzdani u opskrbi biomase	2 . 75
		15. Pruning se smatra sirovinom preniske ekonomske vrijednosti	2 . 38
		16. APPR žetva i transportni poslovi općenito se smatraju preskupima	2 . 38
		17. Malo informacija o mogućnostima financiranja poljoprivrednicima i poduzetnicima u sektoru bioenergetike	1 . 63
		18. Dugi i podijeljeni lanac opskrbe ne bi mogao biti ekonomski učinkovit za svakog aktera	2 . 88
		19. Industrijski ulagači očekuju vrlo visoku dobit i brzi povrat plaća u sektorima	2 . 63

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	obnovljivih izvora energije	
	20. Ograničena ekonomska isplativost u korištenju usluga specijaliziranih agromehaničkih tvrtki za rezanje ili tehnologijskih tvrtki	2 . 50
	21. Struktura farmi i veličina farme premalena kako bi se omogućila isplativost prikupljanja i uporabe	1 . 88
	22. Obrezivanje ne bi trebalo biti nusproizvod nego otpad bez ikakve ekonomske vrijednosti	2 . 00
	23. Poljoprivrednici općenito smatraju obrezivanje kao prepreku običnom upravljanju poljima, a cilj je jednostavno riješiti se što je prije moguće	1 . 88
	24. Sjeckanje na otvorenom polju i dalje se smatra agronomijskim postupkom	1 . 75
	25. Konkurentna poljoprivredna upotreba obrezivanja kao izmjena tla	3 . 14
	26. Agronomске smjernice za upravljanje tlom i obrezivanjem još uvijek nedostaju	1 . 75
	27. Rizik od iscrpljivanja tla ako APPR biomase nije pravilno upravljan na terenskoj skali	2 . 88
	28. Drvna sječka iz obrezivanja je niže kvalitete nego kod šumarstva	3 . 50
	29. U regionalnom bioenergetskom sektoru djeluje slab broj ESCO-a	2 . 88

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Mogućnosti - Poredajte po važnosti (. 1 izuzetno važno 5 najmanje važno)	Prosječna ocjena	Prijetnje - Poredajte po važnosti (. 1 izuzetno važno 5 najmanje važno)	Prosječna ocjena
1. Agroindustrijska integracija prema proizvodnom modelu "bioekonomije"	1 . 25	1. Stvarni niski stupanj valorizacije	2 . 38
2. Nastaviti s "ozelenjivanjem" gospodarstva, povećati uporabu obnovljivih izvora u industriji i dekarbonizirati industrijske aktivnosti, te značajno smanjiti fosilnu energiju i emisije stakleničkih plinova	1 . 13	2. Postrojenja i postrojenja za biomasu i dalje su kapitalno intenzivna	3 . 25
3. Usvajanje pravila koja su u skladu s razvojem kružnog gospodarstva u skladu s okvirom EU	1 . 38	3. Ipak velika ekonomija utječe na sektor	1 . 63
4. Potencijalna razina međusektorske inovacije	1 . 38	4. Konkurentna potrošnja energije iz ostatka šumskog drvnog ostataka, usjeva ili nusproizvoda za preradu hrane kao alternativa obrezivanju	2 . 57
5. Pravila za poticanje među-profesionalnih sporazuma na lancu opskrbe biomase	2 . 00	5. APPR korištenje biomase je manje konkurentno od ostalih oblika obnovljivih izvora energije	2 . 88
6. Lokalna dostupnost agro-mehaničkih servisnih tvrtki kao i graditelji postrojenja za preradu (strojevi za žetvu APPR-a i strugala)	1 . 38	6. Obnovljivi izvori energije naglašenija su snaga nego proizvodnja topline	2 . 63
7. "višenamjenska" imovina trenutne poljoprivrede prema najnovijoj viziji "ruralnog razvoja"	1 . 63	7. Atmosferske emisije uslijed termohemijske pretvorbe biomase općenito se smatraju	2 . 50

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		ekološkim problemom	
8. Primjena "usklađenosti" EU-a s obzirom na obveze poljoprivrednika	1 . 50	8. Grijanje na daljinu je još uvijek neuobičajeno rješenje u općinama (s izuzetkom).	2 . 50
9. Valorizacija i ponovna uporaba poljoprivrednih ostataka za proizvodnju bioenergije	1 . 38	9. Ograničena komunikacija s civilnim društvom / javno mnijenje i nedostatak promotivnih aktivnosti	1 . 75
10. Mjere prilagodbe klimatskim promjenama	1 . 25	10. Nema koherentne politike . bez strateškog stajališta o APPR sektoru od lokalnih vlasti.	1 . 00
11. Osiguranje i očuvanje biološke raznolikosti i pružanja usluga ekosustava	1 . 13	11. NIMBY sindrom ("Ne u mom dvorištu")	2 . 13
12. Mladi i kvalificirani poljoprivrednici koji ulaze u sektor zahvaljujući novim mogućnostima prihoda	1 . 13	12. Rizik velikih fosila potrošnje energije i emisija stakleničkih plinova duž lanca vrijednosti ponude i nedostatak smjernica za zaštitu okoliša	2 . 38
13. Sustavi financiranja koji favoriziraju APPR sektor u poljoprivredi	1 . 63	13. Spaljivanje obrezivanja nije strogo zabranjeno u nacionalnim i regionalnim propisima	2 . 13
14. Kamate općina i lokalnih vijeća za promicanje ulaganja u zajednici na bioenergiju (npr . Sustavi daljinskog grijanja)	1 . 25	14. Potrošnja energije od obrezivanja nije primjereno poduprta	1 . 75

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		ZPP-om	
15. Stalna ekonomska priuštivost nositelja energije biomase u odnosu na fosilna goriva	1 . 50	15. APPR tržište je još uvijek nerazvijeno	1 . 63
16. Potencijalno povećanje tržišne cijene biomase	2 . 25	16. Uvoz sirovine sirove biomase izvan EU	3 . 38
17. Potencijalno povećanje tržišne cijene fosilnih goriva	2 . 00	17. Cijena nafte i fosilnih goriva još uvijek prilično niska za promicanje konkurentnosti iz bioenergije	2 . 63
18. Oznaka i standardi osiguranja kvalitete biomase i sljedivosti	1 . 50	Nedostatak pravih tržišnih poticaja i subvencija	1 . 88
19. Subvencije i poticaji koji promiču raseljavanje fosila	1 . 75	19. APPR biomase još uvijek nisu uključene kao potencijalni izvor biomase u nekom regionalnom energetske planu	1 . 38
20. Javna potpora na strani potražnje APPR-ovog sirovina za korištenje energije ("zelena javna nabava")	1 . 50	20. Poticaji i subvencije potaknuti tržištem progresivno se smanjuju	2 . 75
Značajna "krivulja učenja" o tehnološkoj zrelosti procesa pretvorbe energije.	2 . 13	21. Visoka stopa promjene zakona i velika nestabilnost u odlukama o energetske politici	1 . 88
22 Komercijalna dostupnost malih elektrana	1 . 75	22. Energija je ekonomski održivija od toplote	2 . 63

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23. Moguća kombinacija mobilizacije biomase s informacijskim tehnologijama i sljedivosti proizvoda	2 . 25	
24. Osigurati odgovarajuće uvjete za usvajanje znanja i inovacija	1 . 38	
25. Moguća dostupnost javnih financijskih sredstava za promicanje ulaganja	2 . 00	
26. Moguća primjena "trgovanja emisijama ugljikom" i oporezivanja CO ₂	2 . 00	
27. Segmentiranje poticaja za obnovljive izvore kako bi se olakšao socijalni utjecaj	1 . 88	
28. Dugoročna stabilnost ekonomskog povrata ulaganja u bioenergiju	1 . 50	
29. Značajan trend smanjenja kapitalnih troškova novih ulaganja u sektor bioenergetike	2 . 00	
30. Više ograničavajuće pragove atmosferskih emisija	2 . 63	

Akcije i ciljevi

Koji su glavni ciljevi koje bi bioenergetski sektor APPR-a trebao postići u skoroj budućnosti (recimo, u idućih tri-pet godina)?

Ciljevi - Poredajte po redoslijedu važnosti (1 izuzetno važna, 5 najmanje važna)	Prosječan čin
1. INTEGRIRANJE AGRO-ENERGIJE - s ciljem učinkovitog i integriranog regionalnog agroenergetskog sustava prema modelu bioekonomije	1 . 00

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2. RURALNI RAZVOJ - održiva APPR - proizvodnja energije kao put do ruralnog razvoja	1 . 00
3. NOVO TRŽIŠTE POSLOVANJA I ENERGIJE - marketinški orijentirani PROUN sektor energije za presretanje i zadovoljavanje potreba društva	1 . 75
4. ISTRAŽIVANJE I INOVACIJE - potpora trendu inovacije u bioenergetskoj tehnologiji i prebacivanje na učinkovitu uporabu energije iz biomase	1 . 50
5. SUDJELOVANJE I NOVI OBLICI POLITIKE - pokretanje socijalne i političke inovacije u PROUN sektoru	1 . 38
6. EKONOMSKA SIGURNOST - poticanje ekonomske dostupnosti korištenja biomase i gospodarski povratak duž lanca vrijednosti	1 . 38
7. POUZDANI IZVORI BESPLATNIH BIOMASA - pojačavanje izvora biomase PROUNA i postavljanje uvjeta za jačanje APPR opskrbnog lanca	1 . 38
Dokazivanje izvedivosti APPR lanaca vrijednosti i njene vrijednosti u mikro-generacijskim projektima	1 . 38
9. SOCIJALNA PRIHVATLJIVOST / SVJESNOST - reagiranje na nepravilne i namjerno obmanjujuće informacije promicanjem pune svjesnosti i društvenog prihvatanja	1 . 75
10. STANDARDI OKOLIŠA I ODRŽIVOST - olakšavanje tereta okoliša duž lanca vrijednosti bioenergije, od poljoprivrednih operacija do pretvorbe energije	1 . 13
11. SIGURNOST NA TRŽIŠTU I UPRAVLJANJE GOSPODARSKOG RIZIKA - izdržavanje rizika od kvara lokalnog APPR tržišta	1 . 88
12. PRAVILA I PRAVILA - odupiranje složenosti regulacijskog sustava na bioenergiju i nedostatku šire vizije o sektoru	1 . 25

Strateški plan

Kako bi se dobio bolji interpretativni okvir, interni SW faktori mogu oblikovati zajedno vertikalnu os i vanjski OT čimbenicivodoravanu os. Prema Kombinirajućim internim i vanjskim čimbenicima, mogu biti sljedeće strateške alternative:

SO Strategije (Strategije koje koriste snage kako bi se profitirale prilikama). To su *maksimalni* tipovi strategija, u smislu da kombiniraju najpovoljnije elemente u izgradnji strategije. SO strategije koriste

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snage i moćne elemente kako bi se iskoristile koristi od vanjskih prilika. Strategija postaje dinamična i agresivna (*napada*).

WO strategije (strategije koje nastoje ublažiti učinak slabosti iskorištavanjem mogućnosti). To su strategije *min-max* tipa, u smislu da kombiniraju unutarnje slabosti s vanjskim mogućnostima. Strategija pokušava iskoristiti prilike kako bi se uklonile ili ublažile slabosti (*preusmjeravanje*).

ST strategije (strategije koje koriste snage kako bi se spriječile ili minimizirale prijetnje). To su strategije *maksimalnog* tipa, u smislu da koriste snage kako bi izbjegli ili smanjili vanjske prijetnje (*obrana*).

WT Strategije (Strategije da ublažiti slabosti i tražiti do smanjiti udarac od prijetnje). Oni su strategije *min-min* tipa koje nastoje minimizirati slabosti ako se mogu izbjeći (*preživjele*) vanjske prijetnje .

1. PROMICANJE POLJOPRIVREDE KAO PRIMARNOG KORAKA U VRIJEDNOSNOM LANCU BIOENERGIJE

Strategija: Prednosti + mogućnosti → **SO strategija**

S1. Poljoprivreda je snažan lokalni proizvodni sektor, uz poljoprivrednu obradu

S7. Uočeni trend produbljivanja poljoprivredne aktivnosti duž lanca vrijednosti

S8. Promatran trend u primjeni skupa poljoprivrednih raznolikih aktivnosti.

O1. Agroindustrijska integracija prema proizvodnom modelu bioekonomije

O7. Multifunkcionalna imovina trenutne poljoprivrede prema najnovijoj viziji sektora ruralnog razvoja

Ø12. Mladi i kvalificirani poljoprivrednici ulaze u sektor zahvaljujući novim mogućnostima prihoda

Ø25. Moguća dostupnost javnih financijskih sredstava za promicanje ulaganja

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Ciljevi

- SO1. Iskoristite prednosti snažnog poljoprivrednog sektora za izgradnju i razvoj lanaca vrijednosti bioekonomije
- SO2. Pripremite jasan strateški plan za razvoj sektora PROUNA-a

Aktivnosti / aktivnosti

- Definiranje "najbolje prakse upravljanja" u poljoprivrednom sektoru s obzirom na sirovinu PROUNA-a. Pružanje sveobuhvatnih informacija i savjeta o nekoliko pitanja o uklanjanju rezidbenih ostataka, uključujući rukovanje, logistiku i ekonomiju. Savjetovati poljoprivrednike o mogućim utjecajima na sadržaj ugljika u tlu. Procjena kada i gdje je sadržaj ugljika u tlu kritičan za očuvanje odgovarajućih kemijskih i fizikalnih svojstava tla
- Održavanje poljoprivrednika u razvoju novih PROUN projekata u smislu povećanja količine raspoložive APPR biomase koji treba biti usmjeren na tržište energije i promicanje izravnog i unutarnjeg iskorištavanja energije ove sirovine
- Promicanje velikog sudjelovanja poljoprivrednika i poljoprivrednih organizacija, zajedno s drugim udrugama interesnih skupina, u uspostavljanju operativnih skupina (Operativnih skupina) unutar EIP-a (European Innovation Partnerships), posebno prilagođavanje projekata i ulaganja u APPR korištenje energije i vrednovanju čvrstih energetske vrijednosti iz PROUN materijala

2. STRUKTURA PROUN lanaca vrijednosti i ekonomski POVRAT

Strategija: Prednosti + prijetnje → **ST strategija**

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S2. Velika potencijalna dostupnost biomase na regionalnoj razini i vrlo visoka gustoća lokalne biomase	T4. Konkurentna energija koristi se od šumskog drva, ostataka usjeva ili obrade hrane po proizvodima kao alternativa obrezivanju
S11. Potencijalne uštede troškova u upravljanju površinskim obrezivanjem	T9. Ograničena komunikacija s civilnim društvom / javno mnijenje i nedostatak promotivnih aktivnosti
S3. Dobra razina potencijalnog zapošljavanja koju nudi sektor APP R	T12. Rizik velikih fosila u potrošnji energije i emisije stakleničkih plinova duž lanca vrijednosti i nedostatak smjernica za zaštitu okoliša

Ciljevi

- ST1: Razvijanje sektora naglašavajući pozitivne posljedice suočene s gospodarskim pitanjima

Aktivnosti / aktivnosti

- Usporediti ekonomske i financijske aspekte različitih poslovnih modela u energetsom sektoru PROUN-a, kako bi se opisali prednosti i nedostaci i pružili opću procjenu profitabilnosti
- Odabir optimalnog "poslovnog modela" prilagodbe ekonomske vježbe prema specifičnim uvjetima tvrtki koje sudjeluju u projektu bioenergije, kao i tržišnim i gospodarskim uvjetima (najbolje krojenje)
- Ponuditi financijsko savjetovanje, savjetovanje ili ekonomske i financijske smjernice kako bi informirali potencijalne poduzetnike o ekonomskoj isplativosti energetskih projekata na temelju PROUN biomase

3. AKTIVNOSTI OBUKE I IZGRADNJA KAPACITETA

Strategija: Mogućnosti + slabosti → **WO strategija**

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W4. Nedostatak znanja rada s terenskim strojevima	O21. Značajna "krivulja učenja" o tehnološkoj zrelosti procesa pretvorbe energije
W9. Nedostatak integracije znanja i napora diljem sektora	Ø23. Moguća kombinacija mobilizacije biomase s informacijskim tehnologijama i sljedivosti proizvoda
W10. Način razmišljanja poljoprivrednika, njihova nevoljkost na promjenu i njihov slab stav prema suradnji i inovacijama	O24. Osigurati odgovarajuće uvjete za usvajanje znanja i inovacija
W23. Poljoprivrednici općenito razmatraju obrezivanje kao prepreku običnom upravljanju poljima, a cilj je jednostavno ukloniti ga što je prije moguće	
Ciljevi • WO1 Širenje znanja između aktera u lancu vrijednosti • WO 2 Povećajte upotrebu PROUN-a i novih ulaganja	
Aktivnosti / aktivnosti • Tehnička obuka koja omogućuje stjecanje novih kompetencija i stručnosti u sektoru bioenergetike, s posebnim osvrtom na nove tehnologije i distribuirani model proizvodnje energije • Formiranje regionalne "radne skupine" sastavljene od pravilno osposobljenih tehničara i odabranih konzultanata ili stručnjaka za pružanje tehničke podrške onim poduzetnicima određenim u razvoju novih PROUN projekata • Tehnička pomoć, testiranje postojećih i inovativnih tehnologija, uspostavljanje veza između stručnjaka, operatera, tehničkih instalatera, dionika i zajednice	

4 . POLITIKA I SAVJETOVANJE

	Document:	Task 2.3. Performing a bioenergy sector analysis and developing a strategies plan at national and EU level		
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Strategija: Slabosti + prijetnje → Strategija WT-a	
W12. Nedostatak svijesti o mogućoj uporabi PROUN-a W13. Nedostatak primjera poslovnih slučajeva W17. Malo informacija o mogućnostima financiranja poljoprivrednika i poduzetnika u energetsom sektoru	T10. Nema koherentne politike, bez strateškog gledišta na PROUN sektoru lokalnih vlasti T14. Potrošnja energije od obrezivanja nije primjereno podržana ZPP-om T15. PROUN tržište je još uvijek nerazvijeno T18. Nedostatak poticajnih poticaja i subvencija utemeljenih na tržištu T19. PROUN još uvijek nije uključen kao potencijalni izvor biomase u neki regionalni energetske plan T21. Visoka stopa promjene zakona i velika nestabilnost u odlukama o energetske politici
Ciljevi • WO 3 Napravite strateški okvir implementacije • WO 2 Stvorite stabilno pravno okruženje u biomasi, točnije PROUN sektor	
Aktivnosti / aktivnosti • Usklađivanje regionalnih, nacionalnih i EU strateških planova o razvoju bioenergije PROUN-a • Promicanje snažnog pojednostavljenja zakonodavnih pravila • Predlaganje smjernica strateške politike (poput tržišnih instrumenata, poreznih režima, financijskih poticaja, smanjenja cijena, mogućnosti financiranja, okolišnih i poljoprivrednih okvira, istraživanja i inovacija itd.)	

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Annex and acknowledgements

ANNEX A11

WP2 – Task T2.3

Performing an APPR Sector Analysis and Developing a Strategic Plan at National and EU level France

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SECTOR ANALYSIS

A. National framework on APPR sources

Le French territory has a large diversity of agricultural areas

The European territory of France covers 551,500 square kilometers, bordered by the North Sea in the north, the English Channel in the northwest, the Atlantic Ocean in the west and the Mediterranean Sea in the southeast. Most of the low-lying areas of metropolitan France excluding Corsica, are located in the oceanic climate zone, nevertheless, as the French metropolitan territory is relatively large, the climate is not uniform, giving rise to the following climate nuances. Metropolitan France has a wide variety of topographical sets and natural landscapes: several mountains areas, hilly regions, fertile ground lands etc.

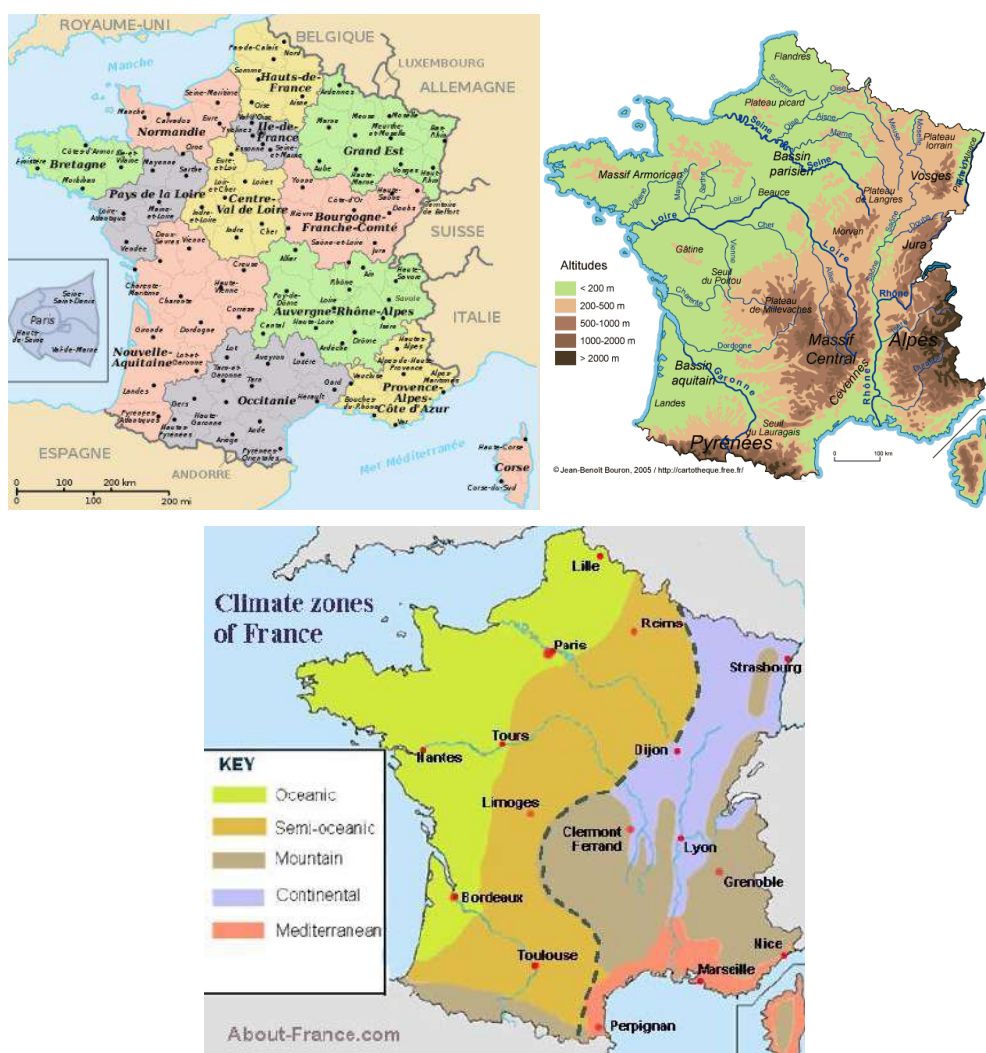


Figure 1 : (1) French regions (e-sushi.fr) (2) French relief (cartesfrance.fr) (3) French Climate (assistancescolaire.com)

Vineyards and orchards in the territory

In 2015, the total superficies of fruit tree plantations was 119,843 ha in metropolitan France (including apricots, cherries, peaches, plums, olives, apples and pears) for more than 2.5 M tons. For grapes, the superficies was 782,734 ha for more than 6 M tons of grapes, mainly for wine. (data from AGRESTE – French Agricultural Ministry).

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FRENCH VINEYARD

Main fruit trees in France are vine. Their variety, labels and management systems are diverse (see **Errore. L'origine riferimento non è stata trovata.**). Around 95,000 vine makers are producing 3,420 different wines, representing more than 45 million of hectoliters (2014) from 383 designations of origin (vin-vigne.com).

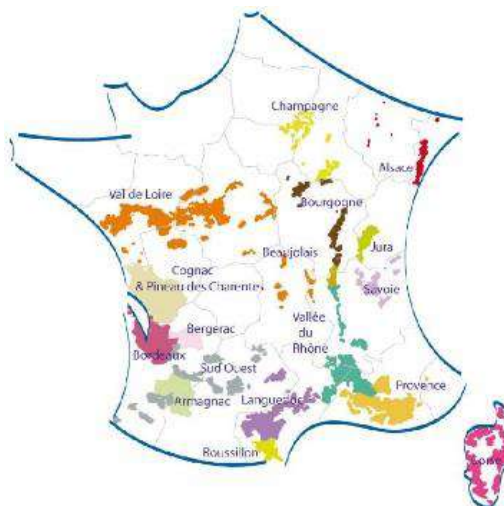


Figure 2 : French vineyard (<http://specialitesculinaires.com/vignobles/>)

Soil: French vineyard is planted on limestone, granitic soil, schist, gneiss, sandstone, clay or sandy soils.

Crop varieties: the main varieties that make for red wine are Pinot Noir, Merlot, Cabernet Francs, Cabernet Sauvignon and Syrah; for white wine, chardonnay, sauvignon, riesling, roussanne and marsanne.

Average production: the average yield of vin is 50 hl/ha.

Climate: vineyards are planted in temperate-continental areas, mountain, Mediterranean or oceanic territories.

Crop management: each designation of origin is organized according to different specifications. Nevertheless, it can be generally noted that prunings are done manually (with mechanized prepruning or not during winter till beginning of April) and irrigation is not frequent. Vine format is generally in Gobelet or espalier (Guyot simple or double) but other specific ones shape can be privileged, depending on each terroir. Generally, 3,000 to 4,000 trees/ha are planted.

APPLE TREES

France is producing around 1.5 million tons of apples. France is producing around 10 different varieties, including the Golden (more than 550,000 tons), Gala (250,000 tons) and Granny Smith (190,000 tons). 8,000 different farms are producing apples, representing 45,000 ha in Loire, South-West of France, Languedoc-Roussillon, Provence and Rhône valley (franceagroalimentaire.com). 5,500 ha of pears are also cultivated (Agreste, 2015).

Hundred to 1500 trees are planted per hectare (depending intensive / extensive crops), as free shape, in gobelet (pyramid) or espalier (2800 trees / ha). 65 % is irrigated. Prunings is generally done with pruning shears.

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STONE FRUITS TREES

In 2015, apple trees were represented 25 % of French fruit trees. Then walnut trees (20,000 ha), plum tree (15,000 ha), apricot trees (12,000 ha), peach trees (10,000 ha), cherries trees (8,000 ha) (Agreste).

Management is very variable, from hundred to 1,500 trees /ha, in natural shape, pyramid or espalier. Around 60 % is irrigated. Mechanised pruning can be done with a second manual pruning.

NUT FRUITS TREES (WALNUT)

Walnut is the second fruits crop after apples in France. It is cultivated in natural shape or gobelet. Different managements can be found in France, with 70 trees to 800 trees per ha and 1/3 of irrigation. Pruning is done every year (twice a year for a very productive plantation, every two years for extensive production).

B. National potential of the APPR availability

General information about APPR biomass in France

National production of vine prunings and vine stocks was estimated, in 2009, around 1.8 t/an (of dry matter), mainly in Languedoc-Roussillon and Aquitaine.

79 % of prunings are used as organic matter, let on the sol (1.1 million t/an). The other part is consumed as solid biomass or burn (outside burning which is generally forbidden but still performed). Some experiments are lead in some areas to exploit wine prunings in green chemistry, for molecules of interest extraction. This use is marginal and still experimental.

From fruit trees, the pruning production is estimated around 650,000 tons dry matter per year. (Observatoire National des Ressources en biomasse - FranceAgriMer). No specific uses are identified.

A lack of available information

Nevertheless, available information is generally not as precise as needed by local stakeholders. As specific demand is quite rare, few precise analyses are carried out. Pruning uses is not a priority in France for the bioeconomy development.

Available data in the territory

The national reference for pruning production in France is the ADEME study, *biomasse forestière, populicole et bocagère disponible pour l'Energie à l'horizon 2020*.

An estimation of the vine pruning yield was performed. In Bordeaux vineyard, with 6,000 plants/ha, 1.8 t/ha of dry matter were calculated; 1.2t/ha/year for 4,300 plants/ha in the Saumurois. In Poitou-Charente, 1,2t /ha of dry mater (6 months drying, 15 % humidity) were weighted; in Languedoc-Roussillon, 2,5 t/ha at 15 % MC.

Depending on the vineyard density, an estimation of stocks productivity was performed. 8.5 tons/ha can be generally observed.

For fruits trees, apple trees are estimated around 1,5 t/ha of dry mater. Other stone fruits around 1,3 t/ha/year of dry matter, depending on the area and the studies. For olive trees, 4,25 t/ha are proposed.

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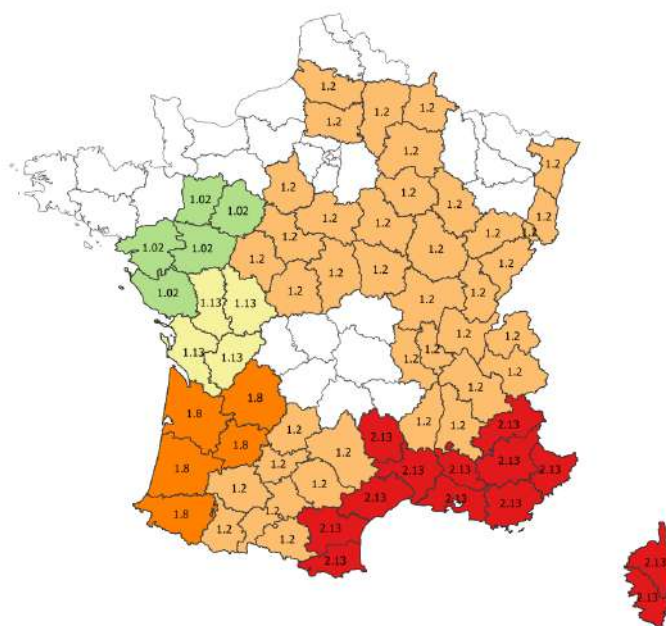


Figure 3 : Vine pruning production (t/ha/yr) in France (Solagro data)

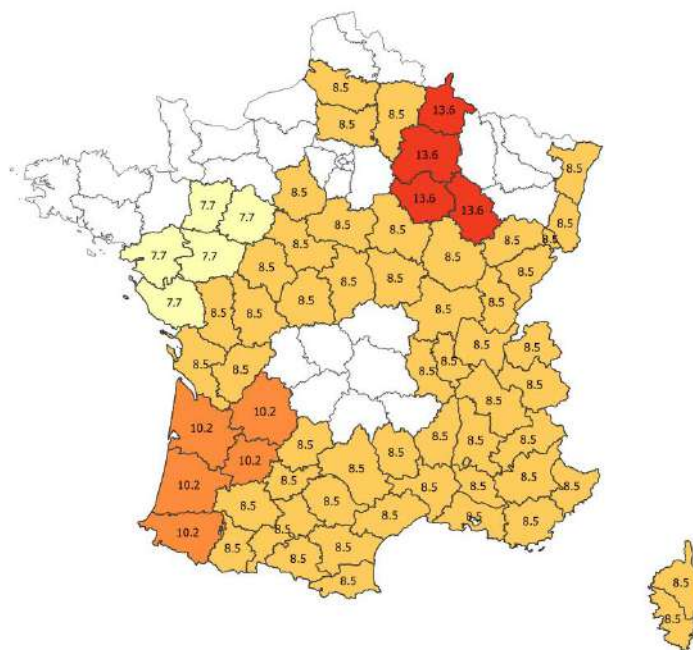


Figure 4 : Vine stocks renewal (t/ha/yr) in France (Solagro data)

The National strategy for biomass mobilization is using the aforementioned Solagro study for production estimations. There is no other specific study uses in this new national program. This document is the reference in all national biomass studies.

It can be noted that wood from tree nursery is also not used. It is cover of resin, necessary for plant development, which does not ease its use.

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C. National state of art of the APPR sector

The National biomass strategy

In 2012, renewable energies were represented 8.8% of the gross inland energy consumption in France (Sustainable development French Ministry). 44.8% were wood energy, 10.7% were biofuel, 4.6 were renewable wastes, 2% were biogas but only 1.3 were from agricultural waste, represented 0.29 Mtoe.

A first estimation shows that 30,000 jobs depends on fire wood. The Heat Found (Fonds Chaleur) of the ADEME created more than 10,000 direct jobs (10,000 others expected within 2020). The French Green Strategy is expected created more than 100.000 jobs in the next few years (nor only in energy but also in chemistry, biofuel, etc.)

Some relevant documents can be used to analyse the bioenergy strategy in France. The National Strategy for biomass mobilization but also the bioeconomy strategy are currently major issues for the Agricultural and Environmental French ministries.

This strategy proposes 3 types of biomass:

- From forest: 3,5 million tons of wood chips were used in 2016.
- From agricultural residues and plants: an estimation of more than 10 million tons of by-products from agricultural resources are estimated. Wine residues are estimated around 0,65 to 1,75 Mt, residues from fruits plantations around 0,65 Mt. Nevertheless, the use of this biomass remains rare.
- Waste from industrial agri-food industries and other green wastes.

The bioenergy sector in France mainly rests on wood production. Agricultural products represent an insignificant part of the biomass use of heat and electricity production. Nevertheless, they represent the main sources for biogas production and biofuel. In this wide bioenergy market, APPR biomass does not represent a significant use.

The biomass in the heat and electricity production

In 2012, renewable energies accounted only for 8.8 % of gross energy consumption in France, and only 1.3% came from agricultural waste. In 2014, biomass represented 17% of the energy supplied for district heating. In 2016, electricity generation from solid biomass reached 1.496 MW, including 425 MW in cogeneration.

The main biomass stakeholders

Several national entities play a major role in the development of biomass valorization sectors.

Among them, we can mention **the ADEME** (the French Environment and Energy Management Agency) which, in addition to financial support for many projects, also capitalizes on technical information via a wide variety of studies and projects it supports. ADEME's missions is to create, animate, coordinate, facilitate or carry out operations aimed at protecting the environment and controlling energy.

FranceAgriMer is also an important stakeholder. The National Establishment for Agricultural and Marine Products is responsible for implementing certain measures provided for in the Common Agricultural Policy and for carrying out some national actions for various agricultural sectors. It manages the National Observatory for Biomass Resources, providing precise data on available biomass for future projects.

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The Union of Renewable Energies (SER) promotes the interests of industrial and French renewable energy professionals and defends French interests in the main European programs.

Lastly, we can cite energy services companies (Engies, Dalkia, etc.), which, thanks to their initiatives, can contribute to a broad development of biomass markets.

With regard to agricultural development, the concerned federation may be added, such as Agricultural Chambers or Coop de France.

Many reflections are in progress on the development of biomass and, by extension, the role of the agricultural biomass in the expansion of renewable energy in France. Many agricultural federations work in this direction, supported by public institutions. A lack of general structuration of the sectors, as well as a low price of renewable energies, continue to slow down their development. However, real political support exists at the national level. The context is favourable for reflections raising the question of the place of agricultural wood in the different sectors related to bioenergy.

Acceptation of biomass projects

Biomass boilers do not seem to suffer from social unacceptance of local residents. They do not suffer from the reputation of the methanizers (mainly olfactory disorders). On the contrary, they seem rather to obtain a relatively positive public opinion via the development of renewable energies. However, it remains difficult to say clearly. Current units are usually small, not visible (buried, in buildings or in industrial areas). Small agricultural units such as those using vine shoots should does not suffer from the syndrome of "it is a very good thing, but not in my backyard".

The main stakeholders of the sector

<i>Biomass producers</i> • Farmers • Cooperatives • Farmers groups	<i>Final consumers from the agricultural sector</i> • Farmers (self-consumption, for farm or housing) • Agro-industries
<i>Industrial partners</i> • Equipment manufacturers (shredder, pelletizer, etc.). • Burning equipment manufacturers (boilers, torrefaction) • Technical centre • Transport company, handling company • Storage platforms • Logistic operators.	<i>Other potential consumers</i> • Heating production unit • Industries • Municipalities • ESCO
<i>Consulting</i> • Professional association • Consulting companies	<i>National decision makers</i> • L'ADEME • Agricultural Ministry, Sustainable Development Ministry • FranceAgriMer
<i>Other stakeholders</i> • Non-Governmental Organization • Local association • Medias	<i>Regional decision makers</i> • Regional state representative • Municipalities • Local Agency of the ADEME, for Energy • Chamber of commerce, agricultural chamber

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	• Technical or innovation centers.

APPR stakeholders are diverse. They do not all have the same expectations. Farmers want to develop new revenues through a value-added activity but also reduce the cost of existing agricultural work. National or local institutions want to be able to reduce greenhouse gas emissions in the territory. Service companies (equipment, energy) want to be able to develop new markets: find new customers, develop new activities or access fuels at better prices. It is important to understand the different expectations of these stakeholders to develop the APPR biomass in a responsible way, creating benefits for all stakeholders in the territory.

The APPR biomass sector

APPR biomass as renewable energy source

APPR biomass used in combustion, is a source of renewable energy. It is produced every year (or by cycle for strains). Coming in addition to agricultural activities and therefore not the main object of the culture, they are reconstituted annually and can thus be considered as an inexhaustible source.

Associated markets

In France, there is no real market for APPR biomass. Prunings are generally left on the soil as organic matter: their management is thus simplified and the working time in the field is reduced (compared to the export of wood).

A very marginal part of these woods is used in energy. Some wine producers are using prunings in their own boiler. For the moment, these projects are small, confined to the farm. At the national level, it is difficult to cite more than a dozen farms that have developed this type of project for the valuation of vine shoots for energy. Among them:

- The Xavier Muller Domaine in Marlenheim,
- Château Haut Peyrat in Cambes,
- Château Poupille in Sainte-Colombe.

Some projects also offer vine shoots for sale as barbecue wood. Other tests, especially on orchards, were conducted, but without success, by various Agricultural Chambers.

However, some projects are running for the use of pruning wood as materials (eg Vitis Valorem, producing wood sticks) or in green chemistry (grape pomace can be used by pharmaceutical industries but tests are alsorealised with wood). Some municipalities (community of Siphem for example) or local organizations (CUMAs, Agricultural Chambers) are also conducting some experiments for the use of agricultural wood in energy. The impact of this work remains, however, for the moment, relatively limited.

In the absence of markets, it is difficult to propose a selling price for APPR biomass. The existing projects in France are often small projects in self-consumption, the calculation of the cost of production of agricultural wood is thus rarely available. However, it may be interesting to keep in mind the wood chips prices, around € 20 / MWh and € 350 / MWh excluding transport for wood pellets. In France, energy wood represents 47% of renewable energies. The sector has been particularly developed for fifteen years, after the storms of the late twentieth century.

These logistics chains are organized and structured, from wood collection to storage in the forest or on dedicated platforms, through shredding platforms and distribution. Seasonality is also taken into account (accessibility to forest plots).

The different business models

Various economic models of valorization of the agricultural wood could be envisaged, some of which

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are proposed hereafter. If professionals in the agricultural sector are best positioned to organize new markets, other actors outside the sector (companies but also municipalities) could offer collection services, or marketing. These economic models may not be profitable if they bring other positive externalities. For example, reduction of outside burning, sustainable development of agriculture or development of renewable energies could benefit a community organizing such logistic chains.

Stakeholders	Business models	Current situation
APPR producers	<u>Self-consumption</u> : farmers use their own resources in small boilers of adapted to their exploitation. They manage the logistics chain.	This model is quite the only one currently developed in France. It is developed by one person, depending on local initiatives, mainly of winemakers.
Producers, cooperatives, local companies	<u>Marketing</u> : the company is managing the collection and marketing of wood.	This model, proposing a wood harvesting by a cooperative / farmers group for its own consumption or resale, has not been developed yet. Some companies offer the resale of wood for barbecues or use it for non-energy purposes according to the same model of collection - processing - resale.
Biomass harvesters	<u>APPR management services</u> : the company proposes to carry out the collection work and is paid for the service. <u>Service for the evacuation of APPR</u> : the company proposes a service to manage stocks and for the rehabilitation of the parcel. <u>Equipment rental</u> : the company rents the equipment associated	In the absence of markets, this model is not yet developed. It could be easily proposed by farmers already harvesting APPR biomass for personal purposes.
Logistic operators	<u>Logistics platform</u> : A company organizes the entire logistics chain, from collection to sale. <u>Storage platform</u> : Existing biomass storage or waste management infrastructures are paid to rent available space or store biomass during the drying period.	The use of existing infrastructures on the territory could reduce the costs of logistics chains. These models is still quite not developed but would represent an important gain for territorial value chains.
Consumers: ESCO, municipalities	The company or municipality takes over the operation of the boiler and sells the energy to the heat consumer.	This model is widespread for forest wood but not in the agricultural sector.

Opportunities APPR biomass development

An innovative sector: the wine sector is an innovative sector. Wine producers are pioneers in launching new projects. Many are also highly aware about sustainable development and innovate in that sense. The French agricultural sector is an important sector that benefits from a strong

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innovation dynamic.

Quite no competitive uses: APPR biomass is not yet used by other sectors, it is available for energy uses and does not compete with other products. APPR biomass is widely available on the territory.

Financial support for the boiler purchase: the Heat Fund of ADEME offer financial support for the investment of biomass boilers. This fund has a major impact in the development of biomass projects in France (it has so far supported more than 3,600 investments for 1.5 billion euros and the production of more than 1.8 million tons oil equivalent). Local support systems also exist, offering investment support, for example for storage areas. However, these aids usually depend on local actors (and not always of national policies).

Innovative projects related to renewable energies can also be financed, entering into different national or territorial calls for projects.

The carbon tax: the increase of the carbon tax should impact the development of biomass boilers by increasing the competitiveness of this resource against fossil fuels.

Air quality: the outside burning of APPR biomass represents a risk for local air pollution. This is why the state and the national authorities are really interested in developing solutions to limit this practice.

CSR and its added value: several farmers have developed projects to value APPR biomass by conviction. A sustainable strategy also allows a better profitability (optimization of the costs) but also an increase of the added value (notoriety by its CSR policy). At the national level, a real desire to green the economy is organised through greenhouse gas emissions reduction, renewable energies development or the development of circular economy plans.

The use of APPR biomass can also be integrated into the agricultural sector policies. The local and national contexts are therefore very favorable for the development of new value chains.

National plans to promote biomass: various national programs for energy and sustainable development support agricultural investments. Some plans, such as New France Industrial, promote the use of biomass, but more particularly in green chemistry and methanation.

The new biomass strategy: national strategies for biomass valorization are being implemented in France. The use of pruning wood can be included in the considerations of some regions.

A positive local impact: The use of APPR biomass could contribute to the diversification of agricultural activities but also create employment in rural areas and participate to the development of locally produced energy.

Main barriers for the APPR biomass development

An underdeveloped market, a real lack of consumers: APPR biomass quality is not as good as wood chips. This is why it is not easy to develop a market and find consumers, this material being not able to be valued as simple forest wood. Without a developed market, local initiatives are rare and are not always sustainable.

No information, no examples to follow: the use of agricultural wood is marginal in France. Quite no information is available for an operator who is interested in developing new projects. The type of equipment needed, the available technologies, the main recommendations, etc., all information is not available for a new entrepreneur.

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Few political (technical, financial) support from local actors: Support is often offered to project carrier to purchase a biomass boiler. However, for the development of new projects, other major investments are needed such as the purchase of a shredder, a granulator, collection equipment, etc. There is no financial support to cover these costs. In addition, since the valorization of agricultural wood is relatively new, new entrepreneurs can not benefit from technical support to assist them in the development of their projects.

The performance of available technologies reduces profitability: technologies for collecting, shredding or pelletizing biomass are becoming more and more efficient. However, as the sector of APPR biomass is not very developed, the material is rarely specifically adapted to its needs. Their performance can also be relatively low for very expensive equipment. The logistics costs therefore represent one of the most important barriers for the development of the valorization of these woods. That is why it is necessary to develop adapted technologies. In addition, grape management systems in France are highly variable. A technology adapted to one territory is not necessarily adapted to another (because of the relief, the distance between the rows, etc.).

Major logistic costs which slow down project development. The time required as well as the investments and the collection on scattered plots impact the profitability of the value chain.

Low yield: depending on the plots, the production of pruning wood is sometimes low and does not make profitable the associated logistics.

Short time to develop new projects: the use of pruning wood is usually a farmer-initiated project. Projects associated to bioenergy are not their main job. They need time to develop these initiatives, but this time is in addition to the usual tasks for agricultural work. That's why they really need local support to develop new sustainable initiatives.

A real lack of information: policy makers do not receive specific requests for the use of APPR biomass. That is why the development of the use of this resource is not a priority.

No precise data: a single study is considered the reference in France, in terms of numerical data, for APPR biomass. Some territories have realised further studies through plot sampling, but these initiatives are rare and not always available. More precise data would be needed at the national level, with a regional vision, to strengthen the use of these resources.

Practices still prohibited in practice: The outside burning is banned by a circular since 2011 but exemptions are often granted. As long as these practices remain tolerated, no lock can really be lifted. True political support for this issue seems necessary.

Strong competition from other energies: the profitability of projects is not always demonstrated. Indeed, the price of fossil fuels being relatively low, the economic interest of biomass is sometimes limited. In addition, the quality of forest wood is higher than the APPR biomass one. Forest wood can also propose a supply whose stability is demonstrated. The arrival of cheap wood from other countries also reduce the profitability of the APPR biomass projects. Moreover, investors are asking for ever shorter return on investment that limit the development of projects.

A resource still poorly considered: wood from APPR biomass are still considered as waste more than as co-products. A change of mentality must take place at all levels. At the farm level, farmers have to accept to get the wood out of the field. At the national level, this resource is little known: it is almost never mentioned in biomass strategies, bioeconomy or energy plans. Although it can fit perfectly into

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these policies, it is rarely explicitly named. No consistent policies are deployed. Energy professionals also have little interest for this unknown resource.

National plans for energy

The Law for Energy Transition and Green Growth (Loi pour la transition énergétique et la croissance verte), published on 18 August 2015, organised the implementation of strategies and plans, which make possible to act on the mobilization of biomass: Multiannual Energy Program, National Low Carbon Strategy, National Biomass Mobilization Strategy and its regional variation or the Bioeconomy Strategy.

Multiannual Energy Program sets the priorities for the energy management in the territory. A 50% increase in of renewable heat production is integrated, thus promoting the mobilization of biomass resources.

The National Low Carbon Strategy mentions in particular the multiplicity of biomass uses and the need to deploy observation tools for biomass resources while preserving soil carbon.

The National Biomass Mobilization Strategy (SNMB) aims to promote bioenergy integrated competitive uses (food and non-food). It enables the coherence of regional biomass schemes being developed in all regions and aims at complementing other programs for the development of renewable energies. The SNMB cites the APPR biomass as a source of biomass to be studied, raising, in general, the need to establish a favorable framework for the mobilization of agricultural biomass.

The Energy Transition and Green Growth Act also provides for the generalization of bio-waste sorting by 2025, which will increase the volume of potentially usable ressource.

The use of biomass for energy is more relevant than ever. Bioenergy is supported by several national and investment plans, particularly in order to reach France's emission reduction targets and increase renewable energies by 2020. The context is therefore favorable for the development of new energy sources.

National plan for energy and climate

Several texts, over the last decade, have defined, at European and national level, the objectives of energy efficiency and the use of renewable energies.

Thus, the **directive of 23 April 2009** for the promotion of the use of energy produced from renewable sources (2009/28 / EC) sets, for France, the target of 23% renewable energy.

At the national level, the **Grenelle 1 & 2 laws of 2009/2010** introduced several proposition aimed at supporting and supervising the development of heating and cooling networks as mobilization tools for renewable energies.

Various incentives and aids have been put in place: aid for the financing of research and development projects, help for the creation of industrial demonstrators, help for the installation or purchase of equipment ...

In 2015, **the law for energy transition** for green growth sets the objectives of increasing the share of renewable energy to more than 30% of final energy consumption in 2030. Multiannual energy

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programming should concretely define the trends to follow.

Climate plan in 2017

In July 2017, the Minister Nicolas Hulot launched the new Climate Plan to accelerate the energy and climate transition. With the Climate Plan, France is accelerating the operational application of the Paris Agreement of the COP 21 by setting ambitious targets in terms of quality of life, carbon neutrality and green economy.

Several developed lines of the Climate Plan can be linked with the valorization of APPR biomass: territories integration, circular economy, decarbonation, ecological taxation (carbon tax) and development of renewable energies (and therefore biomass) and thus the development of the allocated resources, including the ADEME heating Fund. Concrete actions will be proposed depending on the work progress.

This new energy plan is more ambitious than the previous one, while continuing the work previously undertaken. Thus, carbon taxation or sustainable agriculture were already present in the previous Climate Plan of 2004. Carbon taxation is a real opportunity for the biomass sector which suffers from low prices of fossil fuels.

The 17 national Targets for Sustainable Development also include renewable energy development measures

The place of biomass in the different national plans

The valorization of APPR biomass is promoted on these different plans, more or less explicitly, as a source of renewable energy. It is politically encouraged and can solicit various financial and other aids for its development. However, the valorization of the APPR biomass is never mentioned in the energy policies. It only appears in the National Strategy for Biomass Mobilization.

Even without being explicitly mentioned, APPR biomass can benefit from several aid schemes, both at national and local level. Thus, the purchase of APPR boiler can be valued thanks to the Heat Fund of the ADEME. Carbon taxation will also benefit the development of value chains, as biomass can become competitive with fossil fuels, depending on the increase that will done.

The use of APPR biomass and national position

APPR biomass answers the various plans for the development of renewable energies. Although, theoretically, it could also respond to other national issues, particularly for the development of agriculture, it is currently never mentioned outside biomass plans. In general, this resource is quite unknown.

The valorization of APPR biomass would make possible to reduce the outside burning and to develop the renewable energies. This part will be further developed in regional policies during the implementation of Regional Biomass Schemes. Other issues such as the links between bioenergy policies and agriculture, markets and innovation remain very underdeveloped.

Take the step for the valorization of APPR biomass

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State representatives or public institutes that could push the use of APPR biomass receive very few requests on this subject. As the sector is today very underdeveloped, knowledge is lacking to encourage its growth.

In general, it is not the lack of willingness that blocks the development of new projects but the lack of knowledge at all levels of the value chain. At the field level, farmers are subject to various logistical barriers and do not always have the needed knowledge to develop a profitable value chain. The price of fossil fuels limits the profitability of projects and does not push market stakeholders to take an interest in these resources.

Policy makers are seeking information and solutions and are ready to support new projects.

In addition, the development of plans for energy or the environment as well as the new European directives or the desire of France to be a pillar in terms of environmental preservation create very favorable conditions for the development of new projects and for raising the awareness of all stakeholders about the potential of APPR biomass.

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SWOT Analysis

	Positive factors	Negative factors	
Internal Factors	Strengths <i>The sector is dynamic and innovative</i> S1. The French agricultural sector including wine sector is a major sector in France, productive and strongly involved locally S2. Wine and fruits producers motivated by biomass projects S3. Wine and fruits producers are innovative <i>Biomass is widely available</i> S4. A large amount of biomass of locally available with significant spatial density S5. Few competitive uses <i>Sustainable development</i> S6. Energy optimization is part of a CSR strategy (added value) S7. A real integration of sustainable development on farms <i>Contribution to renewable energies</i> S8. The use of APPR biomass in a boiler reduces the consumption of fossil fuels S9. In rural areas, energy needs could be partly cover by local energy sources <i>Contribution to economic development</i> S10. The sector could be a source of jobs in rural areas S11. Circular economy and local use of energy is a priority for consumers S12. The agricultural sector is looking for solution to diversify its activities.	Weakness <i>A lack of feedback</i> W1. Few concrete cases, examples to be followed or available information W2. The absence of current logistics chains implies a significant effort to develop new value chains (lack of examples, development starting from nothing). <i>Low economic profitability</i> W3. The economic balance of this type of project is not demonstrated yet. Few benefits are expected for significant investments. <i>Real logistical constraints</i> W4. APPR biomass is often scattered on plots. They are subject to a strong seasonality W5. Equipment still poorly adapted to the sector W6. A real important logistical cost W7. Low production per hectare on some vineyards W8. Lack of time from project carriers, usually farmers. Need of extra time to develop project. <i>A change of mentalities</i> W9. The relationship to change of some farmers can slow down some projects <i>Equipment still unsuitable</i> W10. Combustion technologies still not entirely adapted / developed <i>Agronomic issues</i> W11. Competitive use as organic matter <i>A lower quality than forest wood</i> W12. Agricultural wood is of lower quality than forest wood <i>A lack of interest from professionals</i> W13. Agricultural biomass does not interest ESCOs	Internal Factors

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External Factors	Opportunities <i>Integration of biomass into new policies</i> O1. Implementation of the new biomass strategy at national level O2. Current development of national plans for the promotion of biomass <i>National willingness to act for sustainable development</i> O3. Willingness to green the economy through a reduction of GHGs, reduction of fossil fuels, development of renewable energies O4. Development of national and European regulations for the development of the circular economy <i>National willingness to act for the development of agriculture</i> O5. Political willingness to develop new remunerative projects for the agricultural sector <i>Favorable regulations</i> O6. Increase of the carbon tax O7. Focus on policies to improve air quality <i>Local initiatives for equipment</i> O8. Local machinists develop equipment adapted to local cultures <i>The possibility of financial support</i> O9. Financial support is possible for the development of innovative projects O10. Possible financial support for the development of renewable energy projects <i>A favorable local context</i> O11. A search for new deposits to complete the wood supply O12. A real interest of some municipalities	Threats <i>A lack of market</i> T1. The market is undeveloped, a real lack of consumers <i>A lack of return on investment</i> T2. Cheap wood is imported from EU or non-EU countries T3. Low energy prices T4. Combustion biomass valorization units ask for a rapid return on investment <i>The competition for the resource</i> T5. APPR biomass competes with better quality and widely available forest wood <i>A lack of local support</i> T6. Continuation of the tolerance of outside burning T7. Local political support sometimes limited <i>An absence of national plans</i> T8. APPR biomass is not integrated in national biomass plans T9. The valuation of APPR biomass is not integrated in the CAP T10. No coherent policies on the valuation of APPR biomass <i>A lack of knowledge</i> T11. A lack of knowledge of some decision makers on the subject T12. A lack of accurate data at the territories scale	External Factors
	Positive factors	Negative factors	

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STRATEGIC PLAN

In order to obtain a better interpretative framework, the internal SW factors may form together a vertical axis and the external OT factors a horizontal axis. By combining internal and external factors, the following strategic alternatives may be obtained:

SO Strategies (Strategies employing strengths in order to profit by opportunities). These are the *max-max* type of strategies, in the sense that they combine the most favourable elements to building a strategy. SO strategies use strengths and powerful elements in order to make it benefit from external opportunities. The strategy becomes dynamic and aggressive (*attacking*).

WO Strategies (Strategies seeking to alleviate the effect of weaknesses by taking advantage of opportunities). They are strategies of the *min-max* type, in the sense that they combine inside weaknesses with external opportunities. The strategy attempts to use opportunities in order to eliminate or alleviate weaknesses (*reorientation*).

ST Strategies (Strategies that employ strengths in order to prevent or minimize threats). They are strategies of the *max-min* type, in the sense that they use the strengths in order to avoid or reduce external threats (*defense*).

WT Strategies (Strategies that alleviate weaknesses and seek to reduce the impact of threats). They are *min-min* type strategies seeking to minimize weaknesses if external threats can be avoided (*surviving*).

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① Integration of operational stakeholders in national development plan

Strategy: Strengths + Opportunities → SO “Attack”

S1. The French agricultural sector including wine sector is a major sector in France, productive and strongly involved locally
S2. Wine and fruits producers motivated by biomass projects
S3. Wine and fruits producers are innovative

O1. Implementation of the new biomass strategy at national level
O2. Current development of national plans for the promotion of biomass
O5. Political willingness to develop new remunerative projects for the agricultural sector

Objectives

- SO1. Take advantage of the motivation of the actors on the field and the development of new strategies to build together an operational strategy.
- SO2. Take advantage of the motivation of the actors on the field and the development of new strategies to co-build tools fostering the development of new projects.

Actions / Activities

- Organize regional information meetings and workshops on national strategies with local stakeholders of the wine and fruit sectors. Use this information to better understand the challenges of the sector and add APPR biomass to national energy and biomass plans, taking into account the information gathered.
- Integrate wine and fruit professionals into regional biomass mobilization strategies.
- Identify innovative local projects and invite their project leaders to national workshops for the development of biomass strategies.
- Integrate bioeconomy and bioenergy into agricultural sector development plans.
- Create a dedicated action plan, with the professionals of the sector, for the development approach of the APPR biomass sector

2 Co-construct a local sustainable development strategy

Strategy: Strengths + Opportunities → SO “Attack”

S6. Energy optimization is part of a CSR strategy (added value)
S7. A real integration of sustainable development on farms
S8. The use of APPR biomass in a boiler reduces the consumption of fossil fuels
S9. In rural areas, energy needs could be partly cover by local energy sources
S11. Circular economy and local use of energy is a priority for consumers

O3. Willingness to green the economy through a reduction of GHGs, reduction of fossil fuels, development of renewable energies
O4. Development of national and European regulations for the development of the circular economy
O6. Increase of the carbon tax
O7. Focus on policies to improve air quality
O10. Possible financial support for the development of renewable energy projects

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Objectives

SO3. Take advantage of the opportunity offered by the valorization of APPR biomass to reduce GHG emissions and the consumption of fossil fuels
SO4. Developing renewable energies from local sources from agricultural biomass

Actions / Activities

- Reinforce final support proposed for pilot logistics chains in the territories
- Technically support municipalities interested in developing APPR biomass logistic chains (feasibility studies, support in building the logistics chains)
- Communicate on the possibility of developing logistic chains for the APPR biomass uses and the associated subsidies, in particular for the installations of boilers.
- Communicate on the positive externalities of APPR biomass projects.
- Conduct studies to quantify positive externalities.
- Communicate on the 3 pillars of sustainable development: economy, environment (sustainable energy, GHG), social (job creation).

3 Promote new project development directly with local stakeholders

Strategy: Strengths + Opportunities → SO “Attack”

S1. The French agricultural sector including wine sector is a major sector in France, productive and strongly involved locally
S2. Wine and fruits producers motivated by biomass projects
S3. Wine and fruits producers are innovative
S10. The sector could be a source of jobs in rural areas
S12. The agricultural sector is looking for solution to diversify its activities.

O1. Implementation of the new biomass strategy at national level
O5. Political willingness to develop new remunerative projects for the agricultural sector

Objectives

SO5 : Support local stakeholders in their innovation projects and encourage reflection for the development of new logistic chains and search for new solutions (logistical optimization, new equipment, new markets).

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Actions / Activities

- Propose brainstorming workshops with local stakeholders to develop new projects, by connecting all stakeholders involved in value chains.
- Reinforce subsidies proposing the installation of pilot logistics chains in the territories
- Technically support the actors in the field, in particular through contacts with competitiveness clusters or specialized consulting agencies.
- Communicate on available financial support mechanisms.
- Develop a guide on available financial support mechanisms available for the sector.

4 Support the development of new competitive markets

Strategy: Strengths + Opportunities → SO “Attack”

S2. Wine and fruits producers motivated by biomass projects
 S4. A large amount of biomass of locally available with significant spatial density
 S5. Few competitive uses
 S9. In rural areas, energy needs could be partly cover by local energy sources

O5. Political willingness to develop new remunerative projects for the agricultural sector
 O6. Increase of the carbon tax
 O11. A search for new deposits to complete the wood supply
 O12. A real interest of some municipalities

Objectives

SO6: Push the development of APPR biomass markets.

SO7: Encourage the development of projects using locally APPR biomass.

Actions / Activities

- Communicate on development opportunities through regional presentations or documented feedback, targeting high-potential areas, integrating all stakeholders (communities, ESCO, farmers, etc.).
- Accompany project carriers in their feasibility study (co-financing, free feasibility study)
- Propose methods of Return on Investment calculation
- Communicate or organize success case visits
- Communicate during specialized events
- Write and distribute a statement on the need to promote appropriate practices
- Membership campaign targeting different sectors and stakeholders

5 Promote positive externalities vs fossil fuel competitiveness

Strategy: Strengths + Threats → ST “Defense”

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S6. Energy optimization is part of a CSR strategy (added value) S7. A real integration of sustainable development on farms S8. The use of APPR biomass in a boiler reduces the consumption of fossil fuels S9. In rural areas, energy needs could be partly cover by local energy sources S10. The sector could be a source of jobs in rural areas S11. Circular economy and local use of energy is a priority for consumers	T1. The market is undeveloped, a real lack of consumers T2. Cheap wood is imported from EU or non-EU countries T3. Low energy prices T4. Combustion biomass valorization units ask for a rapid return on investment T5. APPR biomass competes with better quality and widely available forest wood

Objectives

ST1: Develop the sector by highlighting the positive externalities face to economic issues

Actions / Activities

- Communicate on the positive externalities of APPR biomass projects
- Communicate on existing financial support mechanisms
- Propose feasibility studies by integrating different scenarios of rising energy prices and carbon taxes
- Visit functional units
- Study the incentive different mechanisms for the development of APPR biomass projects.

6 Fight against the lack of integration of APPR biomass into policies by strengthening knowledge

Strategy: Strengths + Threats → ST “Defense”

S1. The French agricultural sector including wine sector is a major sector in France, productive and strongly involved locally S2. Wine and fruits producers motivated by biomass projects	T7. Local political support sometimes limited T8. APPR biomass is not integrated in national biomass plans T9. The valuation of APPR biomass is not integrated in the CAP T10. No coherent policies on the valuation of APPR biomass T11. A lack of knowledge of some decision makers on the subject T12. A lack of accurate data at the territories scale

Objectives

ST2: Increase awareness of the potential of APPR biomass among policy makers to make this resource more integrated into national and regional plans

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Actions / Activities

- Strengthen existing knowledge on the potential of the industry
- Develop a report on the potential develop of the sector, widely communicated, particularly to policy makers and potential project leaders
- Carry out a communication campaign in the newspapers
- Organize workshops, visits or submit technical reports to local stakeholders
- Organize a promotion campaign on polyfuel woods

7 Collection of precise data about APPR biomass

Strategy: Strengths + Threats → ST “Defense”

S1. The French agricultural sector including wine sector is a major sector in France, productive and strongly involved locally
S2. Wine and fruits producers motivated by biomass projects

T11. A lack of knowledge of some decision makers on the subject
T12. A lack of accurate data at the territories scale

Objectives

ST3: Provide reliable quantified information to project leaders

Actions / Activities

- Perform a measurement on the yields of APPR production per hectare according to the different regions
- Suggest an availability measurement
- Draw a potential map

8 Ensure enforcement of sustainable development regulations

Strategy: Strengths + Threats → ST “Defense”

S8. The use of APPR biomass in a boiler reduces the consumption of fossil fuels

T6. Continuation of the tolerance of outside burning
T7. Local political support sometimes limited

Objectives

ST4: Orienting regulations to support the APPR development

Actions / Activities

- Identify bad practices such as outside burning
- Submit a report to the competent authorities
- Conduct a regulatory analysis of the laws that could impact the sector and transmit it to the competent authorities.

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9 Support innovation development, supporting logistic optimisation

Strategy: Weakness + Opportunities → WO “reorientation”

O8. Local machinists develop equipment adapted to local cultures
O9. Financial support is possible for the development of innovative projects

W3. The economic balance of this type of project is not demonstrated yet. Few benefits are expected for significant investments.

W4. APPR biomass is often scattered on plots. They are subject to a strong seasonality

W5. Equipment still poorly adapted to the sector

W6. A real important logistical cost

W7. Low production per hectare on some vineyards

W8. Lack of time from project carriers, usually farmers. Need of extra time to develop project.

Objectives

W1: increasing the efficiency of logistics chains

W2: reducing costs associated to logistics chains

Actions / Activities

- Organize equipment demonstrations
- Realize a web promotion campaign
- Present technical reports about logistics organization of the sector
- Produce a document on the various applicable business models and communicate on them
- Work to identify technical insufficiency in machinery and processing equipment
- Identify existing services on the field that can participate in the optimization of logistics chains and propose a report to the administration and other stakeholders
- Participate in the networking of the local stakeholders (e.g. by local workshop)
- Make calculations on real cases, disseminate results and conclusions
- List existing logistical equipment, their characteristics and their advantages and disadvantages and communicate to operational stakeholders

10 Develop political strategy to develop the valorization of APPR biomass on the field

Strategy: Weakness + Opportunities → WO “reorientation”

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O1. Implementation of the new biomass strategy at national level
O2. Current development of national plans for the promotion of biomass
O3. Willingness to green the economy through a reduction of GHGs, reduction of fossil fuels, development of renewable energies
O4. Development of national and European regulations for the development of the circular economy

W9. The relationship to change of some farmers can slow down some projects
W13. Agricultural biomass does not interest ESCOs

Objectives

WO3: change attitudes of local stakeholders to develop new projects

Actions / Activities

- Communicate at public events
- Organize promotional campaigns on Youtube
- Organize promotional campaigns on the valorization of APPR biomass for energy
- Produce a report analyzing the sector and its opportunities and communicate
- Encourage the Public Administration to support the development of initiative

11 Integrate agricultural biomass (including APPR biomass) on biomass resource usable for energy

Strategy: Weakness + Opportunities → WO “reorientation”

O5. Political willingness to develop new remunerative projects for the agricultural sector
O11. A search for new deposits to complete the wood supply

W12. Agricultural wood is of lower quality than forest wood

Objectives

WO4: Make agricultural woods known as sources usable for energy purpose

Actions / Activities

- Obtain product quality data and communicate
- Define a quality standard
- List combustion equipment able to burn APPR biomass and communicate

12 Participate in the profitability of APPR biomass projects

Strategy: Weakness + Threat → WT “reorientation”

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T1. The market is undeveloped, a real lack of consumers T2. Cheap wood is imported from EU or non-EU countries T3. Low energy prices T4. Combustion biomass valorization units ask for a rapid return on investment	W3. The economic balance of this type of project is not demonstrated yet. Few benefits are expected for significant investments. W4. APPR biomass is often scattered on plots. They are subject to a strong seasonality W5. Equipment still poorly adapted to the sector W6. A real important logistical cost W7. Low production per hectare on some vineyards W8. Lack of time from project carriers, usually farmers. Need of extra time to develop project.

Objectives

WT1: Optimize value chains

Actions / Activities

- Encourage the public administration to support the development of initiatives
- Propose documents on the various applicable business models, communicate, present the different financing opportunities
- Organize a campaign of information / integration with the different sectors
- Organize a communication campaign for consumers
- Work with equipment manufacturers on existing gaps

13 Make the APPR biomass known

Strategy: Weakness + Threat → WT “reorientation”

T11. A lack of knowledge of some decision makers on the subject T12. A lack of accurate data at the territories scale	W1. Few concrete cases, examples to be followed or available information W2. The absence of current logistics chains implies a significant effort to develop new value chains (lack of examples, development starting from nothing)

Objectives

WT2: communicate more about the opportunities of the sector and make known the potential of the APPR resource

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Actions / Activities

- Organize equipment demonstrations
- Realize promotional campaigns on Youtube
- Communicate during public events
- Set up an awareness campaign: newspaper communication, articles
- Technical Report Presentations
- Make calculations from real cases, disseminate results and conclusions
- Promotion campaign on the use of APPR biomass for energy
- Workshops, visits, public technical reports
- Encourage the public administration to support the development of initiatives
- Carry out promotional activities for the agricultural sector

14 Demonstrate the relevance of use of APPR biomass as a complement of forestry wood resource

Strategy: Weakness + Threat → WT “reorientation”

T5. APPR biomass competes with better quality and widely available forest wood

W10. Combustion technologies still not entirely adapted / developed

W11. Competitive use as organic matter

W12. Agricultural wood is of lower quality than forest wood

Objectives

WT3: demonstrate the interest of the resource in comparison with other fuels

Actions / Activities

- Communicate on positive externalities
- Conduct quality analyzes on the resource
- Define a quality standard for the resource
- Communicate on existing combustion technologies
- List insufficiencies for existing combustion technologies
- Conduct technical and comparative studies with other types of residues

15 Focus on developing successful cases for demonstrations

Strategy: Weakness + Threat → WT “reorientation”

T8. APPR biomass is not integrated in national biomass plans

T9. The valuation of APPR biomass is not integrated in the CAP

T10. No coherent policies on the valuation of APPR biomass

W1. Few concrete cases, examples to be followed or available information

W2. The absence of current logistics chains implies a significant effort to develop new value chains (lack of examples, development starting from nothing).

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Objectives

WT4: contribute to the development of demonstration cases as models for the sector

Actions / Activities

- Communicate on financing opportunities for innovation and renewable energies
- Propose dedicated calls for projects
- Work with all stakeholders
- Offer support as advice and feasibility studies
- Support market development

ANNEX A12

WP2 – Task T2.3

**Analyse du secteur de valorisation des bois de taille
et d'arrachage issus des vignes et vergers et
développement d'un plan stratégique en France**

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Analyse sectorielle

A. Contexte national pour la valorisation des bois agricoles

LE TERRITOIRE FRANÇAIS OFFRE UNE LARGE DIVERSITE DE ZONES AGRICOLES

Le territoire métropolitain de la France couvre 551 500 kilomètres carrés, de la mer du Nord à la Manche au nord-est, de l'océan atlantique à la mer méditerranée de l'ouest au sud-est. La quasi-totalité du territoire, exceptée la Corse, est située en zone climatique océanique. Toutefois, la France métropolitaine restant un territoire large, le climat n'y est pas pleinement uniforme, proposant une forte diversité de nuances climatiques (Figure 1, carte 3). La France métropolitaine offre également une large variété de reliefs et de paysages naturels : zones montagneuses, vallonnées ou encore plaines fertiles composent un ensemble complexe des zones agricoles différentes.

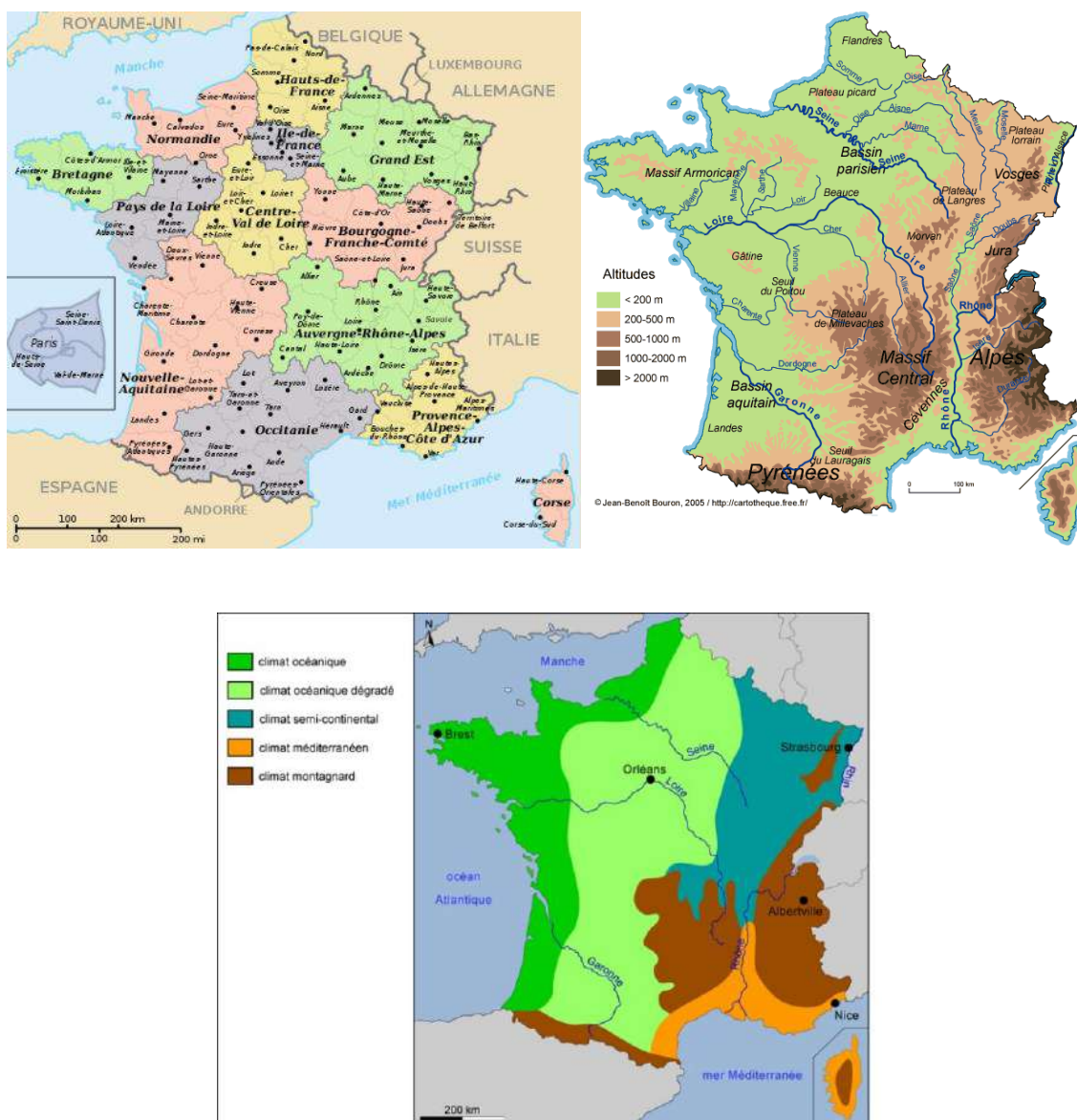


Figure 1 : (1) régions française (e-sushi.fr) (2) relief français (cartesfrance.fr) (3) climat français (assistancecolaire.com)

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LES VIGNES ET VERGERS CULTIVÉS SUR L'ENSEMBLE DU TERRITOIRE

En 2015, la surface totale des plantations d'arbres fruitiers s'élevait à 199 843 ha en France métropolitaine (en intégrant les abricots, cerises, pêches, prunes, olives, pommes et poires) pour une production de plus de 2,5 millions de tonnes. Pour le raisin, la superficie représentait 782 734 hectares pour plus de 6 millions de tonnes de raisin, dont la majorité est utilisée pour la production de vin (Source Agreste).

LE VIGNOBLE FRANÇAIS

La principale culture fruitière en France est le vin. Ses variétés, labels, systèmes de gestion sont divers (Figure 2). Près de 95 000 vignerons produisent 3 420 différents vins, représentant plus de 45 millions d'hectolitres (données 2014) et plus de 383 appellations d'origine (vin-vigne.com).

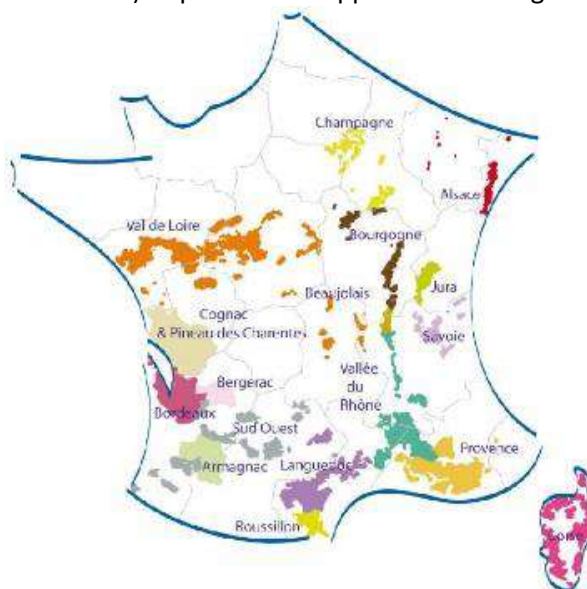


Figure 2 : Le vignoble français (specialitesculinaires.com)

Gestion du sol : en fonction des régions, le vignoble français est cultivé sur des sols très diversifiés : craie, sol granitique, schiste, gneiss, grès, argile ou encore sols sablonneux.

Les cépages : les principaux cépages associés au vin rouge sont le Pinot Noir, le Merlot, le Cabernet Francs, le Cabernet Sauvignon et le Syrah. Pour le vin blanc peuvent être cités le Chardonnay, le Sauvignon, le Riesling, le Roussanne ou le Marsanne. Toutefois, plus de 200 cépages sont autorisés en France.

La production moyenne : le rendement moyen en France est de 50 hl/ha bien que cette donnée puisse varier fortement en fonction des cépages et des systèmes de culture.

Le climat : les vignes sont plantées sur des zones tempérées – continentales, des montagnes ou encore des territoires méditerranéens ou océaniques.

Les systèmes de culture : chaque appellation d'origine est organisée en fonction d'un cahier des charges spécifique. Il peut toutefois être souligné une généralisation des tailles manuelles (avec ou sans prétaille mécanisée) durant l'hiver jusqu'à avril. L'irrigation est également peu fréquente sur le territoire. Le format de taille est souvent en gobelet ou en espalier (Guyot simple ou double) mais d'autres formes spécifiques peuvent être privilégiées, en fonction du terroir. On compte généralement 3 000 à 4 000 arbres par hectare, bien que, là encore, cette donnée puisse varier fortement en fonction des régions.

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LES POMMIERS EN FRANCE

La France produit environ 1,5 millions de tonnes de pommes, via 10 variétés principales dont la Golden (550 000 tonnes), la Gala (250 000 tonnes) et la Granny Smith (190 000 tonnes). 8 000 différentes exploitations agricoles produisent des pommes, représentant 45 000 hectares dans la Loire, le Sud-Ouest de la France, le Languedoc Roussillon, la Provence et la Vallée du Rhône (franceagrimentaire.com). 5 500 hectares de poires sont également cultivés (Agreste, 2015).

100 à 1 500 arbres peuvent être plantés par hectare, en fonction de l'intensité de la culture, en forme libre, en gobelet (pyramide) ou en espalier (2 800 arbres /ha). 65 % des plantations sont irriguées. La taille est généralement réalisée à l'aide de sécateurs spécifiques.

Les arbres à noyaux en France

En 2015, les pommiers représentaient 25 % des arbres fruitiers français. Venaient ensuite les noyers (20 000 ha), les pruniers (15 000 ha), les abricotiers (12 000 ha), les pêchers (10 000 ha), les cerisiers (8 000 ha) (Agreste).

Les systèmes de gestion sont variables, de quelques centaines à plus de 1 500 arbres par hectare, en formes libres, pyramidales ou encore en espalier. 60 % sont irrigués. La taille peut être mécanisée et accompagnée d'une deuxième taille manuelle.

Les noyers

Les noyers sont la deuxième culture d'arbres fruitiers en France après les noix. Ils sont cultivés en forme libre ou en gobelets. Différents systèmes de gestion peuvent être trouvés en France, de 70 arbres à plus de 800 pieds par hectares et 1/3 d'irrigation. La taille est réalisée tous les ans (deux fois par an pour les plantations intensives, une fois tous les deux ans pour les productions extensives).

Les écosystèmes et systèmes de gestion des arbres agricoles sont donc très variables sur le territoire. Les propriétés des bois de taille (quantité, qualité), puisqu'elles dépendent de ces paramètres, le sont également.

B. Potentiel national de disponibilité des bois agricoles

LES GRANDS CHIFFRES SUR LES BOIS DE TAILLE EN FRANCE

La production de bois de taille et de pieds pour la vigne était estimée, en 2009, à 1,8 tonnes par an (de matière sèche), par hectare, principalement dans le Languedoc-Roussillon et en Aquitaine.

79 % des tailles sont utilisées comme source de matière organique, c'est-à-dire laissées au sol, sur les parcelles agricoles, représentant 1,1 millions de tonnes par an. Le reste est utilisé comme combustible solide ou brûlé. Le brûlage extérieur, à l'air libre est généralement interdit mais continue à être utilisé sur de nombreuses exploitations. Plusieurs expérimentations ont également été menées sur diverses zones pour l'exploitation des bois de taille de vigne en chimie verte, pour extraire des molécules d'intérêt. Ces systèmes de valorisation restent toutefois marginaux et expérimentaux.

Pour les arbres fruitiers, la production de bois de taille est estimée autour de 650 000 tonnes de matière sèche (Observatoire National des Ressources en biomasse – FranceAgriMer). Aucune utilisation particulière n'est recensée.

UN MANQUE DE DONNEES DISPONIBLES

Les informations disponibles sur la valorisation des bois de taille ne sont généralement pas aussi précises que le souhaiteraient les acteurs locaux. La demande et le développement de projets demeurant rares en France, peu d'analyses précises sont menées. La valorisation des bois agricoles

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n'est pas identifiée comme prioritaire dans le cadre des politiques nationales de développement de la bioéconomie et peu de demandes de projets sont remontées aux Institutions et Fédérations.

DONNEES CHIFFREES ET TERRITOIRES

La référence nationale pour la production de bois de taille en France est l'étude ADEME *biomasse forestière, populicole et bocagère* disponible pour l'Energie à l'horizon 2020.

Une estimation du rendement de production des sarments de vignes a été menée. Pour le vignoble bordelais, avec des parcelles à 6 000 pieds / ha, 1,8 t/ha de matières sèches ont été calculées ; 1,2 t/ha/an pour 4 300 pieds /ha dans le Saumurois. En Poitou-Charentes, 1,2 t/ha de matières sèches (6 mois de séchage, à 15 % d'humidité) sont mesurées. Pour le Languedoc-Roussillon, 2,5 t/ha à 15 % d'humidité ont été pesées.

En fonction de la densité du vignoble, une estimation de la productivité des pieds de vigne a été mesurée. 8,5 t/ha est généralement cité.

Pour les arbres fruitiers, une estimation autour de 1,5 t/ha de matières sèches est généralement proposée ; 1,3 t/ha/an de matière sèche pour les arbres à noyaux, en fonction de la zone et des études. Pour les olives, 4,25 t/ha sont proposées.

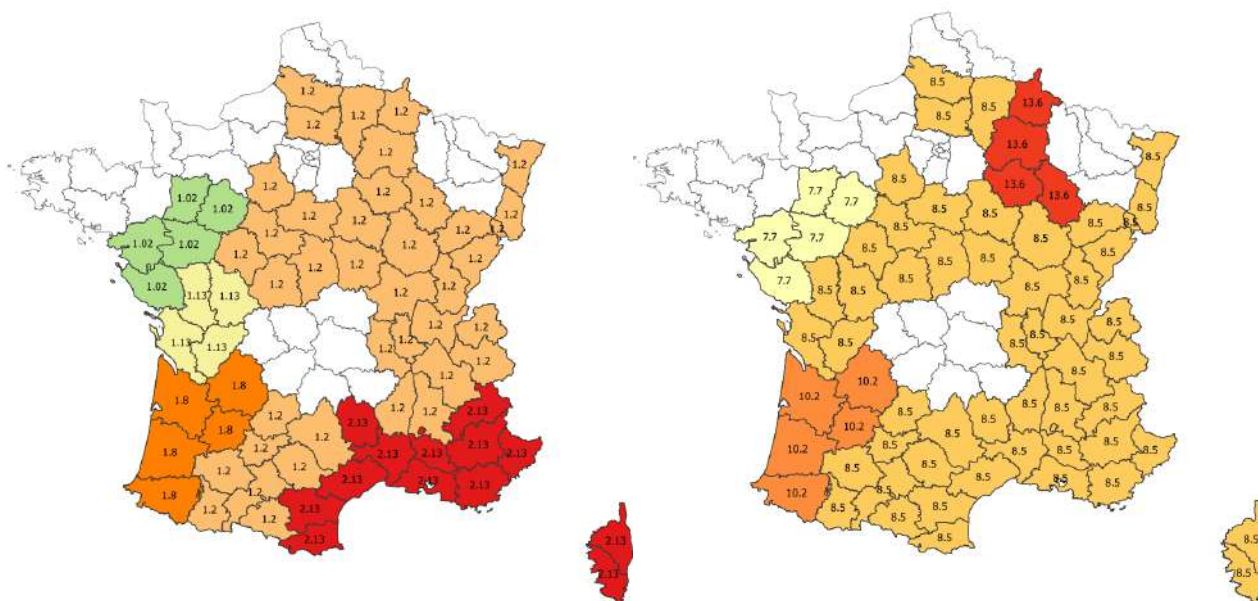


Figure 3 (gauche) : Production de sarments de vignes (t/ha/an) en France (données Solagro) - Figure 4 : renouvellement des pieds de vignes (t/ha/an) en France (données Solagro)

Les données nationales, notamment la Stratégie Nationale de Mobilisation de la Biomasse (SNMB) utilisent les données susmentionnées pour estimer la biomasse disponible. Aucune autre étude nationale n'est proposée. Ce document est la référence validée au niveau national pour les données liées aux bois des cultures pérennes agricoles.

Il peut être noté que le bois des pépinières est également aujourd'hui peu valorisé. Il est toutefois parfois couvert de résine, nécessaire aux pépiniéristes pour le bon développement de la plante, ne facilitant pas son utilisation pour l'énergie.

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C. Etat de l'art pour le secteur des bois de taille et d'arrachage agricoles

LA STRATEGIE NATIONALE POUR LA BIOMASSE

En 2012, les énergies renouvelables (EnR) représentaient 8,8 % de la consommation énergétique intérieure brute en France (Ministère Français du Développement Durable). 44,8 % de ces EnR étaient du bois énergie, 10,7 % des biocarburants, 4,6 % des déchets recyclés, 2 % du biogaz mais uniquement 1,3 % des déchets agricoles, représentant 0,29 millions de tonnes équivalent pétrole (tep).

Une première estimation avance que 30 000 emplois dépendent du bois énergie. Le Fond Chaleur de l'ADEME, à lui seul, a permis la création de plus de 10 000 emplois direct (10 000 autres sont attendus d'ici 2020). La stratégie pour la croissance verte pour la France attend la création de plus de 100 000 emplois dans les prochaines années (non seulement en énergie mais également en chimie, pour les biocarburants, etc.).

Plusieurs documents pertinents analysent la Stratégie bioénergie pour la France. Peuvent notamment être cités la Stratégie Nationale de Mobilisation de la biomasse (SNMB) mais également la Stratégie Bioéconomie, deux chantiers actuels au niveau français, issus conjointement des ministères de l'Agriculture et de l'environnement.

La SNMB met en avant les données suivantes :

- Pour les forêts, 3,5 millions de tonnes de plaquettes forestières ont été utilisées en 2016.
- Pour les coproduits et plantations agricoles, une estimation de plus de 10 millions de tonnes de coproduits agricoles sont produits. Les coproduits bois viticoles sont estimés entre 0,65 et 1,75 millions de tonnes ; les coproduits issus des arbres fruitiers autour de 65 millions de tonnes. Toutefois, la valorisation énergétique de ces biomasses demeure rare.
- Les déchets des industries agroalimentaires et les déchets verts représentent également une ressource importante.

Le secteur français de la bioénergie repose principalement sur la production de bois forestier. Les produits agricoles ne représentent pas une part significative de la biomasse utilisée pour la production de chaleur et d'électricité. Toutefois, ils sont la source principale pour la production de biogaz et de biocarburant. Sur le marché de la bioénergie, les bois de taille agricole et les résidus d'arrachage ne représentent qu'une utilisation très marginale.

LA BIOMASSE DANS LA PRODUCTION DE CHALEUR ET D'ELECTRICITE

En 2012, les énergies renouvelables ne représentaient que 8,8 % de la consommation brute d'énergie en France dont seulement 1,3 % issues de déchets agricoles. EN 2014, la biomasse représentait également 17 % de l'énergie apportée aux réseaux de chaleur. En 2016, la production d'électricité issue de la biomasse solide atteignait 1 496 MW, dont 425 MW en cogénération.

LES PRINCIPAUX ACTEURS DE LA BIOENERGIE

Plusieurs entités nationales jouent un rôle majeur pour le développement des filières de valorisation

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de la biomasse.

Parmi eux, nous pouvons citer **l'ADEME** (l'Agence de l'Environnement et de la Maitrise de l'Energie) qui, outre le soutien financier apporté à de nombreux projets, capitalise également les informations techniques via une large diversité d'études et de projets qu'elle soutient. La mission de l'ADEME est de susciter, animer, coordonner, faciliter ou réaliser des opérations ayant pour objet la protection de l'environnement et la maîtrise de l'énergie.

FranceAgriMer est également un acteur remarquable. L'Établissement national des produits de l'agriculture et de la mer, a pour mission d'appliquer certaines mesures prévues par la Politique agricole commune, et de réaliser certaines actions nationales en faveur des différentes filières agricoles. Il porte notamment l'Observatoire Nationale des Ressources en Biomasse, proposant des données précises sur la biomasse disponible pour de futurs projets.

Le Syndicat des Energies Renouvelables (SER) promeut les intérêts des industriels et des professionnels français des énergies renouvelables et défend les intérêts français au niveau des principaux programmes européens de soutien au secteur.

Enfin, il convient de citer les **sociétés de services énergétiques** (Engies, Dalkia, etc.), qui, par leur prise d'initiative, peuvent contribuer à un large développement des marchés biomasse

Concernant le développement agricole, peuvent être ajoutées **les fédérations** concernées comme les Chambres d'Agriculture ou Coop de France.

Beaucoup de réflexions sont en cours sur le développement de la biomasse et, par extension, sur la place que la biomasse agricole peut prendre dans l'expansion des énergies renouvelables en France. De nombreuses fédérations agricoles poussent en ce sens, soutenues par les institutions publiques. Un manque de structuration général des filières, ainsi qu'un prix faible des énergies renouvelables, continuent à freiner leur développement. Toutefois, un véritable soutien politique peut se faire ressentir au niveau national. Le contexte est propice aux réflexions amenant à s'interroger sur la place des bois agricoles au sein des différents secteurs liés à la bioénergie.

L'ACCEPTATION SOCIALE DES PROJETS BIOMASSE

Les chaudières biomasse ne semblent pas entrainer de contraintes majeures liées à l'acceptation sociale des riverains. Elles ne souffrent pas de la réputation des méthaniseurs qui subissent notamment une peur des troubles olfactifs. Au contraire, elles semblent plutôt obtenir une opinion relativement positive de l'opinion publique via le développement des énergies renouvelables. Il reste toutefois difficile de se prononcer clairement. Les unités actuelles sont généralement de petites tailles, non visibles (enterrées, dans des bâtiments ou en zone industrielle). De petites unités agricoles comme celles proposées pour la valorisation de sarments de vignes ne devraient pas souffrir du syndrome de « c'est très bien, mais pas chez moi ».

LES PRINCIPALES PARTIES PRENANTES ASSOCIEES A LA FILIERE DES BOIS DE VIGNES ET VERGERS

<i>Les producteurs et fournisseurs de biomasse</i> • Les agriculteurs • Les coopératives • Les groupements de producteurs	<i>Les consommateurs finaux du secteur agricole</i> • Les agriculteurs (en autoconsommation, pour les exploitations ou pour les logements) • Les industries agro-alimentaires
<i>Les partenaires industriels</i> • Les équipementiers (broyeurs,	<i>Les autres potentiels consommateurs</i> • Les unités de production de chaleur

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granulateurs, etc.) • Les producteurs d'équipements de combustion (chaudières, torréfaction) • Les centres techniques • Les sociétés de transport, de manutention • Les plateformes de stockage • Les opérateurs logistiques	• Industries • Les collectivités • Les entreprises de services énergétiques
<i>Les organismes de conseil</i> • Les associations professionnelles du secteur • Les sociétés de conseil	<i>Les décideurs politiques nationaux</i> • L'ADEME • Le Ministère de l'Agriculture, du développement durable • FranceAgriMer
<i>Les autres parties prenantes associées</i> • Les Organisations non Gouvernementales (ONG) • Les associations locales • Les médias	<i>Les décideurs politiques régionaux</i> • Les représentants de l'Etat régionaux, départementaux • Les collectivités • Les Agences locales de l'ADEME, de l'énergie • Les chambres de commerce, d'agriculture • Les centres d'innovations et de recherche

Les parties prenantes associées aux filières de valorisation des bois issus des vignes et vergers sont diverses. Elles n'ont pas toutes les mêmes attentes. Les exploitants agricoles souhaitent développer de nouveaux revenus via une activité à valeur ajoutée mais également réduire les amortissements réalisés pour les travaux agricoles existants. Les Institutions nationales ou locales souhaitent pouvoir réduire les émissions de gaz à effet de serre sur le territoire. Les entreprises de services (équipements, énergies) souhaitent pouvoir développer de nouveaux marchés : trouver de nouveaux clients, développer de nouvelles activités ou accéder à des combustibles à des prix plus intéressants que le bois forestier. Il est important de bien comprendre les différentes attentes de ces parties prenantes pour développer le secteur de valorisation des bois des cultures pérennes de façon responsable, permettant des bénéfices pour l'ensemble des acteurs du territoire.

LE SECTEUR DE LA VALORISATION DES BOIS DE TAILLE ET D'ARRACHAGE

Les bois agricoles comme source d'énergie renouvelable

Les bois issus des vignes et vergers, utilisés en combustion, sont une source d'énergie renouvelable. Ils sont produits chaque année (ou par cycle pour les souches). Venant en complément des activités agricoles (n'étant donc pas l'objet principal de la culture), ils sont amenés à se reconstituer annuellement et peuvent ainsi être considérés comme une source inépuisable à l'échelle du temps humain.

Les marchés associés

En France, il n'existe pas réellement de marché pour les bois agricoles. Les tailles sont généralement laissées au sol comme matière organique : leur gestion est ainsi simplifiée et le temps de travail au champ est réduit (par rapport à l'exportation des bois), permettant également un apport de matière organique sur les parcelles.

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Une part très marginale de ces bois est utilisée en énergie. Certains producteurs de vin utilisent les bois de taille dans leur propre chaudière. Pour l'instant, ces projets de valorisation énergétique sont de petits projets, confinés à l'exploitation agricoles. A l'échelle nationale, il est difficile de citer plus d'une dizaine d'exploitation ayant développé ce type de projet de valorisation des sarments pour l'énergie. Parmi elles :

- Le Domaine Xavier Muller à Marlenheim,
- Château Haut Peyrat à Cambes,
- Château Pouville à Sainte-Colombe.

Certains projets proposent également les sarments de vignes à la vente comme bois de barbecue. D'autres tests, notamment sur les vergers, ont été menés, mais sans succès, par diverses chambres d'agriculture.

Toutefois, certains projets sont en cours pour l'utilisation des bois de taille comme matériaux (Vitis Valorem par exemple, produisant des bâtons de bois aggloméré) ou en chimie verte (le marc de raisin peut être utilisé par les industries pharmaceutiques mais des essais sont également en cours sur le bois). Certaines communes (communauté de commune du Siphem par exemple) ou organisations locales (CUMAs, chambres d'agriculture) conduisent également des expérimentations pour l'utilisation des bois agricoles en énergie. L'impact de ces travaux reste toutefois, pour l'instant, relativement limité.

En l'absence de marchés, il est difficile de proposer un prix de vente pour ces bois. Les projets existants en France étant souvent de petits projets en autoconsommation, le calcul du coût de production des bois agricole n'est que rarement disponible. Il peut être toutefois intéressant de garder en mémoire le chiffre de vente de la plaquette forestière, autour de 20 € / MWh et 350 € / MWh hors transport pour les granulés en bois. En France, le bois énergie correspond à 47 % des énergies renouvelables. La filière s'est particulièrement développée depuis une quinzaine d'années, suite aux tempêtes de la fin du XXème siècle.

Ces chaînes logistiques liées au bois forestier sont organisées et structurées, de la collecte du bois, au stockage en forêt ou sur des plateformes dédiées, en passant par les plateformes de broyage et la distribution. La saisonnalité est également prise en compte (accessibilité aux parcelles forestières).

Les différents modèles économiques associés

Entre la collecte, la commercialisation voire la transformation du produit, différents modèles économiques de valorisation des bois agricoles pourraient être envisagés, dont certains sont proposés ci-après. Si les professionnels du secteur agricole sont les mieux positionnés pour organiser de nouveaux marchés, d'autres acteurs extérieurs à la filière (entreprises mais également collectivités) pourraient proposer des services de collecte, ou de commercialisation. Ces modèles économiques peuvent ne pas être rentables s'ils apportent d'autres plus-values. Par exemple, réduction du brûlage au champ, développement durable de l'agriculture ou développement des énergies renouvelables pourraient profiter à une collectivité organisant de telles chaînes logistiques.

Les acteurs associés	Les modèles économiques associés	Constat actuel
Les producteurs de bois issus de la taille ou de l'arrachage des vignes ou vergers	<u>Autoconsommation</u> : les agriculteurs valorisent leurs propres ressources dans des chaudières de petites dimensions adaptées à leur exploitation. Ils se chargent de la chaîne logistique.	Ce modèle est quasiment le seul implanté à l'heure actuelle en France. Il est développé uniquement à titre individuel, par des initiatives locales, principalement de vigneron.

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Les producteurs, les coopératives, autres entreprises locales	<u>La commercialisation</u> : l'entreprise se charge de la collecte et de la commercialisation du bois.	Un modèle proposant une collecte par une coopérative / groupement d'agriculteurs pour sa propre consommation ou la revente n'a pas été développé. Certaines entreprises proposent la revente du bois pour les barbecues ou l'utilisent à des fins non énergétiques selon le même modèle de collecte – transformation – revente.
Les collecteurs de biomasse :	<u>Vente de services de gestion des bois de taille</u> : l'entreprise propose de réaliser les travaux de collecte et se fait rémunérer pour le service. <u>Vente de service pour l'évacuation des souches</u> : l'entreprise propose un service d'arrachage des souches et de réhabilitation de la parcelle. <u>Location d'équipements</u> : l'entreprise loue les équipements associés à ces travaux.	En l'absence de marchés, ce modèle n'est pas encore développé. Il pourrait être facilement proposé par les agriculteurs exploitants déjà les bois agricoles à des fins personnels.
Les acteurs de la logistique	<u>Plateforme logistique</u> : Une entreprise organise l'ensemble de la chaîne logistique, de la collecte à la revente. <u>Plateforme de stockage</u> : les infrastructures existantes de stockage de biomasse ou de gestion des déchets se font rémunérer pour valoriser l'espace disponible ou stocker la biomasse durant la période de séchage.	La valorisation des infrastructures déjà existantes sur le territoire pourrait permettre de réduire les coûts associés au montage des chaînes logistiques. Ces modèles sont encore très peu développés mais représenteraient un gain important pour les chaînes de valorisation territoriales.
Les consommateurs : entreprises de services énergétiques, municipalités	L'entreprise ou la commune se charge de l'exploitation de la chaudière et revend l'énergie associée au consommateur de chaleur.	Ce modèle est répandu pour le bois forestier mais pas pour le secteur agricole.

LES OPPORTUNITES POUR LE SECTEUR

Un secteur innovant : le secteur viticole est un secteur innovant. Les producteurs de vin sont pionniers dans le lancement de nouveaux projets. Beaucoup sont, par ailleurs, fortement sensibilisés au développement durable et innove en ce sens. Le secteur agricole français est un secteur porteur qui profite d'une dynamique d'innovation majeure.

Peu de concurrence d'usage : les bois de taille n'étant pas encore valorisés sur d'autres filières, ils sont disponibles pour une valorisation énergétique et n'entrent pas en concurrence avec d'autres produits. Ces bois sont disponibles largement sur le territoire.

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Le soutien financier pour l'achat de chaudière : le Fonds Chaleur de l'ADEME propose un soutien financier pour l'investissement des chaudières biomasse. Ce fond a eu un impact majeur pour le développement des projets biomasse en France (il a permis jusqu'à présent de supporter plus de 3 600 investissements pour 1,5 milliards d'euros et la production de plus de 1,8 millions de tonnes équivalent pétrole). Des systèmes de soutiens locaux existent également, proposant une aide à l'investissement, par exemple pour les zones de stockage. Toutefois, ces supports dépendent généralement des acteurs locaux (et pas toujours d'une politique nationale).

Les projets innovants liés aux énergies renouvelables peuvent également être financés, entrant dans différents appels à projet nationaux ou territoriaux.

La taxe carbone : l'augmentation de la taxe carbone devrait impacter le développement des chaudières biomasse via une augmentation de la compétitivité de cette ressource face aux énergies fossiles.

La qualité de l'air : la valorisation des bois de taille à l'air libre représente un risque pour la pollution locale de l'air. C'est pourquoi l'Etat et les instances nationales sont réellement intéressées par le développement de solutions permettant de limiter le recours à cette pratique.

La RSE et sa valeur ajoutée : plusieurs exploitants agricoles ont développé des projets de valorisation des bois de taille par conviction. Une stratégie durable permet également une meilleure rentabilité du domaine (optimisation des coûts) mais également une augmentation de la valeur ajoutée (notoriété par sa politique RSE). Au niveau national, une véritable volonté de verdir l'économie se fait ressentir via une réduction des émissions de gaz à effet de serre, le développement des énergies renouvelables ou le développement de plans associés à l'économie circulaire.

Dans cette lignée, la valorisation des bois agricoles peut également intégrer les politiques de développement du secteur agricole. Les contextes local et national sont donc très favorables au développement de nouvelles chaînes de valorisation.

Les plans nationaux de promotion de la biomasse : les différents programmes nationaux pour l'énergie et le développement durable soutiennent les investissements agricoles. Certains plans comme la Nouvelle France Industrielle promeuvent l'utilisation de biomasses, mais plus particulièrement en chimie verte et en méthanisation.

La nouvelle stratégie biomasse : les stratégies nationales de valorisation de la biomasse sont en cours de réalisation en France. L'utilisation des bois de taille peut être incluse dans les réflexions de certaines régions dans le cadre des Stratégies Régionales Biomasse.

Un impact local positif : La valorisation des bois agricoles pourrait contribuer à la diversification des activités agricoles mais également créer de l'emploi dans les zones rurales et participer au développement des énergies produites localement.

LES PRINCIPALES BARRIERES A LEUR DEVELOPPEMENT

Un marché peu développé, un vrai manque de consommateurs : la biomasse issue des bois des vignes et vergers n'est pas d'aussi bonne qualité que la plaquette forestière. C'est pourquoi il n'est pas simple de développer un marché et de trouver des consommateurs, cette matière ne pouvant pas être valorisée comme du simple bois forestier (les équipements de combustion doivent être adaptés). Sans un marché développé, les initiatives locales restent rares et ne sont pas toujours pérennes.

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Pas d'informations, pas d'exemples à suivre : l'utilisation des bois agricoles est marginale en France. Peu d'informations sont disponibles pour un exploitant qui souhaiterait développer un nouveau projet. Le type d'équipements nécessaires, les technologies disponibles, les principales recommandations, etc., toutes les informations ne sont pas aisément disponibles pour un nouvel entrepreneur.

Peu de soutien politique (technique, financier) de la part des acteurs locaux en fonction des régions: Un accompagnement est souvent proposé aux porteurs de projet pour l'installation d'une chaudière biomasse. Toutefois, pour le développement de nouveaux projet, d'autres investissements majeurs sont nécessaires comme l'achat d'un broyeur, d'un granulateur, d'équipements de collecte, etc. Il n'y a pas de soutien financier pour couvrir ces coûts. De plus, la valorisation des bois agricoles étant relativement nouvelle, les nouveaux entrepreneurs ne peuvent pas profiter d'un soutien technique pour les accompagner dans le développement de leurs projets.

La performance des technologies disponibles freine la rentabilité : les technologies pour collecter, broyer ou granuler de la biomasse sont de plus en plus efficace. Toutefois, le secteur de la valorisation des bois de taille et d'arrachage étant peu développé, le matériel est rarement spécifiquement adapté à ses besoins. Leur rendement peut également être relativement faible pour des équipements très coûteux. Les enjeux associés à la logistique représentent donc l'une des barrières les plus importantes pour le développement de la valorisation de ces bois. C'est pourquoi il est nécessaire de développer des technologies adaptées. De plus, en France, la gestion de la vigne est très variable. Une technologie adaptée sur un territoire ne l'est pas nécessairement sur un autre (de par le relief, l'écartement entre les rangs, etc.).

Un coup logistique important qui freine le développement de projet. Le temps nécessaire ainsi que les investissements et la collecte sur des parcelles parfois espacées impactent la rentabilité de la chaîne de valorisation.

Un rendement parfois faible : en fonction des parcelles, la production de bois de taille est parfois faible et ne permet pas de rentabiliser la logistique associée.

Peu de temps pour développer de nouveaux projets : l'utilisation des bois de taille est généralement un projet à l'initiative des exploitants agricoles. Les projets associés à la bioénergie ne sont pas leur principal emploi. Ils ont besoin de temps pour développer ces initiatives mais ce temps vient s'ajouter aux tâches habituellement à accomplir pour les travaux agricoles. C'est pourquoi ils ont réellement besoin d'un soutien local pour développer de nouvelles initiatives pérennes.

Un vrai manque d'information : les décideurs politiques ne reçoivent pas de demandes spécifiques pour la valorisation des bois de taille et d'arrachage. C'est pourquoi le développement de la valorisation de cette ressource n'est pas une priorité.

Pas de données précises : une unique étude est considérée comme la référence en France, en termes de données chiffrées, pour les bois de taille et d'arrachage. Certains territoires ont mené des études plus poussées via des échantillonnages sur les parcelles mais ces initiatives restent rares et ne sont pas toujours disponibles. Des données plus précises seraient nécessaires au niveau national, avec une vision régionale, pour renforcer l'utilisation de ces ressources.

Des pratiques interdites encore en pratique : Le brûlage à l'air libre est interdit par une circulaire depuis 2011 mais des dérogations sont souvent octroyées. Tant que ces pratiques resteront tolérées, aucun verrou ne pourra vraiment être levé. Un véritable appui politique sur cet enjeu et d'aide à l'investissement semble dès lors nécessaire.

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Une forte compétition des autres énergies : la rentabilité des projets n'est pas toujours démontrée. En effet, le prix des énergies fossiles étant relativement faible, l'intérêt économique de la biomasse est parfois limité. Par ailleurs, la qualité du bois forestier est supérieure à celle du bois agricole. Ce dernier peut également proposer un approvisionnement dont la stabilité est démontrée. L'arrivée de bois bon marché venu d'autres pays joue également sur la rentabilité des projets. Face à ces contraintes économiques, les investisseurs demandent des temps de retour toujours plus courts qui limitent le développement des projets.

Une ressource encore faiblement considérée : les bois issus de la taille et de l'arrachage des vignes et vergers sont toujours considérés comme des déchets plus que comme des coproduits. Un changement de mentalité doit s'opérer à tous les niveaux. Ainsi au niveau des exploitations, les agriculteurs doivent accepter le bois de sortir du champ. Au niveau national, cette ressource est peu connue : elle n'est quasiment jamais citée dans les stratégies biomasse, bioéconomie ou les plans énergies. Bien que pouvant s'intégrer parfaitement à ces politiques, elle n'est que rarement explicitement nommée. Aucune politique cohérente n'est déployée. Les professionnels de l'énergie s'intéressent également peu à cette ressource méconnue.

LES PLANS NATIONAUX POUR L'ENERGIE

La Loi pour la transition énergétique et la croissance verte, publiée le 18 août 2015, prévoit la mise en place de stratégies et de plans, dont certaines permettent d'agir sur la mobilisation de la biomasse : Programmation pluriannuelle de l'énergie (PPE), Stratégie nationale bas carbone (SNBC), Stratégie nationale pour la mobilisation de la biomasse (SNMB) et sa déclinaison régionale ou encore la Stratégie bioéconomie.

La programmation pluriannuelle de l'énergie fixe les priorités d'action pour la gestion de l'ensemble des formes d'énergie sur le territoire. Approuvée en 2016, elle sera révisée en 2018 puis tous les 5 ans. Des objectifs précis pour le développement de la consommation de la biomasse y sont proposés. Ainsi, l'augmentation de 50 % du rythme de développement de la production de chaleur renouvelable est intégrée, tout comme l'augmentation de la mobilisation de ressources en biomasse.

La Stratégie nationale bas carbone évoque notamment la multiplicité des usages et la nécessité de déployer des outils d'observation englobant l'ensemble des ressources en biomasse tout en préservant le carbone des sols. L'utilisation des combustibles renouvelables y est également promue.

La Stratégie Nationale de Mobilisation de la biomasse (SNMB) participe à la volonté de développement d'une économie décarbonée, davantage circulaire et durable. Les objectifs donnés sont qualitatifs et quantitatifs. Elle se donne pour objectif de promouvoir les bioénergies dans le respect des usages actuels (alimentaires ou non alimentaires). Elle entre en articulation avec plusieurs plans nationaux comme le Plan National Forêt Bois, le Plan National de Prévention et de Gestion des Déchets, la stratégie Nationale Economie Circulaire ou encore la Stratégie Nationale pour la Bioéconomie. Elle permet la mise en cohérence des schémas régionaux biomasse en cours de développement sur toutes les régions et vise à compléter d'autres programmes pour le développement des énergies renouvelables. La SNMB cite les bois d'entretien des vignes et vergers comme source de biomasse à étudier, soulevant, de façon générale, la nécessité d'implantation d'un cadre favorable à la mobilisation de la biomasse agricole

La Loi pour la transition énergétique et la croissance verte prévoit par ailleurs la généralisation du tri à la source des biodéchets à l'horizon 2025, ce qui va augmenter le volume de ressources potentiellement disponibles.

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L'utilisation de la biomasse pour l'énergie est plus que jamais d'actualité. La bioénergie est soutenue par nombre de plans nationaux et d'investissement, notamment afin de répondre aux objectifs de réduction des émissions de la France et d'augmentation des énergies renouvelables à l'horizon 2020. Le contexte est donc favorable pour le développement de nouveaux projets de valorisation de ressources non encore utilisées.

D. Plan national pour l'énergie et le climat

Plusieurs textes, sur la dernière décennie, ont défini, au niveaux européen et national, les objectifs d'efficacité énergétiques et de valorisation des énergies renouvelables

Ainsi, la **directive du 23 avril 2009** relative à la promotion de l'utilisation de l'énergie produite à partir de sources renouvelables (2009/28/CE) fixe, pour la France, l'objectif de 23 % d'énergies renouvelables et de récupération dans le bouquet énergétique national à l'horizon 2020.

Au niveau national, les lois **Grenelle 1 & 2 de 2009 / 2010** ont introduit un certain nombre de dispositions visant à accompagner et encadrer le développement des réseaux de chaleur et de froid comme outil de mobilisation des énergies renouvelables. D'autres lois associées à l'efficacité énergétique ont également vu le jour.

En application de la directive européenne, et concernant les installations de production d'énergies renouvelables de moyennes et grandes tailles, le choix a été fait de ne négliger aucun gisement d'énergies renouvelables, afin de positionner la France comme un acteur majeur de l'ensemble des technologies de production. Diverses incitations et aides ont été mises en place : aides au financement de projets de recherche et développement, aide à la création de démonstrateurs industriels, aide à l'installation ou à l'achat de dispositifs, prêts bonifiés...

En 2015, la loi sur la transition énergétique pour la croissance verte fixa notamment comme objectifs de porter la part des énergies renouvelables (ENR) à plus de 30 % de la consommation finale d'énergie en 2030 et de baisser à 50 % la part du nucléaire dans la production d'électricité à l'horizon 2025. La programmation pluriannuelle pour l'énergie doit, quant à elle, définir concrètement les tendances à suivre.

LE PLAN CLIMAT DE 2017

En juillet 2017, le Ministre Nicolas Hulot a lancé le nouveau Plan Climat pour accélérer la transition énergétique et climatique. Avec le Plan Climat, la France accélère l'application opérationnelle de l'Accord de Paris suite à la COP 21 en se donnant des objectifs ambitieux en matière de qualité de vie, de neutralité carbone ou encore d'économie verte.

Plusieurs axes de travail développés dans le plan climat peuvent être mis en cohérence avec la valorisation des bois issus de la taille et de l'arrachage des arbres agricoles.

- Ainsi, l'axe 5 promeut le travail au cœur des territoires. La création nette d'emplois issus de nouveaux projets de valorisation de la biomasse, associés à une réduction des émissions carbone est en lien avec cet axe.
- L'économie circulaire est citée en Axe 6. La valorisation de la biomasse entre dans cette logique de valorisation territoriale et de réutilisation locale des ressources.
- L'Axe 8 impacte la décarbonation de la production d'énergie et l'assurance d'une transition maîtrisée.
- Les axes 10 et 11 intègrent la fiscalité écologique afin de redonner au carbone son véritable prix ainsi que la neutralité carbone à l'horizon 2050. Des leviers liés aux taxes carbone et

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ainsi aux énergies renouvelables devraient pouvoir permettre un meilleur développement de la biomasse et ainsi, par extension, de la valorisation de la biomasse agricole dans les prochaines années.

- Enfin, l'axe 14 promeut l'accélération du déploiement des énergies renouvelables. Pour tenir un objectif de 32 % d'énergies renouvelables d'ici 2030, le cadre de développement des ENR doit encore être développé. Les moyens du Fonds Chaleur de l'ADEME seront augmentés.

Des actions concrètes sont proposées au fur et à mesure des travaux pour répondre aux axes de travail proposés dans le cadre de ce plan.

Ce nouveau plan énergie se veut plus ambitieux que le précédent, tout en poursuivant les travaux précédemment engagés. Ainsi, la taxation carbone ou l'agriculture durable étaient déjà présents dans le précédent Plan Climat de 2004. La taxation carbone est une véritable opportunité pour le secteur de la biomasse qui souffre des prix bas sur les énergies fossiles. Les soutiens annoncés devraient également permettre aux porteurs de projet de bénéficier d'un environnement favorable pour la mise en place de nouvelles chaînes de valorisation.

Il convient également de souligner que l'énergie est également présente dans les **17 objectifs développement durable** mis en place par le Gouvernement, via les mesures 7 « Energie propre et d'un coût abordable » et 13 « mesures relatives à la lutte contre les changements climatiques »

LA PLACE DE LA BIOMASSE DANS LES DIFFERENTS PLANS NATIONAUX

La valorisation de la biomasse est promue dans le cadre de ces différents plans, de façon plus ou moins explicite, comme source d'énergie renouvelable. Elle est encouragée politiquement et peut solliciter diverses aides, particulièrement financières, pour son développement. Toutefois, la valorisation des bois agricoles (bois de tailles, bois d'arrachage) n'est jamais citée dans les politiques énergétiques. Elle n'apparaît que dans la Stratégie Nationale de Mobilisation de la Biomasse.

Même sans être explicitement citée, le bois agricole pourra profiter de plusieurs dispositifs d'aides, aussi bien au niveau national que local. Ainsi, l'implantation de chaudières fonctionnant grâce aux bois de taille et d'arrachage peuvent être valorisées dans le cadre du Fonds Chaleur de l'ADEME, au même titre que les chaudières à bois ou à biomasse agricole. La taxe carbone profitera également au développement de chaînes de valorisation, la biomasse pouvant ainsi devenir compétitive face aux énergies fossiles, en fonction de l'augmentation qui sera mise en place.

L'ADEME a également publié récemment l'étude « Un mix électrique 100% ENR en 2050 : quelles opportunités pour décarboner les systèmes gaz et chaleur ? » L'étude évalue dans quelle mesure, en France, un mix électrique 100 % énergies renouvelables pourrait fournir de l'électricité pour décarboner d'autres secteurs de l'économie. Les bois agricoles ne sont pas intégrés à l'étude mais pourraient entrer dans cette dynamique nationale de développement des énergies renouvelables, dynamique mise de nouveau en avant par cette nouvelle étude.

LA VALORISATION DES BOIS AGRICOLES ET POSITION NATIONALE

Le bois agricole s'intègre aux différents plans pour le développement des énergies renouvelables. Même si, théoriquement, il pourrait également répondre à d'autres enjeux nationaux, notamment pour le développement de l'agriculture, il n'est pour l'instant jamais cité hors des plans associés à la biomasse. De façon générale, cette ressource est peu connue. L'Etat est peu sollicité sur la question et les priorités d'actions tournent autour d'autres ressources.

La valorisation des bois agricoles permettrait de réduire le brûlage à l'air libre et de développer les

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énergies renouvelables. Cette partie sera développée davantage dans les politiques régionales lors de la mise en place des Schémas Régionaux Biomasse. Ces externalités sont à privilégier pour promouvoir la valorisation des bois agricoles. D'autres axes comme les liens entre les politiques bioénergétiques et l'agriculture, les marchés ou l'innovation restent très peu développés.

FRANCHIR LE PAS POUR LA VALORISATION DES BOIS AGRICOLES

Les représentants de l'Etat ou les Instituts Publics qui pourraient être amenés à pousser la valorisation des bois agricoles n'ont que très peu de demandes sur le sujet. Le secteur étant aujourd'hui très peu développé, les connaissances manquent pour encourager sa croissance.

Ce n'est, de façon générale, pas l'absence de volonté qui bloque le développement de nouveaux projets mais l'absence de connaissances, à tous les échelons de la filière. Au niveau du champ, les agriculteurs sont soumis à divers freins logistiques et n'ont pas toujours les connaissances associées pour développer une chaîne de valorisation rentable. Le prix des énergies fossiles limite la rentabilité des projets et ne pousse pas les acteurs du marché à s'intéresser à ces ressources.

Les décideurs politiques sont demandeurs d'informations et de solutions et sont prêts à soutenir de nouveaux projets.

Par ailleurs, le développement de plans pour l'énergie ou l'environnement ainsi que les nouvelles directives européennes ou la volonté de la France d'être un pilier en matière de préservation de l'environnement créent des conditions très favorables pour le développement de nouveaux projets et la sensibilisation de l'ensemble des acteurs sur la valorisation et le potentiel des bois agricoles.

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E. Analyse SWOT

	Facteurs positifs	Facteurs négatifs	
Facteurs internes	Forces <i>Le secteur est dynamique et innovant</i> Fo1. Le secteur agricole et notamment vinicole français est un secteur majeur, productif et fortement impliqué localement. Fo2. Des producteurs de vin et de fruits motivés par les projets biomasse. Fo3. Des producteurs de vin et de fruits innovants. <i>La biomasse est largement disponible</i> Fo4. Une large quantité de biomasse disponible au niveau local avec une densité spatiale importante. Fo5. Peu de concurrence d'usage. <i>Intégration au développement durable</i> Fo6. Valorisation énergétique entrant dans une stratégie RSE (valeur ajoutée). Fo7. Un vrai esprit de développement durable sur les exploitations. <i>Contribution aux énergies renouvelables</i> Fo8. La combustion du bois agricole en chaudière permet une réduction de la consommation des énergies fossiles. Fo9. Dans les zones rurales, les besoins énergétiques pourraient être en partie comblés par les sources d'énergie locale. <i>Contribution au développement économique</i> Fo10. Une filière qui pourrait être source d'emplois dans les zones rurales. Fo11. L'économie circulaire et l'utilisation locale d'énergie est une priorité pour les consommateurs. Fo12. Le secteur agricole cherche à diversifier ses activités.	Faiblesses <i>Un manque de retours d'expérience</i> Fa1. Peu de cas concrets, d'exemples à suivre ou d'informations disponibles. Fa2. L'absence de chaînes logistiques actuelles implique un effort conséquent pour développer de nouvelles chaînes de valorisation (absence d'exemples, développement partant de zéro). <i>Une faible rentabilité économique</i> Fa3. L'équilibre économique de ce type de projet n'est pas encore démontré. Peu de bénéfices sont attendus. Des investissements conséquents. <i>De vraies contraintes logistiques</i> Fa4. Les bois de taille sont souvent dispersés sur des parcelles éloignées. Ils sont soumis à une forte saisonnalité. Fa5. Des équipements encore peu adaptés à la filière. Fa6. Un coup logistique réellement important. Fa7. Une faible production à l'hectare sur certains vignobles. Fa8. Un manque de temps de la part des porteurs de projets, généralement également exploitants agricoles. Un temps supplémentaire pour les travaux à réaliser. <i>Un changement de mentalités</i> Fa9. La relation au changement de certains agriculteurs peut freiner les projets. <i>Des équipements encore peu adaptés</i> Fa10. Des technologies de combustion encore peu adaptées / développées. <i>Des enjeux agronomiques</i> Fa11. Utilisation compétitive comme utilisation des bois comme matière organique. <i>Une qualité plus faible que le bois forestier</i> Fa12. Le bois agricole est de moins bonne qualité que le bois forestier. <i>Un manque d'intérêt des professionnels</i> Fa13. La biomasse agricole n'intéresse pas les entreprises de services énergétiques.	Facteurs internes

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Facteurs externes	Opportunités <i>Intégration de la biomasse aux nouvelles politiques</i> O1. Mise en place de la nouvelle stratégie biomasse au niveau national. O2. Développement actuel des plans nationaux de promotion de la biomasse. <i>Volonté nationale d'agir pour le développement durable</i> O3. Volonté de verdir l'économie à travers une réduction des GES, réduction des énergies fossiles, développement des ENR. O4. Développement de réglementations nationales et européennes pour le développement de l'économie circulaire. <i>Volonté nationale d'agir pour le développement de l'agriculture</i> O5. Une volonté politique de développer de nouveaux projets rémunérateurs pour le secteur agricole. <i>Des réglementations favorables</i> O6. Augmentation de la taxe carbone. O7. Accent mis sur les politiques d'amélioration de la qualité de l'air. <i>Des initiatives locales pour les équipements</i> O8. Des machinistes locaux développent des équipements adaptés aux cultures locales. <i>La possibilité de soutien financier</i> O9. Des soutiens financiers sont possibles pour le développement de projets innovants. O10. Des soutiens financiers possibles pour le développement de projets énergies renouvelables. <i>Un contexte local favorable</i> O11. Une recherche de nouveaux gisements pour compléter l'approvisionnement en bois. O12. Un réel intérêt de certaines collectivités.	Menaces <i>Une absence de marché</i> M1. Le marché est peu développé, un vrai manque de consommateurs. <i>Un manque de retour sur investissement</i> M2. Des bois à bas prix sont importés, d'origine UE ou hors UE. M3. Faible prix de l'énergie. M4. Les unités de valorisation de la biomasse en combustion demandent un retour sur investissement rapide. <i>La compétition pour la ressource</i> M5. Les bois agricoles entrent en compétition avec les bois forestiers de meilleure qualité et largement disponibles en France. <i>Une absence de soutien local</i> M6. Poursuite de la tolérance du brûlage à l'air libre. M7. Un soutien politique local parfois limité. <i>Une absence des plans nationaux</i> M8. Les bois agricoles ne sont pas intégrés comme tel aux plans nationaux de valorisation de la biomasse. M9. La valorisation des bois agricole n'est pas intégré à la PAC. M10. Pas de politiques cohérentes sur la valorisation des bois agricoles. <i>Un manque de connaissances</i> M11. Un manque de connaissance de certains décideurs sur le sujet. M12. Une absence de données précises à l'échelle des territoires.	Facteurs externes
	Facteurs positifs	Facteurs négatifs	

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F. Plan stratégique

Afin d'analyser la stratégie SWOT et de proposer un plan d'action à l'échelle de la France, une analyse croisée des forces, faiblesses, menaces et opportunités recensées est proposée.

La stratégie Force – Opportunité est une stratégie de type max-max, permettant de combiner les éléments les plus favorables. Elle utilise les forces pour tirer un maximum de bénéfices des opportunités. C'est une stratégie dynamique agressive (*attaque*).

La stratégie Faiblesse – Opportunité est de type min-max, elle combine les faiblesses internes et les opportunités externes. Elle a pour objectif d'utiliser les opportunités pour éliminer les points de faiblesses (*réorientation*).

La Stratégie Force - Menace est de type max-min, dans le sens où elle utilise les forces afin de réduire les menaces extérieures (*défense*).

La stratégie Faiblesse – Menace est de type min-min. Elle cherche à minimiser les faiblesses si les menaces extérieures peuvent être évitées (*résistance*).

1 Intégrer davantage les opérationnels aux plans de développement nationaux Stratégie : Force et Opportunité → FO "attaque"	
Fo1. Le secteur agricole et notamment vinicole français est un secteur majeur, productif et fortement impliqué localement Fo2. Des producteurs de vin et de fruits motivés par les projets biomasse Fo3. Des producteurs de vin et de fruits innovants	O1. Mise en place de la nouvelle stratégie biomasse au niveau national O2. Développement actuel des plans nationaux de promotion de la biomasse O5. Une volonté politique de développer de nouveaux projets rémunérateurs pour le secteur agricole
Objectifs • FoO1. Profiter de la motivation des acteurs sur le terrain et du développement de nouvelles stratégies pour construire ensemble une stratégie opérationnelle. • FoO2. Profiter de la motivation des acteurs sur le terrain et du développement de nouvelles stratégies pour coconstruire des outils permettant le développement de nouveaux projets.	
Actions / Activités • Organiser des réunions d'informations en région et d'échanges sur les stratégies nationales avec les acteurs locaux des secteurs des vins et fruits. Utiliser ces informations pour mieux comprendre les enjeux du secteur et ajouter les bois agricoles aux plans nationaux pour l'énergie et la biomasse en tenant compte des informations récoltées. • Intégrer les professionnels des vins et des fruits aux stratégies régionales de mobilisation de la biomasse. • Identifier des projets locaux innovants et inviter leurs porteurs de projet aux réunions nationales pour le développement des stratégies biomasse. • Intégrer la bioéconomie et la bioénergie aux plans de développement du secteur agricole. • Créer un plan d'action dédié structuré, avec les professionnels du secteur, sur les perspectives de la filière.	

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2 Coconstruire une stratégie développement durable locale

Stratégie : Force et Opportunité → FO "attaque"

Fo6. Valorisation énergétique entrant dans une stratégie RSE (valeur ajoutée)
 Fo7. Un vrai esprit de développement durable sur les exploitations
 Fo8. La combustion du bois agricole en chaudière permet une réduction de la consommation des énergies fossiles
 Fo9. Dans les zones rurales, les besoins énergétiques pourraient être en partie comblés par les sources d'énergie locale
 Fo11. L'économie circulaire et l'utilisation locale d'énergie est une priorité pour les consommateurs

O3. Volonté de verdir l'économie à travers une réduction des GES, réduction des énergies fossiles, développement des ENR
 O4. Développement de réglementations nationales et européennes pour le développement de l'économie circulaire
 O6. Augmentation de la taxe carbone
 O7. Accent mis sur les politiques d'amélioration de la qualité de l'air
 O10. Des soutiens financiers possibles pour le développement de projets énergies renouvelables

Objectifs

FoO3. Profiter de l'opportunité proposée par la valorisation des bois agricole de réduire les émissions de GES et la consommation des énergies fossiles

FoO4. Développer les énergies renouvelables de sources locales issues de la biomasse agricole

Actions / Activités

- Renforcer les subventions proposant le montage de chaines logistiques pilotes sur les territoires
- Soutenir techniquement les collectivités désireuses de monter des chaines logistiques de valorisation de la biomasse (études de faisabilité, aides aux montages des chaines logistiques)
- Communiquer sur la possibilité de développer des chaines logistiques pour la valorisation des bois agricoles et les subventions associées, notamment pour l'installations de chaudières.
- Communiquer sur les externalités positives de projets de valorisation des bois agricoles.
- Réaliser des études permettant de chiffrer lesdites externalités positives.
- Communiquer sur les 3 piliers du développement durable : économie, environnement (ENR, GES), social (création d'emplois).

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3 Promouvoir le développement de nouveaux projets directement avec les acteurs sur le terrain

Stratégie : Force et Opportunité → FO "attaque"

Fo1. Le secteur agricole et notamment vinicole français est un secteur majeur, productif et fortement impliqué localement Fo2. Des producteurs de vin et de fruits motivés par les projets biomasse Fo3. Des producteurs de vin et de fruits innovants Fo10. Une filière qui pourrait être source d'emplois dans les zones rurales Fo12. Le secteur agricole cherche à diversifier ses activités.	O1. Des soutiens financiers sont possibles pour le développement de projets innovants O5. Une volonté politique de développer de nouveaux projets rémunérateurs pour le secteur agricole

Objectifs

Fo05 : Soutenir les acteurs locaux dans leurs projets d'innovation et encourager la réflexion pour le développement de nouvelles chaines logistiques et de recherche de nouvelles solutions (optimisation logistique, nouveaux équipements, nouveaux débouchés).

Actions / Activités

- Proposer des réunions de brainstorming avec les acteurs locaux pour développer de nouveaux projets, en mettant en relation l'ensemble des parties prenantes impliquées sur les chaines de valorisation.
- Renforcer les subventions proposant le montage de chaines logistiques pilotes sur les territoires
- Appuyer techniquement les acteurs terrain, notamment via des mises en relation avec des pôles de compétitivités ou organismes de conseils spécialisés.
- Communiquer sur les mécanismes de subventions disponibles.
- Réaliser un guide sur les mécanismes de subvention disponibles pour le secteur.

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4 Stratégie :	Encourager le développement de nouveaux marchés compétitifs Force et Opportunité → FO "attaque"
• Fo2. Des producteurs de vin et de fruits motivés par les projets biomasse • Fo4. Une large quantité de biomasse disponible au niveau local avec une densité spatiale importante • Fo5. Peu de concurrence d'usage • Fo9. Dans les zones rurales, les besoins énergétiques pourraient être en partie comblés par les sources d'énergie locale	• O5. Une volonté politique de développer de nouveaux projets rémunérateurs pour le secteur agricole • O6. Augmentation de la taxe carbone • O11. Une recherche de nouveaux gisements pour compléter l'approvisionnement en bois • O12. Un réel intérêt de certaines collectivités
Objectifs	
Fo06 : Pousser le développement des marchés de valorisation des bois agricoles.	
Fo07 : Encourager le développement de projets valorisant les bois agricoles localement.	
Actions / Activités	
• Communiquer sur les possibilités de développement via des présentations en région ou des retours d'expérience documentés, en ciblant les zones à haut potentiel, en intégrant l'ensemble des parties prenantes (collectivités, agriculteurs, entreprises de services énergétiques). • Accompagner les porteurs de projet dans leur étude de faisabilité (cofinancement, étude de faisabilité gratuite) • Proposer des méthodes de calculs de TRI • Communiquer ou organiser des visites de cas de réussite • Communiquer lors d'événements spécialisés • Rédiger et distribuer une déclaration sur la nécessité de favoriser des pratiques adéquates • Organiser une campagne d'adhésion des différents secteurs et parties prenantes	

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5 Mettre en avant les externalités positives face à la concurrence des énergies fossiles

Stratégie : Force et Menaces → FM "défense"

Fo6. Valorisation énergétique entrant dans une stratégie RSE (valeur ajoutée)
 Fo7. Un vrai esprit de développement durable sur les exploitations
 Fo8. La combustion du bois agricole en chaudière permet une réduction de la consommation des énergies fossiles
 Fo9. Dans les zones rurales, les besoins énergétiques pourraient être en partie comblés par les sources d'énergie locale
 Fo10. Une filière qui pourrait être source d'emplois dans les zones rurales
 Fo11. L'économie circulaire et l'utilisation locale d'énergie est une priorité pour les consommateurs

M2. Des bois à bas prix sont importés, d'origine UE ou hors UE
 M3. Faible prix de l'énergie
 M5. Les bois agricoles entrent en compétition avec les bois forestiers de meilleure qualité et largement disponibles en France
 M4. Les unités de valorisation de la biomasse en combustion demandent un retour sur investissement rapide
 M1. Le marché est peu développé, un vrai manque de consommateurs

Objectifs

FoM1 : Développer la filière en mettant en avant les externalités positives faces aux contraintes économiques.

Actions / Activités

- Communiquer sur les externalités positives des projets de valorisation des bois agricoles
- Communiquer sur les mécanismes de soutien existants
- Proposer des études de faisabilité en intégrant différents scénarii de hausse du prix de l'énergie et de la taxe carbone
- Faire visiter des unités de valorisation fonctionnelle
- Etudier des mécanismes d'incitation au développement de projets de valorisation des bois agricoles

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6 Lutter contre l'absence d'intégration des bois agricoles dans les politiques en renforçant les connaissances

Stratégie : Force et Menaces → FM "défense"

Fo1. Le secteur agricole et notamment vinicole français est un secteur majeur, productif et fortement impliqué localement
Fo2. Des producteurs de vin et de fruits motivés par les projets biomasse

M7. Un soutien politique local parfois limité
M8. Les bois agricoles ne sont pas intégrés comme tel aux plans nationaux de valorisation de la biomasse
M9. La valorisation des bois agricole n'est pas intégré à la PAC
M10. Pas de politiques cohérentes sur la valorisation des bois agricoles
M11. Un manque de connaissance de certains décideurs sur le sujet
M12. Une absence de données précises à l'échelle

Objectifs

FoM2 : Faire connaître d'avantage le potentiel des bois agricoles auprès des décideurs politiques afin que cette ressource soit davantage intégrée aux plans nationaux et régionaux

Actions / Activités

- Renforcer les connaissances existantes sur le potentiel de la filière
- Développer un rapport sur les possibilités de développement de la filière communiqué largement, notamment aux décideurs politiques et aux possibles porteurs de projets
- Réaliser une campagne de communication dans les journaux
- Organiser des ateliers de travail, des visites ou proposer des rapports de techniques aux parties prenantes locales
- Organiser une campagne de promotion sur les bois polycombustibles

7 Récupérer des données précises sur la ressource

Stratégie : Force et Menaces → FM "défense"

Fo1. Le secteur agricole et notamment vinicole français est un secteur majeur, productif et fortement impliqué localement
Fo2. Des producteurs de vin et de fruits motivés par les projets biomasse

M11. Un manque de connaissance de certains décideurs sur le sujet
M12. Une absence de données précises à l'échelle des territoires

Objectifs

FoM3 : Proposer des informations chiffrées fiables aux porteurs de projet

Actions / Activités

- Réaliser un calcul des rendements à l'hectare en fonction des régions
- Proposer un calcul des disponibilités
- Réaliser une carte des potentiels

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8 Veiller à l'application des règlements en matière de développement durable

Stratégie : Force et Menaces → FM "défense"

Fo8. La combustion du bois agricole en chaudière permet une réduction de la consommation des énergies fossiles

M6. Poursuite de la tolérance du brulage à l'air libre.

M7. Un soutien politique local parfois limité

Objectifs

FoM4 : Orienter la réglementation de façon à répondre davantage aux besoins de développement du secteur

Actions / Activités

- Identifier les mauvaises pratiques comme le brulage à l'air libre
- Proposer un rapport aux autorités compétentes
- Réaliser une analyse réglementaire des lois pouvant impacter le secteur et le transmettre aux autorités compétentes.

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9 Soutenir le développement de l'innovation en ciblant l'optimisation logistique

Stratégie : Faiblesse Opportunité → FaO "réorientation"

O8. Des machinistes locaux développent des équipements adaptés aux cultures locales
O9. Des soutiens financiers sont possibles pour le développement de projets innovants

Fa3. L'équilibre économique de ce type de projet n'est pas encore démontré. Peu de bénéfices sont attendus. Des investissements conséquents.

Fa4. Les bois de taille sont souvent dispersés sur des parcelles éloignées. Ils sont soumis à une forte saisonnalité

Fa5. Des équipements encore peu adaptés à la filière

Fa6. Un coup logistique réellement important

Fa7. Une faible production à l'hectare sur certains vignobles

Fa8. Un manque de temps de la part des porteurs de projets, généralement également exploitants agricoles. Un temps supplémentaire pour les travaux à réaliser

Objectifs

FaO1 : augmenter l'efficacité des chaînes logistiques

FaO2 : réduire les coûts associés aux chaînes logistiques

Actions / Activités

- Organiser des démonstrations d'équipements
- Réaliser une campagne de promotion web
- Présenter des rapports techniques sur l'organisation logistique des filières
- Réaliser un document sur les différents modèles économiques applicables et communiquer dessus
- Travailler à l'identification des manques techniques en matière de machines et d'équipements de traitement
- Identifier les services existants sur le terrain pouvant participer au montage des chaînes logistiques et proposer un rapport à l'administration ou aux parties prenantes pertinentes
- Participer à la mise en réseau des différents acteurs sur le terrain (en organisant des réunions de travail par exemple)
- Faire des calculs sur des cas réels, diffuser les résultats et les conclusions
- Lister les équipements logistiques existants, leurs caractéristiques et leurs avantages et inconvénients et communiquer auprès des opérationnels et des porteurs de projet

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10 Développer les leviers politiques pour développer la valorisation de la biomasse sur le terrain

Stratégie : Faiblesse Opportunité → FaO "réorientation"

O1. Mise en place de la nouvelle stratégie biomasse au niveau national O2. Développement actuel des plans nationaux de promotion de la biomasse O3. Volonté de verdir l'économie à travers une réduction des GES, réduction des énergies fossiles, développement des ENR O4. Développement de réglementations nationales et européennes pour le développement de l'économie circulaire O11. Une recherche de nouveaux gisements pour compléter l'approvisionnement en bois O12. Un réel intérêt de certaines collectivités	Fa9. La relation au changement de certains agriculteurs peut freiner les projets Fa13. La biomasse agricole n'intéresse pas les entreprises de service énergétique

Objectifs

FaO3 : faire changer les mentalités sur le terrain pour développer de nouveaux projets

Actions / Activités

- Communiquer lors d'événements publics
- Organiser des campagnes de promotion sur Youtube
- Organiser des campagnes de promotion sur la valorisation des bois de taille en énergie
- Réaliser un rapport d'analyse du secteur et de ses opportunités et communiquer
- Inciter l'Administration Publique à soutenir le développement d'initiative

11 Intégrer la biomasse agricole (dont les déchets de bois agricoles) aux ressources biomasse utilisables en énergie

Stratégie : Faiblesse Opportunité → FaO "réorientation"

O5. Une volonté politique de développer de nouveaux projets rémunérateurs pour le secteur agricole O11. Une recherche de nouveaux gisements pour compléter l'approvisionnement en bois	Fa12. Le bois agricole est de moins bonne qualité que le bois forestier

Objectifs

FaO4 : Faire connaître les bois agricoles comme des sources d'énergie

Actions / Activités

- Obtenir des données sur la qualité du produit et communiquer
- Définir un standard de qualité
- Lister les équipements de combustion capable de brûler les bois de taille et communiquer

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12 Participer à la rentabilité des projets de valorisation des bois agricoles

Stratégie : Faiblesse Menaces → FM "résistance"

M1. Le marché est peu développé, un vrai manque de consommateurs
M2. Des bois à bas prix sont importés, d'origine UE ou hors UE
M3. Faible prix de l'énergie
M4. Les unités de valorisation de la biomasse en combustion demandent un retour sur investissement rapide

Fa3. L'équilibre économique de ce type de projet n'est pas encore démontré. Peu de bénéfices sont attendus. Des investissements conséquents.

Fa4. Les bois de taille sont souvent dispersés sur des parcelles éloignées. Ils sont soumis à une forte saisonnalité

Fa5. Des équipements encore peu adaptés à la filière

Fa6. Un coup logistique réellement important

Fa7. Une faible production à l'hectare sur certains vignobles

Fa8. Un manque de temps de la part des porteurs de projets, généralement également exploitants agricoles. Un temps supplémentaire pour les travaux à réaliser

Objectifs

FaM1 : Optimiser les chaînes de valorisation

Actions / Activités

- Inciter l'administration publique à soutenir le développement des initiatives
- Proposer des documents sur les différents modèles économiques applicables, communiquer dessus, présenter les différentes opportunités de financement
- Organiser une campagne d'adhésion des différents secteurs
- Organiser une campagne de communication auprès des différents consommateurs
- Travailler avec les équipementiers aux manques existants dans le secteur

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13 Faire connaître la ressource

Stratégie : Faiblesse Menaces → FaO "résistance"

M11. Un manque de connaissance de certains décideurs sur le sujet

M12. Une absence de données précises à l'échelle des territoires

Fa1. Peu de cas concrets, d'exemples à suivre ou d'informations disponibles

Fa2. L'absence de chaînes logistiques actuelles implique un effort conséquent pour développer de nouvelles chaînes de valorisation (absence d'exemples, développement partant de zéro).

Objectifs

FaM2 : davantage communiquer sur les opportunités du secteur et faire connaître le potentiel de la ressource

Actions / Activités

- Organiser des démonstrations d'équipements
- Réaliser des campagnes de promotion sur youtube
- Communiquer durant les événements publics
- Monter une campagne de sensibilisation : communication dans les journaux, articles
- Présentations de rapports techniques
- Faire des calculs à partir de cas réels, diffuser les résultats et conclusions
- Campagne de promotion sur l'utilisation des bois agricoles en combustion
- Ateliers, visites, rapports techniques publics
- Inciter l'administration publique à soutenir le développement des initiatives
- Réaliser des actions de promotion dans le secteur agricole

14 Démontrer la pertinence de la valorisation de la ressource comme complément du bois

Stratégie : Faiblesse Menaces → FaO "résistance"

M5. Les bois agricoles entrent en compétition avec les bois forestiers de meilleure qualité et largement disponibles en France

Fa10. Des technologies de combustion encore peu adaptées / développées

Fa11. Utilisation compétitive comme utilisation des bois comme matière organique

Fa12. Le bois agricole est de moins bonne qualité que le bois forestier

Objectifs

FaM3 : démontrer l'intérêt de la ressource face à d'autres combustibles

Actions / Activités

- Communiquer sur les externalités positives
- Réaliser des analyses de qualité sur la ressource
- Définir un standard de qualité pour la ressource
- Communiquer sur les technologies de combustion existantes
- Lister les manquements pour les technologies de combustion existantes
- Réaliser des études techniques et comparatives avec d'autres types de coproduits.

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15 Miser sur le développer de cas démonstrateurs

Stratégie : Faiblesse Menaces → FaO "résistance"

M8. Les bois agricoles ne sont pas intégrés comme tel aux plans nationaux de valorisation de la biomasse

M9. La valorisation des bois agricole n'est pas intégré à la PAC

M10. Pas de politiques cohérentes sur la valorisation des bois agricoles

Fa1. Peu de cas concrets, d'exemples à suivre ou d'informations disponibles

Fa2. L'absence de chaines logistiques actuelles implique un effort conséquent pour développer de nouvelles chaines de valorisation (absence d'exemples, développement partant de zéro).

Objectifs

FaM4 : contribuer au développement de cas démonstrateurs comme modèles pour la filière

Actions / Activités

- Communiquer sur les possibilités de financement en innovation et énergies renouvelables
- Proposer des appels à projet dédiés
- Travailler avec l'ensemble des parties prenantes
- Proposer un soutien sous forme de conseils et d'études de faisabilité
- Soutenir le développement des marchés

ANNEX A13

WP2 – Task T2.3

**Performing an APPR Sector Analysis and
Developing a Strategic Plan at National and EU level
Portugal**

	Document:	Task 2.3. Performing a bioenergy sector analysis and developing a strategies plan at national and EU level		
	Author:	UFG / CONFAGRI	Version:	
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SECTOR ANALYSIS

A. National framework on APPR sources

Portuguese agro-forest and diversity

The Portuguese mainland occupies an area of 89,089 km², of which 70% corresponds to the agricultural and forestry area, and covers a population of 10,028 thousand inhabitants, on average 113 inhabitants per km² (source GPP 2017)

In 2015, the agricultural sector comprised 9 percent of companies in Portugal (35 thousand companies), accounting for 14 percent of turnover and 9 percent of the number of people employed. Compared to 2011, the relevance of the agricultural sector in the total of the companies registered marginal variations. Nevertheless, its dynamics compared favorably with that of all companies: the weight of the sector increased by 1.0 percentage points (pp) in terms of number of companies and turnover and 0.4 pp in relation to the number of companies people in the service.

Plant Production (agricultural year 2015/2016) The agricultural year 2015/2016 was characterized by average air temperatures much higher than normal for most of the months, ranking between a dry year of 2015 (the fourth driest year since 2000) and a year of 2016 considered normal for the amount of precipitation; The seeded area of autumn / winter cereals (140,000 hectares) was the lowest since statistical records. On the other hand, the productivities achieved were the highest since 2008; In the orchards there was a decrease in production due to poor floral differentiation, poor fruit revenge, the occurrence of cryptogamic diseases and the delay in fruit maturation; The harvest of 2016 produced 5.84 million hectoliters, which corresponds to a decrease of 15% compared to the previous season. However, the maturations evolved favorably, producing quality wines; The olive-growing season was affected by the rainy spring, with an overall decrease in olive oil production of 36.4% compared to the previous one.

Livestock production in 2016 had a total increase in beef production of 1.8% (+ 5.0% in 2015), driven by increases in the production of beef (+ 2.3%) and poultry (+ 4.9%); Pigmeat production (400 000 tonnes) practically maintained (-0.2%), while sheepmeat and goatmeat fell by 3,0% and 5,3%, respectively; The production of eggs for consumption decreased by 3.3%, with about 111 thousand tons, reversing the growth trend started after the conversion of the production system into cages; Cow's milk (1 865 million liters) decreased by 4.5%. The definition of new milk purchase / sales contracts, setting delivery quantities below those of 2015, and Community support for the reduction of production contributed to this result.

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Forest Production In 2016, the area burned (160.7 thousand hectares) more than doubled in relation to 2015, despite the decrease in the number of forest fires occurring at national level (-18%), with 13 044 recorded occurrences; Imports of timber from Uruguay increased by 31.9% in 2016, strengthening its position as the second largest supplier; In 2016, France was the main target market for the national "Cork" (weight of 19.1%, +1.1 percentage points compared to 2015), surpassing the United States (weight of 17.9%, -1, 9 pp compared to 2015); Balance of the trade balance of "Forest products" recorded a surplus of € 2.5 billion (- € 76.7 million compared to 2015); In the 2016/17 season, 255 thousand hunters (- 3 921 individuals in the previous season) were registered for a total of 121 606 licenses issued (116 029 in the previous season); Revenue from annual activity fees for hunting in associative or tourist areas and hunting licenses amounted to 10.2 million euro

NATIONAL PARP POTENTIAL

Since the industrial revolution, fossil fuels have been the most widely used energy source in the world, and Portugal is no exception. However, with technological development came concerns about environmental issues, in particular greenhouse gas emissions resulting from the processes using such fuels. Portugal and other countries, in order to overcome this question have been the use of renewable energy as substitutes for fossil fuels. Of the available energy sources, biomass has revealed enormous potential due to existing reserves worldwide and is a very flexible resource that can be converted directly into energy in the form of heat or electricity or in biofuels. As can be seen from the following table, the consumption of renewable energies has increased year by year (Source DGEG 2017)

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	Produção Anual (GWh)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 agosto ¹
Total Renovável ²	15 140	19 016	28 754	24 692	20 411	30 610	32 453	25 514	33 383	24 924
Hídrica	7 298	9 009	16 547	12 114	6 660	14 868	16 412	9 800	16 866	8 744
Grande Hídrica (>30MW)	6 281	7 648	14 454	10 615	5 683	12 931	14 168	8 669	14 870	7 696
em bombagem	499	724	399	578	1 038	1 138	843	1 139	1 186	1 564
PCH (>10 e <=30 MW)	445	600	972	620	367	739	866	379	831	413
PCH (<= 10 MW)	573	761	1 121	879	611	1 198	1 377	752	1 165	636
Eólica	5 757	7 577	9 182	9 162	10 260	12 015	12 111	11 608	12 480	11 930
Biomassa ³	1 500	1 713	2 226	2 467	2 496	2 516	2 578	2 518	2 455	2 602
c/ cogeração	1 338	1 364	1 560	1 722	1 710	1 780	1 813	1 723	1 708	1 784
s/ cogeração	163	349	665	745	786	736	765	795	746	819
Resíduos Sólidos Urbanos	561	579	577	592	490	571	481	584	620	618
Fração renovável	281	290	289	296	245	286	240	292	310	309
Biogás	71	83	100	161	210	250	278	294	285	292
Geotérmica	192	184	197	210	146	197	205	204	171	199
Fotovoltaica	41	160	215	282	393	479	627	799	816	847

We thus see the low biomass use compared to hydro and wind power generation in Portugal, but it has many advantages that during this evaluation we will go through, as the advantage of being able to be stored and used only when the demand justifies it, allowing in a certain way a constant supply, unlike other renewable energy sources that are dependent on the wind in the case of wind power and the level of water in the dams in the case of water.

Thus, one of the solutions to reduce energy dependence from abroad is the replacement of fossil fuels, one of the most promising alternatives being biomass, which includes forest, agricultural residues, and all biodegradable organic waste originated by man and animals. This energy source is very flexible and can be used in its pure form or processed to produce biofuels

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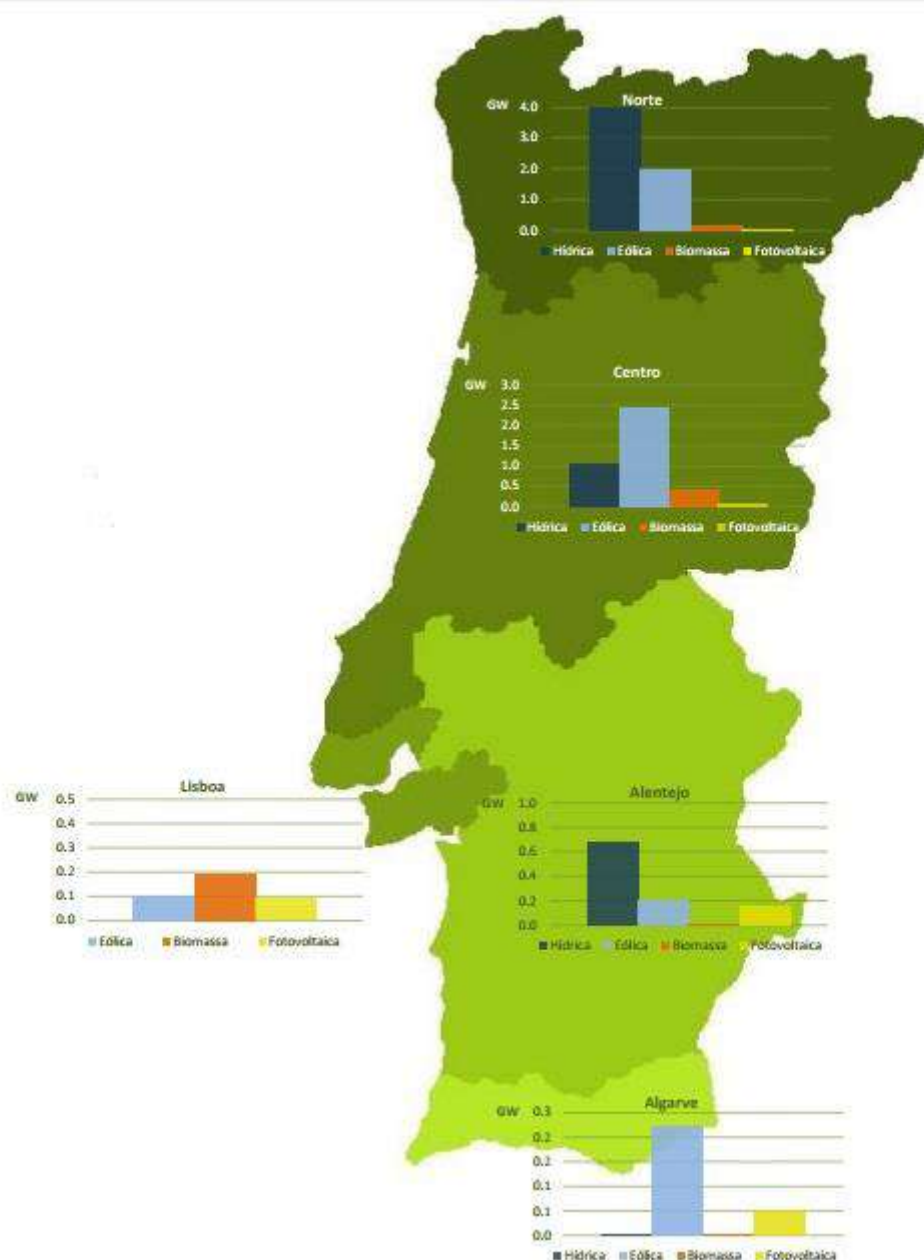


Figure 2 - Production of primary energy by region

At the level of biomass production by region, the center region is the region where more energy is already produced through biomass, according to Figure 3. There is tremendous growth potential.

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Renováveis					Energia elétrica					Biomassa
	Produção por Região (GWh)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 agosto ¹
Portugal	1 852	2 086	2 614	2 924	2 951	3 050	3 097	3 103	3 050	3 204
Continente	1 826	2 059	2 586	2 898	2 930	3 031	3 074	3 076	3 019	3 168
Norte	258	272	285	341	382	392	378	398	371	389
Centro	1 044	1 215	1 663	1 866	1 881	1 912	1 961	1 929	1 926	2 022
Lisboa	520	567	633	684	645	704	707	723	695	729
Alentejo	0	0	0	3	11	11	15	12	14	15
Algarve	4	5	4	4	11	12	13	14	13	13
R.A. Açores	1	2	2	2	1	1	1	1	4	4
R.A. Madeira	26	25	26	24	19	18	22	26	25	30
Não especificado	0	0	0	0	0	0	0	0	2	2

¹ Ano-móvel: setembro de 2016 a agosto de 2017.

Figure 3 - By region, energy production / year

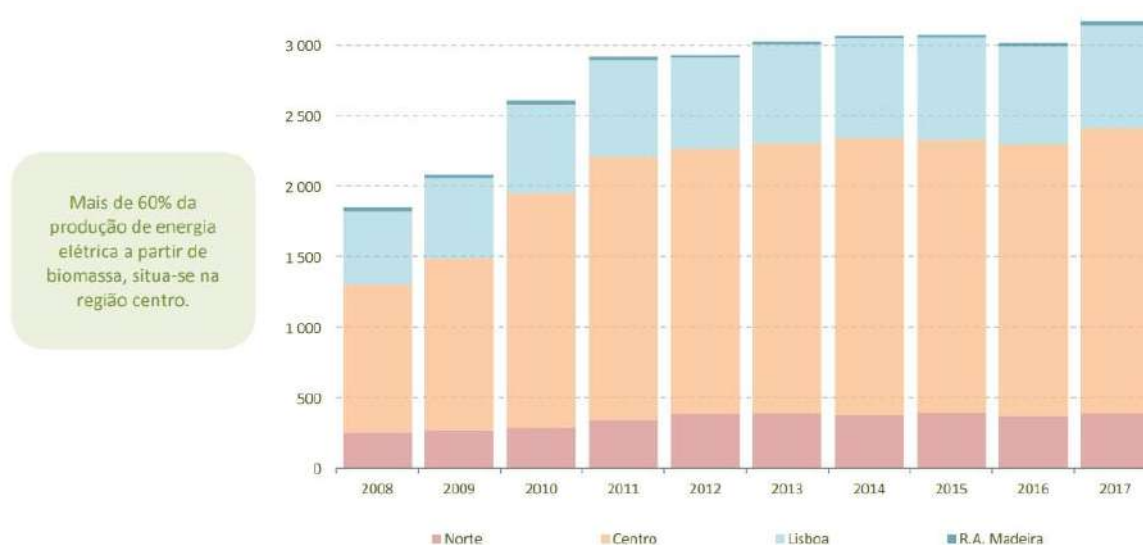


Figure 4 - Production of electric energy by biomass / region

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Localização geográfica (Região agrária)	Produção das principais culturas agrícolas (t) por Localização geográfica (Região agrária) e Espécie; Anual (1)	
	Período de referência dos dados	
	2016	
	Espécie	
	Vinha t	Olival t
Portugal	800 738 &	493 319
Entre Douro e Minho	98 383 &	654
Trás-os-Montes	172 205 &	84 368
Beira Litoral	56 338 &	10 604
Beira Interior	39 791 &	23 143
Ribatejo e Oeste	274 010 &	23 617
Alentejo	149 297 &	348 564
Algarve	5 930 &	2 369

Produção das principais culturas agrícolas (t) por Localização geográfica (Região agrária) e Espécie; Anual - INE, Estatísticas da produção vegetal

Figure 5 - Production of vines and olive groves by region in 2016

It is important to distinguish forest biomass from residual forest and agricultural biomass, the latter being used as raw material for energy production, and is derived from leftovers from the management and forestry or from by-products of the forest products and products processing industry at the end of its life cycle or agreed with the study concerned, of agricultural pruning and removal of crops.

Biomass is a material susceptible of transformation into different types of biofuels, not only solid (briquettes and pellets) but also liquid (ethanol and methanol) or gaseous (methane). In Portugal, an important part of the forest biomass is used for energy use, although the biomass resulting from agricultural pruning and removals from plantations is not known on a large scale, such as the production of pulp, panels, agglomerates and wood residues (briquettes and pellets). In parallel, in 2005, the country made a bet on this type of RES, launching a tender to allocate 100 mW of power for the production of electricity from residual forest biomass (in 15 plants). The goal was to reach 250 mW of power from dedicated biomass power stations, adding to the 150 mW licensed in Projects of Public Interest (PIP) outside these competitions. Given the focus on this renewable energy and considering the potential of forest biomass in Portugal, it is expected that the needs of this raw material will increase. In this sense, the sustainability of the energy subsector based on forest biomass, given the capacities to be installed, may have to be due to the existence of energy forestry crops complementary to the leftovers, in the case of supply shortages to the plants. (study source: Assembly of the Republic - Biomass Working Group) Otherwise, the availability of biomass from forest residues may be insufficient for the country's needs, which may jeopardize the attainment of the initial objectives. In addition, some stakeholders estimate that the raw material requirements to

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supply the dedicated plants (when all the plants in the pipeline are in operation), cogeneration plants, pellet plants and cement plants, will be in the 4 Mton /year. Taking into account the values in Table 2, Portugal may have a deficit of raw material to supply the energy production from forest biomass by about 2 Mton / year, in case the planned and projected plants are put into operation. The use of forest biomass for electricity, or simultaneously for the production of electricity and heat (cogeneration), is part of the organization of the National Electric System, which is based on the existence of two complementary systems: the Public System and the Independent System - Production in a Special Regime, of smaller systems, eg "Mortágua Thermal Power Plant, and cogeneration facilities, both not fully integrated into the large energy sectors, but related to them" (MADRP, 2005).

C- PUBLIC POLICIES

In Portugal, when we talk about the production of electricity from renewable energy sources, we must take into account the fulfillment of various legal procedures. Thus, the legislative framework in Portugal is framed by the European targets for the use of energy from endogenous renewable sources and the substantial improvement in the country's energy efficiency. Firstly, in the "Action Program to reduce Portugal's dependence on oil", approved by RCM no. 171/2004, of November 29, a set of measures was identified to reduce by 20% the energy intensity and the dependence on petroleum, in which are listed measures relevant to renewable energy related to biomass from agricultural, forestry and related industries. The European Commission, for its part, approved the Biomass Plan in 2005, aiming at a coordinated approach to the policies in force in the European area, including measures for the bioethanol and biodiesel (agriculture) ranks, and biomass production for the generation and electrical and thermal energy.

Accordingly, Portugal has approved the following plans:

* Resolution of the Council of Ministers no. 169/2005, of October 24, established the National Strategy for Energy. This document pointed to the need to increase installed capacity (a target to be achieved by means of a public tender for the installation of 15 biomass power plants with a combined power of 100 mW), as well as the adoption of forest biomass, to be compatible with the wood and pulp industries and measures to evaluate the criteria for remuneration of the electricity

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produced, taking into account technological specificities and environmental criteria * The National Strategy for Forests (RCM 114/2006) highlights the need to create a market for fuels that promote the use of weeds and reduce the costs of maintaining and cleaning forest stands.

* The National Action Plan for Energy Efficiency (PNAEE) (2008-2015) set as a goal to achieve by 2015 the implementation of energy efficiency improvement measures equivalent to 10% of final energy consumption (RCM No 80 / 2008, of May 20).

* The Energy Strategy - ENE 2020 - (RCM 29/2010, 15 May) defined the focus on renewable energies and the use of energy policy to promote growth and national energy and financial independence, as well as and for territorially balanced economic development.

* The Resolution of the Council of Ministers no. 81/2010, of November 3, established, within the scope of the National Energy Strategy 2020, measures for the implementation of the projects of plants dedicated to forest biomass for the competitions carried out in 2006. These measures aimed at ensuring the long-term sustainability of the supply of biomass power plants, as well as the construction and operation of these plants by the end of 2013, with the application of an economic incentive.

* The National Plan of Action for Renewable Energies (PNAER), which provides for the generation of heat and electric energy, from the combustion of biomass from different sources, as an important resource in the national energy matrix. This plan, approved on July 30, 2010, imposed by the Renewable Energy Directive (2009/28 / CE), defined a goal of 31% incorporation of energy from Renewable Energy Sources (RES) in the final energy consumption in Portugal , in addition to a target of 10% use of renewable energy in transport.

In 2013, with the Resolution of the Council of Ministers no. 20/2013 of April 10, it approved the National Plan of Action for Energy Efficiency for the period 2013-2016 (Strategy for Energy Efficiency - PNAEE 2016) and the National Plan Action Plan for Renewable Energy for the period 2013-2020 (Renewable Energy Strategy - PNAER 2020), and revoked RCMs no. 80/2008 of 20 May and no. 29/2010 of 15 April. This resolution intends to proceed with an integrated review of the 2014 NEPAP and the PNAER 2020, as the integration of two Plans, which until now has been treated independently, allows for concerted action towards the achievement of national and European objectives, minimizing the necessary investment and increasing national competitiveness. "The use of more efficient biomass systems with a better environmental performance, namely heat recovery

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and pellet boilers, will be gradually promoted, which will help to stabilize the consumption of this RES."

CURRENT SCENARIO

Until 2005, there were only two thermoelectric power plants connected to the grid using forestry biomass as the main fuel - the EDP plant in Mortágua and Centroliva in Vila Velha de Ródão. In 2006, 15 tenders were launched to allocate 100 mW of power for the production of electricity from residual forest biomass. The goal was to reach 250 mW of power from dedicated biomass power stations, adding to the 150 mW licensed in Projects of Public Interest (PIP) outside these competitions. Of these, only two have been concluded so far, and several reasons for the failure of the tender were pointed out: poor location of some of the plants; high raw material costs compared to the available rate; problems in procurement, logistics and availability of raw materials; bureaucracy of tender procedures, and, more recently, lack of funding from banks. The location of 12 of these plants was in the North and Cento regions of Portugal. Between 2007 and 2009, five new power plants with a total power of 78 mW were implemented, totaling just over 100 kW, far from the target of 250 kW.

In 2017, the Government gave the green light to four new forest biomass power plants to be installed in the municipalities of Vila Velha de Rodão, Mangualde, Figueira da Foz and Famalicão, representing an investment of around 185 million euros.

According to the Secretary of State for Energy, the promoters of the projects are the Bioelectrical Society of Mondego, EDP Produção Bioelétrica, PA Biomassa, SA and SIAF - Sociedade Iniciativa e Capitalizações Florestais, Energia, SA, whose plants have installed powers of 55 MW, 35 MW, 15 MW and 12 MW, respectively.

Regarding tenders prior to 2011, approved projects have guaranteed remuneration and must be put into operation by the end of 2019, according to the note from Sanches Insurance Office.

With the attribution of these four production licenses, the number of projects and reinforcements of biomass plants already licensed during the current legislature is increased to eight, joining the previous ones in Famalicão, Fundão, Viseu and Porto de Mós.

In 2006, public tendering procedures were launched to build and operate residual forest biomass power plants, but the private initiative left 50% of the injection power then put to tender and now the Government wants to allocate.

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At the level of the acceptance of people, in Portugal due essentially to forest fires there is a perception that everything is solved with the use of the woody material resulting from the cleaning of forests and weeds in Portugal, that is the agricultural prunings and the removals of the plantations could follow by the same path and the same incentive / support, leading to an increasing investment in the subsidy to the energy producer, but also to projects and / or cases piltotos developed locally by the municipal chambers. There are opinion articles and weekly news that flood the Media with references to forest clearing as a national mandate for fire reduction (source: <http://observador.pt/opinioao/prevenir-os-incendios-e-a-designio-nacional/>)

Even the state energy ministries make press releases and communicate with references of this type: "This measure is in line with the Government's strategy of fire prevention and minimization, with forest intervention, as well as promotion and diversification of the regional economy and exploitation of endogenous resources, "says an official source of the Secretary of State for Energy. (source news July 2017 - newspaper www.Público.pt)

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SWOT Analysis

	Positive factors	Negative factors	
Internal Factors	Strengths <i>The sector is dynamic and innovative</i> S1. Agriculture is a strong local productive sector, together with agro-food processing S2. Farmers have a strong imitation attitude. Positive examples are considered as a model <i>Biomass is widely available</i> S3. Large potential biomass availability at regional scale and very high local biomass spatial density <i>Sustainable development</i> S4. Using locally available resources is considered a priority <i>Contribution to renewable energies</i> S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass) <i>Contribution to economic development</i> S6. Potential cost savings in field pruning management	Weakness <i>Low economic profitability</i> W1. APPR harvesting and transport operations are generally considered too costly <i>Real logistical constraints</i> W2. Structure of farms and farm size too small to allow a profitable pruning collection and use W3. Pruning burning in open field is still considered an agronomic operation W4. A long and subdivided supply chain could be not economically efficient for every actors <i>A change of mentalities</i> W5. Energy conversion from pruning is still considered an overall risky operation <i>Equipment still unsuitable</i> W6. Complexity of biomass supply chains. Lack of well-organized logistics operations	Internal Factors

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External Factors	Opportunities <i>Integration of biomass into new policies and climate change</i> O1. Adaptation measures to climate change O2. Possible application of the “Carbon emission trading” and CO₂ taxation <i>National willingness to act for sustainable development and entrepreneurs interested</i> O3. Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines) O4. Valorisation and reuse of agricultural residues for bioenergy production <i>Favorable market development</i> O5. A prospective increase in the market price of fossil fuels Long-term stability of economic return on bioenergy investment <i>The possibility of financial support</i> O6. Funding schemes favouring the APPR sector in agriculture <i>A favorable local context</i> O7. Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example) O8. Segmenting incentives to renewable to favour social impact	Threats <i>A lack of market</i> T1. Lack of the right market driven incentives and subsidises <i>A lack of return on investment</i> T2. Actual low degree of pruning valorisation <i>The competition for the resource</i> T3. Still large-scale economy are influencing the sector T4. Price of oil and fossil fuels still quite low to promote competitiveness from bioenergy <i>Low policy integrated with and in national plans</i> T6. No coherent policy, no strategic view on the APPR sector from local governments. T7. High rate of law changes and great instability in energy policy decisions <i>A lack of knowledge</i> T8. Limited communication with civil society/public opinion and lack of promotional activities	External Factors
	Positive factors	Negative factors	

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STRATEGIC PLAN

In order to obtain a better interpretative framework, the internal SW factors may form together a vertical axis and the external OT factors a horizontal axis. By combining internal and external factors, the following strategic alternatives may be obtained:

SO Strategies (Strategies employing strengths in order to profit by opportunities). These are the *max-max* type of strategies, in the sense that they combine the most favourable elements to building a strategy. SO strategies use strengths and powerful elements in order to make it benefit from external opportunities. The strategy becomes dynamic and aggressive (*attacking*).

WO Strategies (Strategies seeking to alleviate the effect of weaknesses by taking advantage of opportunities). They are strategies of the *min-max* type, in the sense that they combine inside weaknesses with external opportunities. The strategy attempts to use opportunities in order to eliminate or alleviate weaknesses (*reorientation*).

ST Strategies (Strategies that employ strengths in order to prevent or minimize threats). They are strategies of the *max-min* type, in the sense that they use the strengths in order to avoid or reduce external threats (*defense*).

WT Strategies (Strategies that alleviate weaknesses and seek to reduce the impact of threats). They are *min-min* type strategies seeking to minimize weaknesses if external threats can be avoided (*surviving*).

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① Integration of operational stakeholders in national development plan

Strategy: Strengths + Opportunities → SO “Attack”

S1. Agriculture is a strong local productive sector, together with agro-food processing
S2. Farmers have a strong imitation attitude. Positive examples are considered as a model

O1. Adaptation measures to climate change
O2. Possible application of the “Carbon emission trading” and CO₂ taxation

Objectives

- SO1. Take advantage of the motivation of the actors on the field and the development of new strategies to build together an operational strategy.
- SO2. Take advantage of the motivation of the actors on the field and the development of new strategies to co-build tools fostering the development of new projects.

Actions / Activities

- Organize regional information meetings and workshops on national strategies with local stakeholders of the wine and fruit sectors. Use this information to better understand the challenges of the sector and add APPR biomass to national energy and biomass plans, taking into account the information gathered.
- Integrate wine and fruit professionals into regional biomass mobilization strategies.
- Identify innovative local projects and invite their project leaders to national workshops for the development of biomass strategies.
- Integrate bioeconomy and bioenergy into agricultural sector development plans.
- Create a dedicated action plan, with the professionals of the sector, for the development approach of the APPR biomass sector

2 Co-construct a local sustainable development strategy

Strategy: Strengths + Opportunities → SO “Attack”

S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass)
S6. Potential cost savings in field pruning management

O3. Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines)
O4. Valorisation and reuse of agricultural residues for bioenergy production

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Objectives

SO3. Take advantage of the opportunity offered by the valorization of APPR biomass to reduce GHG emissions and the consumption of fossil fuels

SO4. Explain and demonstrate cost savings, production energy from agricultural biomass

Actions / Activities

- Reinforce final support proposed for pilot logistics chains in the territories
- Technically support municipalities interested in developing APPR biomass logistic chains (feasibility studies, support in building the logistics chains)
- Communicate on the possibility of developing logistic chains for the APPR biomass uses and the associated subsidies, in particular for the installations of boilers.
- Communicate on the positive externalities of APPR biomass projects.
- Conduct studies to quantify positive externalities.
- Communicate on the 3 pillars of sustainable development: economy, environment (sustainable energy, GHG), social (job creation).

3 Promote positive externalities vs fossil fuel competitiveness

Strategy: Strengths + Threats → ST “Defense”

S1. Agriculture is a strong local productive sector, together with agro-food processing
S2. Farmers have a strong imitation attitude. Positive examples are considered as a model

T1. Lack of the right market driven incentives and subsidises
T2. Actual low degree of pruning valorisation
T8. Limited communication with civil society/public opinion and lack of promotional activities

Objectives

ST1: Communicate on the possibility of developing logistic chains for the APPR biomass uses and the associated subsidies, in particular for the installations of boilers.

ST2: Conduct studies to quantify positive externalities.

ST3: Develop the sector by highlighting the positive externalities face to economic issues.

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Actions / Activities

- Communicate on the positive externalities of APPR biomass projects
- Communicate on existing financial support mechanisms
- Propose feasibility studies by integrating different scenarios of rising energy prices and carbon taxes
- Visit functional units
- Study the incentive different mechanisms for the development of APPR biomass projects.

4 Fight against the lack of integration of APPR biomass into policies by strengthening knowledge

Strategy: Strengths + Threats → ST “Defense”

S4. Using locally available resources is considered a priority
S5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass)
S6. Potential cost savings in field pruning management

T6. No coherent policy, no strategic view on the APPR sector from local governments.
T7. High rate of law changes and great instability in energy policy decisions
T8. Limited communication with civil society/public opinion and lack of promotional activities

Objectives

ST3: Increase awareness of the potential of APPR biomass among policy makers to make this resource more integrated into national and regional plans
ST2: Conduct studies to quantify positive externalities.

Actions / Activities

- Strengthen existing knowledge on the potential of the industry
- Develop a report on the potential develop of the sector, widely communicated, particularly to policy makers and potential project leaders
- Carry out a communication campaign in the newspapers
- Organize workshops, visits or submit technical reports to local stakeholders
- Organize a promotion campaign on polyfuel woods

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5	Support innovation development, supporting logistic optimisation
Strategy:	Weakness + Opportunities → WO “reorientation”
W1. APPR harvesting and transport operations are generally considered too costly W2. Structure of farms and farm size too small to allow a profitable pruning collection and use W3. Pruning burning in open field is still considered an agronomic operation W4. A long and subdivided supply chain could be not economically efficient for every actors	O6. Funding schemes favouring the APPR sector in agriculture O7. Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example) O8. Segmenting incentives to renewable to favour social impact
Objectives	
WO1: Promote and organize the farmers in organizations and cooperatives	
WO2: reducing costs associated to logistics chains	
WO3: increasing the efficiency of logistics chains	
Actions / Activities	
• Organize equipment demonstrations • Encourage the Public Administration to support the development of initiative • Present technical reports about logistics organization of the sector • Work to identify technical insufficiency in machinery and processing equipment • Identify existing services on the field that can participate in the optimization of logistics chains and propose a report to the administration and other stakeholders • Participate in the networking of the local stakeholders (e.g. by local workshop) • Make calculations on real cases, disseminate results and conclusions	

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6 Develop political strategy to develop the valorization of APPR biomass on the field Strategy: Weakness + Opportunities → WO “reorientation”	
W5. Energy conversion from pruning is still considered an overall risky operation W6. Complexity of biomass supply chains. Lack of well-organized logistics operations	O1. Adaptation measures to climate change O2. Possible application of the “Carbon emission trading” and CO ₂ taxation O3. Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines) O4. Valorisation and reuse of agricultural residues for bioenergy production
Objectives WO4: change attitudes of local stakeholders to develop new projects WO5: Make agricultural woods known as sources usable for energy purpose	
Actions / Activities • Communicate at public events • Organize promotional campaigns on Youtube • Organize promotional campaigns on the valorization of APPR biomass for energy • Produce a report analyzing the sector and its opportunities and communicate • List combustion equipment able to burn APPR biomass and communicate	

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7	Participate in the profitability of APPR biomass projects	
Strategy:	Weakness + Threat → WT “reorientation”	
W1. APPR harvesting and transport operations are generally considered too costly W2. Structure of farms and farm size too small to allow a profitable pruning collection and use W3. Pruning burning in open field is still considered an agronomic operation W4. A long and subdivided supply chain could be not economically efficient for every actors		T6. No coherent policy, no strategic view on the APPR sector from local governments. T7. High rate of law changes and great instability in energy policy decisions T8. Limited communication with civil society/public opinion and lack of promotional activities
Objectives WT1: Optimize value chains WT2: demonstrate the interest of the resource in comparison with other fuels WT3: contribute to the development of demonstration cases as models for the sector		
Actions / Activities • Encourage the public administration to support the development of initiatives • Propose documents on the various applicable business models, communicate, present the different financing opportunities • Organize a campaign of information / integration with the different sectors • Organize a communication campaign for consumers • Work with equipment manufacturers on existing gaps		

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8 Make the APPR biomass known Strategy: Weakness + Threat → WT “reorientation”	
W5. Energy conversion from pruning is still considered an overall risky operation W6. Complexity of biomass supply chains. Lack of well-organized logistics operations	T1. Lack of the right market driven incentives and subsidises T2. Actual low degree of pruning valorisation T8. Limited communication with civil society/public opinion and lack of promotional activities
Objectives WT4: communicate more about the opportunities of the sector and make known the potential of the APPR resource	
Actions / Activities • Organize equipment demonstrations • Realize promotional campaigns on Youtube • Communicate during public events • Set up an awareness campaign: newspaper communication, articles • Technical Report Presentations • Support market development	

ANNEX A14

WP2 – Tarefa T2.3

**Executar uma APPR análise sectorial e desenvolver
um plano estratégico a nível nacional e a nível
Europeu**

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ANÁLISE SECTORIAL

A. Enquadramento nacional nas fontes de APPR

Agro-floresta Portuguesa e diversidade

O continente Português ocupa uma área de 89,089 km², da qual 70% corresponde à área agrícola e florestal, tendo uma população de 10,028 mil habitantes, uma média de 113 habitantes por km² (Fonte GPP 2017)

Em 2015, o sector agrícola representava 9 % das empresas em Portugal (35 mil empresas), contando com 14 % do retorno e 9 % do número de pessoas empregadas. Comparando com 2011, a relevância do sector agrícola no total das empresas tem uma variação marginal. No entanto, sua dinâmica comparou favoravelmente com a dos restantes sectores: o peso do sector aumentou em 1.0 % em termos do número de empresas e volume de negócios e 0,4 % em relação ao número de pessoas empregadas.

Produção de plantas (ano agrícola 2015/2016) O ano agrícola de 2015/2016 foi caracterizado por temperaturas médias muito superiores ao normal na maior parte dos meses, clasificado como um ano seco em 2015 (o quarto mais seco desde 2000) e o ano de 2016 considerado normal pela quantidade de precipitação; A área semeada de cereais de outono/ inverno (140,000 hectares) foi a menor desde que há registos estatísticos. Por outro lado, a produtividade foi a maior desde 2008; Nos pomares houve uma diminuição da produção devido à fraca diferenciação floral, baixo vingamento dos frutos, the occurrence of cryptogamic diseases e um atraso na maturação dos frutos; A produção de vinho de 2016 foi de 5.84 milhões de hectolitros, o que corresponde a uma diminuição de 15% comparado com a campanha anterior. No entanto, as maturações evoluíram favoravelmente, produzindo vinhos de qualidade; A produção de azeitona foi afetada pela primavera chuvosa, com uma diminuição da produção de azeite de 36,4% em relação à campanha anterior.

A produção pecuária em 2016 teve um aumento total da produção de carne de 1,8% (+ 5,0% em 2015), impulsionada pelo aumento da produção de carne bovina (+ 2,3%) e das aves de capoeira (+ 4,9%); A produção de carne de porco (400 000 toneladas) praticamente manteve-se (-0,2%), enquanto a carne de ovino e caprino diminuiu 3,0% e 5,3%, respectivamente; A produção de ovos para consumo diminuiu 3,3%, com cerca de 111 mil toneladas, invertendo a tendência de crescimento iniciada após a conversão do sistema de produção em gaiolas; O leite de vaca (1 865 milhões de litros) diminuiu 4,5%. A definição de novos contratos de compra / venda de leite, estabelecendo quantidades de entrega abaixo das de 2015, e apoio comunitário para a redução da produção contribuiu para esse resultado.

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Produção Florestal Em 2016, a área ardida (160,7 mil hectares) mais do que duplicou em relação a 2015, apesar da diminuição do número de incêndios florestais ocorridos a nível nacional (-18%), com 13 044 ocorrências registradas; As importações de madeira do Uruguai aumentaram 31,9% em 2016, fortalecendo sua posição como o segundo maior fornecedor; Em 2016, a França foi o principal mercado-alvo da cortiça nacional (19,1%, +1,1 pontos percentuais em relação a 2015), superando os Estados Unidos (17,9%, -1,9 pp em relação a 2015); O saldo da balança comercial dos "produtos florestais" registrou um superávit de 2,5 bilhões de euros (- 76,7 milhões de euros em relação a 2015); Na temporada 2016/17, 255 mil caçadores (- 3 921 pessoas na temporada anterior) foram registrados no total de 121 606 licenças emitidas (116 029 na temporada anterior); A receita de taxas de atividade anual para caça em áreas associativas ou turísticas e licenças de caça foi de 10,2 milhões de euros

POTENCIAL NACIONAL PARP

Desde a revolução industrial, os combustíveis fósseis têm sido a fonte de energia mais utilizada no mundo, e Portugal não é exceção. No entanto, com o desenvolvimento tecnológico surgiram preocupações sobre questões ambientais, em particular as emissões de gases de efeito estufa resultantes dos processos que utilizam esses combustíveis. Portugal e outros países, para superar esta questão, tem recorrido ao uso de energia renovável como substitutos de combustíveis fósseis. Das fontes de energia disponíveis, a biomassa revelou um enorme potencial devido às reservas existentes em todo o mundo e é um recurso muito flexível que pode ser convertido diretamente em energia sob a forma de calor, ou eletricidade, ou em biocombustíveis. Como se pode ver na tabela a seguir, o consumo de energias renováveis aumentou de ano para ano (Fonte: DGEG 2017)

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	Produção Anual (GWh)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 agosto ¹
Total Renovável²	15 140	19 016	28 754	24 692	20 411	30 610	32 453	25 514	33 383	24 924
Hídrica	7 298	9 009	16 547	12 114	6 660	14 868	16 412	9 800	16 866	8 744
Grande Hídrica (>30MW)	6 281	7 648	14 454	10 615	5 683	12 931	14 168	8 669	14 870	7 696
em bombagem	499	724	399	578	1 038	1 138	843	1 139	1 186	1 564
PCH (>10 e <=30 MW)	445	600	972	620	367	739	866	379	831	413
PCH (<= 10 MW)	573	761	1 121	879	611	1 198	1 377	752	1 165	636
Eólica	5 757	7 577	9 182	9 162	10 260	12 015	12 111	11 608	12 480	11 930
Biomassa ³	1 500	1 713	2 226	2 467	2 496	2 516	2 578	2 518	2 455	2 602
c/ cogeração	1 338	1 364	1 560	1 722	1 710	1 780	1 813	1 723	1 708	1 784
s/ cogeração	163	349	665	745	786	736	765	795	746	819
Resíduos Sólidos Urbanos	561	579	577	592	490	571	481	584	620	618
Fração renovável	281	290	289	296	245	286	240	292	310	309
Biogás	71	83	100	161	210	250	278	294	285	292
Geotérmica	192	184	197	210	146	197	205	204	171	199
Fotovoltaica	41	160	215	282	393	479	627	799	816	847

Verificamos assim o baixo consumo de biomassa em comparação com a geração de energia eólica e elétrica em Portugal, tendo esta muitas vantagens que, durante esta avaliação, iremos abordar, podendo ser armazenada e usada somente quando a necessidade o justificar, permitindo de certa forma, um abastecimento constante, ao contrário de outras fontes de energia renováveis que dependem do vento no caso da energia eólica e do nível de água nas barragens no caso da água.

Assim, uma das soluções para reduzir a dependência energética do exterior é a substituição de combustíveis fósseis, sendo uma das alternativas mais promissoras a biomassa, que inclui a floresta, resíduos agrícolas e todos os resíduos orgânicos biodegradáveis originados por homens e animais. Esta fonte de energia é muito flexível e pode ser usada na sua forma pura ou processada para produzir biocombustíveis

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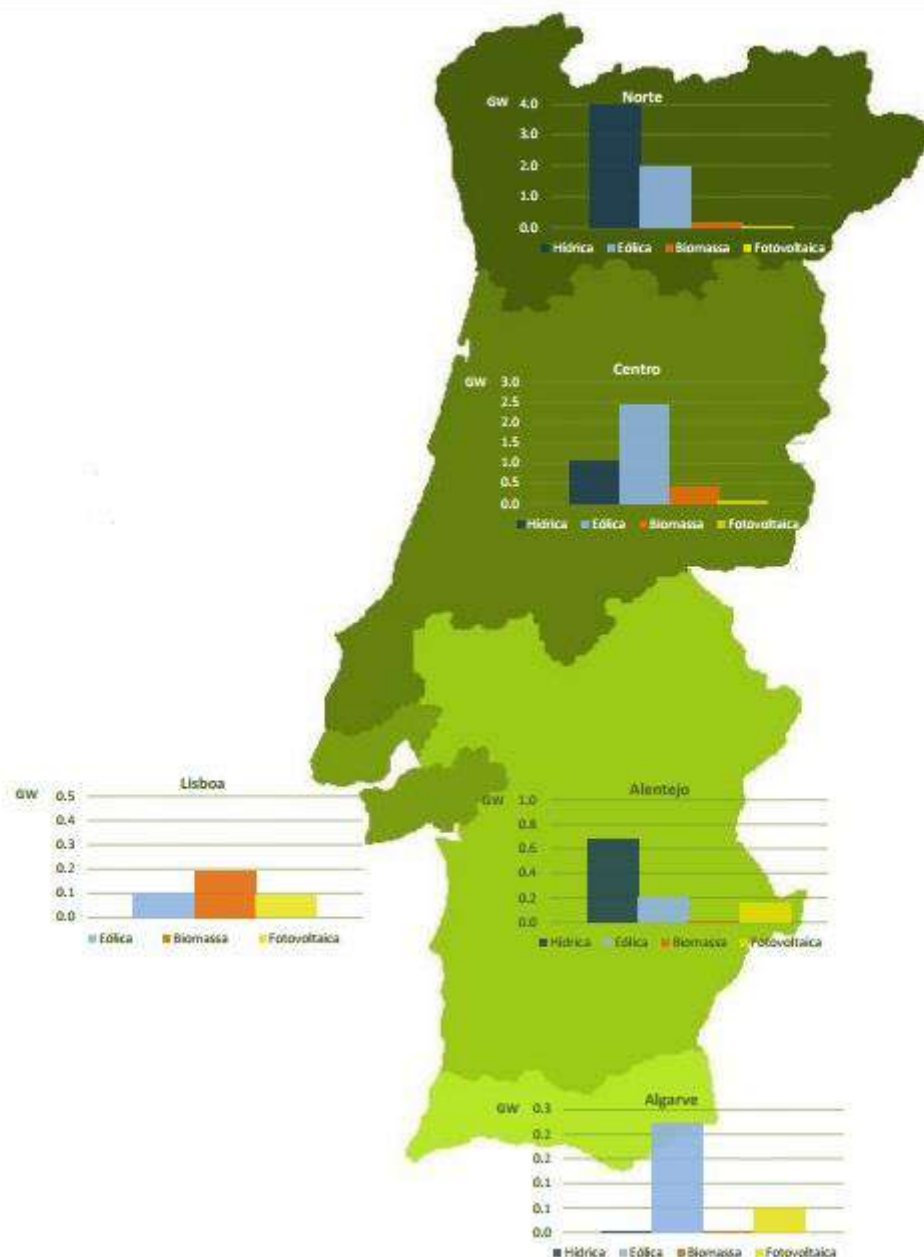


Figure 2 – Produção primária de energia por região

Ao nível da produção de biomassa por região, a região do centro é a região onde já é produzida mais energia através da biomassa, de acordo com a Figura 3. Existe um tremendo potencial de crescimento.

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Renováveis				Energia elétrica				Biomassa		
	Produção por Região (GWh)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 agosto ¹
Portugal	1 852	2 086	2 614	2 924	2 951	3 050	3 097	3 103	3 050	3 204
Continente	1 826	2 059	2 586	2 898	2 930	3 031	3 074	3 076	3 019	3 168
Norte	258	272	285	341	382	392	378	398	371	389
Centro	1 044	1 215	1 663	1 866	1 881	1 912	1 961	1 929	1 926	2 022
Lisboa	520	567	633	684	645	704	707	723	695	729
Alentejo	0	0	0	3	11	11	15	12	14	15
Algarve	4	5	4	4	11	12	13	14	13	13
R.A. Açores	1	2	2	2	1	1	1	1	4	4
R.A. Madeira	26	25	26	24	19	18	22	26	25	30
Não especificado	0	0	0	0	0	0	0	0	2	2

¹ Ano-móvel: setembro de 2016 a agosto de 2017.

Figure 3 - Por região, produção de energia / ano

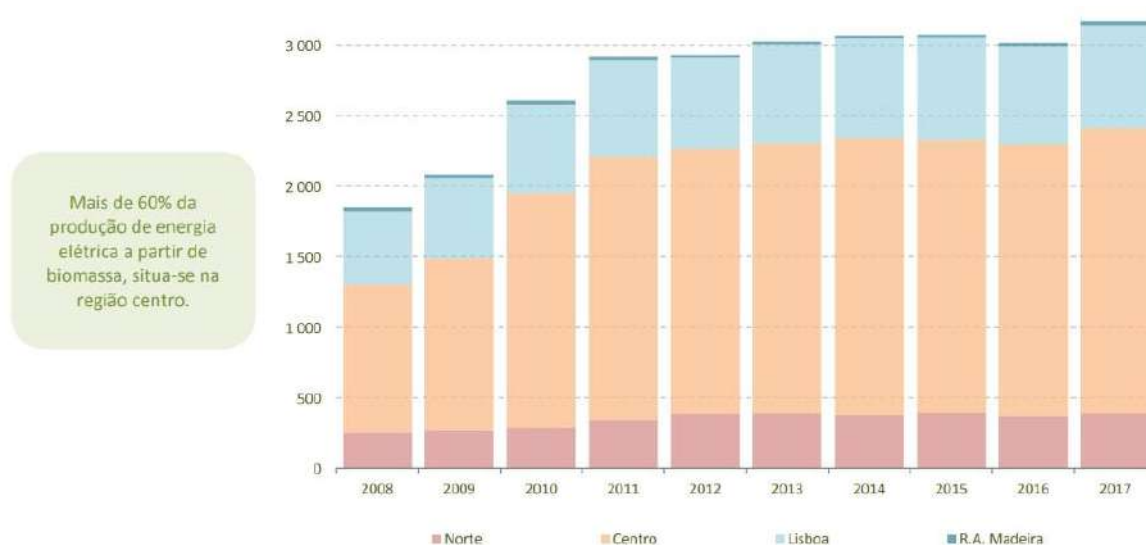


Figure 4 – Produção de energia eléctrica a partir de biomassa / região

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Localização geográfica (Região agrária)	Produção das principais culturas agrícolas (t) por Localização geográfica (Região agrária) e Espécie; Anual (1)	
	Período de referência dos dados	
	2016	
	Espécie	
	Vinha t	Olival t
Portugal	800 738 &	493 319
Entre Douro e Minho	98 383 &	654
Trás-os-Montes	172 205 &	84 368
Beira Litoral	56 338 &	10 604
Beira Interior	39 791 &	23 143
Ribatejo e Oeste	274 010 &	23 617
Alentejo	149 297 &	348 564
Algarve	5 930 &	2 369

Produção das principais culturas agrícolas (t) por Localização geográfica (Região agrária) e Espécie; Anual - INE, Estatísticas da produção vegetal

Figura 5 - Produção de vinhas e olivais por região em 2016

É importante distinguir a biomassa florestal, dos resíduos florestais e da biomassa agrícola, sendo esta última utilizada como matéria-prima para a produção de energia, e resultante das sobras da gestão agrícola e da silvicultura ou de subprodutos da indústria de processamento de produtos agrícolas e produtos florestais no fim de seu ciclo de vida ou de acordo com o estudo em questão, da poda e remoção de culturas agrícolas.

A biomassa é um material susceptível de transformação em diferentes tipos de biocombustíveis, não apenas sólidos (briquetes e grânulos), mas também líquidos (etanol e metanol) ou gasosos (metano). Em Portugal, uma parte importante da biomassa florestal é utilizada para o uso de energia, embora a biomassa resultante de podas e remoções agrícolas de plantações não seja conhecida em larga escala, como a produção de celulose, painéis, aglomerados e resíduos de madeira (briquetes e pellets). Paralelamente, em 2005, o país fez uma aposta neste tipo de RES, lançando um concurso para alocar 100 mW de energia para a produção de eletricidade a partir de biomassa florestal residual (em 15 plantas). O objetivo era atingir 250 mW de energia a partir de centrais de energia de biomassa dedicadas, somando aos 150 mW licenciados em Projetos de Interesse Público (PIP) fora dessas conseqüências. Dado o foco nesta energia renovável e considerando o potencial da biomassa florestal em Portugal, espera-se que as necessidades desta matéria-prima aumente. Nesse sentido, a sustentabilidade do subsector de energia com base na biomassa florestal, tendo em vista as capacidades a serem instaladas, pode ser devida à existência de culturas florestais energéticas complementares às sobras existentes, para o caso de escassez de provisão para centrais. (fonte: Assembleia da República – Grupo de trabalho biomassa) Caso contrário, a disponibilidade de biomassa proveniente de resíduos florestais pode ser insuficiente para as necessidades do centrais a instalar, o que pode comprometer a consecução dos objetivos iniciais. Além disso, alguns

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interessados estimam que os requisitos de matéria-prima para abastecer as centrais dedicadas (quando todas as centrais programadas estiverem em operação), centrais de cogeração, centrais de peletização e fábricas de cimento serão nas 4 Mton / ano. Tendo em conta os valores na Tabela 2, Portugal pode ter um déficit de matéria-prima para abastecer a produção de energia a partir de biomassa florestal em cerca de 2 Mton / ano, no caso de as centrais planeadas e projetadas entrarem em actividade. O uso da biomassa florestal para a eletricidade, ou simultaneamente para a produção de eletricidade e calor (cogeração) faz parte da organização do Sistema Elétrico Nacional, que se baseia na existência de dois sistemas complementares: Sistema Público e Sistema Independente - Produção em um regime especial, de sistemas menores, por exemplo, "Central de energia térmica de Mortágua e instalações de cogeração, não totalmente integradas nos grandes setores de energia, mas relacionadas com estes" (MADRP, 2005).

C- POLÍTICAS PÚBLICAS

Em Portugal, quando falamos sobre a produção de eletricidade a partir de fontes de energia renováveis, devemos ter em consideração o cumprimento de vários procedimentos legais. Assim, o quadro legislativo em Portugal é enquadrado pelos objectivos europeus para a utilização de energia a partir de fontes renováveis endógenas e a melhoria substancial da eficiência energética do país. Em primeiro lugar, no "Programa de acção para reduzir a dependência do petróleo de Portugal", aprovado pelo RCM no. 171/2004, de 29 de novembro, identificou-se um conjunto de medidas para reduzir em 20% a intensidade energética e a dependência do petróleo, nas quais estão listadas medidas relevantes para as energias renováveis relacionadas à biomassa da agricultura, silvicultura e indústrias relacionadas. A Comissão Europeia, por sua vez, aprovou o Plano de Biomassa em 2005, visando uma abordagem coordenada das políticas em vigor no espaço europeu, incluindo medidas para as fileiras de bioetanol e biodiesel (agricultura) e produção de biomassa para geração e eletricidade e energia térmica.

Consequentemente, Portugal aprovou os seguintes planos:

* Resolução do Conselho de Ministros no. 169/2005, de 24 de Outubro, que estabelece a estratégia nacional para a energia. Este documento aponta para a necessidade de aumentar a capacidade instalada (objectivo a ser atingido por concurso público para a instalação de 15 centrais eléctricas de

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biomassa com uma potencia total de 100 mW), bem como a adoção da biomassa florestal, por ser compatível com as indústrias de madeira e celulose e medidas para avaliar os critérios de remuneração da eletricidade produzida, tendo em consideração as especificidades tecnológicas e os critérios ambientais * A Estratégia Nacional para as Florestas (RCM 114/2006) destaca a necessidade de criar um mercado de combustíveis que promova o uso de infestantes e reduza os custos de manutenção e limpeza florestais.

* Plano nacional de acção para a eficiencia energética (PNAEE) (2008-2015) fixou como meta atingir até 2015 a implementação de medidas de melhoria da eficiência energética equivalentes a 10% do consumo final de energia (RCM No 80 / 2008, de 20 de Maio).

* A estratégia para a energia - ENE 2020 - (RCM 29/2010, 15 de Maio) definiu o foco nas energias renováveis e o uso da política energética para promover o crescimento e a independência energética e financeira nacional, bem como para o desenvolvimento económico territorialmente equilibrado.

* A Resolução do Conselho de Ministros no. 81/2010, de 3 de Novembro, estabelece no âmbito da Estratégia Energética Nacional de 2020, medidas para a implementação dos projetos de centrais dedicadas à biomassa florestal para os concursos realizados em 2006. Essas medidas visavam garantir a sustentabilidade a longo prazo do fornecimento de centrais de energia de biomassa , bem como a construção e operação dessas fábricas até o final de 2013, com utilizando um incentivo económico.

* Plano Nacional de Acção para as energías Renováveis (PNAER), que prevê a co-geração de calor e energia elétrica, a partir da combustão de biomassa de diferentes fontes, como um recurso importante na matriz energética nacional. Este plano, aprovado em 30 de Julho de 2010, imposto pela Directiva da Energia Renovável (2009/28 / CE), definiu um objetivo de 31% de incorporação de energia de Fontes de Energia Renovável (RES) no consumo final de energia em Portugal, além de um objetivo de 10% de uso de energia renovável nos transportes.

Em 2013, com a Resolução do Conselho de ministros no. 20/2013 de 10 de Abril, aprovou-se o plano nacional de acção para a eficiencia energética para o período 2013-2016 (Estratégia para a eficiencia energética - PNAEE 2016) e o Plano Nacional de Acção para as Energias Renováveis para o período 2013-2020 (Estratégia para a energía renovável - PNAER 2020), e revogou os RCMs no. 80/2008 de 20 de Maio e no. 29/2010 de 15 de Abril. Esta resolução pretende prosseguir com uma revisão integrada da NEPAP de 2014 e da PNAER 2020, uma vez que a integração dos dois Planos, que até

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agora foram tratados de forma independente, permite ações concertadas para alcançar os objetivos nacionais e europeus, minimizando o investimento necessário e aumento da competitividade nacional. "O uso de sistemas de biomassa mais eficientes com um melhor desempenho ambiental, nomeadamente recuperação de calor e caldeiras de pellets, será promovido gradualmente, o que ajudará a estabilizar o consumo desta RES".

CENÁRIO ACTUAL

Até 2005, havia apenas duas centrais termoelétricas ligadas à rede usando a biomassa florestal como principal combustível - a planta da EDP em Mortágua e Centroliva em Vila Velha de Ródão. Em 2006, 15 concursos foram lançados para atribuir 100 mW de energia para a produção de eletricidade a partir de biomassa florestal residual. O objetivo era atingir 250 mW em centrais de energia de biomassa dedicadas, somando aos 150 mW licenciados em Projetos de Interesse Público (PIP) fora destes concursos. Destes, apenas dois foram concluídos até agora, e são diversas as razões para o fracasso do concurso: má localização de algumas das centrais; custos elevados das matérias-primas em considerando a taxa disponível; problemas de aquisição, logística e disponibilidade de matérias-primas; burocracia dos procedimentos de concurso e, mais recentemente, falta de financiamento dos bancos. A localização de 12 dessas plantas estava nas regiões Norte e Centro de Portugal. Entre 2007 e 2009, foram implementadas cinco novas centrais com uma potência total de 78 mW, totalizando apenas mais de 100 kW, longe do objectivo de 250 kW.

Em 2017, o governo deu luz verde a quatro novas centrais de biomassa florestal a serem instaladas nos municípios de Vila Velha de Rodão, Mangualde, Figueira da Foz e Famalicão, representando um investimento de cerca de 185 milhões de euros.

De acordo com o Secretário de Estado da Energia, os promotores dos projetos são a Sociedade Bioelétrica do Mondego, EDP Produção Bioelétrica, PA Biomassa, SA e SIAF - Sociedade Iniciativa e Capitalizações Florestais, Energia, SA, cujas instalações tem uma potência de 55 MW , 35 MW, 15 MW e 12 MW, respectivamente.

No que diz respeito aos concursos anteriores a 2011, os projetos aprovados garantiram uma remuneração e devem ser postos em operação até ao final de 2019, de acordo com a nota do Sanches Insurance Office. Com a atribuição destas quatro licenças de produção, o número de projetos e reforços de plantas de biomassa já licenciados durante a atual legislatura aumentou para oito, juntando-se aos anteriores em Famalicão, Fundão, Viseu e Porto de Mós.

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Em 2006, foram lançados procedimentos de concurso público para construir e operar centrais eléctricas para residuais de biomassa florestal, mas a iniciativa privada não implementou 50% de injeção de energia na rede, em concurso, que o governo quer agora alocar.

Ao nível da aceitação das pessoas, em Portugal devido essencialmente aos incêndios florestais, existe a percepção de que tudo é resolvido com o uso do material lenhoso resultante da limpeza de florestas e infestantes, ou seja, as podas agrícolas e as remoções das plantações poderiam seguir pelo mesmo caminho e o mesmo incentivo / apoio, levando a um investimento crescente no subsídio à produção de energia, mas também a projetos e / ou casos de piltotos desenvolvidos localmente pelas câmaras municipais. Existem artigos de opinião e notícias semanais que inundam a comunicação social com referências ao à limpeza das florestas como uma obrigação nacional para redução de incêndios (fonte: <http://observador.pt/opiniao/prevenir-os-incendios-e-a-designio-nacional/>)

O Secretário de Estado da Energia fez comunicados de imprensa com referências deste tipo: "Esta medida está em consonância com a estratégia de prevenção e minimização de incêndios do governo, com intervenção florestal, bem como promoção e diversificação da economia regional e exploração de recursos endógenos", diz uma fonte oficial do Secretário de Estado da Energia. (fonte: noticias Julho 2017 - jornal www.Público.pt)

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SWOT Analysis

	Factores positivos	Factores negativos	
Factores internos	Forças <i>O sector é dinâmico e inovador</i> S1. A agricultura é um forte setor produtivo a nível local, juntamente com a industria agroalimentar S2. Os agricultores têm uma forte atitude de seguir os bons exemplos. Exemplos positivos são considerados como um modelo A biomassa está amplamente disponível S3. Grande disponibilidade potencial de biomassa a escala regional e elevada densidade espacial da biomassa a nível local <i>Desenvolvimento sustentável</i> S4. Usar recursos disponíveis localmente é considerado uma prioridade <i>Contribuição para energias renováveis</i> S5. Nas áreas rurais, as necessidades energéticas podem ser satisfeitas pelas fontes de energia locais (como a biomassa do APPR) <i>Contribuição para o desenvolvimento económico</i> S6. Potenciais reduções de custos na gestão das podas nos campos	Fraquezas <i>Baixa rentabilidade económica</i> W1. As operações de colheita e transporte de APPR geralmente são consideradas muito dispendiosas <i>Limitações operacionais logísticas</i> W2. Estrutura e dimensão das explorações muito pequeno para permitir uma colheita e uso de podas lucrativos W3. A queima da poda em campo aberto ainda é considerada uma operação agronómica W4. Uma cadeia de abastecimento longa e subdividida não poderá ser economicamente eficiente para todos os actores <i>Mudança de mentalidades</i> W5. A produção de energia a partir das podas continua a ser considerada globalmente uma operação de risco <i>Equipamentos continuam desajustados</i> W6. Complexidade das cadeias de abastecimento de biomassa. Falta de operações logísticas bem organizadas.	Factores internos

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Factores externos	Oportunidades <i>Integração da biomassa nas novas políticas para as alterações climáticas</i> O1. Medidas de adaptação às alterações climáticas O2. Possível aplicação do “comércio das emissões de carbono” e taxas sobre o CO₂ <i>A vontade nacional de agir para o desenvolvimento sustentável e empreendedores interessados</i> O3. Disponibilidade local de empresas de serviços agro-mecânicos, bem como construtores de instalações de processamento (máquinas de colheita e chipping de APPR) O4. Valorização do uso de resíduos agrícolas para a produção de bioenergia <i>Desenvolvimentos favoráveis do mercado</i> O5. Um aumento prospectivo do preço de mercado dos combustíveis fósseis. Estabilidade a longo prazo do retorno económico do investimento em bioenergia <i>Possibilidade de apoio financeiro</i> O6. Modelos de financiamento favorecendo o setor APPR na agricultura <i>Um context local favorável</i> O7. Interesse dos municípios e administração local em promover investimentos comunitários em bioenergia (sistemas de aquecimento colectivos, por exemplo) O8. Segmentação dos incentivos às energias renováveis para favorecer o impacto social	Ameaças <i>Falta de mercado</i> T1. Falta de incentivos e subsídios orientados para o mercado <i>Falta de retorno do investimento</i> T2. Baixa valorização das podas <i>Competição pelo recurso</i> T3. A economia de grande dimensão está a influenciar o sector T4. Preço do petróleo e combustíveis fósseis continuam baixos impedindo a valorização da bioenergia. <i>Pouca integração das políticas nos planos nacionais</i> T6. Nenhuma política coerente, nenhuma visão estratégica sobre o setor APPR por parte da administração local. T7. Muitas alterações legais e grande instabilidade em decisões de política energética <i>Falta de conhecimento</i> T8. Pouca comunicação com a sociedade civil / opinião pública e falta de atividades promocionais	Factores externos
	Factores positivos	Factores negativos	

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Plano Estratégico

Para obter uma melhor estrutura interpretativa, os fatores SW internos podem formar um eixo vertical e o OT externo é um eixo horizontal. Ao combinar fatores internos e externos, as seguintes alternativas estratégicas podem ser obtidas:

Estratégias SO (Estratégias que empregam pontos fortes para beneficiar das oportunidades). Estas são as estratégias de max-max, no sentido em que combinam os elementos mais favoráveis à construção de uma estratégia. As estratégias de SO usam pontos fortes e elementos poderosos para se beneficie de oportunidades externas. A estratégia torna-se dinâmica e agressiva (ataque).

Estratégias WO (Estratégias que procuram minimizar o efeito das fraquezas aproveitando as oportunidades). São estratégias do tipo min-max, no sentido em que combinam deficiências internas com oportunidades externas. A estratégia tenta usar oportunidades para eliminar ou minimizar as fraquezas (reorientação).

Estratégias ST (Estratégias que empregam pontos fortes para prevenir ou minimizar ameaças). São estratégias do tipo max-min, no sentido em que usam os pontos fortes para evitar ou reduzir ameaças externas (defesa).

Estratégias WT (Estratégias que minimizam as fraquezas e procuram reduzir o impacto das ameaças). São estratégias de tipo min-min que procuram minimizar as fraquezas e evitar as ameaças externas (sobrevivência).

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① Integração dos interessados no plano nacional de desenvolvimento

Estratégia: Forças + Oportunidades → SO “Ataque”

S1. A agricultura é um forte setor produtivo local, juntamente com o processamento agroalimentar	O1. Medidas de adaptação às mudanças climáticas
S2. Os agricultores têm uma forte atitude de imitação. Exemplos positivos são considerados como um modelo	O2. Possível aplicação do "Comércio de emissões de carbono" e tributação de CO2

Objectivos

- SO1. Aproveitar a motivação dos actores no campo e o desenvolvimento de novas estratégias para construir uma estratégia operacional.
- SO2. Aproveitar a motivação dos actores no campo e o desenvolvimento de novas estratégias para construir em conjunto ferramentas que promovam o desenvolvimento de novos projectos.

Acções / Actividades

- Organizar reuniões regionais de informação e workshops sobre estratégias nacionais com os interessados locais dos setores do vinho e da fruta. Usar essas informações para entender melhor os desafios do sector e adicionar a biomassa APPR aos planos nacionais de energia e biomassa, tendo em consideração a informação recolhida.
- Integrar profissionais de vinho e frutas nas estratégias regionais de mobilização de biomassa.
- Identificar projectos locais inovadores e convidar os líderes de projectos para workshops nacionais para o desenvolvimento de estratégias de biomassa.
- Integrar bioeconomia e bioenergia nos planos de desenvolvimento do sector agrícola.
- Criar um plano de acção dedicado, com os profissionais do sector, para a abordagem ao desenvolvimento do sector de biomassa APPR

2 Construir em conjunto a estratégia local de desenvolvimento sustentável

Estratégia: Forças + Oportunidades → SO “Ataque”

S5. Nas áreas rurais, as necessidades energéticas podem ser satisfeitas pelas fontes de energia locais (como a biomassa do APPR)	O3. Disponibilidade local de empresas de serviços agro-mecânicos, bem como construtores de instalações de processamento (máquinas de colheita e chipping de APPR)
S6. Potenciais economias de custos na gestão das podas no campo	O4. Valorização e reutilização de resíduos agrícolas para produção de bioenergia

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Objectivos

SO3. Aproveite a oportunidade oferecida pela valorização da biomassa APPR para reduzir as emissões de GEE e o consumo de combustíveis fósseis. SO4. Explicar e demonstrar economia de custos, produção de energia a partir de biomassa agrícola

Ações / Actividades

- Reforçar o apoio final proposto para as cadeias logísticas piloto nos territórios
- Apoiar tecnicamente aos municípios interessados em desenvolver cadeias logísticas de biomassa APPR (estudos de viabilidade, apoio na construção de cadeias logísticas)
- Comunicar a possibilidade de desenvolver cadeias logísticas para os usos de biomassa do APPR e os subsídios associados, em particular para a instalações de caldeiras.
- Comunicar sobre as externalidades positivas dos projetos de biomassa APPR.
- Realizar estudos para quantificar externalidades positivas.
- Comunicar sobre os 3 pilares do desenvolvimento sustentável: economia, meio ambiente (energia sustentável, GEE), social (criação de emprego).

3 Promover externalidades positivas vs Competitividades dos combustíveis fósseis

Estratégia: Forças + Ameaças → ST “Defesa”

S1. A agricultura é um forte setor produtivo local, juntamente com o processamento agroalimentar
S2. Os agricultores têm uma forte atitude de imitação. Exemplos positivos são considerados como um modelo

T1. Falta de incentivos e subsídios orientados para o mercado
T2. Baixa valorização das podas
T8. Pouca comunicação com a sociedade civil / opinião pública e falta de atividades promocionais

Objectivos

ST1: Comunicar a possibilidade de desenvolver cadeias logísticas para a utilizações de biomassa APPR e os subsídios associados, em particular para as instalações de caldeiras.
ST2: Realizar estudos para quantificar externalidades positivas.
ST3: Desenvolver o sector destacando as externalidades positivas e face às questões económicas.

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Acções / Actividades

- Comunicar sobre as externalidades positivas dos projetos de biomassa APPR
- Comunicar os mecanismos de apoio financeiro existentes
- Propor estudos de viabilidade integrando diferentes cenários de aumento dos preços da energia e impostos sobre o carbon
- Visite unidades operacionais
- Estudar os diferentes mecanismos de incentivo para o desenvolvimento de projetos de biomassa APPR.

4 Combater a falta de integração da biomassa do APPR em políticas através do fortalecimento do conhecimento

Estratégia: Forças + Ameaças → ST “Defesa”

S4. Usar recursos disponíveis localmente é considerado uma prioridade
 S5. Nas áreas rurais, as necessidades energéticas podem ser satisfeitas pelas fontes de energia locais (como a biomassa do APPR)
 S6. Potenciais economias de custos na gestão das podas no campo

T6. Nenhuma política coerente, nenhuma visão estratégica sobre o setor APPR por parte da administração local.
 T7. Muitas alterações legais e grande instabilidade em decisões de política energética
 T8. Pouca comunicação com a sociedade civil / opinião pública e falta de atividades promocionais

Objectives

ST3: Aumentar a consciencialização sobre o potencial da biomassa APPR entre os decisores políticos para tornar este recurso mais integrado nos planos nacionais e regionais

ST2: Realizar estudos para quantificar as externalidades positivas.

Acções / Actividades

- Fortalecer o conhecimento existente sobre o potencial da indústria
- Desenvolver um relatório sobre o desenvolvimento potencial do setor, amplamente divulgado, particularmente entre os decisores políticos e potenciais líderes de projetos.
- Realizar uma campanha de comunicação nos jornais
- Organizar workshops, visitar ou enviar relatórios técnicos aos interessados locais
- Organizar uma campanha de promoção em biomassa de material lenhoso (misto)

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5 Apoiar o desenvolvimento da inovação, apoiando a optimização logística	
Estratégia: Fraquezas + Oportunidades → WO “reorientação”	
W1. As operações de colheita e transporte de APPR geralmente são consideradas muito dispendiosas W2. Estrutura e dimensão das explorações muito pequeno para permitir uma colheita e uso de podas lucrativos W3. A queima da poda em campo aberto ainda é considerada uma operação agronómica W4. Uma cadeia de abastecimento longa e subdividida não poderá ser economicamente eficiente para todos os actores	O6. Modelos de financiamento favorecendo o setor APPR na agricultura O7. Interesse dos municípios e administração local em promover investimentos comunitários em bioenergia (sistemas de aquecimento colectivos, por exemplo) O8. Segmentação dos incentivos às energias renováveis para favorecer o impacto social
Objectivos WO1: Promover a organização dos agricultores em organizações e cooperativas WO2: redução dos custos associados às cadeias de logística WO3: aumentar a eficiência das cadeias logísticas	
Acções / Actividades • Organizar demonstrações de equipamentos • Incentivar a administração pública a apoiar o desenvolvimento da iniciativa • Apresentar relatórios técnicos sobre organização logística do sector • Trabalhar para identificar insuficiências técnica em máquinas e equipamentos de processamento • Identificar os serviços existentes no campo que podem participar na optimização das cadeias logísticas e propor um relatório à administração e outros interessados • Participar da rede de interessadas locais (por exemplo, em workshops locais) • Fazer cálculos sobre casos reais, divulgando resultados e conclusões	

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6 Desenvolver uma estratégia política para promover a valorização da biomassa APPR no campo

Strategy: Fraquezas + Oportunidades → **WO “reorientação”**

W5. A produção de energia a partir das podas continua a ser considerada globalmente uma operação de risco

W6. Complexidade das cadeias de abastecimento de biomassa. Falta de operações logísticas bem organizadas.

O1. Medidas de adaptação às alterações climáticas

O2. Possível aplicação do “comércio das emissões de carbono” e taxas sobre o CO2

O3. Disponibilidade local de empresas de serviços agro-mecânicos, bem como construtores de instalações de processamento (máquinas de colheita e chipping de APPR)

O4. Valorização e reutilização de resíduos agrícolas para produção de bioenergia

Objectives

WO4: mudança de atitude dos actores locais para desenvolver novos projetos

WO5: tornar as biomassas agrícolas conhecidas como fontes utilizáveis para fins energéticos

Acções / Actividades

- Comunicar em eventos públicos
- Organizar campanhas promocionais no Youtube
- Organizar campanhas promocionais sobre a valorização da biomassa APPR para energia
- Produzir um relatório analisando o sector e suas oportunidades e divulgá-lo
- Listar equipamentos de combustão capazes de queimar biomassa APPR e divulgá-los

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7 Participar na rentabilidade dos projetos de biomassa APPR

Estratégia: Fraquezas + Ameaças → WT “sobrevivencia”

W1. As operações de colheita e transporte de APPR geralmente são consideradas muito dispendiosas
W2. Estrutura e dimensão das explorações muito pequeno para permitir uma colheita e uso de podas lucrativos
W3. A queima da poda em campo aberto ainda é considerada uma operação agronómica
W4. Uma cadeia de abastecimento longa e subdividida não poderá ser economicamente eficiente para todos os actores

T6. Nenhuma política coerente, nenhuma visão estratégica sobre o setor APPR por parte da administração local.
T7. Muitas alterações legais e grande instabilidade em decisões de política energética
T8. Pouca comunicação com a sociedade civil / opinião pública e falta de atividades promocionais

Objectivos

WT1: otimizar cadeias de valor

WT2: demonstrar o interesse das biomassas em comparação com outros combustíveis

WT3: contribuir para o desenvolvimento de casos de demonstração como modelos para o setor

Acções / Actividades

- Incentivar a administração pública a apoiar o desenvolvimento de iniciativas
- Propor documentos sobre os vários modelos de negócio aplicáveis, comunicar, apresentar as diferentes oportunidades de financiamento
- Organizar uma campanha de informação / integração com os diferentes sectores
- Organizar uma campanha de comunicação para os consumidores
- Trabalhar com fabricantes de equipamentos em lacunas existentes

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8 Make the APPR biomass known Strategy: Weakness + Threat → WT “sobrevivencia”	
W5. A produção de energia a partir das podas continua a ser considerada globalmente uma operação de risco W6. Complexidade das cadeias de abastecimento de biomassa. Falta de operações logisticas bem organizadas.	T1. Falta de incentivos e subsídios orientados para o mercado T2. Baixa valorização das podas T8. Pouca comunicação com a sociedade civil / opinião pública e falta de atividades promocionais
Objectives WT4: comunicar mais sobre as oportunidades do sector e divulgar o potencial do recurso APPR	
Acções/ Actividades • Organizar demonstrações de equipamentos • Realizar campanhas promocionais no Youtube • Comunicar durante os eventos públicos • Criar uma campanha de consciencialização: comunicação jornalística, artigos • Apresentações de Relatórios Técnicos • Apoiar o desenvolvimento do mercado	