Sector Analysis and Action Plan for the Demo Regions

English summary + Regional analysis

Deliverable 2.1
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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ABBREVIATIONS

AP: *'uP_running'* agrarian partner (agrarian association or cluster)

APPR: Agricultural pruning and plantation removal

ESCO: Energy service company

LCE: (Competitive) Low-Carbon Energy. Within "Horizon 2020" the pillar: "Societal Challenges" also includes "Secure, Clean and Efficient Energy". LCE is a specific call of the latter programme.

SO: Strategy deployed in the "Action plan" consisting in employing strengths in order to profit by opportunities ("*attack strategy*").

ST: Strategy deployed in the "Action plan" consisting in employing strengths in order to avoid or reduce external threats ("*defence strategy*").

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)

WO: Strategy deployed in the "Action plan" seeking to alleviate the effect of weaknesses by taking advantage of opportunities ("*reorientation strategy*").

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 ("*serviving strategy*").

EXECUTIVE SUMMARY

Purpose of the work. "*uP_running*" is an EU H2020 project currently in progress (2016-2019). The project goal is to set out the path in developing bioenergy value chains based on fruit, vines and olive tree residues obtained when performing agricultural pruning and plantation removal (APPR) operations.

Despite significant technological progresses greatly improved the feasibility of this kind of business, still a discouraging immobility is observed and, apart few virtuous exceptions, a "wait-and-see" behaviour is generally detected.

A "*stakeholders' network*" (created in each project "*Demo Region*") is the participating approach considered the most fruitful to overcome barriers, seize the opportunities, and promote the building up of a productive sector able to valorise residual feedstock such as pruning/uprooting.

Results about the first year of the project WP2 ("Supporting local supply bioenergy chain") are reported, focusing on activities aimed at sustaining the local bioenergy value chains through a "*Sector Analysis*" and a consequent "*Action Plan*" performed at regional scale.

Approach applied and analysis carried out. The general status of the sector, its composition and key actors, the structure of possible value chains and the different kind of business models potentially observed were detected through the "*Sector analysis*". Identifying the main sector *constraints and barriers* (negative factors) as well as the sector *driving forces* (positive factors) was the starting phase of the process. Moreover, further discriminating between "internal" and "external" factors smoothed the way to an easy application al the SWOT analysis (Strengths - Weaknesses – Options – Threats). Internal factors are under control of the sector actors and participants, while external factors should be assigned to general socio-economic conditions.

The "*Action plan*" was prepared by applying a paired combination of an "internal" together with an "external" SWOT factor. In this way, *strategies* of sector development were defined and a peculiar set of *targets* was also identified, specifically tailored with respect to the sector's main characteristics in each region.

Each team operating in the *Demo region* of reference prepared its own *Sector analysis* and *Action plan*, according to guidelines and templates prepared by the WP leading partner (UFG). Role and function played by UFG were not simply to summarize each contribution in a single document, but to make a creative merging. Collating, comparing and matching each contribution through the construction of a new framework, the application of a set of interpretive tools and explanatory techniques, was the crucial role UFG has accomplished.

The methodology previously described has been carried out in four Countries, with respect to the so-called '*Demo Regions*': Aragón (in Spain), Apulia (in Italy); Macedonia, Thrace and Peloponnese (in Greece) and Vinnytsa (in Ukraine), respectively.

In each of the considered country, a team formed by an AP (Agrarian partner) and a TP (Technical partner) have followed the methodology to interact with relevant stakeholders of the APPR sector, thus performing the sector analysis and, later, working out the action plan, based on the feedback obtained.

Main features observed. A quite large set of non-technical barriers are constraining the building up of new and efficient bioenergy value chains based on pruning/uprooting feedstock. These constrains pertain to a wide range of factors. Both policy and institutional factors have a relevance: the lack of a clear agenda at EU, national and regional level able to sustain the biomass-to-energy developing process, as well as the regulation framework, too often showing little consistency and acute contradictions in authorizing these activities. These could be considered "exogenous" factors to the sector development, but "endogenous" factors are, probably, even more influential and represent a pre-requisite to allow the structuring of local value chains. Those latter are the main concerns that should be dealt with to raise the necessary awareness about the business opportunities, the useful mind-openness in establishing collaborations among the key actors along the value chains, and the convenient local connections in starting up the investment activities.

The relevance of networking. Fostering stakeholders' engagement and commitment through the establishment of a "*network*" that meets the participants' requests by a large majority of actors operating along the value chain was the main objective of the project WP2. Single farmers, farmer cooperatives or agricultural productive organizations, agricultural service companies, feedstock suppliers, machinery producers and/or dealers, techno-logistic service companies, energy service companies, final users of bioenergy carriers, heat or power are the wide categories of stakeholders that joined the "network".

Workshops (in the form of "forum") and meetings (in the form of "focus group") took place to aggregate the multifaceted players of the regional potential value chains. Conditions of horizontal and vertical co-operation among key actors for the development of new and effective supply chains and for opening up local markets/services can be properly tested through a "Sector Analysis" and a consequent "Action Plan" conducted at regional level. These instruments are considered of crucial importance in order to promote the APPR sector development. The next step (to be performed in the second year of project activities) is to apply a similar approach at national and EU scale.

Consultation and participation tools. A preparatory phase was centered on creating awareness among regional stakeholders, developing a vision for the region, and gaining commitment from relevant stakeholders to put their specific regional vision into action. The essential tool selected in these phases were the "*focus group*". This was a relevant step in preparing the "*Sector analysis*".

Beyond the preparatory phase, the following phase was dedicated to carry on the regional strategy through the stakeholders' active contribution and to develop the regional "*Action Plan"*. The tool used in this phase was, preferably, the "Forum". Differently from a "focus group", a "forum" is a public meeting that provides an opportunity to consult large numbers of people (mainly stakeholders together with policy makers, institutional representatives, opinion leaders, etc.).

Results obtained. The approach outlined was successful, allowing the following results:

- Establishing a dialogue among key actors. Facilitating the exchange of expertise and good practices among stakeholders. Collecting and disseminate information, including innovative technologies to be applied.
- Enabling the inclusion of all stakeholders into a "knowledge exchange process"; encouraging participation in the network; generating a mutual collaborative milieu in view of further initiatives and sector investments.

- Preparing a "*Sector Analysis*" (with a SWOT as a preliminary step) to detect status, internal and external conditions, barriers and options for the APPR sector at regional scale and possible "business models" as "trajectories" of sector development.
- Through a participative process, an "*Action Plan*" was the consequent document identifying a set of activities to be deployed in the region.

Considering the results achieved, a similar strategy will be applied in the continuation of the project, first at national and then at EU level.

What else? One of the specific task of the "*uP_running*" project is to favour awareness, connections and mutual collaborations, firstly at regional level, in order to promote an aggregation process ("***seeding***"), stimulate new production chains ("***fertilizing***"), and supporting these initiatives in their starting period ("***tutoring***") through demonstration, training and consultancy. *Seeding*→ *Fertilizing* → and *Tutoring* are exactly the activities that '*uP_running*" is implementing in the course of the project programme.

The approach followed is similar to the strategy designed in the EU CAP (1305/2013 Regulation) to support Rural Development, with specific reference to Art. 35 (Co-operation); Art. 53 (European Innovation Partnership) and Art. 56 (Operational Groups).

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1 INTRODUCTION

1.1 About this document: background, structure and contents

'*uP_running*' is a H2020 project, performed under the call LCE-14-2015 (Competitive) Low-Carbon Energy. The present document is a formal and public deliverable (D2.1) of the project itself, the first outcome of Work Package 2 (WP2) "*Supporting local bioenergy supply chains*".

The *'uP_running'* project is specifically focused on one particular kind of biomass as energy feedstock, that is to say the 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. Hereafter, this particular kind of biomass will be named with the acronym 'APPR' that stands for 'agrarian pruning and plantation removal'.

The specific objective of this deliverable is reporting about the *Sector analysis* and the *Action plan* resulting from the activities developed in four European Countries, namely: Spain, Italy, Greece and Ukraine. According to the *'uP_running'* jargon, these are called *Demo Countries* [1].

The first two tasks of WP2 [2] are related to the local and regional dimension of the APPR sector. Explore, inquiring and analysing this local/regional dimension was the core action of the first year of project activities (from M1 to M12) with respect to WP2. Consequently, it is also the focus issue of this document. At this level of the analysis, Demo-Countries are exactly coincident with Demo-Regions: each country team, indeed, have identified a specific regional district as a target of reference. To better understand how the project activities were organized, it should be considered that each project country team is made of two partnering organizations, so that they are working in "tandem": the agrarian and the technical partners, respectively. An *Agrarian Partner* (AP) mostly represents the agrarian sector and the agricultural organizations that are involved and committed in the sector itself, with specific interests on bioenergy and the APPR kind of feedstock. Differently, a *Technical Partner* (TP) is represented by a research or technology centre whose technicians have consolidated a wide and comprehensive expertise on the needs and obstacles of biomass value chains. They know very well the best conditions to promote the value chain feasibility, and they are able of interacting among multiple actors participating in the value chain from different sectors.

Each Demo Country team prepared its own *Sector analysis* and *Action plan*, according to guidelines and templates prepared by the WP leading partner (UFG). Role and function played by UFG were not simply to summarize each contribution in a single document (it would have been quite easy), but to make a creative merging. Collating, comparing and matching each contribution through the

[1] The wording 'Demo Countries' derives from the fact that in the course of the 'uP_running' activities several new APPR biomass value chains will be tested and demonstrated in collaboration with local stakeholders. These specific actions are included in the Work Package 3.
[2] Task 2.1: "Promoting stakeholders' commitment and consolidate a common vision"; Task 2.2: "Performing a bioenergy sector analysis and an action plan for the Demo Regions".

construction of a new framework, the application of a set of interpretive tools and explanatory techniques, was the crucial role UFG has accomplished.

Methodologically speaking, some of these tools can be considered conventional and frequently applied (such as the SWOT analysis as well as, to a lesser extent, also its "strategic" application); conversely, others can be deemed original and innovative. For instance, some proposed graphical representations could be considered very useful in contributing to the analyses and interpretation of the APPR sector. Similarly, the methods applied to "coagulate" a wide range of positive and negative features about the APPT sector, thus obtaining a clear and operative set of strategic lines, came out to be useful and effective.

As said already, we first started from the local dimension of the problem (*Task 2.1* and *Task 2.2*), analysing the specific conditions experienced in selected regional areas in Europe. Later on, a closer connection to the political dimension at a broader scale will be considered, both at national (*Task 2.3*), and European level (*Task 2.4*). Therefore, in the following phases of the project a scaling-up will expand the analysis, first at national and then at European level. In this way, an overall picture will be offered and a clear vision will inform the developing of effective and incisive policy tools and measures. This latter will be the content of the second project deliverable within WP2, to be issued at the end of the second project year.

After a general introduction to the project and its main issues (*Section 1*), the methodology applied in performing the analyses is reported (*Section 2*), both considering the "Sector analysis" and the consequent "Action plan" carried out on the APPR sector.

The general status of the sector, its composition and key actors, the structure of possible value chains and the different kind of business models potentially observed are topics making up the following section (*Section 3*) totally dedicated to the "Sector analysis". Identifying the main sector constraints and barriers (negative factors) as well as the sector driving forces (positive factors) was the starting phase of the process. Further, discriminating also between "internal" and "external" factors (i.e. factors from inside the APPR sector, totally under control of the sector participants or, conversely, factors outside the APPR sector, to be assigned to general socio-economic conditions) is the tool that have smoothed the way to an easy application al the SWOT analysis (Strengths - Weaknesses – Options – Threats).

The next part of the document is devoted to the "Action Plan" of the APPR sector (*Section 4*). The "Action plan" was prepared by applying an approach based on a paired combination of an "internal" together with an "external" SWOT factor. A peculiar set of strategies, specifically tailored with respect to the sector's main characteristics, is the outcome of this procedure.

Sections 5, 6 and 7 correspond to conclusions, bibliography and acknowledgements, respectively. Finally, *annexes* include the results of the sector analysis and action plans developed in the four Demo Regions. For each region, the attached document was written in the corresponding national language.

1.2 uP_running project and APPR sector

"*Market uptake of existing and emerging sustainable bioenergy*" is the issue of the call identified with the acronym LCE (Competitive) "Low-Carbon Energy", part of the Horizon 2020 '*Secure, Clean and Efficient Energy*' challenge.

This considered, the *'uP_running'* project foresees and includes those strong actions still 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 (EU, 2013).

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. Therefore, farmers should be encouraged to produce non-food bioenergy carriers, alongside food, feed, fibre and many other products. Of course, sustainability criteria should be rigorously applied to avoid unconstrained exploitation of ecological resources and to gain real environmental advantages, while positive social influences being encouraging in terms of rural development, industrial growth, job creation.

Having stressed the relevance of the bioenergy sector from the *supply side*, several issues also lie ahead on the *demand side*. Reinforcing the market of bioenergy carriers, as well as promoting the final use of energy from biomass, are effective targets on condition that reliable and affordable energy conversion technologies are available, being strongly competitive with other technological solutions. Increase the awareness of the final bioenergy consumers (households or companies; private or public organizations; single or collective entities) about the advantage of renewable energy as compared to fossils is another relevant challenge.

Finally, the sector operates at the intersections of several other economic and productive activities and it is largely affected by policy, regulations and social pressure (the so called "external" conditions). Well-tailored subsidies and supporting schemes, for example, may contribute to an efficient use of bioenergy and promote a balanced sector development. Conversely, adverse decisions or erroneous policies might compromise its growth. Targeting the main stakeholders and boosting collaboration among key actors in the bioenergy sector, together with social and political representatives playing a role in driving decisions, is very important and should be achieved at every different scales, from local to national and European level.

Ensuring sustained public acceptance on bioenergy is another very critical task, together with disseminating best practises and sharing the acquired expertise.

Both technical and non-technical barriers to the production and use of bioenergy are constraining the sector and should be overcome. The *'uP_running'* project, for its part, is specifically addressing non-technical barriers, while technical issues were the specific targets of previous European projects. If necessary, the direct involvement of experts from allied companies, professionals or researchers will be decisive in supporting technical issues within this project activities.

1.3 The EU energy framework

The EU energy policy is currently addressing significant reductions in greenhouse gas emissions by increasing the share of renewables compared to fossils and addressing improvements in energy use efficiency. In particular, great efforts have been assigned in promoting renewable domestic energy market and ensuring, as far as possible, internal reliable energy supply (EU, 2011). Within this general frame, the use of biomass, preferably from inside the EU, could offer a significant contribution in providing a clean and trustful energy source.

Biomass has the capability to contribute strongly to meeting the European Union's renewable targets for both heat and electricity within 2020 and beyond. What is relevant from the analyses is that a significant majority of the required biomass can be obtained inside the EU. In order to get this potential, the primary EU supply of solid biomass should increase substantially.

From the first stage of biomass supply to the final energy use, that is to say all along the value chain, the system should be sustainable, effective in reducing GHG emissions, economically viable, not competing with food and feed availability, while protecting natural resources and safeguarding human health (EU, 2013). In this regard, three core dimensions, entailing complex interwoven links, constitute the so-called energy 'trilemma': affordability, security, and environmental friendliness, respectively.

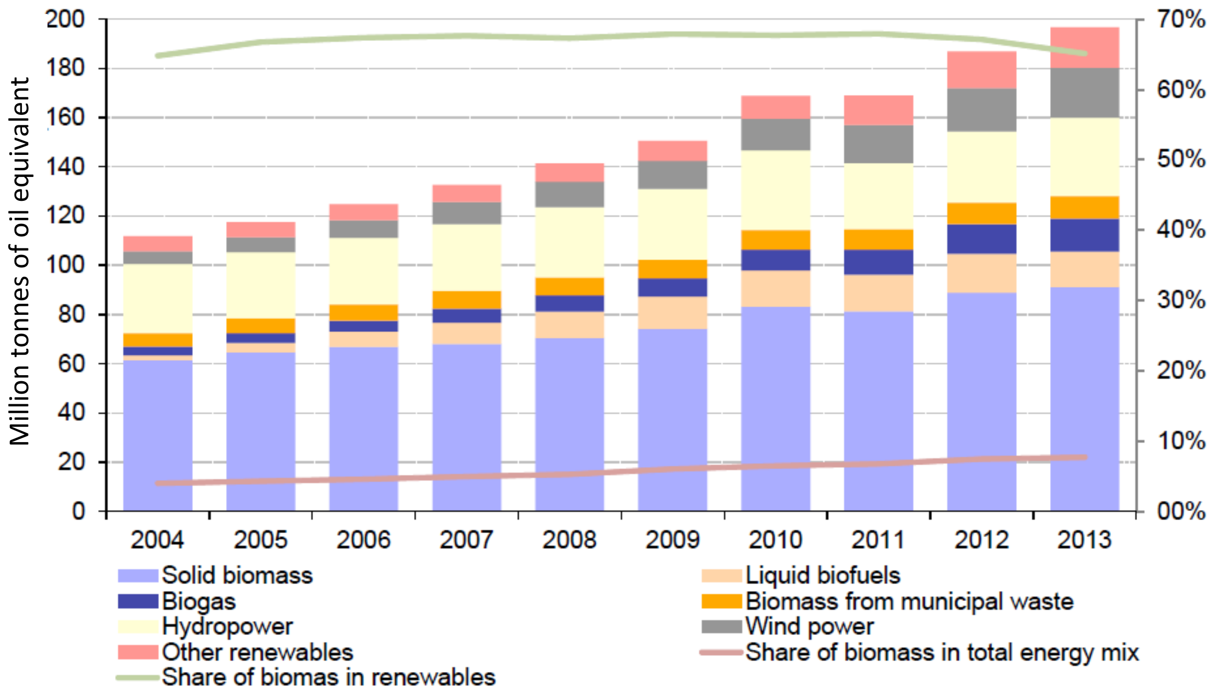


Figure 1: Renewable energy sources in million tonnes of oil equivalent (left hand size axis) and percentage share of biomass (right hand size axis) from 2004 to 2013) in Europe (EU28). Graph excerpted from EPRS, 2015.

Affordability means enough and cheap energy sources; *security* means stable energy availability, avoiding any kind of price volatility, but also *social equity* in the access to energy; being *environmental friendly* means displace fossil fuels and mitigate global climate change. These are the greater challenges facing the EU energy sector in the following decades.

The energy sector should be launched resolutely in a 'decarbonizing' track, increasing momentum towards the transition to a 'low carbon energy' (as an essential part of a more general 'low carbon economy' or 'bioeconomy', as also it is said). Technological developments together with dynamic policies on renewable energy are key factors. Governments (from global institutions to national and local authorities) have an important role in building up the right conditions to speed up the transition, while bottom-up consensus should urge these changes.

The final energy consumption from biomass in the EU28 has grown from 72 million tonnes of oil equivalent (Mtoe) in 2004 to 128 Mtoe in 2013 (*Figure 1*). Although the total share of biomass among renewable energy sources has remained stable (approximately at 65%) over the past decade, the share of biomass in the overall energy mix has grown from 4% in 2004 to 7.7% in 2013.

At present, 46% of renewable energy in the EU comes from solid biomass, almost exclusively wood (EPRS, 2015).

According to the European observatory on renewable energy (EPRS, 2015), in 2013, solid biomass accounted for 3% (7 Mtoe) of the electricity produced in the EU and 15% (8.8 Mtoe) of the heat produced in industrial units. A further 63.5 Mtoe of heat from biomass was produced by domestic users. The per capita use of biomass for heating and electricity in EU Member States in northern Europe is significantly higher than the EU average. In 2013, the European solid biomass and biogas sectors generated turnover of close to € 42 billion and employed 380,200 people, including many in rural areas (EPRS, 2015).

These statistics confirm the importance of the sector at EU level, its steady growth, the excellent potential that can be achieved if the right programme were applied at regional, national and European scale.

1.4 The 'uP_running' framework

The starting step of the '*uP_running*' project is that, despite considerable amounts of biomass in the form of tree crop residues from 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 hardly encouraged to start new businesses and setting up innovative biomass to energy activities. Starting to use APPR biomass involves a change in the management of an agricultural residue, and thus, should involve a change of agronomic practices, which is one of the reasons for immobility.

Before putting in place a set of actions aimed at reinforcing the APPR sector, we strongly believe that a sound and clear understanding of the conditions currently prevailing in the sector is warmly advisable. Once these conditions have been sufficiently explained, we will have strong arguments to identify specific tools aimed at increasing the awareness on the sector potential development, boosting its capacity to impact significantly in the local areas, supporting the creation of new supply chains, new businesses, new jobs, and promoting well-targeted dissemination activities.

The immediate objective, however, should be 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, we have to identify barriers having the greatest impact, and the highest obstacles hindering the sector development. Intuitively, this should be the first analysis to be performed.

On the other hand, 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 local and regional circumstances.

Of course, this represents a preliminary activity within the project work program, to be accomplished at the very beginning. The main purpose of the project's second 'work package' (*WP2*) is to perform a detailed analysis of the operating conditions currently governing the bioenergy sector based on the APPR kind of feedstock. The work teams involved in each *Demo Region* (in Spain, Greece, Italy and Ukraine, respectively) are responsible to conduct this assessment and to work out a consequent Action Plan. The deployment of a well-structured methodology made it possible to take due account of the contribution of the most influential stakeholders.

1.5 The two goals addressed by this document

Before elaborating a strategic plan for the APPR sector, the current state of art and the actual conditions of the sector should be clearly identified. To put it differently, the better we understand the sector conditions, the better we can detect effective targets and the way to proceed.

The final objective, as reported already, is to speed up the APPR sector development and promote the creation of new value chains, thus contributing to the valorisation of the APPR biomass.

For this purpose, two reporting instruments have been applied, with the intention to sharpen the project's ability to be as effective as possible.

- *Sector Analysis*.

Sector Analysis is a review and assessment of the current condition of the productive sector, useful to inform future prospects. Sector Analysis serves to provide an actor of the sector itself, a policy maker, or an investor, with a clear idea of how the sector is expected to perform as a whole or in specific productive compartments (branches of the value chain). It is also a market assessment tool designed to provide a business with an idea of the complexity of a particular productive process. Analysis involves reviewing the technical, economic, market, and political factors that influence the way the sector is developing. Apart from supply conditions and logistics, major factors can include the influence exerted by buyers, potential entry of new consumers, the condition applied of competitors, and the likelihood of new market development.

This analysis should stress both technical and non-technical barriers, especially considering that non-technical elements, including awareness, risk perception and interest on innovation, regulations and market instruments, funding, subsidies and incentives, communication capacity, social acceptance, are extremely influential in order to generate a successful and sustainable bioenergy sector and are quite frequently disregarded.

- *Action Plan*.

An Action Plan is the outline of a strategy, suggesting measures and interventions needed to reach specific goals. A sequence of steps that should be taken, or activities that should be performed, to successfully achieve those goals. An Action Plan has some major elements, very essentially: it should be clearly defined, ready for implementations, and it should answer to the following questions (FAO-ENEP, 2010):

- *what* are the goals to be reached (state the objectives);
- *who* is going to be committed in the process (recognize by whom the selected tasks should be achieved);
- *how* to get the results (identify the tools to be implemented);
- *when* these goals will be likely obtained (specify the time horizon of the plan);
- *where* the sector will be positioned in the next future (agree a roadmap targeting the new sector conditions and consider possible adjustments).

Usually, of relevant interest is also to decide on the resources to be allocated to the process by setting the funds available for each specific activity. This is not our purpose in this case.

The unremitting dialogue with all the operators of the supply chains allowed to clearly capturing current conditions (barriers and constraints as well as opportunities and chances) in the frame of possible future perspectives. Real targets should be identified and effective tools and instruments deployed, according to a roadmap properly agreed with the most representative stakeholders.

2 METHODOLOGICAL APPROACH

A sound and solid methodological approach was arranged at the project start. In particular, this approach provided the basic understanding for the successful engagement of stakeholders. Stakeholders' opinions and orientations were the source of the "sector analysis" and were useful to determine the kind of interests that should be taken into account in developing and implementing the sector "Action Plan". Little further, in progressing the project, a sector policy analysis will come and a strategic plan at national and EU level will be performed. In those cases, different kind of stakeholders will be involved. In this first part of the project activities stakeholders are directly participating in the sector at regional level and should be considered key actors of the sector itself. Promoting stakeholders' commitment and consolidate a common vision is one of the first objectives of *'uP_running'*. This goal can be achieved by giving priority to forming a structured and consolidated "stakeholder network" in each Demo Region. Strengthen trust and collaborative relationships among key actors in the sector was considered a proper and useful strategy. Based on this approach, performing the Sector Analysis was accomplished thanks to the large stakeholder participation. Finally, interesting perspectives in considering the Action Plan were also developed and further processed inside the stakeholder network and through internal discussions.

In order to address effectively both technical and non-technical issues in the course of the project activities, the project consortium brought together multidisciplinary and complementary working teams. Specifically, in each Demo Region one technical partner (TP) in coordination with one agrarian partner (AP) have formed the team "nugget" (i.e. its first aggregation). While TPs are best suited to deal with technical issues, the AP role is important in contacting and engaging key actors of the value chains and possible beneficiaries of the project initiatives, as well as in disseminating the project results.

2.1 Developing a "Sector Analysis" through the stakeholder network

A process of progressive insight into the APPR sector was applied at regional level. A phone call or a letter by e-mail marked the networking start-up. In this way, the interest of potential stakeholders to join the "*uP_running*" regional network was tested and the participation in the project initiatives properly solicited. Therefore, initially, the most influential stakeholders were reached directly by phone or e-mail. Later, they were personally involved through the participation in a workshop (in the form of a "focus group"). Further interviews and questionnaires through bilateral meetings were applied to deepen the understanding of the role each stakeholder was playing within the sector. All these tools were important to approach the key actors and obtain a personal view and opinion about the APPR sector. The main initial activities were the following:

- *Stakeholders' identification*: to contact and engage relevant actors including farmers, farmer cooperatives, agro-industrials, businessmen and entrepreneurs, local/regional public authorities, advisers, innovation support services, etc., whose actions are related to the collection, management and utilization of APPR.

- *Stakeholders' selection and involvement*: creating and maintaining the "stakeholder network" through collective and bilateral meetings and consultations.
- *Stakeholder analysis*: to recognize and address technical, economic, regulatory and social barriers and opportunities in the setting-up of new APPR biomass value chains.

During the first project months (in the period *M1-M4*), three consecutive workshops (preferably in the form of a "focus group") took place in different regional areas (*Figure 2*). Optionally, a workshop in the form of a "forum" was organized (before the three consecutive "focus groups" took place) to launch the '*uP_running*' project and activate a communication campaign to the large public. One returning workshop (preferably in the form of a "forum") was held in each Demo Region (in the period *M9-M12*), this time specifically with the aim of discussing the outcomes of the "Sector Analysis" and exchange opinions about the "Action Plan", trying to find the larger agreement and stakeholders' commitment on the identified strategic tools (*Figure 2*).

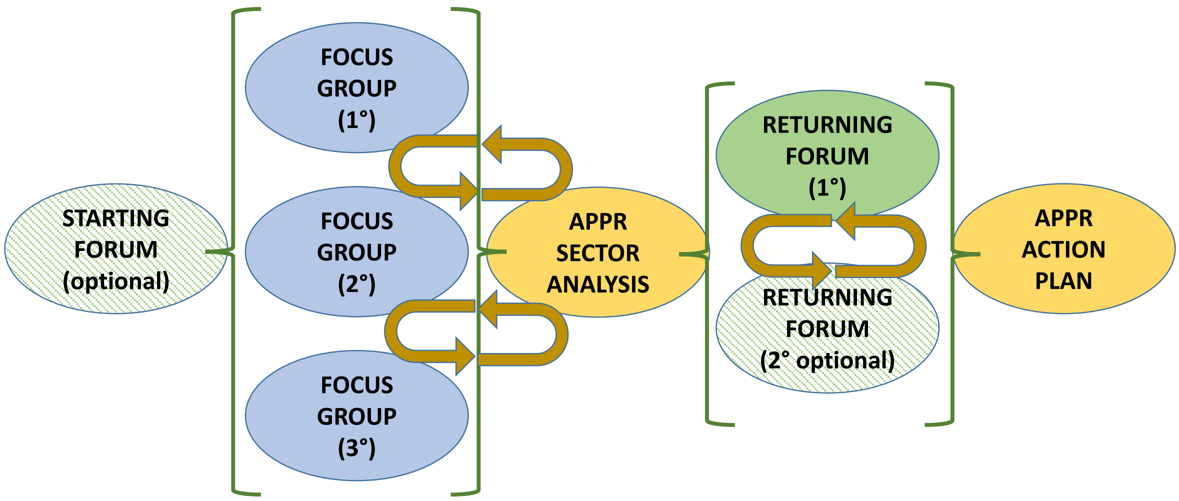


Figure 2: Workshops (forums or alternatively focus groups) took place in each Demo Region during the first project year to promote stakeholders' commitment, perform the Sector Analysis, and consolidate a common vision about the APPR sector and its strategic development.

The workshops were very useful in setting up the stakeholder network and starting cooperation among the principal actors of the APPR value chains. Stakeholders' commitment was accomplished through the workshops, but also through meetings that registered the participation of farmers, agricultural cooperatives and associations, logistic service companies, machinery producers, biomass suppliers, regional administrators, policy makers and planners, etc. A good (sometimes large) participation was observed in the workshops and a good level of willingness and openness was showed by participants in sharing knowledge and information on pruning potential as energy carriers, its actual utilization and possible exploitation scenarios.

As said before, two different approaches in the workshop participation were applied: a) the focus group and b) the forum, respectively.

- *Focus group*. Groups of ten to twelve target stakeholders, brought together to discuss a specific set of issues under the guidance of a *facilitator* properly trained to stimulate and guide the discussion. The purpose of the group is to produce qualitative data to provide insights into the attitudes, perceptions, and opinions of participants. Differently, focus groups are not intended to develop consensus, to arrive at an agreeable plan, or to make a decision about which course of action to take. Focus group is a tool to express opinions about stakeholders' problems and needs.

- *Forum*. The forum is a public meeting that provides an opportunity to consult large numbers of people (mainly stakeholders but also simply observers or interested people). Public forums tend to be both larger in number of participants and broader in scope than focus group. They give people of diverse backgrounds a chance to express their views. Forums (or *fora*) were designed to exchange information about the APPR sector, to discuss the strengths, weaknesses, opportunities and threats of the sector itself, to obtain ideas and innovative thinking to make a way forward in the sector development, or they can be geared towards specific prioritization and the working out of an Action Plan.

Apart from workshops (either focus group or forum), also *interviews*, *questionnaires*, *bilateral meetings*, and social networking were used to approach stakeholders and to perform the assessment of the APPR bioenergy sector at regional level. Interviews followed by an in-depth data analysis, offered information about farmers' behaviour, logistics organizations, market gaps, but also suggested relevant success cases at regional scale. The feasibility and the market opportunities related to the biomass sector were also examined, based on the results of previous analysis and deliverables (such as the Euro-Pruning project), in order to get additional ideas and suggestions.

Analysis were carried out considering both economic and social factors, market investigation from the supply and demand side, options to improve the availability and use of biomass, conditions to generate cost-effective and sustainable biomass-based APPR supply chains, etc. Other essential information to complete the assessment were, for example, the degree of actors' awareness and readiness, their positive or negative interactions within the sector, the existence of other possible competing players among actors or competing uses of feedstock, together with key elements for success, or benchmark cases.

A close and open dialogue among participants to the stakeholder network showed to be essential in detecting a proper set of "business models" and identifying opportunities for SMEs (farmers but not only farmers) in the Demo Regions.

In consulting *Table 1*, it is worth to mention that a complete supporting material together with templates in facilitating the conduction of the workshops and the consequent reporting was prepared by UFG, the WP2 leading unit. *"Guidelines to establish a stakeholder network"* and properly conduct the workshops were prepared at the very beginning of the project activities (delivery date 22.04.2016). Moreover, a set of "*Workshop Templates*" were made available (delivery date 11.05.2016) to enhance the capacity to capture the main features of the APPR sector in each respective regions and to start proper relationships with stakeholders and leading actors. "*Guidelines for interviews*" were prepared (delivery date 04.08.2016) in order to facilitate the administration of questionnaires, interviews and bilateral meetings and properly contact key actors in the APPR sector in each Demo Region. Interviews with stakeholders were very relevant to clarify the content of the Sector Analysis and the consequent Action Plan. Another reason of relevance about interviews is related to the strong connection of this activity to Task 3.1 ("Beneficiary selection"). The guide of this last preparatory activity was the "*Template on Sector Analysis and Action Plan*" (delivery date 27.11.2016).

Table 1: Supporting materials, guidelines and templates of WP2 in the first project year

Task	Action	Objectives & Comments	Reference document	Date of issue
2.1	Setting up the stakeholder network in each Demo Region	Foster cooperation among the actors composing the potential value chains based on APPR biomass	Guidelines to establish a stakeholder network	22.04.2016
2.1	Conduct the workshops in each Demo Region and prepare the consequent documentation about the outcomes	Check farmers' readiness, willingness to sell the available residual biomass, assess the technological equipment along the supply chains, the forms of organization and logistics, the market targets and the demand level. Check the external conditions surrounding the sector	Workshop Templates	11.05.2016
2.2	Perform interviews, bilateral meetings and questionnaire	Information about farmers' behaviour, logistic organization, market gaps, relevant success cases, examining feasibility plans, possible business models, key actors, potential prime movers,	Guidelines for interview (contributing to the Sector Analysis and Action Plan)	04.08.2016
2.2	Sector Analysis and Action Plan by each Demo Region	Collecting stakeholders' opinions about technical and non-technical constraints and opportunities. Identify short-, medium- and long-term interventions to promote the take-off of bioenergy value chains based on APPR feedstocks.	Template on Sector Analysis and Action Plan	27.11.2016
2.2	DeliverableD2.1	English summary + regional analysis (in each DC language)		31.03.2017

The present document represents the final deliverable that reports the outcomes of all the WP2 activities performed until now (first year) of the '*uP_running*' project. Specifically, the deliverable is aimed at reporting a summary of the Sector Analysis and the Action Plan worked out in every Demo Region.

2.2 Developing a "Strategic Plan" through SWOT analysis

The team in each Demo Region (TP and AP together) prepared the "Action Plan" starting from the outcomes of the previous "Sector Analysis" and by collecting all the stakeholders' opinions and perceptions (*Figure 2*). By detecting the main constraints and opportunities, the aim was to identify, discuss and agree about some specific technical and non-technical measures to be applied to favour the APPR sector take-off, including regulations, market instruments, funding and incentives, communication actions, and all other factors considered useful to boost a successful and sustainable bioenergy sector.

Preliminary to the "Action Plan", each Demo Region team carried out a SWOT analysis, in order to schematize the outcomes of the "Sector Analysis" in a very coherent and understandable framework. SWOT analysis is a process that identifies an organization's strengths, weaknesses, opportunities and threats. Specifically, SWOT is a basic, analytical framework that assesses what the sector key actors can and cannot do, for factors both internal (the strengths and weaknesses) as well as external (the potential opportunities and threats) to the sector itself. Evaluating the "position" of the sector, a SWOT analysis determines what assists the sector in accomplishing its objectives, and what obstacles must be overcome or minimized to achieve the desired results. In other words, where the sector is today, and where it may be positioned in the future.

Listing the main APPR sector characters (as identified and discussed in the "Sector Analysis"), they were initially grouped into two different categories. The "*barriers*" (or "constraints"), and the "*driving forces*". The former are recognized as negative factors affecting the APPR sector, while the latter are considered positively influencing the sector growth and development. According to the conventional SWOT structure, it was straightforward 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 (*Figure 3*).

The common understanding of the four SWOT factors are reported below (Claessens, 2016).

- ***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;
- ***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.

Just investigating on strengths, weaknesses, opportunities and threats, independently from each other, does not help too much. It is only half of the SWOT analysis. Only when internal factors are combined with external factors, the SWOT analysis can be used in its full advantage. The SWOT analysis, indeed, is often used as part of a strategic planning process. Therefore, SWOT analysis was particularly effective in identifying the proper strategy to be applied in constructing the "Action Plan".

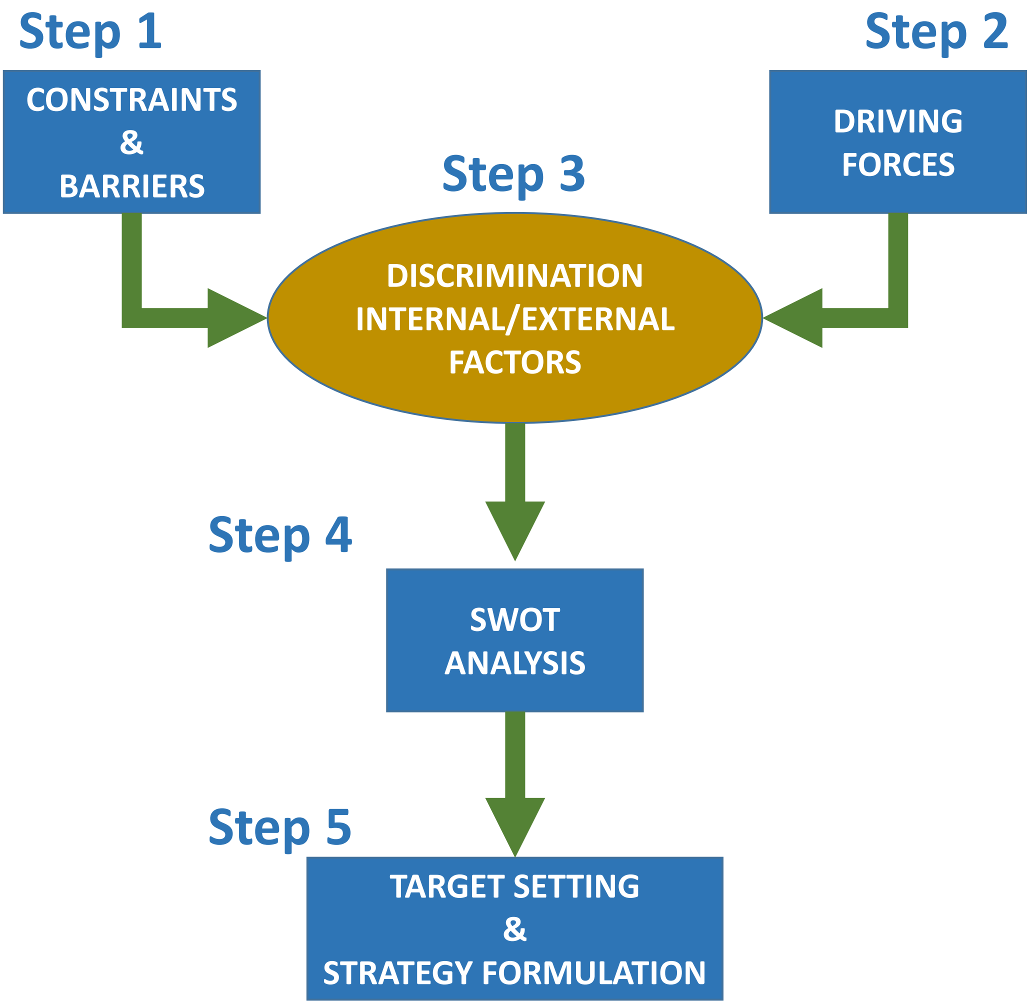


Figure 3: Flow chart visualising the main steps of defining an integrated APPR bioenergy action plan through sector analysis by stakeholders and SWOT analysis.

Four basic strategies to meet the four elements of the SWOT analysis can be identified. To find them, each element is combined with each of the other ones. For instance, a “strength” (internal factor) can meet an “opportunity”, but also a “threat” (the two external factors); similarly, for a “weakness” (the other internal factor).

In order to obtain an overall picture of the APPR sector, the internal S and W factors were placed, graphically, at the opposite side of a unique vertical axis. Similarly, the external O and T factors were placed at the opposite side of a horizontal axis. The procedure allowed forming a Cartesian plan with four quadrants (*Figure 4*).

By the pairwise combination of internal and external factors, the following strategic alternatives might be obtained (Seebohm, 2014):

- ***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 (*defense 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*).

Figure 4: Graphical representation of the SWOT analysis according to the four quadrants of a Cartesian plan. Alternative strategies to be applied in the “Action Plan” are reported as the outcome of a pairwise combination of the SWOT factors.

The strategic alternatives described above are only theoretical, for the moment, but methodologically very useful in elaborating the “Action Plan”, provided these strategies applied to the conditions of the APPR sector in each Demo Region.

2.3 Summary of the work performed in each Demo Region

The methodology previously described has been carried out in the four countries, with respect to the so-called ‘Demo Regions’: Aragón (in Spain), Apulia (in Italy); Macedonia, Thrace and Peloponnese (in Greece) and Vinnytsia (in Ukraine).

In each of the considered country, a team formed by an AP (agrarian partner) and a TP (Technical partner) have followed the methodology to interact with relevant stakeholders of the APPR sector and later, to perform the sector analysis and action plan, based on the feedback obtained.

The interaction with stakeholders to perform the sector analysis was based on e-mailing, phone calls, personal interviews and a series of workshops. Workshops were a fundamental tool in sharing the vision among stakeholders involved or interested in the use of APPR biomass. They have served to raise awareness, gain confidence with the sector, detect some potential new entrepreneurs or some key actors necessary to start new value chains, and to create an initial feeling of network or community. The next *Table 2* summarises the basic figures of the work performed in each country.

Table 2: Summary of the networking actions performed during the preparation of the sector analysis and the action plan in uP_running demo countries

Country / Regions	Spain (Aragón)	Italy (Apulia)	Greece (Macedonia, Thrace, Peloponnese)	Ukraine (Vinnytsia)
Nr. of Initial Workshops	3	4	3	3
Nr. of Returning Workshops	2	1	1	1
Nr. of attendants	152	185	187	125
Nr. of interviews §	6	4	12	14

§ Interviews performed to further complete the sector analysis

The workshops celebrated served to interact with 649 participants as a whole. Due to the relevance of the workshops as a central axis for approaching stakeholders, reinforce the stakeholders network, launch ‘*uP_running*’ messages and disseminate the project content and initiatives, the main figures about the workshops are presented below (*Table 3*).

Table 3: Details of the workshops executed for the involvment and sharing of vision with the APPR stakeholders in the four demo countries

Workshops	Spain (Aragón)	Italy (Apulia)	Greece (Macedonia, Thrace, Peloponnese)	Ukraine (Vinnytsia)
Starting Workshop (Forum Optional)		Foggia (FG) 28/04/2016 FO Nr. Attendants: 50		
First Workshop (Focus Group - FG or Forum - FO)	Fraga (Huesca) 25/04/2016 FG Nr Attendants: 13	Foggia (FG) 21/06/2016 FG Nr. Attendants: 22	Nemea (Peloponnese) 30/05/2016 FO Nr. Attendants: 21	Vinnytsia 31/05/2016 FO Nr Attendants: 33
Second Workshop (Focus Group - FG or Forum - FO)	Fraga (Huesca) 24/05/2016 FG Nr. Attendants: 25	Bari (BA) 24/06/2016 FG Nr. Attendants: 16	Palaiopanagia Lakonias (Peloponnese) 25/07/2016 FO Nr. Attendants: 79	Kyiv 10/06/2016 FG Nr Attendants: 34
Third Workshop (Focus Group - FG or Forum - FO)	Valjunquera (Teruel) 21/06/2016 FG Nr. Attendants: 28	Manduria (TA) 28/06/2016 FG Nr. Attendants: 17	Aridaia (Makedonia) 20/10/2016 FO Nr. Attendants: 54	Vinnytsia 30/06/2016 FG Nr Attendants: 28
Fourth Workshop (Optional) (Focus Group - FG or Forum - FO)	Barbastro (Huesca) 30/06/2016 FG Nr. Attendants: 21			
First Returning Workshop (Forum)	Zaragoza 14/02/2017 FO Nr. Attendants: 34	Bari (BA) 15/09/2016 FO Nr. Attendants: 50	Sparti (Peloponnese) 07/07/2017 FO Nr. Attendants: 33	Vinnytsia 31/01/2017 FO Nr Attendants: 30
Second Returning Workshop (Forum – Optional)	Zaragoza 31/03/2017 FO Nr. Attendants: 31	Foggia (FG) 01/05/2017 FO Nr. Attendants: 30		

The action plans prepared by each regional project team are attached to the present document in the Annex section (from Annex I to Annex IV). The Sector analysis and Action plans for the four Demo regions have been prepared in the local languages (ES, IT, GR, UA). The next *Table 4* summarises the main figures gathered from the different sector analysis and action plans.

Table 4. Barriers and driving forces found by demo region and country, and summary of Strengths, Weakness, Opportunities and Threats

	Spain (Aragón)	Italy (Puglia)	Greece (Macedonia, Thrace, Peloponnese)	Ukraine (Vinnytsia)
Nr. of Barriers detected	76	18	4	29
Nr. of Driving Forces detected	34	11	2	12
Nr. of Strengths reported	17	6	2	12
Nr. of Weakness reported	16	13	5	16
Nr. of Opportunities reported	17	12	4	11
Nr. of Threats reported	18	8	3	9

Demo Region: Aragón (Spain). Work Team: CIRCE and ASAJAHU


Workshop in Fraga (second one, May 2016), one of the largest fruit producing areas in Aragón (Eastern Aragón) hand next by to Lleida (Catalonia) fruit-producing area. Total of 25 attendants. Session included a presentation of uP_running, the presentation of some success cases and the discussion about status of the sector in the area.


Third Workshop (June 2016, Valjunqura, South-Eastern Aragón), an area where olive, almond abut also stone fruits quite expanded.. Total of 28 attendants. Session included a presentation of uP_running, the presentation of some success cases and the discussion about status of the sector in the area.


Fourth Workshop in Barbastro, one of the wines DOPs in Aragón, also with large areas of almond and olives. Total of 21 attendants. Session included a presentation of uP_running, the presentation of some success cases and the discussion about status of the sector in the area.

First Returning workshop (5th workshop), celebrated in the Zaragoza Fair facilities, in framework of Tecnovid (Oleotec/Fruiver), fair on wine, olive and fruit production, attended by more than 26.000 professionals. Session attended by 31 persons included a presentation of uP_running, some success cases, external speech of Vineyards4Heat project and machinery builder (SERRAT Trituradoras), and a round table to present the draft of the uP_running sector analysis and action plan, and the draft of the memorandum

Second Returning workshop (5th workshop), celebrated in the Zaragoza Fair facilities, within the framework of the 13th International Fair for Animal Production attended by more than 70.000 professionals. Session attended by 31 persons included a presentation of uP_running, some success cases, synergy of the livestock and feed producing sector with APPR potentials (SUCELLOG project), and 3 speeches from key sector companies: Molinos AFAU, APISA S.L. and ENSACO E.C. The uP_running sector analysis and action plan were presented, as well as the memorandum undersigned by the Aragonese Agro-food Alliance.

Demo Region: Apulia (Italy). Work Team: UFG and Dare

Starting Workshop (Forum) in Foggia (28/04/2016), presentation of the project during the International Agricultural Fair. Total number of attendants: 50.


First Workshop (“Focus Group”) in Foggia (21/06/2016). Total number of attendants: 22.


Second Workshop (“Focus Group”) in Bari (24/06/2016) on the left. Total number of attendants: 16.
Third Workshop (“Focus Group”) in Manduria - TA (24/06/2016) on the right. Total number of attendants: 17.


First Returning Workshop (“Forum”) in Bari (15/09/2016) during the international event “Fiera del Levante”. Presentation of the Sector Analysis to an audience of 50 stakeholders.



Second Returning Workshop (“Forum”) in Foggia (01/05/2017). Presentation of the main results of the activities of the first year of the project during the International Agricultural Fair. Some local experiences on APPR management were also introduced. Number of attendants: 30.

Demo Region: Macedonia, Thrace, Peloponnese (Greece). Work Team: CERTH and PASEGES

Second Workshop (Palaiopanagia Lakonias, Peloponnese – 25/07/2016). Total of 79 attendants. Session included a presentation of uP_running, the presentation of some success cases, discussion on the potential of pruning in the area and the current management techniques and discussion about the potential of energy recovery of prunings

Third Workshop (Aridaia, Macedonia – 20/10/2016). Total of 54 attendants. Session included a presentation of uP_running, the presentation of some success cases, discussion on the potential of pruning in the area and the current management techniques and discussion about the potential of energy recovery of prunings

Returning Workshop (Sparti, Peloponnese – 07/07/2017). Total of 33 attendants. Session included a presentation of uP_running project, general issues related to APPR (fuel quality, harvesting, value chains, and costs), including results from the regional analysis and related uP_running activities from the first year of the project (e.g. field measurements of biomass productivity in the area). The memorandum of understanding was signed at the end of the event.

Demo Region: Vinnytsa (Ukraine). Work Team: SECB and UCAB


First workshop (forum) in Vinnytsia 31/05/2016. Total number of attandants is 33.


Second workshop in Kyiv (10/06/2016) – in a form of focus group for builders and sellers of processing facilities, builders and sellers of energy plants and bioenergy enterprises. Total number of participants is 34.


Third workshop (Vinnytsia 30/06/2016) in a form of focus group for farmers (fruit plantations) with discussion session. Total number of participants - 28

Final returning workshop in Vinnytsia (31/01/2017). Total of 30 attendants. Session included a presentation of uP_running, the presentation of some success cases, presentation of sector analysis for the region and discussion on the potential of pruning in the area. The "memorandum of cooperation" between UCAB and Vinnytsia horticulture association have been signed (on the right).

2.4 Agreeing on a memorandum

A “memorandum of understanding” was considered to be a very useful tool in attracting public interest, obtaining some strategic alignment of institutions and organizations to the project's positions, asking for commitment or early positioning to public and/or private influential actors with respect to the main project's issues.

According to the ‘*uP_running*’ programming workshops will be held (preferably in the form of a forum and in the frame of important disseminating campaign) to testify the “memorandum of understanding” on policy recommendations agreed with a broad and qualified representatives of institutions, public authorities, farm associations, business consortia, and organizations involved in the development of the bioenergy sector.

This will be a specific and relevant activity in the course of the second year of project, but it was also clearly underlined the importance to be ready and timely prepared in the initial drafting and the final delivering of this public position paper to be agreed upon. To reach this agreement, some discussions and a sort of negotiation between parties is also needed.

For this reason, it was warmly suggested to partners to arrange, early in advance, this sort of public agreement on the strategic relevance of promoting the APPR sector, through policy recommendations, both general in principle and specific for the regions involved. The main regional and national representatives, both public and private, will publicly declare their support to the sector development through the signing of the agreement. Stakeholders should accompany the debate, favourably orienting the acceptance of policy recommendations.

The *Memorandum* is conceived as a form of engagement by representatives of regional administration, government agencies, local and national policy makers, leaders of industrial organizations and business associations in promoting the APPR sector. Formally signing this *Memorandum* in the presence of the operators of the APPR sector as well as in front of the larger citizen community should testify a full assumption of commitment. The *Memorandum* could also be considered as a first attempt to promote an advocacy action at regional and national scale, in preparation of stronger and well-planned activities of this type at European level (to be accomplished later in the project programmed activities).

Aiming at achieving the higher possible impact, different versions of the *Memorandum* are available, with similar content but different structure:

- 1st version: it may be considered more a “manifesto” than a “declaration” (or also a sort of “position paper”). Therefore, the text is longer, the concepts are explained considering the relevance of the “vision” and the “mission” pertaining to public organizations and policy makers.
- 2nd version: schematic, direct, smooth and very simple to be signed by a wide range of organizations. A list of 12 bullets made up a sort of "declaration".

On top of that, partners would be able to prepare a “memorandum” on its own, according to specific needs and targets, selecting one of the two documents as a model or a benchmark.

These different options allow to adapt the message to be provided according to the expected audience when signing such “memorandum”, according to local conditions and specific opportunities perceived by the project partners. Probably, the first version could be adopted when relationships with key political actors are still in a preliminary phase and need to become stronger and more reliable hereafter. Conversely, if collaboration with public agencies and regional authorities is already strong and successful, if a common vision about the APPR sector is shared already with them, and the project team is supporting the regional policy makers in implementing tools and measures to promote the sector taking-off, then the second document could be applied.

What should be clear is that the signing of the "Memorandum" is not a goal "per se", but rather a tool to attract attention, sharing the vision, stimulate cooperation specifically from the side of public authorities, regional and national authorities, large and influencing business associations.

At this stage, the two documents are ready to be signed during relevant public meetings and project forums in the course of the second year of activities. The progress in obtaining signed the "Memorandum" is shown below by country.

SPAIN

The memorandum, in form of short declaration or position paper, was adopted as the most convenient form to obtain an early alignment of multiple organisations influencing in the agricultural sector and to policy makers. It was presented in the first returning workshop (14th February 2017) held in the framework of a relevant fair for the fruit, wine and olive industries. ASAJAHU worked in contact with the Agro-food Alliance of Aragón Region, who undersigned the declaration on 27th February 2017. The declaration is undersigned by next organisations, forming part of the mentioned alliance.

Spain (Aragón)
ASAJA – Aragonese agrarian association of young farmers
AIAA – Association of agro-food industries of Aragón
COIAANPV – Official College of Agronomic Engineers of Aragón, Navarra and Basque Country
COIAANPV – Official College of Agronomic Engineers of Aragón, Navarra and Basque Country
COITA – Official College of technical engineers and agrarian technicians of Aragón
Official College of Veterinary of Zaragoza
Official College of Veterinary of Teruel
Official College of Veterinary of Huesca
CAA - Aragonese association of agro-food cooperatives
UAGA – Union of farmers and livestock breeders of Aragón
UPA – Union of small farmers and livestock breeders of Aragón

ITALY

The memorandum, in the form of a "declaration" (longer form but modified in the Italian version to be more direct and effective) is informally circulating within the regional organizations of the agricultural sector, of the renewable energy sector, the regional industrial associations, regional productive districts and technological districts.

The same document was also delivered and "entrusted" to the chief of two Apulia Regional Departments, the Agriculture and Environment Depts., respectively. The involvement of regional policy makers is considered of the uppermost relevance since the "Regional Energy and Environmental Plan" of the Apulia region is going to be revisited and updated within the end of this year.

The Italian DC team is acquiring the position of the regional institutions and their preliminary agreement. The target is to convene the memorandum in the frame of the *AgriLevante Exposition* in Bari (Apulia – IT), 12-15 October 2017. The memorandum will be probably signed by the following organizations, both regional and national:

Italy (Apulia)
Department of Agriculture – Apulia Region
Department of Environment – Apulia Region
Department of Economy and production activities – Apulia Region
COLDIRETTI - Puglia (Farmers' Union)
CIA – Puglia (Farmers' Union)
COPAGRI – Puglia (Farmers' Union)
CONFAGRICOLTURA – Puglia (Farmers' Union)
DARe (Regional Technology District on Agro-Food)
La NUOVA ENERGIA (Regional Productive District on Renewable Energy)
DIPAR (Regional Productive District on Environment, Reuse & Recycling)
Department of Agriculture – University of Bari
Department of Agriculture – University of Foggia
Regional professional orders (agronomists, engineers, biologists, etc.)
ARTI - Regional Agency for Technology and Innovation of the Apulia Region
ENEA – Italian National Agency for New Technologies, Energy and Sustainable Economic Development
ITABIA – Italian Biomass Association
Chimica Verde – Bionet – Research and Development on Biobased Economy
Apulia Industrial Associations

Regional Union of the Chambers of Commerce

GREECE

The 2nd option for the memorandum (a short declaration of 12 points) was considered as the most appropriate form in order to obtain a common consensus between stakeholders from the agricultural authorities, regional government, municipal authorities and other organizations. The memorandum was formally presented during the returning workshop of the uP_running project, held on the 7th July 2017 in Sparta; hence, it is summarily referred as the "Sparta Declaration". Most of the adhering organizations hail from the Laconia regional unit of Peloponnese. It is signed by the following organizations.

Greece (Peloponnese)
Region of Peloponnese (represented by the President of the Regional Council and the Vice-Regional Governor for Laconia) The Municipality of Sparta The Municipality of Monemvasia Union of Agricultural Cooperatives of Lakonia (represented by the President and General Manager) Agricultural Cooperative of Anogia Lakonias Agricultural Cooperative of Vordonia Lakonias Agricultural Cooperative of Gkoritsa Lakonias Agricultural Cooperative of Palaiopanagia Lakonias Agricultural Cooperative of Ksirokampi Lakonias Agricultural Cooperative of Goranon Lakonias Agricultural Cooperative of Agion Apostolon Vocational Training Centre "Diastasi" Implementing agency for the Regional Operational Programme of Peloponnese General Secretariat for Research and Technology Centre for Research and Technology Hellas INASO-PASEGES

UKRAINE

The memorandum, in form of Memorandum of Cooperation has been signed between the Association "Ukrainian Agribusiness Club" as an agrarian partner of the project and the newly organized association of farmers who deal with fruit trees growing – the Association "Ukrsadprom". It was officially signed and presented in the returning workshop (31st January, Vinnytsa). Within the fulfilment of the project UCAB also worked in contact with two universities and the Institute of Horticulture of the National Academy of Agrarian Sciences of Ukraine (IH NAAS) who are ready to work in cooperation within the project. The organisationsaligned with the contnts of the memorandum are cited in next list.

Ukraine
Farmers Association Ukrsadprom (nationalwide) The Institute of Horticulture of the National Academy of Agrarian Sciences of Ukraine (IH NAAS) National University of Life and Environmental Sciences of Ukraine (NUBiP of Ukraine) – Kiev Region Uman National University of Horticulture – Cherkassy Region Illintsy State Agrarian College – Vinnytsa Region

3 A Joint Sector Analysis

The general status of the sector, its composition and key actors, few basic information about market and trade, the structure of possible value chains and the different kind of business models potentially observed are the main topics making up the “Sector analysis”. Identifying the main sector constraints and barriers (negative factors) as well as the sector driving forces (positive factors) was the next phase of the process. A creative merging process was applied in collating, comparing and matching each of the four singular Demo Region contribution to "sector analysis", thus attaining the construction of a very new framework through the application of a set of interpretive tools and explanatory techniques.

3.1 Introduction to the sector analysis

Decisions to be taken in the bioenergy sector are complex because the sector cuts across different supply segments and productive areas covered by a vast range of activities, notably energy, agriculture, industry, environmental technologies, market, trade, logistics and many others (FAO-ENEP, 2010). Hence, strategic planning in the bioenergy sector (and in the APPR segment as well) needs to be embedded in a broader context of relevant economic conditions and policies (*Figure 5*).

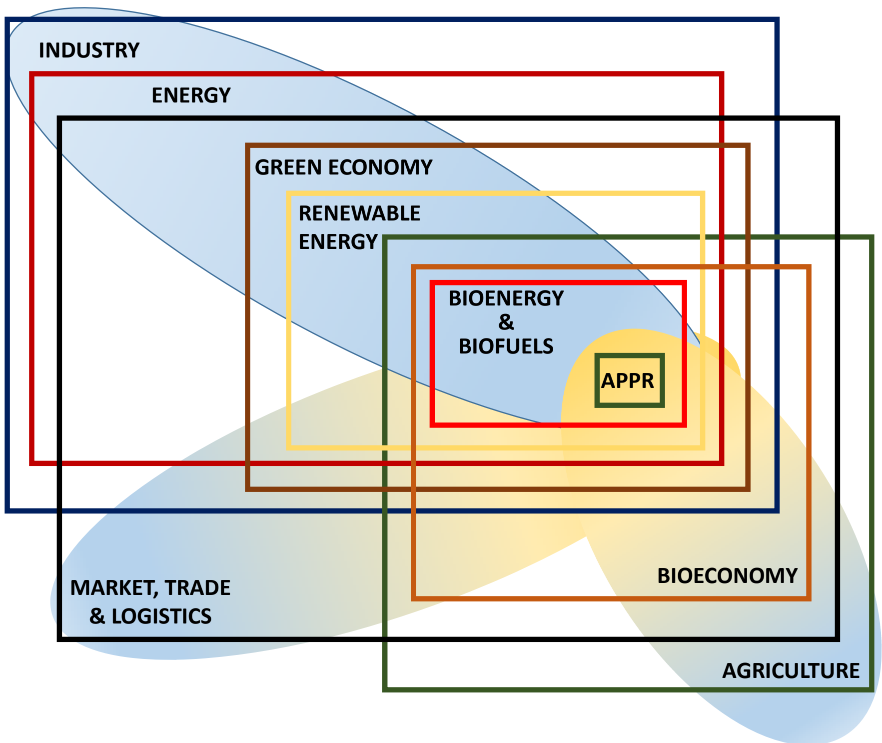


Figure 5: *Diagram considering the three main dimensions of the APPR sector: the primary sector (i.e. agriculture), the secondary sector (i.e. industry and manufacturing) and the tertiary sector (i.e. services), together with their reciprocal embedded relationships, similar to ‘matryoshka dolls’ or ‘chinese boxes’.*

The development of a bioenergy strategy and policy should be undertaken with a clear view of the objectives to be prospected, also considering the analysis of possible trade-offs between different goals. For example, a considerable feedstock exploitation might results from the construction of few large-size biomass power stations in a region, thus collecting the majority of the available residual wood biomass. While this process could develop relatively fast, quite large amounts of investment capitals are needed; consequently, just a few economic or financial actors would dominate the sector, preventing an open participation by other entrepreneurs. Moreover, a quite relevant social impacts might result when large biomass plants are in operation. Conversely, a distributed energy model, consisting in a plurality of small energy plants scattered on the land, requires more time to be progressively developed, but also entails a more balanced utilization of local biomasses; moreover, it does not require a substantial imports of biomass from outside the district and provides favourable social and environmental effects.

Similarly to the previous considerations, a range of analyses should be undertaken as part of the strategy and policy formulation process. In this respect, stakeholders are very relevant in the participation process and are the primary source of information.

Every geography and regional context is different from another; therefore, the best strategic process is the one that is developed through an adequate stakeholder engagement within its own particular set of conditions.

What follows is a list of the main issues considered in preparing the regional *Sector Analysis*, trying to explore the main interesting "dimensions" of the APPR sector.

1. *Regional potential of the APPR sector.* Information on APPR potential availability at regional level reporting on the APPR main statistics and assessing the main features affecting the amount of available APPR biomass.
2. *APPR value chains and sector overview.* Information on the APPR sector *status* reporting on the willingness of farmers to collect APPR residues, alternative management of residues, main difficulties in harvesting the APPR biomass and supply an energy value chain. Possible typologies of APPR business models and role of the main actors or investors (prime movers) in creating the supply chains have been reported, together with the leading businesses in the APPR sector and the multiple organizations that came together forming the stakeholders' network. Quite interesting are also the main connections of the APPR sectors with other productive sectors and the final energy products that are supplied on the market.
3. *Barriers and driving forces affecting the APPR sector.* Main factors (technical, cultural, regulatory, structural, organizational, economic or financial factors) that are constraining the sector development have been detected (both internal "weaknesses" and external "threats"). Conversely, also relevant are the main driving forces in promoting the APPR sector development (both internal "strengths" and external "opportunities"). Again, the analysis is performed at local/regional level: main regulations acting on the APPR sector, authorization procedures governing the APPR sector and influencing its development, the potential benefits due to incentives, subsidies, tax breaks, etc. Sustainability criteria and quality standards, if any, to be applied should be identified, as well as alternative end-uses (apart energy) or competitive supply chains involving APPR biomass.

Clearly, the entire process of assessment and analysis should be inclusive, engaging the relevant stakeholders in agriculture, industry, government and civil society, to ensure that the interests and concerns of all the actors affecting or affected by bioenergy decisions are adequately taken into consideration.

3.2 Regional potential of the APPR sector

Europe accounts with a total area of 10.6 Mha of vineyards, olive and fruit plantations. This area represents a share in the cultivated area of 6%; several other information sources point out that the potential of pruning wood range from 20 to 25 Mt (of fresh biomass) per year (CIRCE, 2014; Elbersen et al., 2012). Wood from tree removal at the end of a plantation may add further 15 Mt of resource. Altogether, the potential as dry matter can reach 20 Mt/yr (García-Galindo et al., 2016).

The '*uP_running*' strategy is twofold: (a) to operate in Countries with a large potential source of APPR biomass, and (b) to select Countries and Demo Regions with a wide type of climatic and crop management practices.

The European Southern countries have an enormous potential in terms of pruning biomass production. In fact, in this area the cultivation of the majority of permanent crops is quite concentrated. Grapes and olives are the main species: olive groves are prevalent in Spain (2.5 10^6 ha), in Italy (1.1 10^6 ha) and in Greece (850 10^3 ha). Vineyard is widely cultivated in Spain (963 10^3 ha), in France (764 10^3 ha) and in Italy (725 10^3 ha). Large areas are interested in the cultivation of citrus in Spain (313 10^3 ha) and in Italy (168 10^3 ha). Furthermore, Italy and Spain record the main cultivations of peaches (both more than 80 10^3 ha), and of the other orchards (respectively 160 10^3 ha and 120 10 ha). As for the fruit with shell, the figure for the cultivation of the almond trees in Spain (536 10^3 ha) and hazelnut in Italy (70 10^3 ha) stands out. The previous statistics were extracted from the website of the PANACEA group (http://www.gruppo-panacea.it).

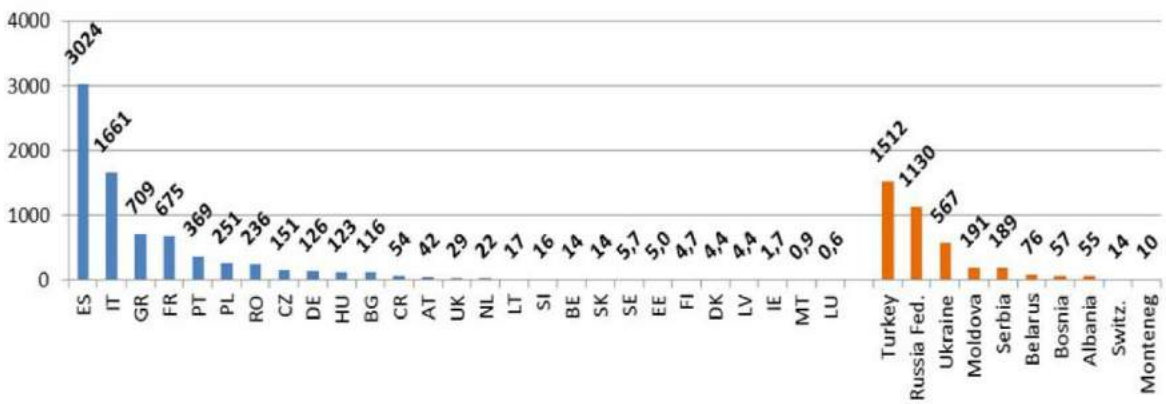


Figure 6: Potential amount of APPR biomass estimated for the EU28 member States (in blue) and other European Countries (in brown). Numbers expressing biomass are in kilo tons of dry matter per year.

As observed in *Figure 6*, the key countries are Spain, Italy, Greece, Ukraine and France. As consortium strategy, it has been decided to target the main actions in four countries. Aiming to have a wider reality, it was encouraged to have included in this group of four countries also Ukraine, which recently adhered the H2020 program. Spain, Italy, Greece and Ukraine constitute the group of "Demo Countries" (DCs) in *uP_running*.

In particular, considering the Demo Regions in each of the four selected Countries, *Table 5* briefly reports a very broad estimate (from different sources) of the amount of APPR biomass potentially available and the consequent amount of gross energy attainable from the conversion of that biomass. Please, be also warned that the amount of energy was computed without taking into account the efficiency of this conversion, nor into electricity neither into heat.

Great interest is associated with values of spatial densities resulting from the ratio of the gross biomass to the overall surface in each region or, correspondingly, the ratio of the gross energy totally collected to the overall surface of the region. High values of spatial density reveal a great resource concentration and, therefore, the possibility to activate efficient biomass supply chains.

Table 5. Estimated APPR potentials in the four Demo Regions considered by the project

	Unit	SPAIN	GREECE		ITALY	UKRAINE
		Aragon	Macedonia Thrace	Peloponnese	Apulia	Vinnytsia
Agricultural Area covered by fruit-tree crops						
• Olive grove	*ha*	44,470	56,680	260,302	355,446	
• Vineyard	*"*	32,109	12,620	34,051	94,585	
• Citrus	*"*		9	26,866	9,015	
• Other fruit-trees	*"*	67,130	67,017	12,839	33,279	22,900
Total Area	*ha*	**132,910**	**136,326**	**334,058**	**492,325**	**22,900**
Gross Available APPR Biomass						
• Olive grove	*kt/year*	61	188	654	1027	0
• Vineyard	*"*	65	81	172	629	0
• Citrus	*"*			388	67	0
• Other fruit-trees	*"*	123	438	45	181	73
Total Biomass	*kt/year*	**248**	**708**	**1259**	**1904**	**73**
Total Energy	*toe*	99.163	283,109	503,661	761,521	29,200
Total Regional Area	*km^2*	47,719	42,756	21,380	19,345	26,492
Spatial density (in relation to the total regional area)						
• Surface density	*%*	2,79	3,19	15,62	25,45	0,86
• Biomass density	*t/km^2*	5,20	16,55	58,89	98,41	2,76
• Gross energy density	*toe/km^2*	2,08	6,62	23,56	39,37	1,10

The Annex section of this document (from Annex I to Annex IV) reports a detailed description concerning each *Demo Region* with particular reference to the regional potentials of APPR availability.

3.3 General status of the APPR sector

Despite its large availability, the APPR kind of biomass is scarcely used as energy feedstock in the considered regions and only limited business experiences based on its utilization have currently developed.

From one hand, the biomass-to-energy sector is at the early stage of development in the considered regions and it should demonstrate to be based on very sound social, economic and environmental pillars. On the other hand, we can say that a virgin operational field for new businesses might be opened in the next future, on condition that the main barriers and constraints (both technical and non-technical) are properly overcome.

The biggest obstacles to the start-up of the bioenergy sector are indeed more than simply technical constraints, being mostly related to non-technical features. Among these, lower level of organization, lower propensity to investments, lower readiness to innovation, lower willingness to association and a limited availability of financial credit, are the ones, in general terms, characterizing agriculture with respect to the industrial sector.

Taken independently, almost all the key actors in a complete APPR supply chain are present in the considered regions. According to our opinion (gained as a result of a first-hand knowledge), the major difficulty that slows the take-off of new businesses lies in the fact that the key operating actors are playing on their own. Definitely, the two main production sectors (i.e. non-food agriculture and energy industry, respectively) are separated and far apart, being their main players unaware of each other.

The organization of a bioenergy supply chain largely depends on specific regional characteristics due to farm structures, organization and management, feedstock availability, local constraints and opportunities, market dimensions and distances, etc.

Distribution channels

The distribution of wood fuels from APPR biomass can follow several channels (F.L.E., 2007):

- Farmers, independently or in associated forms, can organize the collection and the distribution of wood fuels.
- Biomass wholesalers and traders (generally involved in the storage and commercialization of several kind on solid biofuels, such as firewood, olive pomace, olive pits, straws, wood waste and by-products from forestry industry, etc.).

So far, the latter have been very active in this sector and usually most successful than the former in aggregating the offer and delivering wood fuel to final consumers, even quite far from the primary source of feedstock. Single and dispersed modern household heating systems are mostly supply with pellet, although firewood is still largely used in traditional fireplaces and stoves. Wood chips have a still limited diffusion in the considered regions and are usually delivered to regional bioenergy plants, within 40-50 km of radius from the plant location. In every conditions, the contribution of APPR feedstock to the delivered wood fuels is very limited or almost insignificant. It means that the market from APPR is still in its infancy.

Final users and potential customers

Besides the large scale power plants, domestic heating and collective heating plants are the main facilities requiring wood fuels. To date, pellets and firewood logs are more popular than wood chips in the domestic heating sector; consequently, they are both rewarded by better prices than wood chips. For this reason, a very effective supply chain was organized. However, considering the huge consumption of wood fuels in domestic heating systems, significant amount of wood chips could be potentially absorbed by the market in the near future (F.L.E., 2007).

The heating sector shows to be quite diversified, offering several options to potential market players, such as (F.L.E., 2007):

- Farm energy self-supply;
- Community building (schools, offices, housing, etc.);
- Leisure centres (swimming pools, gyms, SPAs, etc.);
- Industrial activities (industrial areas, equipped technology parks, industrial districts and manufacturing site);
- Tourism sector (mostly large hotels);
- Process-heat users (especially in the agro-food industry, like dairies, breweries, wineries, olive oil milling, etc.);
- Warm up greenhouses in floriculture and plant nursery activities;
- Use of cold (three-generation systems) in food-industry, to preserve fruits and vegetables;
- Remote rural mansions, large farms, isolated villages in rural areas.

APPR wood fuel quality

It is difficult to generalize about quality. The wood chips from APPR biomass is obtained in rather inhomogeneous forms, and this is the main quality constraint, apart a rather lower heating values with respect to wood chips from forestry biomass.

Biomass quality could be different, needing different quality standards, according to its specific final use. Higher quality is requested for small size combustion plant (like household boiler); conversely, the quality could be lower with an increasing size of the plant, for example considering large power plant based on combustion technologies. Not homogeneous APPR wood chips can be used in supplying robust biomass boilers adapted to an irregular feedstock feeding. Alternatively, different batches of specific size ranges can be selected by applying simple screening procedures. In this way, different customers' needs could be conveniently satisfied.

Biomass moisture together with ash content are, perhaps, the most important single quality parameter for a fuel, which must be as dry as possible. Natural air-drying is the most viable strategy to reduce moisture content to desirable levels. Drying can proceed directly at the soil surface of the tree-fruit plantation (before harvesting) or, alternatively, at the storing platform (after harvesting) both as wood chips or pruning bales. High moisture levels cause microbial attacks and the consequent biomass decay that reduces its weight. The biomass piles heat up, the temperature inside the bulks rises over 60-70 °C for prolonged period and dry matter losses can reach something like 1% of the total for every week of storage (Janzé, 2011; Eriksson, 2011).

Wood-chip fuel can be attributed to different grades according to moisture content and size distribution. Attribution to different grades through standard testing methods facilitates the definition of universally understood fuel specifications. Such specification will depend on boiler technology. *Standardization* is, therefore, a very relevant issue; recognizing and compare different wood-chip categories on the market should be the basis for a well-informed purchase.

Moreover, biomass *traceability* is regarded as an added value. Consumers' preference is to know where the biomass comes from. However, it should not lead to much higher costs. A price increase of 1 €/t could be an acceptable range when deciding if starting a traceability system or not. PEFC schemes may be followed as a straightforward method. It seems the process can be applied to APPR wood, though it has not been stated any similar experience in the considered regions. From the customers' side, the environmental *sustainability* of wood energy carriers (i.e. their "eco-friendly" character) is remarkably appreciated. However, at the current stage of the market development, this positive feature is not considered a main driver for the consumers in the purchasing decision, being price and quality the leading factors.

Market and prices

APPR biomass markets are still not developed in the considered regions. A large and diffused market of wood pellets is to be remarked, mainly made of standard pellets (locally produced but also largely imported) from forestry feedstock. There are also local biomass suppliers, a consolidated market for different kind of biomass fuels (particularly straw bales, firewood, olive pomace, olive pits or stones, almond shells, etc.) but APPR wood chips are still quite unusual, and its trade is still limited.

The market price of the biomass from APPR feedstock should be compared with some reference biomass prices detected in the same area where the new APPR energy carrier is to be traded. Depending on the area and the season, the prices of biomass might vary significantly. Therefore, it is advisable to survey the local market identifying the types of biomass that could be the most competitive and their current prices.

Wood chips price depends on season and location, and is greatly affected by quality properties such as moisture, ash content, and particle size distribution. The wood from forests can have a price as low as 30 €/t for batches of very moist and inhomogeneous wood. The usual price for G50 for industrial consumers is in the range 40 to 50 €/t, whereas G30 for medium sized consumers reaches a usual range of 60 to 70 €/t. Woodchips of class A, from debarked stem wood and dry, can reach prices as high as 90 €/t.

Similar prices are observed in Apulia (Italy), with a raw general average of 60 €/t. In Apulia (Italy) firewood price is in the range 110-130 €/t, while pellet (A1) in the range of 230-250 €/t and briquettes 200 €/t. Small round bales of pruning (approximately 30 kg each) can be sold at a price of 3 €, that means approximately 85 €/t based on as received feedstock.

The dynamic of prices in Spain shows that the biomass prices underwent a general rise in the last decade, reaching a peak in 2012. From then onwards, the price has sunk until 2016, accompanied by a lower demand of wood, the reduction of the energy consumption by the industry and a decay in the petrol price (IDAE, 2016).

In Aragón (Spain) it has been observed a sharp decrease in the wholesale price of almond shells from 120 to 70 €/t, from 2012 to 2015. Regional variations are also very remarkable. For instance, in Aragon almond shells are currently commercialised in the range of 60 to 130 €/t. In areas where almond shells are abundant and considering wholesale trade, the price can be lower. Besides regional variations, seasonal variations could be also remarkable and range up to ±40% have been reported.

Olive pit prices in Aragón (Spain) have been reported to be 120 to 150 €/t, even though they can decrease to 90 €/t in the season when it was immediately produced. Firewood ranges usually 120 to 150 €/t, with prices up to 220 €/t for particulars logs.

In Apulia (Italy), almond shells are priced approximately 150 €/t, while washed olive pit are generally valued 190 €/t and exhausted olive pomace 100 €/t.

In Macedonia and Thrace, it is fairly easy to find pellets made from sunflower husk, usually imported from Bulgaria or Ukraine. Their price is reported as being below 100 €/t which make them very competitive for industrial use, despite their high ash content.

Firewood from larger pruning branches and stems as well as tree parts from plantation removal are traditionally harvested and supply to a parallel market. The price that such feedstock can obtain in the domestic fuel market are in the range of 100 €/t in Macedonia and Thrace, 110-130 €/t in Apulia. These prices are already quite high for a biomass feedstock and it is unlikely that it will be competitive to use these materials as feedstock for other energy projects, e.g. biomass to electricity applications.

As a general consideration, it can be assumed that wood obtained from fruit tree uprooting operations is sold at a price comparable to that of firewood or only slightly lower.

Straw has a mature market both in Aragon (Spain) and Apulia (Italy), with prices from 36 to 40 €/t (in form of standard bales). Weathered straw of lower quality may be acquired at much lower prices, from 10 to 20 €/t. Baled maize stalks can be about 33 €/t (prices obtained from SUCELLOG, 2014). Other fuels from agro-food industry by-products, like grape pit and dry, exhaust olive oil cake have market prices in ranges from 60 to 85 €/t and from 80 to 130€/t respectively. Pellets are commercialised bulk in Aragon (Spain) at prices of 190 €/t (as an approximate value).

Effects of biomass prices on the value chain

To date, industrial power plants are the main consumers of wood chips and set the pace for the whole market (F.L.E., 2007). Current market prices are largely the result of industrial prevalence and are relatively low. Power station offer between 40 and 45 €/t, delivered at the plant. At this price, harvesting pruning is hardly economically viable and probably possible only if biomass is already available at the external side of the fruit-tree plantation and simply collected at the roadside. Probably, collective heating station could still turn a profit if they pay 50 to 60 €/t for the wood fuel. This is sure with respect to biomass energy plants that are benefiting of a very high feed-in tariff established years ago and, today, not so convenient anymore for new installations.

Assuming that plant managers wanted to renounce 10 to 20 € of profit per tonne of fuels, such higher prices may drastically increase the actual availability of APPR chips for energy generation.

Delusion on renewables

Besides biomass, other forms of renewable energy have gradually emerged and spread significantly in the rural areas during the past decades (including wind power turbines and photovoltaic plants). Due to their great economic affordability and large tariff subsidies, in some regions and circumstances, the large diffusion of this kind of industries was carried out without a consolidated regulation or a properly configured regional energy planning, thus creating social discontent. As an indirect consequence, this "delusion" also affected the biomass energy sector. Today, the so called "social acceptability" of biomass plants is an issue and the NIMBY syndrome ("Not in My Back yard") a diffused problem to be properly addressed (Aris, 2017).

3.4 Composition of the sector: the value chain and its key actors

Several types of stakeholders, both directly and indirectly involved in the APPR supply chains, were approached to perform the analysis. *Table 6* reports the list of categories whose representatives or company managers have been contacted through collective or bilateral meetings, or through participation to workshops, trying to capture their feeling, past experiences and possible plans for the future with respect to the APPR energy value chains.

Farmers, of course, are the primal source of biomass from the pruning of tree-crop plantations. On the opposite side of the supply chain, ***final energy users*** or ***consumers*** may potentially belong to very different categories. Potential consumers could be the farmer himself, a household, a municipality setting up a district heating system, an agro-food processing plant or a manufacturing industry, both facing substantial energy consumptions, or a quite large power plant producing electricity for a large community or the national electric grid.

Along the whole supply chain, agricultural and industrial companies may play their collaborative role, and the length of the chain could be shorter or longer according to the corresponding business model applied. Apart from the initial (biomass source) and final (biomass sink) stages, the biomass-to-energy path is made of several possible sequential steps through which the biomass is harvested, pressed or chipped, transported, conditioned and stored according to the best-known procedures (*Figure 7*). We can identify this step as ***biomass mobilization and conditioning***.

According to the size or capacity of the energy plant, the total amount of biomass addressed to the energy facility can vary widely. Larger capacities need larger biomass volumes and, correspondingly, a well-planned supply network should be arranged. This requires a wide farmers' participation and a massive biomass contribution. Biomass storing facilities are needed to collect and prepare the biomass to the process of energy conversion. Logistics, therefore, could play a crucial role in the overall organization of the biomass supply chain. Specific consideration should be assigned to the setting up of an equipped "biomass platform" that could significantly increase the efficiency of biomass mobilization. In this regard, the challenge is to optimize the upstream and downstream management of biomass with respect to the pivotal "node" of the platform. Logistically, several satellite platforms of biomass storage could serve one large size energy plant. Much easier is the logistic organization in the case of a smaller size energy plant, taking into account the possibility to reduce significantly the supply radius and the related haulage costs; also easier is to find the proper biomass availability in the region.

Biomass fractionation and mixing according to its quality characteristics, storage, conditioning, densification, torrefaction, transport and trading are just some of the treatments biomass could be processed in a platform facility. Correspondingly, its energy value is enhanced and other technical qualities significantly improved.

Table 6. Stakeholders and key actors in the APPR sector

A. *Agricultural Biomass Suppliers:* • Farmers • Farmer Consortia and Cooperatives • Agriculture Productive Organizations	**C.** *Bioenergy Final Users in Agriculture:* • Farmers (energy self-consumption) • Livestock farms • Farmer household • Agro-food processing industries
B. *Biomass Mobilization & Treatment:* • Agro-Mechanical Service Companies • Biomass Storage Platforms • Biomass Handling & Transport • Techno-Logistic Centres • Biomass Pellettization & Torrefaction Centres	**D1.** *Bioenergy Final Users in Industry:* • Power Companies • Handicraft and Manufacturing • Industrial Laundries **D2.** *Other Bioenergy Final Users* • Municipalities (district heating) • Food refrigeration
E. *Assistance & Advice in Agriculture:* • Farmer Associations • Professional Associations in Agriculture • Professional consultants **F.** *Assistance & Advice in Industry:* • Industrial Associations • Professional Associations in Industry • Professional consultants in Industry	**G.** *Industrial Suppliers:* • Energy Service Companies (ESCOs) • Renewable Energy Enterprises • Builders & Sellers of Energy Plants • Builders & Sellers of Processing Facilities (harvesters, shredders, dryers, chippers, etc.)
H. *Other main influencing actors:* • Policy Makers (Regional and National Representatives) • Decision Makers (Regional and National Governing Persons) • Opinion Makers (Mass Media Editors and Communication Professionals) • Non-Governmental Organizations (ONGs) • Public Opinion and Local Community	**I.** *Local / Regional representatives of public institutions:* • Governance and Administrators at Province / Regional level • Municipalities • Institutions Promoting Local Economy (Chambers of Commerce) • Local Action Groups (LAG) • Research and Innovation Centres

Several specialized ***mechanical service companies*** are offering services of mechanical operations (such as soil ploughing, harrowing, mowing, grain harvesting, fruit tree pruning operations, etc.). These companies are usually hold by “developed” farmers that have a real interest in specializing their firm in the collection of pruning and their subsequent mobilization. The same companies also have the investment capitals needed to buy the pruning harvesting machines (baling or chipping) and to amortize their cost in organizing a collecting and storage system.

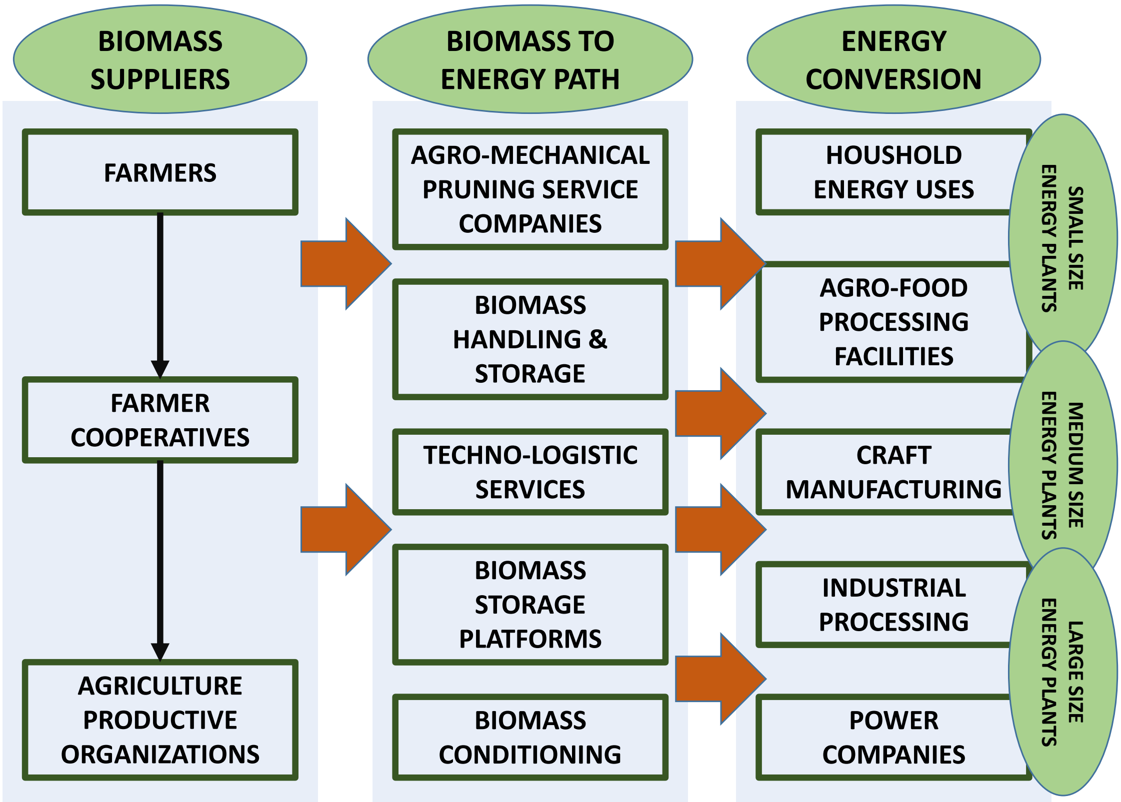


Figure 7. Diagram showing the key actors characterizing the composition of the APPR sector, specifically considering three different branches: a) biomass suppliers; b) biomass mobilization and conditioning; c) biomass conversion into energy (i.e. final energy users).

Other "developed" kind of farmers are currently playing the role of ***wholesalers of agricultural products*** (thus serving as collectors of crop yields and products from a wide range of farmers in the region). They can be also large ***dealers of agro-technical inputs*** (such as fertilizers, seeds, herbicides, etc.). In both cases, these actors are closely connected to farmers and they know very well their attitude, being able to attract and convince them collecting the pruning thus contributing to the biomass supply chain.

Other relevant potential operators in the APPR sector are large ***agricultural machine and equipment dealers***. Similarly to the previous potential actors (i.e. providers of mechanical services, wholesalers, agro-dealers) they have a great influence on farmers and can steer farmers entering in the APPR sector, mostly as biomass provider but, sometimes, also as biomass transformers or sellers of transformed (densified or torrrefied) biomass. Their business could be much diversified by becoming an ESCO (Energy Service Company). In most cases, they simply sell the pruning collecting machines; in other cases, they sell also small energy plants; finally, they can sell chipped or pelletized biomass or they directly produce power energy transmitted to the grid. Less frequently, final consumers placed close to the energy plant can use the extra-heat obtained from the same plant.

These potential relevant key actors in the APPR value chain are closely related to farmers and originally farmers themselves but, differently from farmers, are quite economically solid and willing to diversify their productive activities and ready to invest their capitals.

Still within the agricultural sector, ***farmers' associations***, in agreement with ***industrial electrical companies*** managing large size power plants, are proposing specific "biomass supply contract" between farmers (biomass suppliers) and energy companies (biomass buyers), according to a collective kind of contract. The duration of this contract could last for a ten-year period or even more. A special "loyalty" bonus is provided based on the duration of the agreement. The longer is the contract duration, the higher is the price agreed for the biomass. Indeed, the duration of the commitment in the provision of biomass is of vital importance for the energy company because it provides stability to the supply and ensures the continuity of plant operation.

Farmers' cooperatives might also manage agro-food processing plants (e.g. olive oil mills or wineries). These processing activities need energy (both power and heat) that could be satisfied by the farmer members of the cooperative itself through the supply of pruning from their tree-crop plantations. This form of biomass supply could be indirectly considered a form of energy self-supply, taking into account the close relationship between farmers and their own cooperative.

The companies directly managing ***agro-food processing plants*** can play almost the same role as farmers' cooperatives, by producing for their own the energy required in the production process and using for this purpose the residues of wood biomass obtained from the farmers providing their grapes or olives. Olive oil milling facilities have also a large availability of other kind of combustible by-products such as olive pomace and olive stones. Similarly, wineries easily have a large availability of other kind of by-products, such as wine lees and marc, which can be used to generate energy to be spent in the same processing facility. In this respect, multi-fuels energy plants, i.e. energy facilities able to use different kind of residues or wood, are a key elements in the technological proposition of the supply chains and, as a consequence, of the entire business model. Considering the agro-food industries, the marked seasonality in the availability of biomass can be a problem. A well-organized logistics and the setting up of biomass platforms for a long-term storage of biomass, sorted according to homogeneous characters, is a key issue if effective value chains should put in place.

In some regions, the agro-industries are large energy consumers. This is the case of Aragón, where an important part of the biomass is consumed by forage dehydration facilities, cereal drying industries, or distilleries. This small consumption niches show an interesting alternative to power plants. In the agro-industry sector, biomass use according to a "proximity" concept is of great relevance. Switching from gasoil or natural gas to biomass showed to be largely convenient; moreover, these industries are usually more prepared to treat inhomogeneous materials.

Other large energy consumers are horticultural farmers' cooperatives specialized in vegetable production and post-harvest processing. In this case, the energy need is mostly related to the cold storage of vegetables. Refrigeration of fruits and vegetables is necessary while waiting that fresh product is packaged for sale or while waiting that vegetables are transported abroad. Heat can also be used in livestock breeding, dairy and cheese factory, aquaculture, and many other activities, still within the agriculture sector or at the cross-road between agriculture and food-industry. Similarly, a high heat demand also characterises nursery farms producing vegetable seedlings in greenhouses or floriculture farms in glasshouses.

District heating / cooling is a system for distributing heat (or cool) generated in a centralized location for residential and commercial heating requirements. It offers excellent opportunities for achieving the twin goals of saving energy and reducing environmental pollution. Indeed, district heating with combined heat and power (CHPDH) is one of the cheapest method of cutting carbon emissions. It is an extremely flexible technology with the possibility to use biomass and, specifically, chipped APPR. At municipal level, district heating (and cooling) is an efficient way to heat (and cool) public buildings, gyms and swimming pools, as well as industrial facilities. Today, it is considered a very smart solution for a city administration to be environmentally sustainable and (at least partially) fossil-free.

Besides the cases of power supply close to the agricultural sector, other major energy end users are the ones fully included into the industrial sector. ***Large size power plants*** (in the range of some units to tens megawatts of electrical power) are usually not working in CHP alignment (therefore, their efficiency is quite low – 30-35% - as compared to CHP facilities). In some cases, heat could be recovered by heating greenhouses, located very close to the plant. The total covered surfaces of the greenhouse system is proportional to the power size of the energy plant and is used to grow vegetable, flowers, ornamental plants. Considering the energy cost of managing a greenhouse production activity, this final use of heat is generally very profitable and sustained by public funding as well.

Another possible industrial use of APPR biomass is in large electric coal-fired plant. In this case, biomass could serve as a co-fuel of the power plant, thus reducing the amount of coal needed and significantly abating CO_2 emissions into the atmosphere. The contribution to decarbonisation could be very substantial in proportion to the amount of biomass supplied to the plant. Similar use of APPR biomass is in industrial furnaces to attain a higher processing temperature to be spent in manufacturing processes. Industrial laundries, thermal bath (spa), drying processes, and many others are the applications of heat obtained by industrial boilers.

3.5 Different types of organizations: the business models

A “business model” describes the rationale according to which an organization generates, captures and delivers value. Applying this concept to the problem we are facing in this document, we can say that through a “business model” we want to describe the sequence of segments that make up the value chain and the relationships through which they are connected. The aim, in general, is to generate a new value (economic, environmental and social). In the case of APPR, the added value is obtained starting from a low valuable residues or by-product (i.e. wood from pruning and trees/plants removed). In simple words, it is intended to disclose the "connecting pattern" made by the key actors and reveal the main functions within the chain structure.

Any different combination in the constituents of the value chain is able to generate a different "business model", involving several actors and companies and diversifying the business scenario. Accordingly, optimal solutions should be detected only with reference to a specific project, just considering local features and the way these features can affect the starting theoretical model.

A first attempt in mapping the business model is proposed in *Figure 8*. We can introduce a graphical pattern useful to identify different business typologies or, in other words, different structural organizations of the APPR value chains. Every business model could be identified as a point or an area on the Cartesian plane made by the orthogonal interception of two axes. The vertical axis discriminates between agriculture and industrial sector of the proposed business, while the horizontal one divides projects conducted by single companies from those conducted in partnership, also considering the participation of public entities (such as municipalities or province /district administrations).

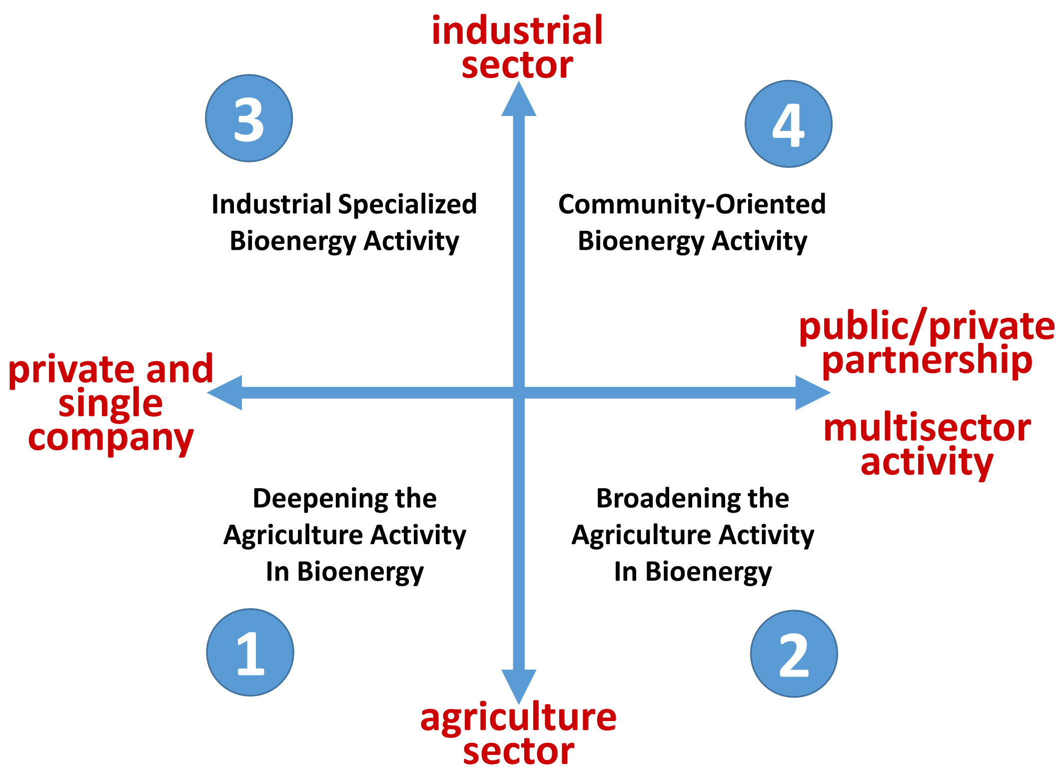


Figure 8. Every business model could be identified as a point or an area on the Cartesian plane made by the orthogonal interception of two axes: the vertical axis discriminates between agriculture and industrial sector of the proposed business, while the horizontal one divides projects conducted by single companies from those conducted in partnership with public entities.

Four quadrants are originated from this Cartesian plane:

1) *Deepening the agriculture activity in bioenergy*. The agricultural side is deepened through rural development. That is, agricultural activities are transformed, expanded and/or relinked to other players and agencies in order to deliver products that entail more value added per unit,

precisely because they fit better with the demands in society at large (van der Ploeg and Roep, 2003). Specifically, energy or energy carriers are produced from biomass collected inside the farm and this activity represents an opportunity to capture added value through biomass transformation and conversion. Energy can be either sold or self-consumed (Fig. 9, A and B).

2) *Broadening the agriculture activity in bioenergy.* The rural side of the farm enterprise might be reorganized and amplified as well. The process of broadening occurs in that case. Broadening can follow different trajectories. We refer here to the development of new activities and to diversification in the sector of energy production. Such activities enlarge the income flows of the farm enterprise, while they simultaneously imply the delivery of goods and services society is willing to pay for (van der Ploeg and Roep, 2003). Specifically, energy or energy carriers are produced through the setting up of a supply chain involving farmers, farmers cooperatives, or collective infrastructures (*Figure 9, I and J*). One typical example of this kind of business model is the one supplying APPR biomass to agro-food processing facilities, such as wineries and olive oil mills. The energy consumptions of these rural facilities can be satisfied by farmers' biomass, supplied together with grapes and olives at the same cooperative. The energy surplus can be, eventually, transferred to the electricity grid taking advantage of the tariff subsidy. This model of business is still within the true dimension of rural development but, differently from the previous strategy, it overcome the boundaries of the farm, as a single and isolated activity, to involve the rural dimension of the territory as a whole (farmers' cooperatives, farmers' associations and productive organizations).

3) *Industrial specialized bioenergy activity*. On the other side of the Cartesian plane, the ordinary business model of bioenergy production is presented. This model is the classical agro-industrial solution that, concerning the agroenergy sector, replicates the same organization of the agro-food industry. Agriculture (single farms) is involved in the supply of APPR biomass that, considered as an ordinary feedstock, is transferred to the Industry (energy companies) to allow its conversion into a final energy product, generally electricity (*Figure 9, C →D →E*). According to this model, farms are the biomass "source", while private energy companies are the "sink", in the middle several possibilities to collect and mobilize biomass employing the best technical and logistics solutions. In this case, the agro-industrial integration is applied moving the pivot at the side of industry and squeezing the agricultural sector. The agriculture sector, accordingly, gives up to any strategy to capture fractions of the added value generated along the supply chain. To mitigate the "squeezing" risk of farmers, the only applicable form of protection is to sign a "supply chain contract". This contract is very convenient also from the side of Industry, in order to assure a steady and regular biomass supply.

4) *Community-oriented bioenergy activity*. This model progressively expand the concept of rural development already expressed in the previous points (1) and (2) just considering that rural society is now becoming the community at large. From single farms to farming cooperatives and productive association is the step performed from quadrant (1) to (2).

   The collective management of structures intended to harvest, transport, and store APPR biomass is a step forward to the organization of villages and communities that take energy production into their own hands, following the principle of a community-related energy supply.

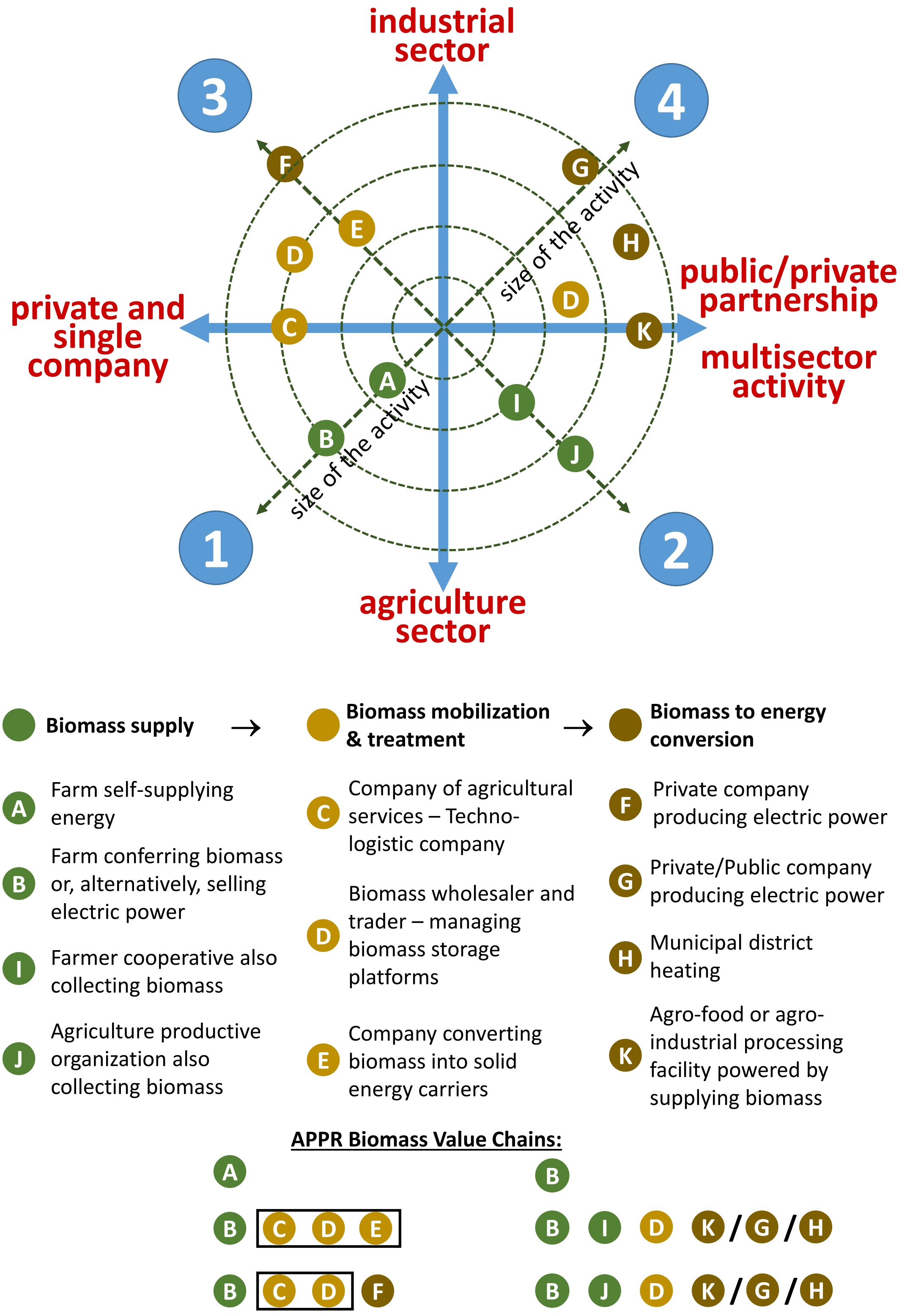


Figure 9. Adopting the diagram already presented in Figure 8, several APPR activities are positioned on the Cartesian plane according to their specific features and potential business models are represented, possibly connecting those single activities.

An ecologically, and socially friendly energy supply is achieved with the development of renewable energy models that allow the vision of a "distributed" energy generation and use. Differently from the strategy presented in quadrant (3) – that is the "shorter" path to bioenergy - this strategy could be named the "longer" path (or the "long march", paraphrasing the Mao Zedong's well-known revolutionary episode), as clearly shown in *Figure 10*. The "bioenergy community" concept involves the residents of small towns or villages in planning, funding and implementing the conversion of the energy supply from fossil fuels to biomass, and is a great chance to approach sustainable energy scenarios at the community level.

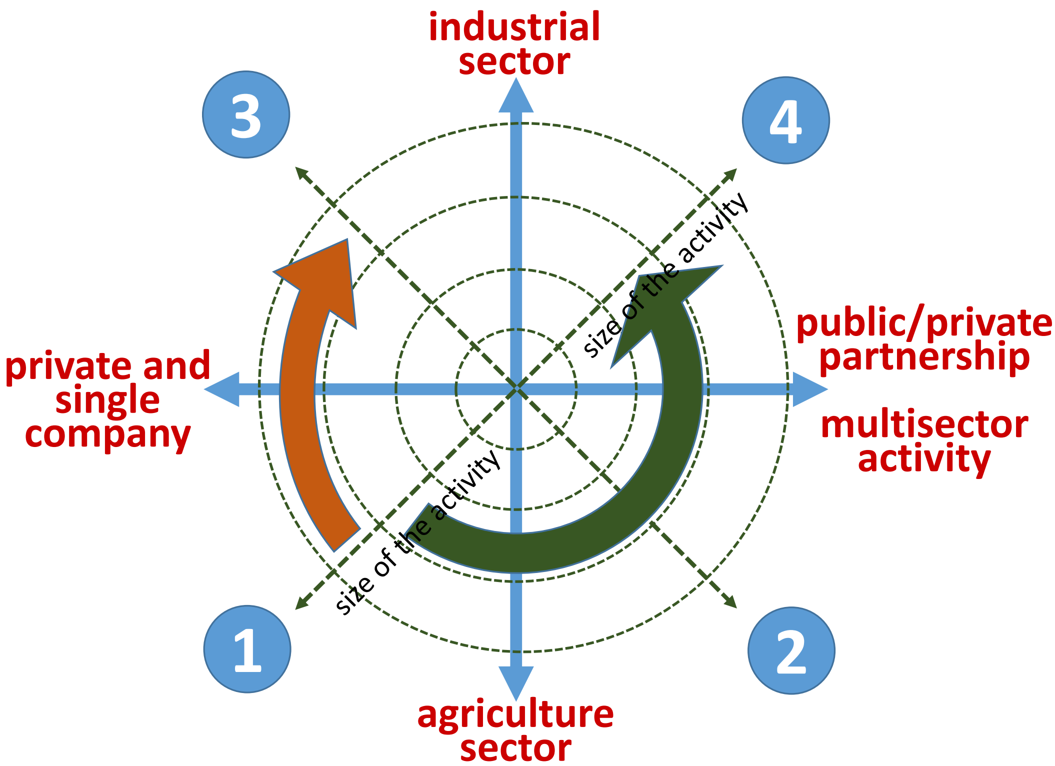


Figure 10. Two opposing strategies of APPR sector development can be identified according to the reported diagram. The first (brown clockwise arrow), from (1) to (3), is the "shorter" path to industrial specialization of large power plants; the second (green counter clockwise arrow) is the path to rural development, from (1) to (2), followed by the development of the community at large, from (2) to (4). This "longer" path is based on the vision of a "distributed" model of energy generation and use.

Concerning the structure of the APPR value chains, different kind of relationships among actors or participants to the productive process can be detected. These structures can be graphically represented according to the models shown in the following figures (*Figure 11.1, 11.2* and *11.3*).

Figure 11.1. Structure of the APPR value chain according to the models of both "deepening" and "broadening" the agriculture activity into the bioenergy sector. Deepening is achieved moving vertically (downwards) the sector activities, while broadening requires shifting laterally (to the right) towards a productive integration establishing effective links with other actors operating along the value chain.

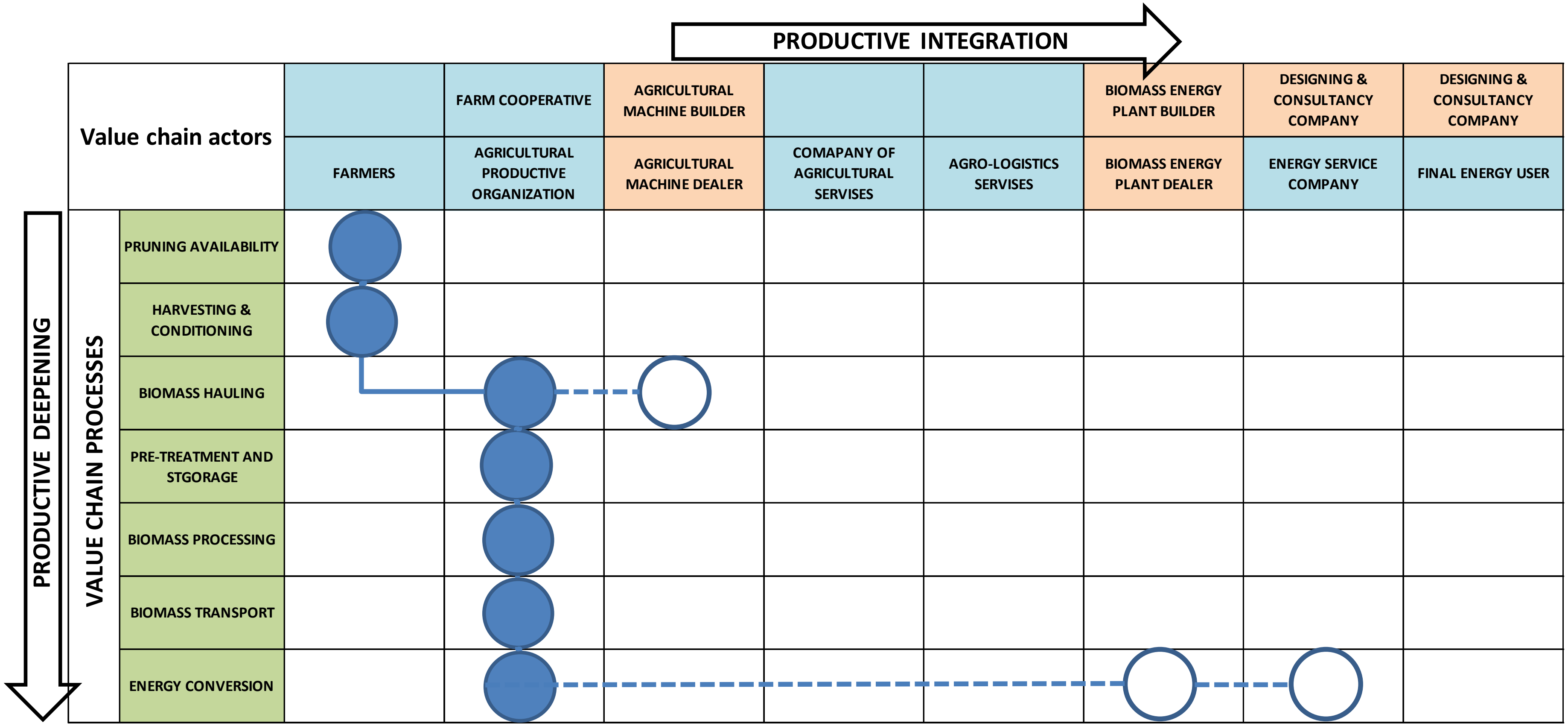


Figure 11.2. Similarly to the previous figure, but the structure of the APPR value chain is according to the model of "industrial specialized bioenergy activity".

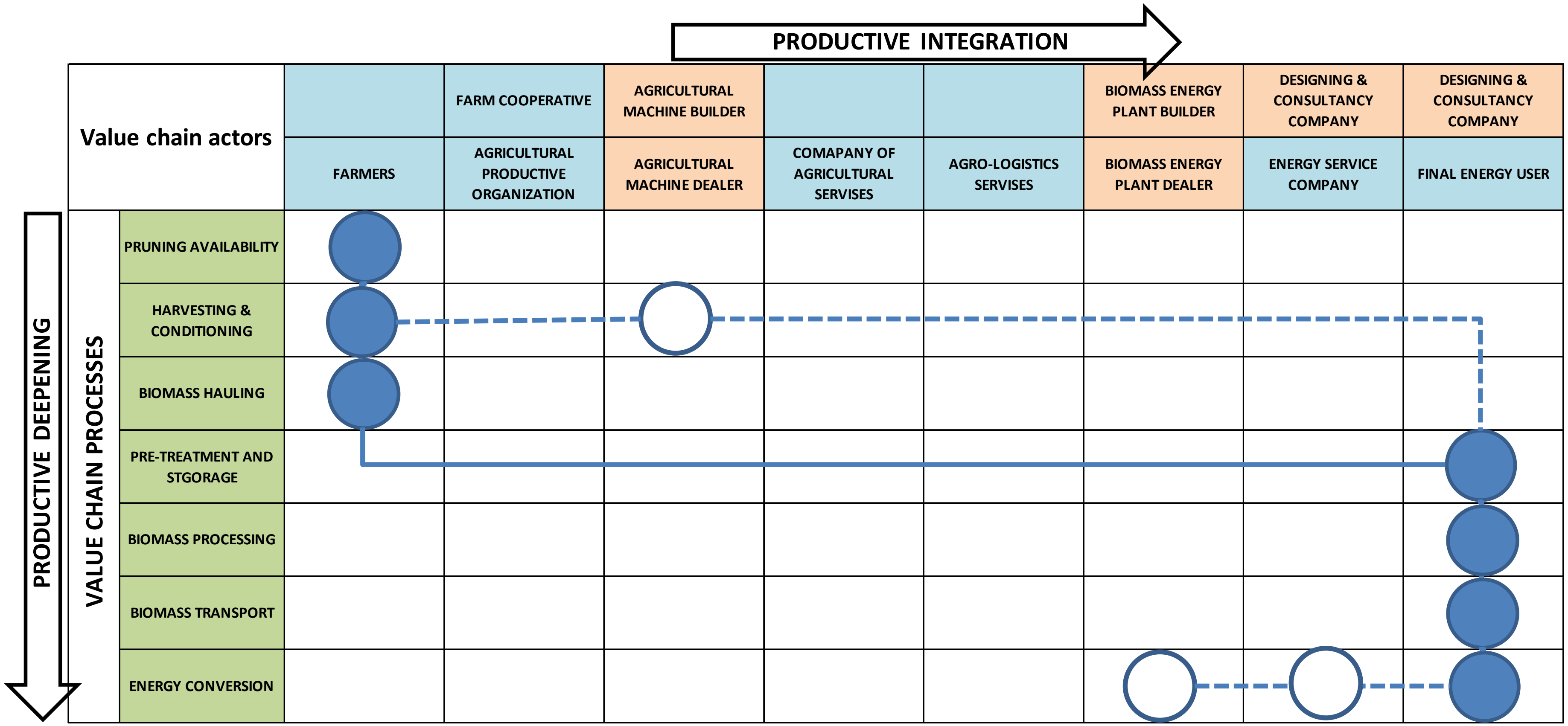
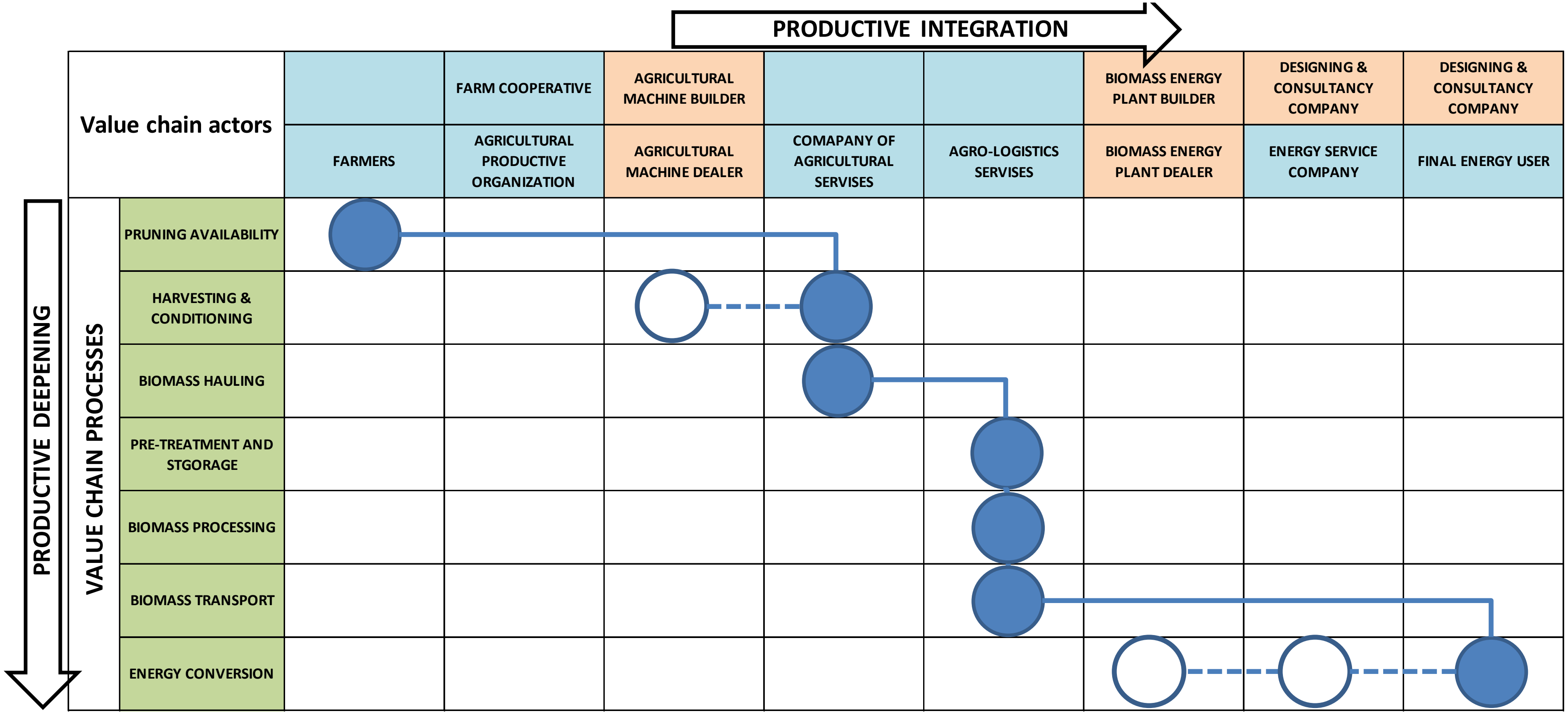


Figure 11.3. Similarly to the previous figure, but the structure of the APPR value chain is according to the model "community oriented bioenergy activity".



3.6 Barriers and constraints affecting the APPR sector

More than the technical constraints, the non-technical ones generally showed to be the most important barriers to the APPR sector development. At a first glance, it appears quite clear that the agricultural sector is significantly weaker than industry. Lower levels of business organization, scarce readiness in implementing technological innovation, modest willingness to partnership and limited availability of financial capital to be invested in new business are the general traits of agriculture with respect to industry.

As a result, in most cases, investors and prime movers in new business come from the industrial sector, while farmers or farmer cooperatives and farmer organizations are not ready enough to start new businesses.

The most relevant barriers and constraints to the take-off of APPR value chains are reported in the following part of this section, as identified in each Demo region, and following the classification criteria presented in *Table 7*.

Table 7. Barriers to the APPR development classified by productive sector categories (vertically) and classes of factors (horizontally).

FACTORS → SECTORS ↓	(A) CULTURAL ATTITUDE	(B) KNOW HOW & TECHNOLOGY	(C) ECONOMY & FINANCE	(D) GOVERNANCE & POLICY
(1) AGRICULTURE	• Mind-set of farmers, reluctance to change and low attitude in cooperating and innovating. • Pruning is supposed to be not a by-product but a waste without any economic value.	• Pruning burning in open field is still considered an agronomic operation. • Competitive agricultural use of pruning as soil amendment. • Agronomic guidelines on soil and pruning management are still lacking. • Unawareness that APPR residues is not a negligible source of energy (not worse than forestry wood in energy terms).	• Structure of farms and farm size too small (in certain cases) to allow a profitable pruning collection and use. • Pruning is considered a feedstock of too low economic value. • Little info on funding opportunities for farmers in the bioenergy sector.	• Pruning burning is not roundly forbidden by national/regional regulation. • The energy use from pruning is not adequately supported by the CAP. • Risk of soil depletion if APPR biomasses are not properly managed at field scale.
(2) LOGISTICS	• 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. • 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). • Scarce interest on APPR residues by biomass suppliers. They intend APPR as a minor biomass resource, more difficult to manage than others feedstock types.	• APPR is largely spatially dispersed and need to be collected over a wide land area. Strong seasonality in harvesting. • Complexity of biomass supply chains. Lack of well-organized logistics operations. • Low degree of mechanization. Lack of knowledge on field mechanization. • Harvesting and chipping machines need technological improvements.	• APPR harvesting and transport operations are generally considered too costly. • Low amounts of APPR in t/ha as compared to forestry wood need to reduce handling to keep costs reasonable. • Limited economic affordability in utilizing services offered by specialized agro-mechanical pruning companies or techno-logistic companies. • A long and subdivided supply chain could be not economically efficient for every actors.	• Risk of large fossils energy consumptions and GHGs emissions along the supply value chain and lack of environmental guidelines.

(3) INDUSTRY	• Distrust that farmers may be reliable in biomass supply. Need of long-term contracts to build farmers' loyalty. • Distance in the vision of the problem. Industry needs secure, economic and constant supply, whereas farmers need to perform agronomic operations for a good fruit productivity and plantations health.	• Inadequate or insufficient technical reliability of biomass plant. • Renewable energy more emphasized as power than heat generation.	• Industrial investors are expecting very high profits and a fast payback time in the renewable energy sectors. • Biomass plant and energy facilities are still capital intensive. • Still large-scale economy are influencing the sector. • Little info on funding opportunities for entrepreneurs in the bioenergy sector.	• APPR biomasses are still not included as potential biomass sources in some regional energy plan. • High rate of law changes and great instability in energy policy decisions. • Atmospheric emissions due to biomass thermochemical conversion are considered an environmental problem. Biomass of lower quality may find constraints to be utilised in small combustion units in future.
(4) MARKET	• Lack of awareness about the potential use of APPR biomass as an energy carrier/source.	• Competitive energy use from forest wood, crop residues or food-processing by-products as alternatives to pruning. • Woodchip from pruning is of lower quality than from forestry. • Vision that APPR biomass is just a bad fuel • Energy products that do not comply with international standards and labelling.	• Price of oil and fossil fuels still quite low to promote competitiveness from renewables. • Actual low degree of pruning valorisation. • APPR market still underdeveloped. • Imports of cheap biomass feedstock from outside the EU.	• Market driven incentives and subsidises are progressively decreasing. • APPR biomass use is less competitive than other forms of renewable energies. • Electricity more economically sustained than heat.
(5) SYSTEM ARRANGEMENT	• Energy conversion from pruning is still considered an overall risky operation. • NIMBY syndrome ("Not In My Back Yard").	• District heating is still an uncommon solution in municipalities (with exceptions). • Lack of integration of knowledge and efforts across sectors.	• Agro-industrial integration is hard to be achieved. • Lack of exemplary business cases • A scarce number of ESCOs are operating in the regional bioenergy sector. • APPR are residues needing management. APPR to energy should be observed as a change in the management of residues, and not as a lucrative driven activity (APPR to energy works when all value chain actors find in the new APPR management advantages: either tangible or intangible).	• No coherent policy, no strategic view on the APPR sector from local governments. • Limited communication with civil society/public opinion and lack of promotional activities

Cultural attitude

- Mind-set of farmers, their reluctance to change and their low attitude in cooperating and innovating
- Pruning is supposed to be not a by-product but a waste without any economic value
- 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
- 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)
- Distrust that farmers may be reliable in biomass supply
- Lack of awareness about the potential use of APPR biomass as an energy carrier/source
- Energy conversion from pruning is still considered an overall risky operation
- NIMBY syndrome ("Not In My Back Yard")

Farmers are usually unprepared and sceptical on the possible energy use of APPR and, ordinarily, are not directly involved in biomass energy projects. "Biomass provider" is, in most cases, the only role they see for them in a bioenergy value chain. Therefore, there are limited chances for expanding and deepening agricultural value chains towards the biomass energy sectors as long as farmers do not make up their minds and start to consider themselves as potential "prime movers".

Moreover, farmers are usually unaware of the possibilities to mobilize APPR biomass for energy conversion (other than firewood). Often, they do not have any real information about the amount of biomass that pruning operations could yield on a regular basis. For farmers, pruning disposal is just a running cost generally not accounted in the economy of the fruit-tree plantation. Moreover, pruning is not conceived as a potential source of supplemental revenues. Differently, when the amount of costs supported in disposing operations are finally accounted for, alternative treatments and possible energy uses start to be considered.

Farmers generally believe that pruning residues are just waste to be disposed the sooner as possible, in order to avoid obstacles to farming operations. This particular believe is the reason why pruning is often burned at the side of the field or even in the inter-rows of plantation. The concept of "crop residues" and the intrinsic value they can offer both to the cultivated soil and as energy feedstock is often ignored or simply underestimated. Moreover, there is not awareness about the negative effects of burning pruning in the open field, in terms of risk of accidents and also considering the soil quality and its long-term fertility. Although media, technicians, academics, etc. are spreading the concept that the burning of crop residues should be considered a "bad" agronomic operation (which is forbidden by some regional regulations, somewhere and somehow), it is hard to erase from the mind of the farmers the deep conviction that, conversely, combustion is a simply and ordinary farming practice.

If pruning is a "waste", in the opinion of the majority of farmers, the only possible management is "disposal". Labour, machines, and time (therefore money, after all) spent in removing pruning from the field are taken as "shaded" costs and usually not accounted for, simply ignored or at least underestimated.

The farmer's purpose is to free the surface of the soil as soon as possible so as not to hinder other agricultural operations (irrigation, fertilization, soil harrowing, pest treatments, etc.). This means that even if a specialized company is collecting the pruning, usually the farmer is not willing to wait that pruning wood runs dry directly in the field.

There are also other sources of scepticism generally testified by farmers in respect to the potential APPR energy use. A farmer generally believes that biomass from pruning residues is relatively poor, of low quality, with a low energy content, not competitive in comparison with other biomass feedstock. Most of all, he/she believes that the setting up of a value chain will mainly favour other actors rather than the farmer himself. If the energy potential of pruning is brought to the farmers' attention, sometimes they fear that an external company will force them to pay for the service of their pruning collection. Additionally, if they are dissatisfied with their cultivation revenues, they cannot be persuaded that the energy use of APPR biomass can provide sufficient economic benefits or cost savings to make this operation worthwhile.

As already explained, in general, farmer's mind-set is not very opened in establishing collaboration with other farmers, unless driven by necessities and circumstances. Considering the limited farm surface and the limited capital availability, a small farmer has strong difficulties in purchasing the full farming equipment and operational machines. Apart the high costs, the option to properly amortize these investments is considerably low. It would be very favourable to jointly purchase machineries and use them collectively according to self-governance rules (such as a form of internal renting). In this respect, specialized agro-mechanical service companies are able to offer turnkey mechanical operations to a wide range of small farmers that, in this way, do not have the need to purchase the specialized equipment.

One of the most critical features in considering the relationship between biomass supplier (a farmer) and the biomass user (generally the manager of an energy plant) are the terms and conditions of the contracts. Apart from the biomass quality, that should be clearly defined, another very critical issue is the timeframe of the agreement. From one side, the biomass user is concerned about the supply stability conditions (every year exactly the same fixed amount of biomass is needed), on the other side, the farmers would like to be more free to decide how to use the available biomass and who should be the best bidder. To reconcile these conflicting trends (between who offers and who buys) and optimally adjust the agreement, usually the contract also states that the biomass price is higher in proportion to the number of years of enforcement. In other words, it is like applying a reward (or an extra-value) to the loyalty in the biomass supply. Of course, penalties are also applied when farmer does not comply with the contractual terms.

Apart from the farmers' category, a general scepticism regarding the APPR biomass has spread along the entire supply chain, also involving other key players, such as technicians, engineers, ESCO operators, public administrators, etc. A still limited numbers of success cases is affecting the "mood" and influencing the willingness to invest in the sector. It is worth mentioning that, sometimes, they get to know the failed cases, of some neighbour, or published in press. That simple information brings them the idea of "impossibility" or "unfeasibility" of the APPR biomass for energy purposes. Sometimes even the final energy consumer, in the person of the citizens who will benefit from the obtained energy, are not in favour of the project. This latter factor is pertaining to the frequently observed NIMBY syndrome, i.e. the opposition to energy installations by resident citizens because it is close to their houses, often with the connotation that such residents believe that these developments are needed in society but should be further away.

Finally, it is useful to highlight a general fragility of the agriculture sector (probably this fragility is not confined to this sector only, especially considering these current times of financial crisis). Substantial obstacles to the start-up of a local bioenergy sector could be also related to a systemic inadequacy of the regions themselves: lower infrastructural availability, lower readiness to innovation, lower willingness to farmer association, limited accessibility to financial credit, etc. The overall outcome of this picture is that investments in bioenergy are still considered a high financial risk, not necessarily because of technological reasons or due to the intrinsic investment features, but for the surrounding context where investments are taking place.

Know how & technology

- Pruning burning in open field is still considered an agronomic operation.
- Competitive agricultural use of pruning as soil amendment.
- Agronomic guidelines on soil and pruning management are still lacking.
- APPR is largely spatially dispersed and need to be collected over a wide land area.
- Strong seasonality in the harvesting operations.
- Complexity of biomass supply chains. Lack of well-organized logistics operations.
- Low degree of mechanization. Lack of knowledge on field mechanization.
- Harvesting and chipping machines need technological improvements.
- Inadequate or insufficient technical reliability of biomass plant.
- Renewable energy more emphasized as power than heat generation.
- Competitive energy use from forest wood, crop residues or food-processing by-products as alternatives to pruning.
- Woodchip from pruning is of lower quality than from forestry.
- Energy products that do not comply with international standards and labelling.
- District heating is still an uncommon solution in municipalities (with exceptions).
- Lack of integration of knowledge and efforts across sectors.

Although agronomic technicians and academics have proved, long ago, that burning crop residues on the cultivated soil is an irrational and counterproductive operation (with respect to both sustainable use of agro-ecological resources inside the farm and environmental compatibility outside the farm), most farmers still consider this as an ordinary practice.

The “burning” practice is still frequently applied, while in more intensive agricultural areas this practice is less applied and is almost disappearing. Indeed, those farmers who are more technically prepared prefer an alternative management practice consisting in a shredding operation on pruning residues, leaving them on the soil surface to create a mulching cover or, differently, burying them into the upper soil layer in order to increase the soil organic content. This is generally considered a valuable and sustainable practice, strongly promoted by technicians as a good alternative to burning. Protection from bacterial and virus diseases is considered a very sound reason to avoid shredding and thus, an opportunity to derive the APPR residues for energy. However the preferred option is in general burning the residues in open air; theoretically this should happen only exceptionally, i.e. when diseases are actually detected, and not as a generalised practice, as it is the case in the countries analysed.

The setting up of an APPR value chain is generally considered a too much difficult effort to tackle and a too much complex organization to be effective. So many intermediaries are operating in it, that it might not ensure an economic return to all the actors playing a role. A technical optimization of logistics is needed. It is not yet adequately understood what may be the mechanized collection systems of pruning, whether it is better shredding or chipping than baling, which are the most efficient systems for handling wood residues inside the field.

The availability of machines and specialized equipment at farm level is frequently incomplete, neither sufficient nor adequate to allow a good technical performance of pruning handling in the field or at the side of it. Logistics represents a crucial factor in the success of an APPR supply chain, considering the existence of multifaceted constraints. APPR is largely spatially dispersed and need to be collected over a large area. Farms generally have a limited total surface and fields are frequently very narrow in size, thus mechanization is harder while more difficult is the use of the equipment, considering both accessibility to the field and the operability in the field. Field slope could also greatly affect the level of potential mechanization in the APPR collection procedure.

Farmers are reluctant in sharing the facilities so that the collective use of harvesting or chipping machines could be complex to be arranged. The time available for pruning harvesting is usually very limited, considering that farmers need to be free to perform other cropping operations. Moreover, APPR availability is affected by a strong seasonality and therefore long storage facilities are needed.

Apart from logistic reasons (i.e. the need to speed up the harvesting operations inside the field, increase the work capacity, reduce the machine stops and the loose of time, as well as cut the attending workforce), another relevant target is to take in due account the exact biomass quality with respect to the specific energy conversion the biomass is addressed. The majority of boilers or other biomass-to-energy facilities are designed to use the highest quality woodchip but, unfortunately, this is not always the case. Chips from APPR biomass are frequently of poor quality and they need specific technical care to be harvested and conditioned, the level of their humidity should be detected properly and the dimensional size of the chip pieces should be regular. The quality of pruning wood is generally intrinsically lower also considering the larger fraction of bark present in pruning as compared to wood from forestry (unless bark is removed). Other important features affecting woodchip quality are related to the harvesting operations in the field (specifically considering the possible contamination with soil particles) and the pruning management along the supply chain.

Besides the fuel quality due to intrinsic wood characteristics, the shredding or chipping operation may produce a large variability in the dimensions of the chip pieces, thus obtaining heterogeneous solid fuels in their size. This condition creates problems in the feeding phase of the energy plant operation, causing delays in the biomass supply stream or even forcing the stop. The adjustment of the boiler combustion parameters could also be required when APPR chips are supplied. Chips made from APPR biomass may need investments in a new feeding systems of the boiler; alternatively, the use of APPR pelletized biomass would be required or the switch to a multi-fuel heating system.

Quality standards on biomass feedstock and on wood fuels should be applied; strict traceability schemes should also be properly deployed along the value chains in order to provide full warranty to the final users.

Considering that thermochemical energy conversion processes are the most suitable when solid and wood biomass is available, boilers, stoves and closed fireplace for domestic heating have reached a very stable technological maturity, as well as large boiling systems coupled to a steam turbine for power generation. Differently, small size gasification or pyrolysis CHP plants are difficult to find commercially and their regular and stable operation is still technologically uncertain.

Renewable energy production was greatly emphasized as power generation (i.e. electricity), while heat generation was considerably less supported. This happened at regional and national level as well. The efficiency of biomass conversion into electricity, as compared to heat generation, is significantly lower, but the energy quality is much higher, considering that the national electric grid is able to transfer energy on the long distance and ensure the power supply on regular and stable conditions. On the other hand, the obtained heat should be used very close to the generation point and should assist an urban or productive district according to a model of “energy island” or a concept of “distributed” energy production. The same is true considering cogeneration (CHP – combined heat and power). Unfortunately, these specific conditions deserve a much more accurate and rigorous land planning to be applied, coordinated at local and regional level. General speaking and in almost all the considered regions, both regional and municipal administrations have not been timely and forward-looking in promoting these processes.

Municipal projects of district heating serving public buildings (schools, offices, gyms, swimming pools, theatres, etc.) are still in a very small number and should be further encouraged. These initiatives, in fact, in addition to being cost-effective and environmentally beneficial solutions, allow increasing the positive attention and awareness of citizens about this form of renewable energy.

Economy & finance

- Structure of farms and farm size too small to allow a profitable pruning collection and use.
- Pruning is considered a feedstock of too low economic value.
- Little info on funding opportunities for farmers in the bioenergy sector.
- APPR harvesting and transport operations are generally considered too costly.
- Limited economic affordability in utilizing services offered by specialized agro-mechanical pruning companies or techno-logistic companies.
- A long and subdivided supply chain could be not economically efficient for every actors.
- Industrial investors are expecting very high profits and a fast payback time in the renewable energy sectors.
- Biomass plant and energy facilities are still capital intensive.
- Still large-scale economy are influencing the sector.

- Little info on funding opportunities for entrepreneurs in the bioenergy sector.
- Price of oil and fossil fuels still quite low to promote competitiveness from renewables.
- Low degree of pruning valorisation.
- APPR market still underdeveloped.
- Imports of cheap biomass feedstock from outside the EU.
- Agro-industrial integration is hard to be achieved.
- Lack of exemplary business cases.
- A scarce number of ESCOs are operating in the regional bioenergy sector.

On average, the regional farm size is very limited and tree-farms are even smaller as compared to farms with herbaceous and industrial crops. Direct farming is the most diffused form of farm management: the farmer is the manager and, at the same time, the landowner; the family members are generally the main farm workers, while the aid of external employees is limited (with the exceptions of high demanding periods when seasonal workers are hired). On these conditions, capital availability to make new investments is limited, propensity to business risk is also narrow, the business scale is restricted and the amounts of potential mobilized biomass do not reach significant dimension to be economically viable.

Except in cases of self consumption at small scale, when a farmer decides to replace gasoil heating of a farm facility by biomass, he way to start properly new investments in the APPR sector is by promoting a large cooperation among small farmers and establish a large network of associated farmers. These are very ambitious challenges, curbed by the traditional condition of social backwardness of farmers, reluctant to be associated and to work together.

Pruning residues are generally considered a feedstock of too low value to represent an economic resource to be used conveniently in energy conversion. The very poor value of its unit mass, its dispersed spatial distribution, and the technical complexity associated to collection, harvesting, transportation and storage are identified as the main constraints rising the costs along the supply chain. These reasons can explain the current under-exploitation of pruning and wood residues from fruit-tree plantations. An efficient optimization of the logistics procedures related to pruning collection should minimize these costs.

While the additional costs related to pruning handling and its mobilization for energy conversion are surely accounted for, the costs associated with the ordinary operations of pruning management (burning or shredding) are usually not considered (being “shadow” or “ghost” factors) or largely underestimated. Indeed, the use of machinery and labour required to manage such residues generates extra-costs not routinely added in the balance sheets of the tree-plantation. Conversely, the potential economic benefit of pruning addressed to energy is not adequately estimated, whatever might be its energy utilization.

Some farmers are in contact with companies specialized in the collection and transportation of wood waste, wood residues, and wood from the maintenance of public parks, gardens, extra urban landscape, etc. The final disposal of this kind of heterogeneous and low quality biomass are, usually, large waste-to-energy power plant. Under these specific conditions, the removal of biomass is done at no cost but no value is assigned to these collectible pruning residues. This low degree of pruning valorisation does not promote organizing pruning collection activities by specialized companies.

The APPR market is still underdeveloped. Indeed, while other kind of wood fuels are quite diffused in the regional markets (such as firewood, almond shells, olive oli pomace, olive pits, etc.), woodchip from pruning is still uncommon and its supply on the market is currently quite limited. This also means market uncertainty in the APPR availability, no consolidated APPR sources, high risk of supply break, large price volatility and possible sudden price spikes, causing problems in the regular biomass availability. These difficult conditions on the supply side prevent, correspondently, the growth on the demand side, and the persisting of this vicious loop slows down the market development as a whole. Market speculations are even possible and conventional rules are still to be agreed in order to regulate the market conditions. On the other hand, the oil price and that of other fossil fuels is still quite low to promote an effective competitiveness from biofuels.

Taxation, and specifically the VAT rate on pellets or woodchips, can greatly affect the market development and the level of competitiveness of this solid biofuels with respect to the traditional fossil fuels. To switch from a 10% to a 22% of VAT on pellets, for example, had a strong effect both in Italy and in Spain. Currently, Italy has returned to a 10% VAT imposition.

Agro-industrial integration is hard to be achieved. While agro-food industry is well establish in the regions and it represents a solid and long-term partnership between agriculture and industry, no kind of previous experience are observed in non-food industry. In this respect, a mutual integration between the two sectors should be promoted. First, their complementarity should be highlighted, and then profitable connections should be created and boosted, based on business collaborations and joint ventures. The risk is that the agricultural component might be considered the weakest side in comparison with industry, possibly leading to a marginal role in the cooperation agreement, particularly with regard to the economic benefits the investment is going to produce.

Still very limited is the number of ESCOs operating in the sector. An energy service company (ESCO) is a commercial or non-profit business providing a broad range of energy solutions including designs and implementation of energy savings projects, energy infrastructures, power generations, energy supply, etc. The still underdeveloped market conditions are also the reason why new ESCOs are limited in number and in their capacity to attract and promote investments in the bioenergy sector. More and better information is required, especially on the demand side. Both SME clients and ESCOs often lack a sufficient credit rating with a specific view to long-term investments. Pricing and tariffs are currently imposing a disadvantage on ESCOs. The market is still moving forward against these barriers but the outlook could be much more positive without them.

In general, limited or not sufficient information on public funding promoting bioenergy projects is available. More emphasis on promotion and dissemination should be paid to this kind of public initiatives. Public funding, incentives and subsidizes are still very relevant to allow the sector development. Investment costs in purchasing the energy plants as well as the facilities needed to perform pruning harvesting, transport and storage are still quite expensive and the companies that could be potentially involved in these projects are generally small and with limited amounts of available capitals. The market is still strongly characterized by the economy of large scale, i.e. as a firm grows in size, it is-possible for it to reduce its cost. This is particularly clear considering the initial cost of investment. The consequence is that large-size energy plants are more convenient than small capacity facilities; therefore, the concept of “distributed” energy generation, thanks to the spreading of small but numerous energy plants over the regional territory, is difficult to be achieved.

Small APPR energy projects are more difficult to be launched and to remain vital. Several kind of risks are shown: smallholders should finance the project, the amount of mobilize biomass might be too limited to be effective and the incidence of fixed costs and depreciation costs are much higher than in larger project. All this considered, small farm companies usually renounce to the project investment or, if they proceed, they frequently undergo a financial collapse few time later the activity has started. This kind on negative experiences are not a good requisite to promote further investments in the sector.

APPR biomass as energy feedstock usually has lower value and lower quality with respect to wood biomass from forest. Large quantity of wood can also be imported from abroad, or collected from wood-processing factories (such as sawmills and industrial carpentry), or recovered from waste disposal operations. In these latter cases, wood is considered a waste and, therefore, can be purchased at a smaller price. Differently from wood waste, APPR biomass, and specifically APPR woodchips, is characterized by a much higher collecting cost. Therefore, collection costs should be reduced to a minimum if APPR biomass is to be competitive.

Moreover, other wood residues and food processing waste could be of great interest as energy carrier, thus competing with APPR as a cheap solid biofuel. Exhausted olive cake, for example, is a biomass fuel produced by olive mill pomace and widely used in olive oil producing areas. It has a quite high ash content (5% dry basis or more) and a strong odour and it exhibits fluctuations of its production level (depending on the olive yield of the year) as well as of its price (as a function of the olive productivity). However, it is very competitive in terms of price (around 70 €/t in the last years) and has a quite high heating value. Olive pits or olive stones are also quite diffused and available as solid fuels. In Apulia, cleaned olive stones are used in household boilers as alternative fuel to wood pellets and they are rapidly spreading on the market. In Macedonia and Thrace, it is fairly easy to find pellets made from sunflower husk, usually imported from Bulgaria or Ukraine. Their price is reported as being below 100 €/t which make them very competitive for industrial use, despite their high ash content. In both areas, biomass end-users can be quite satisfied with these fuels and unwilling to start an APPR biomass initiative on their own.

Governance & policy

- No coherent policy, no strategic view on the APPR sector from local governments.
- High rate of law changes and great instability in energy policy decisions.
- Lack of the right market driven incentives and subsidizes.
- Pruning burning is not roundly forbidden by national/regional regulation.
- The energy use from pruning is not adequately supported by the CAP.
- Risk of soil depletion if APPR biomasses are not properly managed at field scale.
- Risk of large fossils energy consumptions and GHGs emissions along the supply value chain and lack of environmental guidelines.

- APPR biomasses are still not included as potential biomass sources in some regional energy plan.
- Atmospheric emissions due to biomass thermochemical conversion are considered an environmental problem.
- Electricity more economically sustained than heat.
- Limited communication with civil society/public opinion and lack of promotional activities

A stable and supportive policy is crucial for the successful deployment of the bioenergy sector. Unfortunately, this is not always the case. Moreover, a policy initiative for bioenergy is most effective when it is part of a consistent, long-term vision. Such a vision should be clear about its motivation. Long-term continuity and predictability of policy support appears to be pivotal for successful development of bioenergy options. This implies that, from the start, policies should take into account the specific characteristics of the options involved (e.g. in terms of the key factors affecting the sector) and provide sufficiently long-term measures to address them.

Bioenergy policies should take into account the development stages of specific bioenergy technologies, and provide incentives consistent with the barriers that an option is facing. Similarly, there is a need for clarity and foresight in regulatory aspects, such as planning regulation and emissions standards.

Conversely, at least in some of the regions, it is difficult to detect a coherent strategic vision and, above all, specific measures could be numerous, but rarely harmonized in a comprehensive framework.

An effective and coordinated bioenergy policy is very complex to be deployed and need to be planned very carefully. It should pay attention to agriculture and forestry policy, in order to satisfy convenient biomass supply channels while promoting rural development. It should focus on market and financial instruments supporting the sector economy, from both the supply side and the demand side. Tax reductions, subsidies, discount rates, capital founding, etc. make up a wide range of leverage instruments that should be properly and carefully applied without generating a shock on the market or in neighbouring sectors. That is why a general and coordinated plan is absolutely needed.

Frequently, a high rate of change of the laws was observed, with alternating periods of rapid acceleration in setting up favourable conditions in developing the bioenergy sector, followed by idle periods, when some of the benefits gained by the sector just before were lost and dissolved in a short span of time. This, as can be seen, is not a forward-looking vision.

Bioenergy policy also involves planning in the energy sector at regional level, considering specific targets to be reached in terms of fossil energy displacement and GHG emission savings. For this reason, the environmental policy of the region is also directly involved, with remarkable consequences in fixing the standards of flue gases, particulate matters, and specific pollutants.

Besides market and prices, over and above the legal framework and the environmental agenda, research and innovation are also greatly affected by a well-structured bioenergy policy, together with very sound measures from the side of the industrial development.

A very confusing legal situation is currently characterizing the possibility to burn crop residues and tree pruning in the field by farmers. According to the majority of laws and regulations (at EU, national and regional level), residue burning is not allowed any more, although it is generally considered a very traditional farmers' practice. Cross-compliance and CAP regulations prescribe that burning is forbidden, with the exception when a sanitary risk occurs with consequent cautionary reasons. Regionally, derogations to the general rule allow the controlled on-site combustion of agricultural and forestry residues resulting from pruning or mowing.

Regional energy plans should specifically consider the APPR biomass among the potential feedstock to be potentially used in energy conversion processes. A preliminary information to be obtained is, therefore, the amount of APPR biomass available in the region as well as in the districts or provinces in the region government policies can have a direct effect on feedstock price

Finally, public and NGO acceptance is a major risk factor for all alternative energy sources, but bioenergy in particular. While concerns of NGOs and the public are usually global (social justice, impact of land use change, deforestation and overall CO_2 balance), local public resistance is more likely due to specific issues, such as traffic movements, local air pollution, smells, noise, visual impacts, etc. In general, society needs to be informed and confident that bioenergy is environmentally and socially beneficial and does not result in negative environmental and social trade-offs on a global or local level.

3.7 Driving forces favouring the APPR sector

Driving forces are those factors (both external and internal) that could have the most influence on the boosting process of creating a biomass value chain based on APPR feedstock at regional level. The same forces that should be activated in the "Action Plan". *Table 8* lists of the driving forces potentially favouring the development of the APPR sector as identified in each Demo region.

Table 8. Driving forces favouring the APPR sector classified by productive sector categories (vertically) and classes of factors (horizontally).

FACTORS → SECTORS ↓	(A) CULTURAL ATTITUDE	(B) KNOW HOW & TECHNOLOGY	(C) ECONOMY & FINANCE	(D) GOVERNANCE & POLICY
(1) AGRICULTURE	• Using locally available resources is considered a priority. • Farmers have a strong imitation attitude. Positive examples are considered as a model. • Cohesion is considered a social responsibility among farmers; this should promote cooperation. • Young and skilled farmers entering in the sector thanks to new incomes opportunities.	• Large potential biomass availability at regional scale and very high local biomass spatial density. • In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass). • Adaptation measures to climate change. • Ensure biodiversity conservation and the supply of ecosystem services.	• Agriculture is a strong local productive sector, together with agro-food processing. • Observed trend in deepening the agricultural activity along the value chain. • Observed trend in applying a set of agricultural diversified activities. • Potential cost savings in field pruning management.	• The “multifunctional” asset of current agriculture according to the most recent vision of “rural development”. • Application of the EU “cross-compliance” with respect to farmers’ commitments. • Funding schemes favouring the APPR sector in agriculture.
(2) LOGISTICS		• Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines).	• Good level of potential employment offered by the APPR sector.	• Rules encouraging inter-professional agreements along the biomass supply chain.
(3) INDUSTRY	• Specially in agro-industry, branding the use of APPR as a evidence of good practices and compromise with the environment	• Notable “learning curve” on the technological maturity of energy conversion processes. • Local operation of some real business cases and successful examples. • Ensure proper conditions for the adoption of knowledge and innovations.	• Long-term stability of economic return on bioenergy investment.. • Significant reduction trend in the capital costs of new investment in the bioenergy sector. • Possible availability of public financial funding to promote investments.	• Proceed in “greening” the economy, increase the use of renewables in industry, decarbonize industrial activities, save fossil energy and GHG emissions significantly. • More restrictive atmospheric emission thresholds

(4) MARKET		• Widening and diversification of the productive activities. • Commercial availability of small size power plants.	• Steady economic affordability of biomass energy carriers as compared to fossil fuels. • A prospective increase in the market price of biomass. • A prospective increase in the market price of fossil fuels. • Label and standards of biomass quality assurance and traceability.	• Subsidies and incentives promoting fossil displacement. • Public support on the demand side of APPR feedstock for energy use ("green public procurement"). • Segmenting incentives to renewable to favour social impact.
(5) SYSTEM ARRANGEMENT	• A potential level of cross-sector innovation. • Valorisation and reuse of agricultural residues for bioenergy production.	• Possible combination of biomass mobilization with information technologies and product traceability. • Agro-industrial integration towards a "bioeconomy" productive model.	• Possible application of the "Carbon emission trading" and CO_2 taxation. • Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example).	• Adoption of rules consistent with the development of circular economy according to the EU framework.

Cultural attitude

- Farmers have a strong imitation attitude. Positive examples are considered as a model.
- Cohesion is considered a social responsibility among farmers; this should promotes cooperation.
- Young and skilled farmers entering in the sector thanks to new incomes opportunities.
- Valorisation and reuse of agricultural residues for bioenergy production.
- Using locally available resources is considered a priority.
- A potential level of cross-sector innovation.

Horizontal association of small farmers is a requisite to reach critical amounts of mobilized APPR biomass, to be treated or to be sold. Considering the weaknesses of the APPR sector (first of all the limited unit value of this kind of resource, its spatially distributed location and the cost of collection), association and clustering is the best strategy to compete in a sector with increasingly industrial character and with respect to a progressively developing energy market. Coordination and concentration, indeed, are factors able to increase significantly the efficiency of APPR harvesting, transport and storage and to make fuel wood production from APPR feedstock more competitive on the market. Such operational clustering can be managed directly by the farmers' associations with the active commitment of each single farmer.

Cooperation among farmers (horizontal association) and among key operators along the APPR value chain (vertical association) could be an important driver in promoting and reinforcing the APPR sector. In this respect, and besides the positive effect in mobilization and commercialization of APPR biomass, there are several benefits and services resulting from association and cooperation. First, and more generally, cooperation increases the awareness of members (especially farmers) about the productive potentials of their fruit-tree residues and possible investments and projects to be carried out in order to reinforce their incomes. Secondly, training and consultancy services provided to members can be organized and performed at easy cost, especially favouring small landowners and self-employed farmers. Other services may be offered more effectively within a cooperation structure, such as supporting members in bureaucratic issues or reaching more easily public subsidies to members. Cooperation, moreover, might boost job opportunities for professionals and consultants and, not to be forgotten, significantly increases political power and higher advocacy capacity by the APPR sector as a whole.

The frequently observed conservative habits of farmers and their moderate motivation to build up new business could be probably overcome if younger farmers have the chance to manage the farming activity, by replacing the aging parents, considering they are usually more open-minded, more attracted by innovations and changes, and show more attitude to develop cooperative services and collaborative initiatives.

It is impressive to read the stirring stories of what can be accomplished through the power of good example.

It is impressive how useful and influential the "power of example" would be, especially in the rural sector as well as in the industrial one. Considering each specific region, identifying entrepreneurs that have started a new business in the APPR sectors is of the uppermost relevance. We like to name this particular kind of entrepreneurs "*prime-movers*" (or "first-mover"). A prime mover is to be recognize as the first starter of a new kind of business. This considered, it takes on him/her-self the great risk to produce and sell some kind of products never shaped before, but at the same time, being the first to enter in a new market, he/she gains a competitive advantage through control of resources. With this advantage, prime-movers can be rewarded with huge profit margins and a monopoly-like status. Not necessarily prime-movers are rewarded. If the first-mover does not capitalize on its advantage, he/she leaves opportunity for new entrants to enter the market and compete more effectively and efficiently. In any case, prime-mover "open a new door" and new "movers" can follow, especially if the challenge shows benefits and rewards.

Significant amount of information can be obtained from "prime-moving" experience, and a very positive "contaminating" effect might be generated from this kind of experience on other entrepreneurs in the same or other sectors, thus delivering a multiplicative "seed" able to spread in the region and giving strength to the new sector and to its market.

Bioenergy sector, and the APPR energy use as well (being part of the same sector), is related to a wide range of productive activities along the value chain; at each step of the chain, specific conversions and transformations are affecting the value of the final product. This means that an interlinked and systemic approach should control and optimize the productive chain and a cross-sectorial dimension should be set in the overall organization of the system. Reaching this organization level is, first of all, a cultural attitude and a radical change in the conventional mind-set of farmers, industrialists and businessmen is needed.

Know how & technology

- Large potential biomass availability at regional scale and very high local biomass spatial density.
- In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass).
- Adaptation measures to climate change.
- Ensure biodiversity conservation and the supply of ecosystem services.
- Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines).
- Notable "learning curve" on the technological maturity of energy conversion processes.
- Local operation of some real business cases and successful examples.
- Ensure proper conditions for the adoption of knowledge and innovations.
- Widening and diversification of the productive activities.
- Commercial availability of small size power plants.
- Possible combination of biomass mobilization with information technologies and product traceability.
- Agro-industrial integration towards a "bioeconomy" productive model.

The very first consideration about the setting up of a strong APPR sector in the considered regions is about the APPR resource availability. If this availability is present and is quite remarkable, the potentials in setting up structured supply chains, new productive activities based on APPR biomass, new businesses and a consolidated market are fully met.

Getting clear and detailed information about the amount of pruning that can be obtained from different kind of fruit-tree species, is not an easy task as it would seem at first glance. Largely different estimates are obtained according to geographies, forms of cultivation, age and number of trees per unit surface, etc.

Collecting, archiving and forming a spatially referred inventory could be a very relevant assignment to be accomplished, very useful in order to better organizing the logistic of the value chain at regional level. Geographical Information System (GIS) could be very useful in producing specific and detailed maps that are directly processing the huge amount of spatial data previously collected and stored.

Technology and technological innovation in this sector means “logistics” as the first and most relevant requisite. Logistics is a field of endless development. What should be taken into consideration in the assessment of the APPR potential in the region is not merely the total amount of available feedstock, but the spatial biomass density. The higher this density, indeed, the lower is the radius of biomass collection and transports. In terms of logistics, this is the factor able to reduce significantly the total amount of APPR collection costs, of course considering the same energy size or capacity.

Logistics is a clear example of agro-industrial integration and “cross-fertilization” too, especially when considering R&D and innovation transfer. The same is true when considering the agro-food sector, and its development in the considered regions.

The potential savings obtained with appropriate logistics are huge, hence the need for refining these kind of tools. These tools must be based on a detailed knowledge of both the territory and its land use. It is also needed a specific knowledge about the handling technologies through which feedstock can be collected and mobilize. The combination of GIS (Geographical Information System) and GPS (Global Positioning Systems) is very important in this respect. Such techniques can be coupled to supply system models, in order to manage the flow of material and minimize procurement costs. The building up and constant update of biomass inventories, with information on the quantities available on each field or area, or the planned collecting date, the location of the closest storing platform, the potential users and their distance, etc. With a GIS, different procurement scenario could be simulated and compared, in order to inform decisions on product allocation, destination and routing. Another possibility by combining GIS and GPS through the management of a “computerized” platform is the biomass tracking and, therefore, the fulfilment of a full traceability system.

Technology development and progress also means improvement in the equipment and machinery installation, considering both biomass mobilization and energy conversion. Improve the functional efficiency means obtain more useful work with the same amount of input. Efficiencies are multiplier factors along the value chain and their increase (as close as possible to the unit) is largely influential. Another very relevant improvement pertains the investment cost related to the unit of power or unit of energy produced. The technological “learning curve” allows a progressive reduction in the productive cost of machineries, equipment, plants etc. The economic consequence of this improvement is "competitiveness". The higher the competitiveness, the easier is to start a new energy project and the faster will be the "pay-back" period of the investment. The same technology improving process could also influencing the size of the project.

The "learning curve" also results in reducing significantly the large-scale economy effect; therefore, small investments, not convenient at an early stage, become very profitable after a certain time. This specific effect promotes small size, spatially distributed, energy plants supplied with locally harvested APPR biomass, according to a "business model" that promotes rural development, a sustainable form of agriculture, income diversification from farming, also reducing energy price volatility and offering more income stability to farmers.

Another relevant outcome of technology development is "environment". The technological improvement should be addressed on reducing the environmental burdens of human activities, trying to solve (at least mitigate) the ecological threats we have generated in the past until today.

According to the RED (EU Renewable Energy Directive 2009/28/EC), no direct impacts (i.e. no GHG emissions or energy consumptions) should be assigned to the agricultural phase of a bioenergy value chain if crop residues (such as pruning) are removed from the agricultural land with the purpose of energy conversion. Clearly, this assumption is a very rough simplification and does not consider indirect effects and drawbacks that might be related to a systematic removal of crop residues. Crop residues, indeed, could play a relevant role in sustaining agricultural activities and their contribution in terms of agro-ecological services should be properly accounted.

APPR feedstock are "carbon neutral", therefore, but GHG savings and fossil energy balance should be carefully determined considering each kind of "business model" applied in a region, and specific LCA procedures should be adopted, possibly following international standards.

Technical development also means a progressive reduction in the concentration of pollutants in the flue gases released by the chimneys of energy plants based on thermochemical processes; more efficient procedures to clean, to filter, to remove toxic or dangerous compounds, etc. Fine-tuning multi-fuel boilers, expanding the energy use of several kind of biomass feedstock notwithstanding their irregular size, or their large ash content, or their quite high humidity, and without adverse effects, malfunctions or environmental impacts.

The concepts of "bioeconomy" and "circular economy" should be assumed as a reference when considering the APPR sector development. APPR biomass is a kind of agricultural resource strictly linked to the region from where it comes from. Considering an APPR bioenergy district, the "vision" is to promote a local energy system, able to provide energy (both heat and power) to those innumerable energy uses distributed across the regional land: rural tenements, small villages, workshops and manufacturing centres, agro-food industries, neighbourhoods, etc.

A circular economy is a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. To agree on this setting means to re-think, re-shape, re-model our conventional production system and embrace a new concept that, first of all, is based on the use of biological resources and in the (total or almost total) refusal of fossil fuels.

This vision so wide calls into question and involves not only the productive sectors, but the civil society as a whole, being a great challenge in the near future. "Awareness" is the magic word;

raising the level of company managers' awareness in promoting biomass and not refusing APPR biomass as an option; raising the level of consumer awareness on the possibilities to use APPR biomass as fuel; raising the level of citizens'' awareness of the social and environmental benefits of a switch to APPR residues as energy carriers.

Economy & finance

- Agriculture is a strong local productive sector, together with agro-food processing.
- Observed trend in deepening the agricultural activity along the value chain.
- Observed trend in applying a set of agricultural diversified activities.
- Potential cost savings in field pruning management.
- Good level of potential employment offered by the APPR sector.
- Long-term stability of economic return on bioenergy investment.
- Significant reduction trend in the capital costs of new investment in the bioenergy sector.
- Possible availability of public financial funding to promote investments.
- Steady economic affordability of biomass energy carriers as compared to fossil fuels.
- A prospective increase in the market price of biomass.
- A prospective increase in the market price of fossil fuels.
- Label and standards of biomass quality assurance and traceability.
- Possible application of the "Carbon emission trading" and CO2 taxation.
- Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example).

Considering the agricultural sector, bioenergy is conventionally presented as a kind of new business activity suitable to promote productive deepening and diversification, specifically in the key of the so called "multifunctional" role ascribed to the primary sector.

"Deepening" the productive value chain means to improve the ability of the sector in obtaining a higher fraction of the added value associated to the final product. This happens, for example, in the case residual biomass recovered from fruit-tree plantations is not simply sold, but is transformed into a commercially well-fitted biofuel (or energy carrier). Alternatively, the same biomass can be further used to generate energy, which is sold to the public power utility, whether it is electricity, or sold as a thermal service, if it is in the form of heat (or both, in case of CHP units). At every stage along the bioenergy value chain, a fraction of the overall extra-value assigned to the final product or service is captured and embedded within the energy company. Exactly the same happens in the agro-food sector, when the same crop-growing company directly transforms the harvest into food and then the food is further processed into a ready-to-eat product. This is a very powerful mechanism to increase significantly the profits, or at least to keep this extra-profit within the same sector. It is quite unlikely that a single farmer has this type of business ability or large capitals at his disposal to start this kind of projects (although some relevant exceptions might be available). Differently, a farmer cooperative or a farmer productive association (made of dozens of single farmers) have a sufficient amount of biomass and capitals, easy access to bank credit, good capacity in influencing public opinion and government institutions about the benefit of the project, good possibility in accessing to the service of experts and consultants.

Within this interesting rearrangement of the agricultural sector, each single farmer has the chance to diversify the production activities, without being confined to the food-crops only, but also embracing the wider set of activities usually referring to the so-called "bioeconomy". Bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy via innovative and efficient technologies. It offers great opportunities and solutions to a growing number of major societal, environmental and economic challenges, including climate change mitigation, energy and food security and resource efficiency. Apart the direct advantage in terms of environmental performance, the bioenergy sector (as participant to the larger bioeconomy sector) offers today great chances to increase the job opportunity and to consolidate the local and regional economy while also being a powerful leverage in promoting rural development.

Certainly, these outcomes are neither obvious nor guaranteed; they must be properly guided through appropriate economic and financial instruments, but also driven by reliable regional and national policy.

Considering the supporting economic action displayed by national and regional institutions, Interesting earnings prospects are credited to this type of investment, a short payback return of the invested capitals is usually detected together with high yield margins. Subsidies and preferential tariffs, moreover, are guaranteed over a long period, thus creating conditions of great stability and limited risk.

Future prospective are also foreseen quite positively, considering the reduction trend in the capital costs of new investment in the bioenergy sector, together with the expected increase in the market price of fossil fuels as well as in the market price of biomass feedstock.

Of course, public support to bioenergy is justified in the beginning period, considering the high risk of investment, the not yet mature technology, a not yet well-developed market, but it cannot be extended for longer. This means that, prospectively, subsidies and facilitated tariffs will be progressively reduced; but this is well known and fully expected.

In order to consolidate the market position of these several (sometime too different and variable) energy products, standardized biomass quality criteria, quality assurance and certification, and product traceability should be implemented the sooner. Best quality should be translated into higher prices and a much better capacity to stand out on the market.

The public sector could significantly contribute to boost the APPR biomass demand and to promote public investment. In addition to providing useful and flexible energy solutions, these public investments can fully demonstrate the technical and economic feasibility of the adopted solutions. Therefore, it would be very desirable for public municipalities to be equipped with biomass energy facilities, thus behaving like a "prime mover", role otherwise always assigned to the most enlightened and brave entrepreneurs.

Energy Service Companies (ESCOs) could play a significant role in this respect, being a "*trait d'union*" between suppliers and final biomass users, but specifically promoting financial engineering solutions able to carry out APPR facilities with success. ESCOs can avoid those public municipalities to be severely indebted but, at the same time, making investments possible and fundable.

"*Green public procurement*" indicates purchasing procedures by the Public Administration to choose those products and services that have a minor or have a reduced effect on human health and the environment than other products and services used for the same purpose. In other words, "buying green" means buying a good or service taking into account the environmental impacts that this may have during its lifecycle. The practice of Green Public Procurement involves the possibility to include environmental qualification criteria in the applications that Public Administrations express when purchasing goods and services.

Another relevant economic instruments is the "*Carbon emission trading*". Carbon trading is an approach used to control CO_2-equivalent pollution by providing economic incentives for achieving emissions reductions. It is also called "cap and trade". Companies are granted permissions that require them to hold allowances (or credits) in order to emit an equivalent amount of CO2. The total amount of credits cannot exceed the cap, limiting total emissions to that level. Companies that need to increase their allowance must buy credits from those who pollute less. The transfer of allowances is referred to as a trade. The buyer therefore pays to pollute, while the seller is financially rewarded for reducing CO_2 emissions. In theory, those companies that can easily reduce emissions most cheaply will do so. Although this policy has been heavily criticised and is beset with problems, nonetheless, Europe has a price on carbon and a working mechanism to limit and reduce climate pollution, which puts it further ahead than other major regions in the world. To enlarge, extend and deepen the "cap and trade" system (for example also including agriculture), while simplifying its application is currently under debate.

Governance & policy

- The "multifunctional" asset of current agriculture according to the most recent vision of "rural development".
- Application of the EU "cross-compliance" with respect to farmers' commitments.
- Funding schemes favouring the APPR sector in agriculture.
- Rules encouraging inter-professional agreements along the biomass supply chain.
- Proceed in "greening" the economy, increase the use of renewables in industry, and decarbonize industrial activities, save fossil energy and GHG emissions significantly.
- More restrictive atmospheric emission thresholds.
- Subsidies and incentives promoting fossil displacement.
- Public support on the demand side of APPR feedstock for energy use ("green public procurement").
- Adoption of rules consistent with the development of circular economy according to the EU framework.

"Driving forces" pertaining to "policy & governance" are all external to the APPR sector and, therefore, they are all "opportunities". Policy and governance will be the central focus of the second deliverable of the project WP2 (D2.2) and this issue will be discussed and commented mostly considering the national and European perspectives. At this stage of the analysis, the local and regional dimension of "policy" will be mostly taken into consideration.

Policy and governance can be assessed from several fields of application. Indeed, policy can be deployed considering the legal framework which governs the sector, with particular reference to the rules directing the authorizations to build and operate of the energy plants. Policy may be also related to the preservation of the environmental asset at regional level and, therefore, the rules attending the emissions threshold, the specific place where plant installation should be forbidden or restricted, or conversely, the area where energy plants should be preferentially located. Apart environmental constraints, policy has also the responsibility of planning. The regional energy plan is the essential instruments foresighting (i.e. looking forward) in the near future and producing possible scenarios of energy development, according to the society needs and the available resources. Knowledge and insight gained in this exercise could be important in affecting other planning exercises. Undoubtedly, the regional energy plan should be intersected with other regional plans, such as the "Landscape and Environmental" plan or the "Waste management" plan, the "Water management" plan, and many others.

Moreover, regional policy is involved in addressing Research & Development, in particular by managing *ad hoc* funds made available by the European Commission and the national government.

Other relevant governing strategy that might affect the bioenergy sector are agriculture, industry and market. The regional Rural Development Plan is a funding instrument addressed to farmers and agro-industry entrepreneurs that plays a crucial role in orienting and directing the investments. Agro-energy is recognize as a specific field of application of those funding measures introduced in the Rural Development Plan. Local Action Groups (LAG), for example, through the *Leader +* package of measure, can deploy a very influential set of funding opportunities, some of them specifically related to biomass and bioenergy.

Funding opportunities are also relevant when industrial investments are proposed and relevant social benefits can be the outcomes of those investments. Job creation, for example, is considered a very important criterion when private investment are proposed and public funding are possibly requested in order to facilitate the business initiative.

Market instruments are mostly applied at national and EU level. While regional administration (in general) is less involved in the definition of a strategy related to the reinforcing of the market at both the supply and demand side.

In any case, the overarching objective of the energy policy should be to ensure secure and sustainable supplies of competitively priced energy to all consumers. Many public strategic documents from many EU regions recognize the important role energy security, sustainability and competiveness play in driving economic activity. Cost-effective harnessing of sustainable, locally based, renewable energy resources is crucial to reducing the dependence on expensive fossil fuel imports, improving competitiveness over time, reducing harmful emissions and delivering growth and jobs in the green economy. These objectives are fully aligned with those of EU energy policy, reflecting the common challenges faced by many EU regions in decarbonising their energy systems.

Of course, it is widely recognised that bioenergy has an important role to play to meet the low carbon targets in the EU, and it is an important part of the regional government policy. Whilst regional governments are committed to supporting the development of bioenergy, it is also becoming increasingly mindful that its policies should only encourage and support the development of bioenergy operations that are “truly” sustainable, specifically in terms of the impact of the feedstock used and the wider carbon impact of the project. Indeed, there is a huge debate going on around ‘hidden’ carbon in bioenergy. National governments aw well as he EU Commission are pushing for more demanding and stringent criteria around full lifecycle carbon assessments, which will take into consideration indirect impacts such as changes of land use and of feedstock use. It is likely that financial incentives will increasingly require more reporting on emissions from the whole lifecycle of feedstock development and processing. These criteria should be turned into a set of regulation.

4 A JOINT ACTION PLAN

The present section, similarly to the previous one, includes a joint action plans obtained by collecting and merging the analyses performed in the four *Demo regions*, in Spain, Italy, Greece and Ukraine, respectively. The present wrap-up does aim to summarise for the reader the set of actions identified as necessary to boost the utilisation of APPR biomass.

It should not be considered as an action plan for Europe at all, though it can be a key document to find instruments and actions that may be utilised elsewhere for that purpose. In conclusion, the present action plan consist of a compendium of actions capable to promote the use of APPR biomass. Many of them could be regarded as potential actions able to promote the expansion in the use of other kind of agro-residues as well.

4.1 Introduction to the action plan

The list of internal features of the APPR sector, namely *Strengths* and *Weakness*, is presented in *Table 9.1* and was obtained by properly selecting internal positive factors (strengths) from *Table 8*, and internal negative factors (weaknesses) from *Table 7*. Similarly, external features affecting the utilisation of APPR biomass, namely *Opportunities* and *Threats*, are listed in *Table 9.2* and were sorted by properly selecting external positive factors (opportunities) from *Table 8*, and external negative factors (threats) from *Table 7*.

Once this procedure is applied, the SWOT usual framework is obtained, smoothly and almost automatically, thus deriving an effective synthesis on the analyses performed in the four Demo region, Spain, Italy, Greece and Ukraine, respectively.

Table 9.1 Listing of the SWOT factors influencing the APPR sector (only Strengths, Weaknesses, are considered in this table).

Strengths	Weaknesses
1. Agriculture is a strong local productive sector, together with agro-food processing. 2. Large potential biomass availability at regional scale and very high local biomass spatial density. 3. Good level of potential employment offered by the APPR sector. 4. Local operation of some real business cases and successful examples. 5. In rural areas, energy needs can be satisfied by local energy sources (such as APPR biomass). 6. Using locally available resources is considered a priority. 7. Observed trend in deepening the agricultural activity along the value chain. 8. Observed trend in applying a set of agricultural diversified activities. 9. Farmers have a strong imitation attitude. Positive examples are considered as a model. 10. Cohesion is considered a social responsibility among farmers; this should promotes cooperation. 11. Potential cost savings in field pruning management.	1. Energy conversion from pruning is still considered an overall risky operation. 2. APPR is largely spatially dispersed and need to be collected over a wide land area. Strong seasonality in harvesting. 3. Complexity of biomass supply chains. Lack of well-organized logistics operations. 4. Low degree of mechanization. Lack of knowledge on field mechanization. 5. Harvesting and chipping machines need technological improvements. 6. Inadequate or insufficient technical reliability of biomass plant. 7. Agro-industrial integration is hard to be achieved. 8. Energy products that do not comply with international standards and labelling. 9. Lack of integration of knowledge and efforts across sectors. 10. Mind-set of farmers, their reluctance to change and their low attitude in cooperating and innovating. 11. 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). 12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source. 13. Lack of exemplary business cases. 14. Distrust that farmers may be reliable in biomass supply. 15. Pruning is considered a feedstock of too low economic value. 16. APPR harvesting and transport operations are generally considered too costly. 17. Little info on funding opportunities for farmers and entrepreneurs in the bioenergy sector. 18. A long and subdivided supply chain could be not economically efficient for every actors. 19. Industrial investors are expecting very high profits and a fast payback time in the renewable energy sectors. 20. Limited economic affordability in utilizing services offered by specialized agro-mechanical pruning companies or techno-logistic companies. 21. Structure of farms and farm size too small to allow a profitable pruning collection and use. 22. Pruning is supposed to be not a by-product but a waste without any economic value. 23. 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 24. Pruning burning in open field is still considered an agronomic operation 25. Competitive agricultural use of pruning as soil amendment. 26. Agronomic guidelines on soil and pruning management are still lacking. 27. Risk of soil depletion if APPR biomasses are not properly managed at field scale. 28. Woodchip from pruning is of lower quality than from forestry. 29. A scarce number of ESCOs are operating in the regional bioenergy sector.

Table 9.2 Listing of the SWOT factors influencing the APPR sector (only, Opportunities and Threats are considered in this table).

Opportunities	Threats
1. Agro-industrial integration towards a "bioeconomy" productive model. 2. Proceed in "greening" the economy, increase the use of renewables in industry, and decarbonize industrial activities, save fossil energy and GHG emissions significantly. 3. Adoption of rules consistent with the development of circular economy according to the EU framework 4. A potential level of cross-sector innovation. 5. Rules encouraging inter-professional agreements along the biomass supply chain. 6. Local availability of agro-mechanical service companies as well as builders of processing facilities (APPR harvesting and chipping machines). 7. The "multifunctional" asset of current agriculture according to the most recent vision of "rural development". 8. Application of the EU "cross-compliance" with respect to farmers' commitments. 9. Valorisation and reuse of agricultural residues for bioenergy production. 10. Adaptation measures to climate change. 11. Ensure biodiversity conservation and the supply of ecosystem services. 12. Young and skilled farmers entering in the sector thanks to new incomes opportunities 13. Funding schemes favouring the APPR sector in agriculture. 14. Interest by municipalities and local councils to promote community investments on bioenergy (district heating systems, for example). 15. Steady economic affordability of biomass energy carriers as compared to fossil fuels. 16. A prospective increase in the market price of biomass. 17. A prospective increase in the market price of fossil fuels. 18. Label and standards of biomass quality assurance and traceability 19. Subsidies and incentives promoting fossil displacement. 20. Public support on the demand side of APPR feedstock for energy use ("green public procurement"). 21. Notable "learning curve" on the technological maturity of energy conversion processes. 22. Commercial availability of small size power plants. 23. Possible combination of biomass mobilization with information technologies and product traceability. 24. Ensure proper conditions for the adoption of knowledge and innovations. 25. Possible availability of public financial funding to promote investments. 26. Possible application of the "Carbon emission trading" and CO_2 taxation. 27. Segmenting incentives to renewable to favour social impact. 28. Long-term stability of economic return on bioenergy investment. 29. Significant reduction trend in the capital costs of new investment in the bioenergy sector. 30. More restrictive atmospheric emission thresholds.	1. Actual low degree of pruning valorisation. 2. Biomass plant and energy facilities are still capital intensive. 3. Still large-scale economy are influencing the sector. 4. Competitive energy use from forest wood, crop residues or food-processing by-products as alternatives to pruning. 5. APPR biomass use is less competitive than other forms of renewable energies 6. Renewable energy more emphasized as power than heat generation. 7. Atmospheric emissions due to biomass thermochemical conversion are generally considered an environmental problem. 8. District heating is still an uncommon solution in municipalities (with exceptions). 9. Limited communication with civil society/public opinion and lack of promotional activities. 10. No coherent policy, no strategic view on the APPR sector from local governments. 11. NIMBY syndrome ("Not In My Back Yard"). 12. Risk of large fossils energy consumptions and GHGs emissions along the supply value chain and lack of environmental guidelines. 13. Pruning burning is not roundly forbidden by national/regional regulation. 14. The energy use from pruning is not adequately supported by the CAP. 15. APPR market still underdeveloped. 16. Imports of cheap biomass feedstock from outside the EU. 17. Price of oil and fossil fuels still quite low to promote competitiveness from bioenergy. 18. Lack of the right market driven incentives and subsidises. 19. APPR biomasses are still not included as potential biomass sources in some regional energy plan. 20. Market driven incentives and subsidises are progressively decreasing. 21. High rate of law changes and great instability in energy policy decisions. 22. Electricity more economically sustained than heat.

From the previous table (*Table 9.1*), it can be observed that the list of *Strengths* is made of 11 factors, while the list of *Weaknesses* is much longer, consisting of 29 factors. This large difference reflects, in general, the actual status of the APPR sector in the considered regions and the "feelings" or "impressions" expressed by the sector stakeholders. Accordingly, negative features prevail on the positive ones. The investors potentially operating in the APPR sector are currently quite cautious. They intend to face, realistically, the complexity in the take-off for new biomass-to-energy value chains and the related difficulties that this business projects could represent.

The vision changes almost completely when the sector is viewed in terms of future perspective. In this case (*Table 9.2*), the list of *Opportunities*, made of 30 factors, is quite longer than the list of *Threats*, consisting of 22 factors.

This means that, notwithstanding current difficulties, there is still great confidence in the potential of the sector and its ability to succeed in developing strong and efficient APPR value chains.

These observations are in perfect agreement with the '*uP_running*' basic concepts and vision, confirming all the project strategic value in carrying out action boosting the APPR bioenergy sector and promoting the setting up and strengthening of local bioenergy supply chains.

Following the methodology as explained in *Section 2.2*, the pairwise analysis of *Strengths, Weakness, Opportunities* and *Threats* leads to the identification of different strategies to promote, defend, reform and let survive the APPR sector (*Table 10*).

For a better understanding of the different strategies that have been presented in *Table 10*, the following table (*Table 11*) list the definition and the questions to be answered in order to focus on the objectives and measures to be included in the Action Plan.

Finally, the remaining part of *Section 3*, reports a series of boxes where each strategy is further presented and developed. Each box includes:

- Name of the strategy.
- Factors involved: strengths (S), opportunities (O), weaknesses (W) and threats (T).
- Objectives of the strategy.
- Actions or Activities that can be implemented.

Table 10. Summary of the Action Plan of the APPR sector considering the four strategies identified by the SWOT analysis and the twelve general targets.

SO	STRENGHTS	STRENGHTS	ST
OPPORTUNITIES	**ATTACK STRATEGY** 1. AIMING AT AN EFFICIENT AND INTEGRATED REGIONAL APPR ENERGY SYSTEM 2. SUSTAINABLE APPR ENERGY GENERATION AS A PATH TO RURAL DEVELOPMENT 3. A MARKET ORIENTED APPR ENERGY SECTOR TO INTERCEPT AND SATISFY SOCIETY NEEDS	**DEFENCE STRATEGY** 8. PROVING THE FEASIBILITY OF THE APPR VALUE CHAINS AND ITS VALUE IN MICROGENERATION PROJECTS 9. REACTING TO AN IMPROPER AND DELIBERATELY MISLEADING INFORMATION BY PROMOTING FULL AWARENESS AND SOCIAL ACCEPTANCE	**THREATS**
OPPORTUNITIES	**REORIENTATION STRATEGY** 4. SUPPORTING AN INNOVATION TREND IN BIOENERGY TECHNOLOGY AND A SHIFT TO MORE EFFICIENT ENERGY USE FROM APPR BIOMASS 5. TRIGGERING SOCIAL AND POLICY INNOVATION IN THE APPR SECTOR 6. CONSOLIDATING THE ECONOMIC AFFORDABILITY OF BIOMASS USE AND THE ECONOMIC RETURN ALONG THE APPR VALUE CHAIN 7. BOOSTING APPR BIOMASS SOURCES AND SETTING UP CONDITIONS TO STRENGTHEN THE APPR SUPPLY CHAIN	**SURVIVING STRATEGY** 10. MITIGATING THE ENVIRONMENTAL BURDENS ALONG THE BIOENERGY VALUE CHAIN, FROM FARMING OPERATIONS TO ENERGY CONVERSIONS 11. WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE 12. RESISTING THE COMPLEXITY OF THE REGULATION SYSTEM ON BIOENERGY AND THE LACKING OF A FARSIGHTED VISION ABOUT THE SECTOR	**THREATS**
WO	**WEAKNESSES**	**WEAKNESSES**	**WT**

Table 11. Questions to be answered in order to focus on the objectives and measures to be included in the Action Plan of the APPR sector

Target & Strategy	Definition	Questions to be answered
① SO "Attack"	Aiming at an efficient and integrated regional agro-energy system according to the bioeconomy model.	Are the foreseen actions strengthening the collaboration between agriculture and industry?
② SO "Attack"	Sustainable APPR energy generation as a path to rural development.	Are the foreseen actions favourable to rural development?
③ SO "Attack"	A market oriented APPR energy sector to intercept and satisfy society needs.	Are the foreseen actions promoting the development of the APPR market?
④ WO "Reorientation"	Supporting an innovation trend in bioenergy technology and a shift to more efficient energy use from biomass.	Are the foreseen actions boosting the technological innovation in the APR sector?
⑤ WO "Reorientation"	Triggering social and policy innovation in the APPR sector.	Are the foreseen actions experimenting new forms of collaboration between civil society and policy makers as well as public administrations?
⑥ WO "Reorientation"	Consolidating the economic affordability of biomass use and the economic return along the value chain.	Are the foreseen actions improving the economic affordability of APPR investments?
⑦ WO "Reorientation"	Boosting APPR biomass sources and setting up conditions to strengthen the APPR supply chain.	Are the foreseen actions promoting a better supply chain organization?
⑧ ST "Defence"	Proving the feasibility of the APPR value chains and its value in micro-generation projects.	Are the foreseen actions improving the level of feasibility of the APPR projects in the region?
⑨ ST "Defence"	Reacting to an improper and deliberately misleading information by promoting full awareness and social acceptance.	Are the foreseen actions favouring awareness about 'facts uncertain, values in dispute, stakes high and decisions urgent'?
⑩ WT "Surviving"	Mitigating the environmental burdens along the bioenergy value chain, from farming operations to energy conversion.	Are the foreseen actions in favour of a sustainable use of ecological resources?
⑪ WT "Surviving"	Withstanding the risk of a local APPR market failure.	Are the foreseen actions creating fair market conditions and a good balance between supply and demand?
⑫ WT "Surviving"	Resisting the complexity of the regulation system on bioenergy and the lacking of a farsighted vision about the sector.	Are the foreseen actions facilitating the application of rules and norms in the APPR sector?

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

- 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" (or "renewable energy association" or other corresponding agricultural and industrial organizations) connecting single entrepreneurs among them and with the regional government institutions. These organizations are competent in addressing the sector barriers and constraints and planning the sector development at regional level.
- Elaborating a coordinated approach to logistical operations along the supply chains, from field to market. Such strategy helps developing an efficient logistic chain starting from the field side. Similar action can be taken downstream, from the side of the wood fuel market, where aggregating the offer may reduce the cost sustained by the users, while increasing the revenues for the suppliers.
- 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.
- 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). 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.
- 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 value chain.
SO9. Strong political leadership with clear market targets to support bioenergy and the APPR sector.

Actions / Activities

- Strengthening the organization of the APPR supply chain, in order to secure the market and to provide customers with fuels that meet quality requirements at reasonable price.
- 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.
- 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.
- 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. Delivery, indeed, must be prompt, regular and secured, since no energy plant can afford temporary shut down due to biomass constraints.

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.	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.

W6. Inadequate or insufficient technical reliability of biomass plant. W7. Agro-industrial integration is hard to be achieved. W8. Energy products that do not comply with international standards and labelling. W9. Lack of integration of knowledge and efforts across sectors	O9. Valorisation and reuse of agricultural residues for bioenergy production. O21. Notable "learning curve" on the technological maturity of energy conversion processes. O22. Commercial availability of small size 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, 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 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 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-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"**

Weaknesses	Opportunities
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.

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"**

Strengths	Threats
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.

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 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 f 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

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.

<table>
<tr><td colspan="2">Target ⑪ WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE.

Strategy: Weaknesses + Threats → WT “Surviving”</td></tr>
<tr><td>W12. Lack of awareness about the potential use of APPR biomass as an energy carrier/source.
W15. Pruning is considered a feedstock of too low economic value.
W22. Pruning is supposed to be not a by-product but a waste without any economic value.
W25. Competitive agricultural use of pruning 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.</td><td>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
T15. APPR market still underdeveloped.
T16. Imports of cheap biomass feedstock 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.</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">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.</td></tr>
</table>

- 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 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 pubic 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"**

Weaknesses	Threats
W1. Energy conversion from pruning is still considered an overall risky operation. W7. Agro-industrial integration is hard to be achieved. W9. Lack of integration of knowledge and efforts across sectors. W19. Industrial investors are expecting very high profits and a fast payback time in the renewable energy sectors. 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	T10. No coherent policy, no strategic view on the APPR sector from local governments. T21. High rate of law changes and great instability in energy policy decisions. T22. Electricity more economically sustained than heat. T6. Renewable energy more emphasized as power than heat generation.

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.

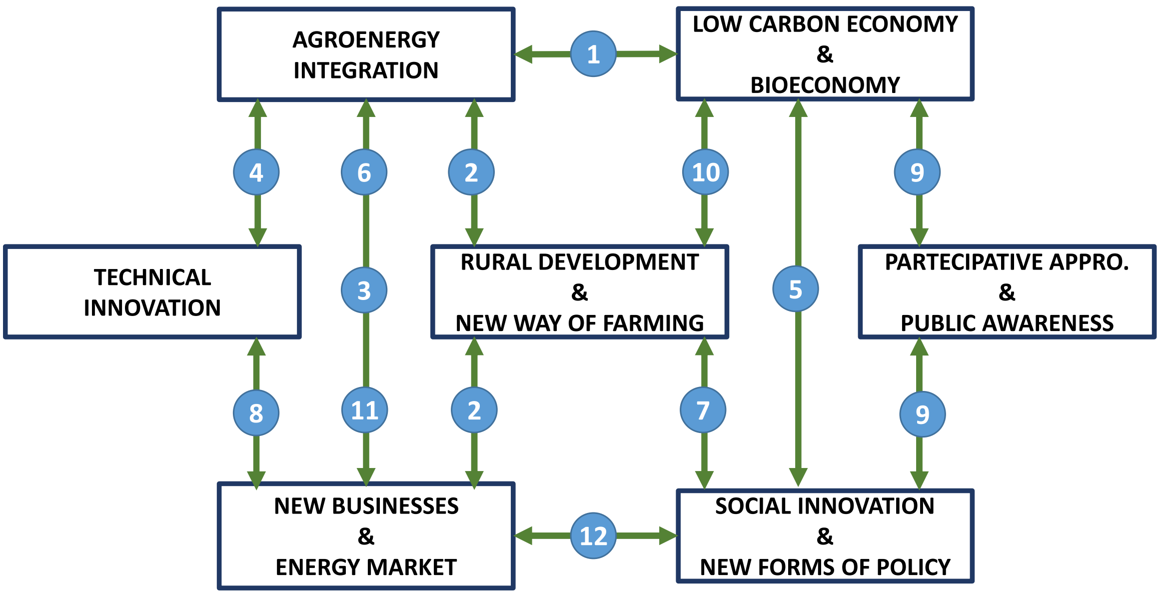
WT5. A farsighted and coherent energy policy should be worked out by regional administration (even if the national and EU framework is highly influential).

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 exists, badly affecting the decision to invest.
- Create a secure and stable financial environment that does not create investment uncertainty. Local banks, credit founds 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.

The figure reported on the next page (*Figure 12*) presents a comprehensive diagram where relationships between several targets of the “Action Plan” are made through the identification of some main thematic pillars. The diagram, indeed, shows different field of issues (agroenergy integration, low carbon economy, technical innovation, rural development and new way of farming, new business and energy market, social innovation and new forms of policy, participative approach and public awareness) and depicts how the strategies identified in the “Action Plan” are connecting them. This map allows a better understanding of where the actions derived from the strategies proposed can be applied, and so, the type of policies or instruments that can be involved, as well as the sectors, and thus, the stakeholders potentially solicited.

Finally, *Table 12* shows the timeframe that the different targets / strategies to be implemented in applying the “Action Plan”, the actors to be involved, and the targeted actors.



Target ① AIMING AT AN EFFICIENT AND INTEGRATED AGRO-ENERGY SYSTEM ACCORDING TO THE BIOECONOMY MODEL

Target ② SUSTAINABLE APPR ENERGY GENERATION AS LEVERAGE TO RURAL DEVELOPMENT.

Target ③ A MARKET ORIENTED APPR ENERGY SECTOR TO INTERCEPT AND SATISFY SOCIETY NEEDS.

Target ④ SUPPORTING AN INNOVATION TREND IN BIOENERGY TECHNOLOGY AND A SHIFT TO MORE EFFICIENT ENERGY USE FROM BIOMASS.

Target ⑤ TRIGGERING SOCIAL AND POLICY INNOVATION IN THE APPR SECTOR.

Target ⑥ CONSOLIDATING THE ECONOMIC AFFORDABILITY OF BIOMASS USE AND THE ECONOMIC RETURN ALONG THE VALUE CHAIN.

Target ⑦ BOOSTING APPR BIOMASS SOURCES AND SETTING UP CONDITIONS TO STRENGTHEN THE APPR SUPPLY CHAIN.

Target ⑧ PROVING THE FEASIBILITY OF THE APPR VALUE CHAINS AND ITS VALUE IN MICROGENERATION PROJECTS.

Target ⑨ REACTING TO AN IMPROPER AND DELIBERATELY MISLEADING INFORMATION BY PROMOTING FULL AWARENESS AND SOCIAL ACCEPTANCE.

Target ⑩ MITIGATING THE ENVIRONMENTAL BURDENS ALONG THE BIOENERGY VALUE CHAIN, FROM FARMING OPERATIONS TO ENERGY CONVERSION.

Target ⑪ WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE.

Target ⑫ RESISTING THE COMPLEXITY OF THE REGULATION SYSTEM ON BIOENERGY AND THE LACKING OF A FARSIGHTED VISION ABOUT THE SECTOR.

Figure 12 Schematic and comprehensive diagram of the APPR "action plan": the twelve numbered targets/strategies are in connection with seven thematic pillars on which the entire architecture of the plan is based.

Table 12. Timeframe of the Action Plan (see Table 6 to identify the letters reported in the last two columns)

Target	Definition	Time frame	Performing Entities	Target Entities
① SO "Attack"	Aiming at an efficient and integrated regional agro-energy system according to the bioeconomy model.	**M** (Medium Term)	E, F, (H)	A, B, C, D, (I)
② SO "Attack"	Sustainable APPR energy generation as a path to rural development.	**S** (Short Term)	E, F, I	A, B
③ SO "Attack"	A market oriented APPR energy sector to intercept and satisfy society needs.	**L** (Long Term)	E, F, I	C, D
④ WO "Reorientation"	Supporting an innovation trend in bioenergy technology and a shift to more efficient energy use from biomass.	**L** (Long Term)	I, E, F	G, (B)
⑤ WO "Reorientation"	Triggering social and policy innovation in the APPR sector.	**M** (Medium Term)	H	I
⑥ WO "Reorientation"	Consolidating the economic affordability of biomass use and the economic return along the value chain.	**S** (Short Term)	I	A, B, G
⑦ WO "Reorientation"	Boosting APPR biomass sources and setting up conditions to strengthen the APPR supply chain.	**S** (Short Term)	E, H	A, B
⑧ ST "Defence"	Proving the feasibility of the APPR value chains and its value in micro-generation projects.	**S** (Short Term)	E, F, H	C, D, I
⑨ ST "Defence"	Reacting to an improper and deliberately misleading information by promoting full awareness and social acceptance.	**S** (Short Term)	E, F, H	I
⑩ WT "Surviving"	Mitigating the environmental burdens along the bioenergy value chain, from farming operations to energy conversion.	**M** (Medium Term)	E, F	E, F, G
⑪ WT "Surviving"	Withstanding the risk of a local APPR market failure.	**M** (Medium Term)	E, F, (I)	H, (I)
⑫ WT "Surviving"	Resisting the complexity of the regulation system on bioenergy and the lacking of a farsighted vision about the sector.	**M** (Medium Term)	E, F, (I)	I, H

5 CONCLUSIONS

After a preparatory phase, workshops (*forums* or alternatively *focus groups*) were organized in each of the four *Demo Region* during the first project year to promote stakeholders' commitment, consolidate a common vision about the APPR sector, perform the "*Sector Analysis"*, and define guidelines and trajectories of strategic development through the "*Action Plan*".

Three consecutive workshops ("focus group") took place in different regional areas. Optionally, a "forum" was organized before, to launch the '*uP_running*' project and activate a communication campaign. One returning "forum" (optionally two) was held in each Demo Region, this time specifically with the aim of discussing the outcomes of the "*Sector Analysis*" and exchange opinions about the "*Action Plan*", trying to find the larger agreement and stakeholders' commitment on the identified strategies.

Both "focus groups" and "forums", together with interviews, bilateral meetings or discussion panels, were very useful in constructing a regional "*stakeholders' network*" in each project Demo Region and creating a challenging entrepreneurial "*ecosystem*". The latter should be considered a shared "*niche*" where all the relevant stakeholders and key actors of the APPR sector collaborate and cooperate one each other providing the proper milieu for business creation and expansion. A useful tool to gain mindedness, trust, collaboration and cooperation between regional stakeholders is to create an environment in which stakeholders within the network are confident to launch new ideas and proposals.

A "bottom-up" participatory approach was followed. This kind of approach favoured stakeholders' commitment, and collaboration. Opinion leaders, experts and entrepreneurs with a good propensity to invest (i.e. "prime movers") can play a relevant role in directing the network activities and put forward new proposals but, in general, they also need consensus and support from the other stakeholders. On the other side, they can be the "pivotal" subjects to arrange and set up new bioenergy value chains.

The general status of the sector, its composition and key actors, the structure of possible value chains and the different kind of business models potentially observed were detected through the "*Sector Analysis*". Identifying the main sector constraints and barriers (negative factors) as well as the sector driving forces (positive factors) was the starting phase of the process. Further discriminating between "internal" and "external" factors smoothed the way to an easy application al the SWOT analysis.

The "*Action Plan*" was prepared by applying a paired combination of an "internal" together with an "external" SWOT factor. In this way, strategies of sector development were defined and a peculiar set of targets, specifically tailored with respect to the sector's main characteristics in each region, was also identified.

The biggest obstacles observed in starting up new APPR bioenergy value chains are more than simply technical constraints, being mostly related to non-technical features. Among these, lower level of organization, lower propensity to investments, lower readiness to innovation, lower willingness to association and a limited availability of financial credit, are the ones, in general terms, characterizing agriculture with respect to the industrial sector.

Taken independently, almost all the key actors in a complete APPR supply chain are present in the considered regions. According to our opinion (gained as a result of a first-hand knowledge), the major difficulty that slows the take-off of new businesses lies in the fact that the key operating actors are playing on their own. Definitely, the two main production sectors (i.e. non-food agriculture and energy industry, respectively) are separated and far apart, being their main players unaware of each other.

The organization of a bioenergy supply chain based on APPR feedstock largely depends on specific regional characteristics due to farm structures, organization and management, residual biomass availability, local constraints and opportunities, market dimensions and distances, etc. Different kind of sector development "trajectories" were identified in this document, which of these should be the most suitable "business models" depends on the right combination of specific regional conditions and the level of entrepreneurship shown by the actors potentially operating along the value chain. A wide range of opportunities was detected. Both the "*Sector Analysis*" and the "*Action Plan*" (for each of the considered *Demo Region*) are largely useful to get a good level of awareness about the APPR sector at regional scale, and represent an effective guide in applying the best conceived approach to promote and start new businesses within the APPR sector according to a strong collaborative attitude.

The present document, jointly assembled starting from the four regional contributions, was prepared by collating, comparing and matching each of them. The construction of a comprehensive framework, the application of a set of interpretive tools and explanatory techniques was the added value of this unified version, thus representing (we believe) an original and interesting tentative of summarizing a large amount of information without losing the capacity of a clear and penetrating understanding.

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SPAIN

Person/Department	Company/Institution	Current role with respect to APPR biomass
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Ms. María José Murciano	REDR – Spanish Network for rural Development (Madrid)	Third sector, interest of rural areas
Mr. Juan de Dios Escolar / Responsible of Energy Crops	Forestalia Renovables (Zaragoza)	Potential consumer of APPR biomass
Mr. Sergio Breto Asensio / Responsible of Energy planning service	Government of Aragón (Zaragoza)	Regulation (energy plans Aragón)
Mr. Hector Filloy Viver	Filloy-Viver agricultural service (Mazaleón)	Agriculture service company
Mr. Chema Alquézar Alquézar / Vicepresidente	CERAI Aragón (Centro de Estudios Rurales y de Agricultura Internacional)	Sector productivo / Tercer sector
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ITALY

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Barbara Valenzano, Francesco Corvace	Ecology Department – Apulia Region	Strategic planning on environment, territory and industry
Antonio Baselice	Agritoppi Srls	Farmer and pellet producer
Andrea Iantoschi	CIA – Italian farmer confederation	Representative of the interests of farmers
Pietro Spagnoletti	Coldiretti – Farmer Association	Representative of the interests of farmers
Vincenzo Patruno, Miriam Girone, Mario de Angelis	Confcooperative –FedAgri Puglia	Representative of the interests of farmers
Maria Teresa Chiarella	GAL - Terre del Primitivo	Local Action Group
Giuseppe Bratta Riccardo Amirante	Distretto "La Nuova Energia"	Network of companies with the aim of promoting the use of renewable energy
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UKRAINE

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Havryshok Serhii Vasylovych	SVAROG	Agri company (fruit horticulture)
Kekuh Sviatoslav Ivanovych	Farmer, entrepreneur	Farmer (fruit horticulture)
Harchuk Lilia Ivanivna	COOPERATYVNYI SAD «UROZHAI»	Agri company (fruit horticulture berries production)
Inna Semerog	Farmer, entrepreneur	Farmer (fruit horticulture)
Viktor Kobetc	UKRANISKYI PELETNYI SOUZ	Association of pellets and granules producers
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Evgeny Oleynik	NGO «BIOENERGETYCHNA ASSOTSIATSIA UKRAINY»	Bioenergy association
Iryna Gnap	LLC «Salics Energi»	Service company operating in growing energy crops
Serhii Zibcev	National University of life and environmental sciences of Ukraine	Bio resource scientist
Bilous Andrii Myhailovych	National University of life and environmental sciences of Ukraine	Sustainable bio resources scientist
15 responders representing diversified sub sectors as agriculture, bioenergy and science have took its party in conducted sector analysis to develop action plan.		

ANNEXES

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Annex C1: summary of the sector analysis and action plan for the Demo Regions in Greece (language: EN)

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ANNEX A1

WP2 - TASK T2.2

Performing an APPR Sector Analysis and Developing an Action Plan for the Demo Regions Aragón (Spain)

Contents of the document

2.1 SECTOR ANALYSIS

A.Regional framework on APPR

Aragón is an Autonomous Community of Spain located in the northeast area and comprises the central section of the Ebro valley, the central Pyrenees and the Iberian Sierras (see figure 1). It is located in the north of Spain, and limits on the north with France (Languedoc-Roussillon-Midi-Pyrenees), on the west by the autonomous communities of Castilla-La Mancha, Castile and Leon, La Rioja, Navarra; and on the east with Catalonia and the Valencian Community. The surface of Aragón is of 47,719.2 km² of which 15,636.2 km ² belong to the province of Huesca, 17,274.3 km ² to the province of Zaragoza and 14,808.7 km² to the province of Teruel. As a whole Aragón represents 9.43% of the surface of Spain, being thus the fourth autonomous community in size.

Aragon has 1,308,563 inhabitants (2016) and is one of the four communities with the lowest population density in Spain. 73% of the Aragonese population is concentrated in the province of Zaragoza. It has a traditional economy in the primary sector with predominance of cereal and forage crops, supported by a significant sheep population, though it has been greatly modified in recent years by the unstoppable rise of the industrial sector, services and trade, followed by tourism. To these effects the role of Zaragoza and its commercial and logistic capacity in the peninsular northeast sector is remarkable.

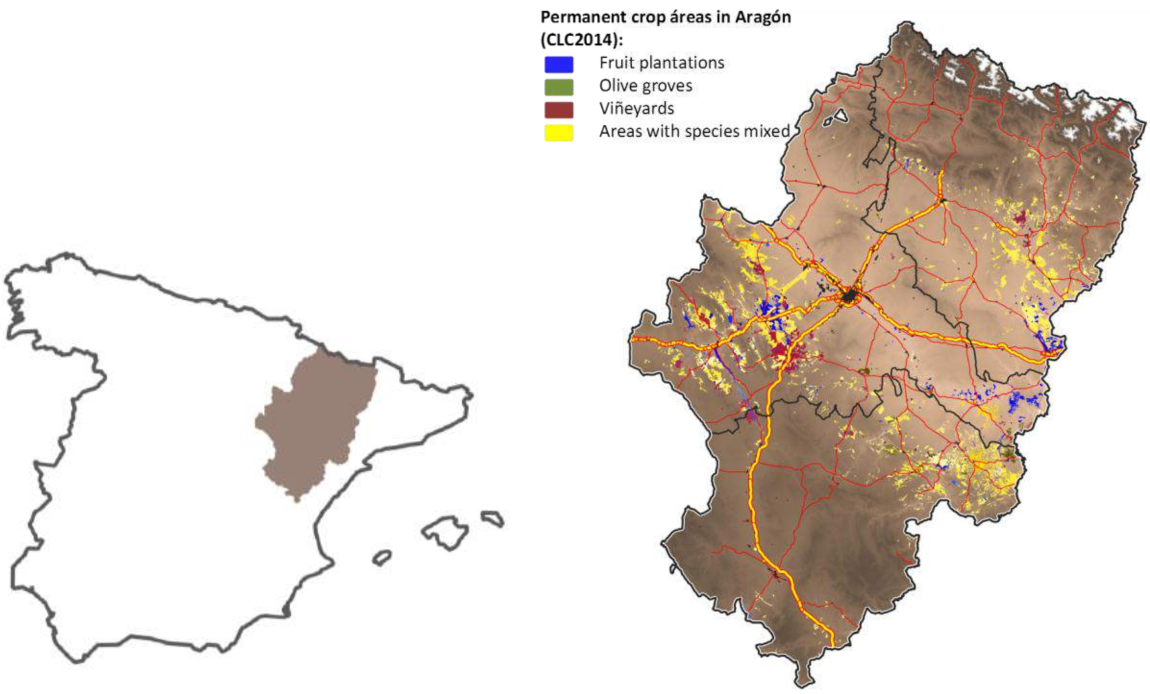


Figure 1: Aragón. Left: location in Spain. Right: Location of the main areas of land cultivated with permanent crops

Figure 1 shows the location of the permanent crops in Aragón, according to Corine Land Cover (version 17, 2014). When expressed in numbers (as summarised in Table 1 and Table 2) it is possible to observe important areas of al crop groups (table 1), adding a total of more than 175,000 hectares in the region (average area declared for the CAP between 2009 and 2013). When crops are disaggregated by species, and the trend is observed, it is worth mentioning the increase in the declared area of olive grove, as opposed to a decline in the vineyards. The stone fruits present an expansion, whereas seed fruit group shows to be in a period of contraction. The almond, stable as shown in the table, is being subject currently of an increase in the very last years in Aragon, with an expansion of irrigated almond trees entering production. As shown in the table, the area of permanent crops remains stable, which in principle makes it possible to expect that the productive potential of agricultural pruning and plantation removal (PARP) will not be subject of any gradual expansion or reduction.

Table 1: Areas by crop group for permanent crops in Aragón (data according to the CAP declarations, averaged in the period 2009.2013)

Area (hectares)			
	Rainfed	Irrigated	TOTAL
Olive	37,704	6,766	44,470
Vineyard	28,075	4,034	32,109
Dry fruit	60,303	3,778	64,081
Sweet fruit	6,827	29,459	36,286
TOTAL	**132,910**	**44,037**	**176,948**

Table 2: Areas by permanent crop species in Aragón (data according to the CAP declarations, averaged in the period 2009.2013) and detected trends.

Area (hectares)					
	Species	Rainfed	Irrigated	TOTAL	Last 5 years trend
OLIVE	Olive	37,705	6,766	44,470	+5.0%
VINEYARD	Vineyard	28,040	3,968	32,008	-9.2%
	Table grape	35	67	102	+32.7%
DRY FRUIT	Almond	60,221	3,612	63,833	Stable
	Walnut	82	166	248	+13.6%
SWEET FRUIT (stone)	Peach	1,317	10,703	12,019	+12.6%
	Nectarine	481	6,132	6,613	+20.9%
	Apricot	123	1,302	1,425	+46.8%
	Cherry	4,110	3,072	7,182	+2.1%
	Plum	290	852	1,142	-8.9%
SWEET FRUIT (seed)	Pear	245	3,981	4,226	-20.9%
	Apple	169	3,329	3,498	-11.1%
OTHER	Other fruits	93	88	181	+8.4%
	TOTAL	**132.911**	**44.038**	**176.948**	**Stable**

According to data analysed by CIRCE (from the declaration of agricultural parcels for the CAP) (S2Biom, 2016), about 11% of the fields for permanent crops are smaller than 0.25 ha in Aragón. Fields from 0.25 to 1.0 ha represent 34%, fields from 1 .0 to 2.5 ha represent 25%, and only 30% of the fields are larger than 2.5 ha.

B. Regional potential of the APPR availability

The theoretical potential of agricultural pruning in Aragón is evaluated to be about 274.000 t/yr of dry matter. This potential refers to an estimation of all the residues produced annually. Several reports have been found, which results are shown in Table 3. The studies have been arranged into three classes. On the one hand those based on regional statistics for Aragón, and use of local ratios (obtained from field measurements or from surveys). On the other hand, those scoped to obtain national or EU potentials, but providing figures disaggregated by NUTs3 or NUTs2. These studies usually base on general ratios (one ratio of tons per hectare by crop for the whole area of study, based on literature or on average data) and in more inaccurate statistics. As a matter of fact it is observed how some of them fail when predicting a potential of pruning biomass from citrus, probably due to a wrong classification of the crop areas in the statistical data of origin.

Table 3: Theoretical potentials (t of dry matter per year) for agricultural pruning in Aragón according to several data sources..

Theoretical potentials for agricultural prunings (t of dry matter per year)								
	Report	**Ref***	**Vineyard**	**Olive**	**Dry fruit**	**Sweet fruit**	**Citrus**	**TOTAL**
Studies based on local data	Atlas biomass 1997	[1]	36,724	19,854	13,825	14,907	0	85,310
	Lignostrum/Felix de Azara	[2]	60,084	47,557	34,029	59,529		201,199
	Luis Roldan 2007	[3]	61,874	137,164	32,940	154,825	0	386,803
	SUCELLOG	[4]	86,022	78,761	27,323	83,739	0	275,845
Studies scoped at national level	ACVCOCO	[5]	63,281	54,235	69,315	93,249	0	280,079
	Bionline	[6]	n.d.	n.d.	n.d.	n.d.	n.d.	780,507
	Bioraise	[7]	40,109	9,650	92,855	n.d.	n.d.	142,614
Studies scoped at European scale	S2biom	[8]	101,000	58,000	n.d.	69,000	35,000	263,000
	Biomass Futures	[9]	99,324	83,723	181,416		78,230	442,693
	EuroPruning 2016	[10]	34,987	55,601	38,555	73,981	0	203,124

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

It has to be highlighted that the potentials provided in Table 3 refer to annual prunings. So, they do not include the biomass produced from other pruning operations that may take place every 5 or 10 years as could be: pruning for structuring the tree (removal of old branches); topping (to keep height of the tree; pruning executed prior grafting of new variety (all branches removed at the basis). These pruning operations produce important amounts of biomass, that have not been included in the potentials mentioned above, except in the case of Biomass Futures project. Therefore the average figure of 274.000 t/year could be observed as a base theoretical potential, probably larger when considering pruning from other type of operations.

Biomass of plantation removals has not been estimated by any of the previous studies for Aragon. In fact no inventory or estimate has been found. The productivity can be very variable as it depends on the crop species, climate, plant vigour and age, among others. But it is also very influenced by the harvesting method, since the farmers have applied the pruning operations along the lifetime of the planation, to allow the harvesting according to their particular preferred system. That affects the size of the plant when the plantation is removed. CIRCE carried a rough estimation for Aragón through the project S2biom (S2Biom, 2016), which indicates a theoretical potential of about 100,000 t of dry matter per year of the aerial part of the trees (aboveground biomass), and about 50,000 t of dry matter per year from stumps and roots (only wood, without soil).

The availability of the APPR biomass for energy is an issue that needs further to be explored. The factors of competitiveness and feasibility have to be explored for such purpose. About competitiveness, several of the abovementioned studies have also reported figures on availability of pruning biomass. According to SUCELLOG, ACVCOCO, Lignostrum/FELIX Azara, S2biom y EuroPruning, a rather small percentage of the pruning wood from annual prunings is currently being object of use (from 2 to 10%), generally as firewood (thick branches). The agricultural prunings are being mainly object of burning in fires at the field side, or mulched in small pieces on the top of the soil of the plantations. The latter practice may contribute to an increase of the organic matter in soil, though not all farmers perform the operation with this objective, but as the most rapid system to dispose the wood. It can be argued that in vineyards an olive groves, where the pruning is considered a potential vector for pest and diseases propagation, obtaining the pruning for energy should not be considered a problem. In other plantations, there may be a part of the sector preferring to use the biomass as an organic input, and then a part of the potential should not be considered available. This has to be considered zone by zone, and cannot be generalized, since during the multiple consults of uP_running, it was observed marked differences in the preferences of farmers. It is interesting also to be noted hat, whereas burning in open fires is allowed in Aragón and most sites in Spain, this practice is minority in other countries like France, Germany, Austria, Slovakia or Poland.

The biomass of the tree stem from plantation removals is utilized partially as firewood. However, since the disposal practice is the burning in open areas in large piles, farmers sometimes prefer to burn the pile with the whole tree, as it facilitated the total incineration of the wood from roots: burning roots alone is difficult due to the large amount of soil they contain. Therefore it cannot be argued that the wood from stem is for firewood as default, which is quite dependent on the habits of each zone. About the rooting system, there is currently no use, and no interest. And its management usually involves costs for the farmer, who may have to pay a fee to a composting plant so that they accept their material. Under a hypothetical ban for the burning of residues in the open air, it could happen that the wood could be derived for energy, and then it is not necessarily expected an increase of the firewood consumption. Therefore the competitive uses are just low.

A potential constraint to implement the use of the APPR biomass, and which may constraint the exploitation of the relevant potential existing in Aragón, is the feasibility of the mobilization. APPR biomass is disperse, and as mentioned in previous section, the field size is in general rather small. Therefore it involves difficulties, and high costs. Mobilization of biomass from small fields may require alternative models for the management of the residue, like the creation of green points where farmers can dispose their residues, and from where local operators can gather the material to produce APPR woodchips, for example. Several of the barriers are mentioned in the corresponding section below.

C. Regional potential in the setting up of an APPR value chain: describe the productive sector

There is currently no APPR sector in Aragon, meaning that at the moment there is practically no use of APPR biomass. This means, as for the most of the regions in Europe, starting from the scratch when promoting new entrepreneurship for APPR. The fact is that there is no “APPR sector” and so, no vision, or no sense of a mission. Even not a network. It has been stated that in general stakeholders ae sceptical, no matter the sector branch they belong.

At the current stage, the APPR sector could be defined as the owners of the vineyards, olive groves and fruit plantations, the potential final consumers, companies potentially interested in providing services to mobilise the biomass, and other transverse actors. A description of the relevant actors for Aragón to be activated is presented in Table 4.

Table 4: Summary of main actors of relevance to participate in new APPR biomass mobilisation in Aragón

Actors of relevance for APPR in Aragón			
APPR biomass producers	**Stakeholders able to participate in biomass mobilisation**	**Potential APPR biomass consumers**	**Other stakeholders**
• Small farmers • Owners of large fields • Cooperatives • Agro-industries	• Residues handler • Agricultural services • Forestry companies	HEAT • Livestock farms • Councils in rural areas • Agro-industry • Households • ESCO POWER • Projected plants	• Councils • County board for development • Local action groups (Leader) • Agricultural associations • Province and local trade chambers
Note that they produce the residue, but under several of the applicable business models, they can play a role in APPR mobilisation and use	They can be intermediaries, but also both final consumers or farmers can participate in biomass mobilisation.	Single farmers could use for self-consumption. Agro-industries can be a key piece to mobilise APPR in Aragón.	They can play a role to dynamise the actors and to put in contact potential providers and consumers

As observed, there is a vicious circle in respect APPR in Aragón. Here is no large biomass consumer able to use the first batches of APPR biomass. A large pelleting plant will be commissioned at end of 2017. And one or two large biomass power plants may be built, and enter in operation during 2019. Therefore any attempt to start a new value chain, needs to involve the potential consumers and ESCOs. Potential consumers may have to adapt their boilers feeding systems to the new biomass for that purpose. This makes the adoption of the new fuel less interesting to consumers.

In respect to biomass consumption, Aragón has a very low population density. Even more, 60% of the population lives in Zaragoza. The population is distributed in the territory in small towns and villages, which are the areas of concentration of APPR biomass. Therefore a key point to mobilise consumption can be the councils in these towns, usually very sensitive with the management of APPR residues. As well agro-industry like olive mills, caves and distilleries. Aragón is a region producing important amounts of forage, and therefore alfalfa dehydration and cereal grain drying facilities can be a potential consumers. As well Aragón is important in livestock, and involving the livestock farm sector is strategic to promote APPR biomass.

The business models potentially applicable in Aragón in the short term are described below. A business model has been described by each actor type. In this way it is highlighted what are the current options for each stakeholder profile, to benefit from a new activity based on APPR utilization.

Table 5: Summary of potential business models applicable in short-medium term in Aragón for each type of stakeholder

Business models currently applicable to Aragón		
Value chain actors	**Applicable models**	**Not currently applicable**
APPR producers	Self-consumption: applicable to small or large land owners, cooperative and agro-industry. Either carrying harvesting and biomass handling themselves. External company providing services applicable for large sized cases.	Harvesting for sale in "biomass market" (no consumers ready to use it; no biomass logistic centres, but small suppliers). E.g. a cooperative harvesting pruning and selling it, not applicable now.
APPR harvesting	Pruning collection service: a service company, or a company / agro-cooperative (fruit, grape, olive) can provide service to collect pruning: farmer contracts and pays a fee for the service (fee being chipper than the cost of usual pruning management they do) Plantation removal service: the farmer / plantation owner contracts the service to terminate the plantation and restore the soil (to be ready to start new one). The farmer pays a fee per hectare lower than a regular service (thanks to the fact the service company compensate costs with the biomass sales). Rental of machinery: machinery builders to start renting (not selling) business. The pressure and risk of investment is then lowered for service companies or farmers willing to use such equipment.	Companies dedicated to rent pruning harvesters, or chippers for APPR. The risk is too high: they invest, but customers may do a first try, and then forget about collecting APPR biomass anymore.
Biomass handling / transfer	Green landfill for APPR biomass: established by city councils in rural areas with concentration of permanent crops. The point to be opened 1 day per week, with a municipal worker (or subcontractor) to organise the unloading of residues brought by farmers. Intermediaries or biomass suppliers could then move their machinery there when collection points have sufficient material, to gather, treat and market it. Multipurpose logistic centre (biomass yard): promoted by a public entity (costs internalised in favour of the community), a waste manager (in its own existing facilities, with minor investments) or through joint ventures. Aim is to gather multiple biomass residues, treat and classify them and provide to multiple consumers (each consumer the right fraction).	APPR biomass logistic centres: seasonality, and the limited concentration of areas rich in resource. In Aragon there are not even biomass logistics centres. Only small/medium-sized distributors, or waste managers. But even in existing facilities, it requires a high involvement of the local actors who take the biomass to the centre. In future, once the biomass use of PARP is started it could be a model to consider.
Consumers	Heat supply: ESCO can offer heat services, not biomass supply. Thus, once the terms are accepted, the customer only pays the fee for the heat, and the ESCO is responsible for installation and maintenance (ESCO assumes installation of multi-fuel boilers, to be partially fed with PARP biomass). Dedicated biomass consumption of PARP: only within the reach of municipalities. It needs security of supply, and face costs and risks that a private entity could not possibly assume.	Creating a facility based only on APPR biomass not an option at the present time for private sector (unless in self-consumption schemes). At the moment no consumer has the strength to organizes the APPR biomass collection (as a large consumer could do).

It must be noted that each business model requires that biomass ends in hands of a final consumer. It has been detected in Aragón that in rural areas it is possible to gather potential local consumers from farms, agro-industries and councils sited nearby. The close relations between actors make possible the start-up of new initiatives based on bilateral relations of confidence (e.g. a company providing APPR biomass to 3 farms; both companies managers having good relations). Afterwards, the business to be expanded to other farms how replicate because of the appealing savings they can have by consuming APPR biomass.

In this sense APPR woodchips or shredded material is the option currently applicable. Pelleting and briquetting involve more investments, and just add higher risks for entrepreneurs, since pelleting or briquetting also do not directly lead to penetrate in new markets. Since the biomass consumers for a provider may be multiple, it may be strategic to harvest the biomass on fields in the most efficient way, no matter the shape of the APPR biomass. Then the provider to perform further operations of screening and classifying, to serve the different batches with the appropriate quality to different consumers. This may involve extra investments, an therefore for an initial stage, it may be crucial that entrepreneurs associate with ESCOs, waste managers or agro-industries belonging such facilities.

D. Barriers or constraints to enter into the APPR value chain or to start up the value chain

In the full extent sector analysis (document in Spanish) a total of 94 barriers constraining the use of APPR biomass have been detected: technical (9), cultural (23), legal and regulatory (9), structural (17), market (11), value chain organization (10), economic (9) and financial (6). Quoting all of them is out of the scope of this executive summary. Table 6 summarizes the barriers detected. As observed, in structural barriers, it has been pointed the “uncertainty” as a consequence of the multiple barriers existing. Uncertainty is a therefore a strong barrier itself, but to abate it, it is needed to work in the multiple barriers that lead to this structural uncertainty for the APPR use.

About driving forces, a total of 34 have been pointed out through the workshops and interviews, arranged as next: structural, related to the APPR as an opportunity (4); consumption (6); policy (6); open fires regulation (4); market (10); and awareness (5). It is observed as summary, that the voice of stakeholders consulted lead to see that most of the driving forces relate to market and to the public sector. In the case of the latter it refers to new regulations on the use of wastes, but also on subsidizing good practices, APPR biomass use, or campaigns to raise awareness.

Table 6: Summary of barriers detected for the utilisation of APPR biomass in Aragón

Barriers for APPR biomass in ARAGÓN						
Technical	**Cultural**	**Legal**	**Structural**	**Market**	**Value chain organization**	**Economic & Financial**

• ower quality than woodchips • More variable quality • t/ha rather small/unknown • Immature harvesting mach. • No specific mach. for chipping plantation removal wood • PARP biomass use need adapting regular boilers • Need to adjust combustion param. in regular boiler • Scarce models adapted or PARP biomass	• Reluctance to changes • Farmers want things to be easy, no further complicat. • PARP biomass thought to be of low energy content • Belief it won't be competitive • Farmers only see the new costs, not the savings in APPR residue management • Perception: other is making money out of my residues • Belief: best use of running is soil amendment • Not sensitive that APPR burning = bad practice • Belief: we are at the tail of Europe. Here it is normal. • Biomass: unknown, risky • Belief: biomass boilers not automatic (manual work) • Scepticism about the cases of success (cannot be real) • Belief: tree stumps cannot be utilised for energy • Engineers & ESCO do not trust APPR biomass • Belief: only large consumer can use this biomass	• PARP biomass not in reginal energy plans • Currently allowed disposal APPR in open-air fires • No incentive, no law to hinder the open-air fires • Renewable energy framework unstable (Spain) • Government changes of mind and direction of policies • New regulations on emissions in small & medium sized boilers (PARP considered wood!) • Subsidies when leaving APPR biomass on soil • CAP: cross compliance measures (GAEC) include pruning to soil, but not to energy • Pressure for eliminating the residues (farmers exposed to fines)	• PARP as biomass unknown • Unawareness on the potential solutions • Absence of examples for replication • Informal economy • APPR very widespread • No a declaration or signal from government on its interest in APPR residues • Absence of public initiatives as example • Aragón: lots of forest biomass accumulated. APPR kind of secondary interest • Limited budget from government to start promotional programs • Absence of a regional strategy for agrarian residues • No pressure from lobbies: "who pollutes should pay" • Fossil fuel companies offer very good conditions to make client stop thinking on biomass Risk and uncertainty	• Scarce biomass market in Aragón • Tendency to speculation and changes in prices • Suppliers/consumers distrust APPR biomass • Fear to APPR supply break • No large consumer in Aragón • In general, scarce biomass consumers • Scarce ESCOs willing to promote APPR biomass • Consumers may try APPR biomass at low price, and cause a failure • Scarce biomass companies able to integrate APPR as new feedstock • No clear view of the marketing strategies for APPR biomass	• APPR biomass logistics is complex • Farmers may request very short times to get rid of their residues • Sharing machinery, not always easy to arrange • Distrust to external companies operating on your fields • Difficulty/reluctance to coordinate APPR harvest in an area • Difficulty to cover every actor expectation. Sometimes unrealistic. • Difficulty to get a solid agreement with APPR biomass owners before starting the investment → risk • Small parcels: difficult organising collection. • Access to small parcels	• Last years petrol price has been low • Margin of benefit small • Not all value chain actors ready for small benefits • Mortgage of machinery costs require mobilise important volumes of biomass • Need of high volumes to make money. Stop business driven initiatives. • Some companies broke. No one wants to repeat it • Variable market prices • Uncertainty of prices for APPR harvest. No reference • Boilers adapted for APPR are more expensive • Risk factor may cause to fail in finding funds • Small farmers/companies need to be extremely sure before starting investment • VAT on biomass in Spain 21% (other countries 10%) • Biomass not in all rural development programs • No specific funds to obtain or use APPR biomass

Table 7: Summary of driving forces for the utilisation of APPR biomass in Aragón

Driving forces for APPR biomass in ARAGÓN					
Structural (APPR opportunity)	**CONSUMPTION**	**POLICY**	**OPEN FIRES REGULATION**	**MARKET**	**AWARENESS**
• Huge potential in Aragón • Areas where the potential is concentrated • Increase in prices of woodchips • Increase of price of petrol	• Start of a large consumer • Increase of biomass consumption in agricultural sector • Public sector creating new demands to exemplify APPR is feasible • Wine, fruit and olive oil industry integrating APPR biomass for self-consumption • Strong promotion from local councils in areas of high APPR potential • Increase of biomass consumption in rural areas of high potential	• 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 favour those sources having more priority/social impacts • Promotion of RTD in topics for bio-economy and closed loop solutions for wastes • Incentives to use PARP biomass / to make more uneconomic other practices	• Promotion of a catalogue of good practices including APPR biomass to energy as one of them • More restrictive environmental policies • When promoting subsidies for machinery, include pruning harvesters as a priority • CO_2 taxation for open fire disposal of APPR biomass	• Support / visualization of ESCOs or companies with proved capacity to provide solutions for APPR • Labels, standards to facilitate the quality assurance • Biomass market stable • Creation of biomass yards (multipurpose logistic centres) • Cooperation, collaboration among farmers to facilitate coordinated harvest and large volumes • Promotion of flagship cases • Activities to promote pioneers to know from inside existing success cases (show-case days) • Activities for matchmaking of agriculture and energy sector • Support to RTD for machinery and boilers ready for APPR • Machinery manufacturers open to rent, not just to sell the equipment	• Subsidies to re-shape the mind-set of agricultural sector, energy sector, public sector and community • Raising awareness of the social benefits of a change in APPR residues management • Raise awareness to consumers on the possibilities to use APPR biomass as fuel • Raise awareness in company managers (to promote biomass, and not reject APPR biomass as an option) • A more aware society, already including in school ideas of what should not be considered environmentally acceptable

E. Regulation and promoting initiatives from the side of policy makers

There is in general no specific legislation for PARP waste itself. All that affects it is based on legislation related to agriculture, environment or waste management, or energy (biomass as renewable resource). But no specific regulation in most cases attaining APPR biomass.

In respect the regulations of renewable electricity, the former RD-661/2007 included APPR biomass was the b.6.2 renewable resources sub-group, entitled “biomass from gardens and agricultural activities” (pruning wood mentioned in the description of the group). However from 2012, the regulation was cancel through the RD Law 1/2012, and a period of moratorium on the incentives started. From then the policy for renewable power generation has been modified, and currently the quotas for feed-in tariff for new renewable energies are granted through a bidding process. A total of 700 MWe were granted in a biding carried out during 2015, and a new call for 3,000 MWe has been opened recently (January 2017). This process aims to reach the objectives of the current renewable Energy plan towards 2020, by causing the minimum impact in the costs of electricity. In other words, the bidding is not segmented by renewable energy class, and aims to cover the quota with the cheapest renewable energy projects. Under this situation, those technologies mature are promoted, but the mechanism does not allow special consideration for energy resources having a need for special support, or causing larger social impacts.

Currently the 2030 climate and energy framework sets three key targets for the year 2030: (1) at least 40% cuts in greenhouse gas emissions (from 1990 levels); (2) at least 27% share for renewable energy; (3) at least 27% improvement in energy efficiency. It builds on the 2020 climate and energy package. The directive link renewable energies and climate. The transposition of the directive might be treated as a whole for Europe, each country deciding the best strategy to contribute to it. Therefore how this directive is transposed to Spain will highly affect how much the biomass, and the APPR biomass, is promoted. Specifically, a firm commitment with a higher share of biomass renewable heat, could benefit APPR biomass. By first of January 2018, each Member State will have to present a draft of the integrated energy and climate plan.

There are currently 2 relevant policy instruments on emissions that may hinder the utilisation of APPR biomass. On the one hand, for medium sized combustion plants (from 1 to 50 MW of thermal power), the Directive EU2015/2193 (25 November 2015), which establish the limitation of emissions of certain pollutants into the air. It does not any distinction of the type of the solid biomass consumed as fuel, and so, wood of good quality has an advantage in respect other biomass residues. Anyway, the relevant issue is how each country transposes through national regulations, which may determine variations in respect the emissions thresholds set by the directive.

In respect small scale combustion (< 500 kW of thermal power), the EU2015/1185 and the EU2015/1189 regulations implement the directive 2009/125/EC of in regard to ecodesign requirements for solid fuel local space heaters and solid fuel boilers (respectively). The regulations establish the limits on pollutants like dust, VOC, CO and NOx. In respect to biomass, these regulations apply to “wood” fuels, so in principle the APPR biomass is included. This situation has the positive effect that the APPR biomass is under regulation. So, any boiler able to combust APPR biomass efficiently, can be utilised. This is an advantage to other biomass types (herbaceous) which fall out of the regulation. On the other and, the restrictions are very constraining, and so, quite difficult to be achieved with biomass types having ash contents like pruning biomass (3-5%) in respect regular woodchips or pellets (< 1%). A review of this regulation is expected in 2019, possibly including other types of fuel. In case it occurs, it will be crucial where APPR biomass falls, if under the generic group of “wood” biomass, or in other potential groups like “herbaceous” or “agro-residues”.

Independent to the existing and coming regulations on pollutants from combustion facilities based on solid fuels, the main issue in Spain are the limited instruments to put the regulations in force. Even if regulated and transposed, the mechanisms of control are weak, especially in rural areas and in farms or facilities far from rural towns or villages. In such places no controls are carried out, and there may exist facilities burning any type of biomass or fuel without emissions control. Therefore such types of mechanisms are missing.

In respect to agricultural residues management, each Autonomous Community (each NUTs2 government) decides the specific regulations. In case of Aragón, burning APPR residues in open fields falls under the Forestry Act (law 15/2006). An authorization for the use of fire on agricultural or forestry surfaces is necessary to be obtained, and its procedures are published under annual orders. There is however, no regulation banning, or limiting the burning of residues in open air. Directive 2008/50 / EC on ambient air quality and cleaner air for Europe introduces regulations for new pollutants. However, it does not refer to outdoor burning practices, but to regulated activities that emit pollutants. The current law in force in Spain (Law 34/2007 on air quality and protection of the atmosphere) and the Directive transposition, RD 102/2011, do not consider it.

The current common agricultural policy (CAP) covers the period 2014-2020. It consists of three strategic funding schemes: the direct payments, the market measures and the rural development programs. The funding schemes for the new period are expected to be announced by end of 2017. In relation to the support lines for direct payments (Royal Decree 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 Royal Decree 202 / 2012 in articles 41 to 45. These articles developed the aid program for measures to promote higher agri-environmental benefits in certain species of the dry fruits. This measure was applicable to the collection and removal of pruning to be utilised either as biomass, or as cover for the soil. However, since 2015 there is no such mechanism. In terms of cross-compliance measures, there are some references to pruning in the good agricultural and environmental conditions (based on Royal Decree 486/2009) which establish that:

- When pruning of woody crops is eliminated, it will be carried out, according to the established norm
- No tree can be removed from woody crops located in slopes equal to or greater than 15%

An opportunity for APPR biomass could be a higher strengthen of the environmental measures leading to a promote less polluting activities. That could lead to a revision of cross-compliance measures, and then the burning of residues could be object of limitation, or of the reinforcement of practices leading to a reduction of burning (like APPR biomass to energy concept).

The Achile’s heel of for APPR and in general for any issue attaining several national (or regional) Ministries, is the scarce, and in some cases non-existent communication and collaboration among them. This has been highlighted by multiple stakeholders consulted by uP_running, being a unanimous vision. In case of the APPR residues, there can be a political interference between Ministries if for example the industry and energy department promotes a regulation for utilising the agrarian residues for energy purposes. The reverse also works, since the Ministry of agriculture promoting the use for energy in rural areas of APPR biomass could interfere the competences of the Ministry of Energy.

Another driving force for APPR are regulations promoting its use. Some of them are currently managed by IDAE, with programs for biomass, from which new facilities based on APPR biomass could benefit (e.g. BIOMCASA program). As well Feader funds can be exploited by creating operative groups. There is currently (2017) a call for “Sustainable supply of biomass for food processing and energy production and industrial processes". From Leader, local companies in rural areas could be benefited of subsidies to create new activities in the treatment and marketing of APPR biomass. As well local councils could benefits of subsidies for “non-productive” projects to replace their former boilers by biomass boilers (councils in areas of high density of APPR residues could subsidize purchase of a multi-fuel biomass boiler).

In terms of any regulation constraining the use of APPR as renewable energy resource, there was in Aragon a subsidy program for the purchase of pruning mulchers (to chop the wood to be left as pieces on the soil). This tips the balance towards the chopping to soil in respect the use of APPR for biomass. As well in dry fruit species, object of direct support, the cross-compliance measures may cause all pruning wood to be left as mulching for almond under rainfed conditions, or for hazelnut (either rainfed or irrigated). Another potential constraint is the absence of a clear framework for the APPR biomass. Theoretically feasible, but subject of potential obstacles in the acquisition of permits by local competent authorities.

In summary, APPR is considered biomass, and not a waste, in Spain and Aragón. There are regulations affecting its use as energy resource, the emissions caused, and the permits for burning residues outdoors. However it has been stated almost no specific measure directed specifically to APPR residues.

F. Finance, market and final energy users

The following information are very crucial to characterize the APPR sector in the region, but also not easy to be detected (unless you have a long experience and a deep knowledge about). Especially if the APPR sector is still to be fully developed and the market is still limited, we ask you to reply at the best of your possibilities.

Capital requirements: Considering the main interesting “business model”, roughly, how large investments are required for entry? Is this a strong barrier or it could be overcome by public funding (example: Rural Development Plan at regional level; SME instruments in H2020, etc.) or bank loans?

Report information about: feedstock access, manufacturing capability, logistic organization, distribution and delivery, competence development, service provisioning, and other possible features of the APPR sector.

Roughly, establish trends in sales and price over recent years for the main or most common energy products potentially obtainable from APPR feedstock. What kind of marketing strategies are prevalent within the APPR sector, if any? Are there possible solutions to overcome the seasonality of the APPR sector? Is the APPR sector very sensitive to economic fluctuations?

Are APPR biomass suppliers and sellers in the region numerous and dispersed or limited and concentrated? Is the APPR market relatively free or it is dominated by few prevailing actors? Is the final APPR energy market fragmented or the buyers are few and very powerful? In other terms, do we have a sort of oligopoly situation? How big is the share among end-users? How final energy users perceive the quality standards of the final energy products? How important are some specific sustainability criteria in affecting the market? What about a possible product quality assurance (or certification) and a product traceability along the supply chain?

Can you recognize alternative uses of the available APPR biomass? Are these alternative uses very attractive in terms of revenues? Can you recognize competitions among alternative uses? If possible, provide an estimate to account roughly for the size of the APPR sector (e.g. 50% of current plantation removal wood used for firewood. But les s and less is used as it is a traditional practice progressively in contraction; 20% of pruning utilised for firewood, …).

Funding and subsidising can be a method to promote the use of APPR biomass. It has been stated a high uncertainty for whole actors when starting a new value chain (see Table 6, depicted as a consequence of the current barriers). Facilitation of funding (not always easy to be obtained) and specific subsidising for APPR biomass (not for biomass in general) are not existing and may be driving forces.

The biomass market is in Aragon not well developed, except for standard wood pellets. Other fuels are subject of seasonal variations, and sometimes subject of speculation. There are local biomass suppliers, but not in general a market for biomass (except for straw bales). The most suitable form to commercialise APPR biomass would be woodchips. In close loop or self-consumption schemes, the APPR biomass can be produced in form of a rather inhomogeneous material, and then the strategy can be the utilisation of a robust biomass boiler adapted to irregular feedstock feeding. In contrast, when multiple consumers are targeted an alternative can be the preparation of different batches according to the quality of consumers (by applying screening, drying processes).

About quality, it is not possible to generalise. It is true that consumers may reject batches if they do not comply the specifications (aware consumers), or simply, if the biomass cause a wrong work or a shut-down of the facility (probably what a non-proficient user may realise). So, quality is an issue. It has been observed during workshops and interviews; however, the consumers refer to it in a different way depending their knowledge.

Traceability is regarded as an added value. Consumers prefer to know where the biomass comes from. However it should not lead to much higher costs. An increase of 1 €/t could be acceptable range when deciding if starting a system for traceability. PEFC schemes may be followed as a straightforward method. It seems the process can be applied to APPR wood, though it has not been stated any experience in Spain. Sustainability is regarded as an added value. However the positive side-impacts are not at the moment a main driver for the consumers when deciding, as they principally base on the price.

About the prices of biomass, they have been explored for Aragón through interviews and through the information compiled in few previous projects. The framework of prices for Spain has been also reviewed, which shows that the biomass prices underwent in the last decade a rise, reaching a peak in 2012. From then onwards the price has sunk till 2016, accompanied by a lower demand of wood, the reduction of the energy consumption by the industry and a decay in the petrol price. Figure 2 shows the variation in prices detected in last months and years, as reported by AVEBIOM (AVEBIOM, 2016) and IDAE (IDAE, 2016).

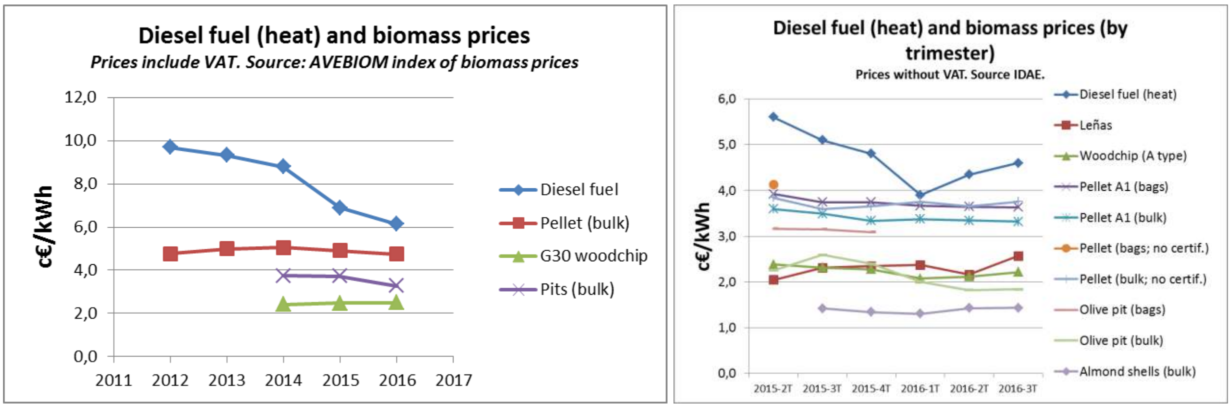
These tendencies have ben also reported by multiple stakeholders in Aragón. It has been referred sinks of the almond shells from 120 to 70 €/t from 2012 to 2015 for large consumers. However it is also true it depends quite on the zone. Almond shells are commercialised currently in a range of 60 to 130 €/t. In areas where almond shells are abundant, and for large consumers, the price can be low. It has been also reported seasonal variations of up to ±40%.

Olive pit prices in Aragón have been reported to be 120 to 150 €/t, even though they can get own to 90 €/t in the season when it is being produced. Firewood ranges usually 120 to 15 €/t, with prices up to 220 €/t for particulars.

Woodchips price also depends on season and location, but is more affected than others by properties like: moisture, ash content, and particle size distribution. The wood from forests can have a price as low as 30 €/t for batches of very moist and inhomogeneous wood. The usual price for G50 for industrial consumers is in the range 40 to 50 €/t, whereas G30 for medium sized consumers reaches a usual range of 60 to 70 €/t. Woodchips of class A, from debarked stemwood and dry, can reach prices as high as 90 €/t.

Straw has a mature market, with prices from 36 to 40 €/t (in form of standard bales). Weathered straw of lower quality may be acquired at much lower prices, from 10 to 20 €/t. Maize stalks can be about 33 €/t, baled (SUCELLOG,2016). Other fuels like grape pit and exhaust olive oil cake (dry) have market prices in ranges from 60 to 85 €/t and from 80 to 130€/t respectively. Pellets are commercialised bulk in Aragon at prices of 190 €/t (as orientative value). , The marketing of APPR biomass, or its advantage as fuel, should be compared with the price of reference of the biomass in the area where the APPR wants to be marketed. The reality in Aragón is that depending the area and the season, the prices of the biomass vary in a wide range. Therefore it is always precise to review the local context to realise which biomass is the main competitor, and the usual market prices they have, before preparing any strategy for APPR biomass.

Figure 2: Price of biomass fuels in Spain. Left: AVEBIOM data series 2012-2016. Right: IDAE data series of last trimesters.



The projections It is now at end of 2016 when the prices of biomass are detected by AVEBIOM to stay stable (Avebiom,2016).

G. Summary of a basic SWOT analysis

<u>STRENGTHS</u>

S1. APPR reduces GHG emissions in comparison with fossil fuels and even other biomass fuels.
S2. APPR allows circular economy and proximity.
S3. Farmers can save in APPR management.
S4. Agriculture sector is strong in Aragón.
S5. Wine, olive and fruit agro-industry can consume APPR biomass (km0).
S6. Sharing collection and treatment machinery.
S7. Seasonal collection of APPR: operation can be extended during the whole year.
S8. APPR creates jobs in agrarian zones.
S9. Some agrarian zones are aware of outdoors burning implications.
S10. Proximity of the APPR resources (local environment).
S11. Proximity of consumers to the APPR biomass location.
S12. Multi-fuel boilers can consume either APPR biomass or other type biomass fuels.
S13. APPR chips can be used in appropriated medium and large boilers for low quality fuels.
S14. Oil pruning can use the same commercialization network than olive marc and pit.
S15. Olive and vineyard pruning must be removed from field in order to avoid plagues.
S16. Short payback periods for biomass facilities.
S17. Energy Service Companies (ESCOs) are able to carry out APPR facilities with success.

<u>WEAKNESSES</u>

W1. Not optimum machinery for pruning collection.

W2. Scarce experience in APPR chipping.
W3. APPR biomass has lower quality than other types of biomass.
W4. No APPR biomass regulation or standardization (uncertainty).
W5. Fewer available combustion technologies than for other biomass types.
W6. There are no exclusive APPR biomass consumption facilities.
W7. Agriculture sector, energy sector and society do not know APPR biomass potential.
W8. Difficulties to obtain private financing since there is too much uncertainty.
W9. Low profitability due to logistic chain high costs.
W10. APPR biomass geographical dispersion hinders its management.
W11. APPR biomass tonnes per hectare are lower than for forest biomass.
W12. There is not enough market for APPR biomass.
W13. Black economy in agriculture sector hinders the growing of agriculture service companies.
W14. Other renewable energies are ahead of biomass in the region of Aragón.
W15. Other renewable energies are in better position regarding new power auction.
W16. APPR biomass is not taken into account in Aragón Energy Plans.

OPPORTUNITIES

O1. There exists a high APPR biomass potential in Aragón.
O2. There exists a very high APPR biomass concentration in particular locations from Aragón.
O3. Some technicians from the Administration are totally aware of environmental issues.
O4. District Heating is rising in Spain and it is expected to continue increasing.
O5. Try to reduce GHG emissions from wine sector with km0 solutions.
O6. Oil price is rising.
O7. There exist ECOs that can reduce uncertainty to consumers (just service cost).
O8. There exist ECOs seals of quality that give visibility to experienced installators.
O9. Promotion of heat from biomass within the new Renewable Energy Directive.
O10. New agriculture policies that regularize waste utilization.
O11. More restrictive environmental policies that can remove outdoors burning.
O12. Higher emissions reduction from renewable energies.
O13. Financing to projects in the agriculture sector, including APPR collection (Leader).
O14. Financing to energy efficiency projects in local governments (Leader).
O15. Financing to improve production process in agriculture and industry sectors (Feader).
O16. Financing to develop innovative products and services at local and national level.
O17. Development of a seal of quality for APPR biomass (olive and vineyard, Biomasud).

THREATS

T1. No renewable energies segmentation.
T2. Administration can promote other competitor sectors instead of APPR biomass.
T3. Changes in the Administration policies.
T4. Changes in local governments.
T5. More restrictive emissions for biomass in new directives.
T6. If APPR biomass is classified as wood, emissions levels will be more restrictive in small facilities (Ecodesign directive)
T7. APPR biomass can be stay out of the legislation if it is not considered as fuel.
T8. Legislation can consider wood from APPR as a waste not biomass.
T9. Too much high expectations if biomass potential is not accurately calculated.
T10. Reduction in the olive, vineyard and fruit production due to climate change and frequent drought.
T11. Cuts in agriculture production funding.
T12. Olive, vineyard and fruit relocation to lower costs markets.
T13. Other low quality agro-wastes with lower price can compete with APPR biomass.

T14. Black economy regarding agriculture services can cut the private initiatives.
T15. Not experienced installators with fail projects can create bad press.
T16. Bad experiences (word of mouth)
T17. Rejection to the novelty.
T18. Alternative non energy uses.

After the analysis one of the doubts was whether to incorporate uncertainty and risk as one of weaknesses or threats. However, it has been decided not to include, as it is the result of multiple uncertainties, weaknesses and threats. That is why the reader should not be surprised by its absence in the table. It was decided to reflect it as a structural barrier that currently affects all aspects for the use of APPR biomass.

SWOT Analysis Summary			
Strengths	**Weaknesses**	**Opportunities**	**Threats**
S1. APPR reduces GHG emissions in comparison with fossil fuels.	W1. Not optimum machinery for pruning collection.	O1. There exists a high APPR biomass potential in Aragón.	T1. No renewable energies segmentation.
S2. APPR allows circular economy and proximity.	W2. Scarce experience in APPR chipping.	O2. There exists a very high APPR concentration in particular locations from Aragón.	T2. Administration can promote other competitor sectors instead of APPR biomass.
S3. Farmers savings in APPR management.	W3. APPR biomass has lower quality than other types of biomass.	O3. Some technicians from the Administration are totally aware of environmental issues.	T3. Changes in the Administration policies.
S4. Agriculture sector is strong in Aragón.	W4. No APPR biomass regulation or standardization (uncertainty).	O4. District Heating is rising in Spain and it is expected to continue increasing.	T4. Changes in local governments.
S5. Wine, olive and fruit agro-industry can consume APPR biomass (km0).	W5. Fewer combustion technologies than for other biomass.	O5. Try to reduce GHG emissions from wine sector with km0 solutions.	T5. More restrictive emissions for biomass in new directives.
S6. Sharing collection and treatment machinery.	W6. There are no exclusive APPR biomass consumption facilities.	O6. Oil price is rising.	T6. If APPR biomass is classified as wood, emissions levels will be more restrictive in small facilities (Ecodesign directive)
S7. Seasonal collection of APPR: operation can be extended during the whole year	W7. Agriculture sector, energy sector and society do not know APPR biomass potential.	O7. There exist ECOs that can reduce uncertainty to consumers (just service cost).	T7. APPR biomass can be stay out of the legislation if it is not considered as fuel.
S8. APPR creates jobs in agrarian zones.	W8. Difficulties to obtain private financing (too much uncertainty)	O8. There exist ECOs seals of quality that give visibility to experienced installators.	T8. Legislation can consider wood from APPR as a waste not biomass.
S9. Some agrarian zones are aware of outdoors burning implications.	W9. Low profitability due to logistic chain high costs.	O9. Promotion of heat from biomass within the new Renewable Energy Directive.	T9. Too much high expectations if biomass potential is not accurately calculated.
S10. Proximity of the APPR resources (local environment).	W10. APPR biomass geographical dispersion hinders its management.	O10. New agriculture policies that regularize waste utilization.	T10. Reduction in the olive, vineyard and fruit production due to climate change and frequent drought.
S11. Proximity of consumers to the APPR biomass location.	W11. APPR biomass tonnes per hectare are lower than for forest biomass.	O11. More restrictive environmental policies that can remove outdoors burning.	T11. Cuts in agriculture production funding.
S12. Multi-fuel boilers can consume either APPR biomass or other type biomass fuels.	W12. There is not enough market for APPR biomass.	O12. Higher emissions reduction from renewable energies.	T12. Olive, vineyard and fruit relocation to lower costs markets.
S13. APPR chips can be used in appropriated medium and large boilers for low quality fuels.	W13. Black economy in agriculture sector hinders the growing of agriculture service companies.	O13. Financing to projects in the agriculture sector, including APPR collection (Leader).	T13. Other low quality agro-wastes with lower price can compete with APPR biomass.
S14. Oil pruning can use the same commercialization network than olive marc and pit.	W14. Other renewable energies are ahead of biomass in Aragón.	O14. Financing to energy efficiency projects in local governments (Leader).	T14. Black economy regarding agriculture services can cut the private initiatives.
S15. Olive and vineyard pruning must be removed from field in order to avoid plagues.	W15. Other renewable energies are in better position regarding new power auction.	O15. Financing to improve production process in agriculture and industry sectors (Feader).	T15. Not experienced installators with fail projects can create bad press.
S16. Short payback periods for biomass facilities.	W16. APPR biomass is not taken into account in Aragón Energy Plans.	O16. Financing to develop innovative products and services at local and national level.	T16. Bad experiences (word of mouth)
S17. Energy Service Companies (ESCOs) are able to carry out APPR facilities with success.		O17. Development of a seal of quality for APPR biomass (olive and vineyard, Biomasud).	T17. Rejection to the novelty.
			T18. Alternative non energy uses.

2.2 ACTION PLAN

ACTION LINE: promotion of the acceptance of APPR biomass					
Strategies/ Targeted action type	**Items**	**Objectives**	**Actions / Activities**	**Actors engaged/ Targeted stakeholders**	**Already included in “uP_running”? (YES / NO)**
SO6 To give visibility to the goodness of APPR	S8: APPR develop employment in agrarian zones O1: Aragón has high APPR potential O2: There exist locations with high potential in Aragón	SO6 – To introduce and release the APPR utilization profits for the Society.	SO6.a – General campaign in Aragón. SO6.b – Specific campaign focuses on locations with high potential.	- Public - Agrarian zones with high potential: local governments, farms, agro-industry	Yes (T.7.4, T.2.1, T.3.1)
SO4 To give visibility to opportunities in agrarian zones	S11: Heat consumption in agrarian zones (e.g. farms, etc.) O4: District heating development in Spain O10: Increase of biomass heating targets (RREE plans)	SO4 – To sensitize local governments, companies and all the involved sectors in order to promote the APPR utilization as energy resource.	SO4.a – To promote real demos for the APPR involved sectors. SO4.b – To spread actual success cases and the main keys of this success.	- Potential biomass consumers in agrarian zones - Public	Yes (T.7.4, T.7.5, T.3.3, T6.3)
WT7 Campaign: APPR biomass is possible	W7: APPR opportunities unknown T16: Bad press T17: To reject the new	WT7 – To encourage APPR opportunities and to avoid unfounded bad rumours.	WT7.a – News campaign focus on the APPR promotion. WT7.b – Demos videos in Youtube. WT7.c – Clear message in public events.	- Agriculture sector - Public	Yes (T.7.4., T7.5, T7.6, T7.7)

ACTION LINE: Defend the advantages of APPR biomass utilization as energy resource					
Strategies/ Targeted action type	**Items**	**Objectives**	**Actions / Activities**	**Actors engaged/ Targeted stakeholders**	**Already included in "uP_running"? (YES / NO)**
WT6 To advice and to prevent bad habits regarding APPR utilization	W7: Agriculture sector does not know biomass T5,T6: More restrictive emission levels for boilers T15: Not experience installers (opportunistic) T16: Bad experiences	WT6 – To advice, to raise awareness and to prevent the agriculture sector from future legislation and to ensure biomass utilization in adequate boilers.	WT6.a – Sensitize campaign: news publication. WT6.b – Development of in-depth studies. WT6.c – Technical reports publication.	- Agriculture sector - Potential biomass consumers in agrarian zones - Public	Yes (T7.4, T7.5, T3.4)
SO1 More restrictive GHG emissions regulations	S1: Low GHG emissions from APPR biomass O13: More restrictive GHG emissions regulations	SO1 – To prove and to openly show that GHG emissions from APPR biomass are lower than from fossil fuels and even from other biomass types.	SO1.a – To calculate GHG emissions from real cases. SO1.b – Publication of the main results and conclusions.	- Pioneers and APPR biomass on-going projects - Public and private agents. - Public	Yes (T3.4, T6.3) (T7.4,T7.5)
SO10 Fuel and natural gas price	S17: Short Payback periods in biomass heat projects O6: Oil price is raising	SO10 – To demonstrate that APPR biomass utilization is feasible regarding oil prices whether biomass is obtained in an adequate way.	SO10.a – To give visibility to success application cases. SO10.b – Oil price following and implied Payback periods.	- Potential biomass consumers in agrarian zones, agro-industry and local governments.	Yes (T6.3) No
ST5 Promotion of APPR as a good quality fuel	S14: APPR biomass quality is not worse than other biomass types T13: Other agriculture wastes are cheaper and with lower quality	ST5 – To demonstrate that APPR quality as fuel is not bad and it can be even higher than other alternative fuels.	ST5.a – Campaign of promotion of the APPR biomass as fuel. ST5.b – Technical reports with comparisons between APPR and other wastes.	- Potential biomass consumers in agrarian zones, agro-industry and local governments. - Agriculture sector, energy sector and ESCOs	Yes (T7.4.) No
WO2 APPR biomass	W3: APPR biomass quality is lower and more	WO2 – To develop an APPR biomass quality standard based	WO2.A – To obtain APPR biomass quality data: sample collection	- ESCOs and manufacturers.	Yes (T.3.2., T.6.3.)

quality standard	variable O17: Pruning standard by Biomasud	on composition data.	campaign and literature. WO2.B – To create a certification for ensuring APPR biomass quality.	- APPR producers, new entrepreneurs. - Consumers (local governments, farms, agro-industry) - Administration and regulators.	No
WT1 APPR biomass is not toxic.	W3: APPR biomass quality is lower and more variable T7: No regulation and no standardization T8: APPR can be considered as a waste, not a biomass	WT1 – To avoid that APPR can be considered as a waste within the legislation.	WT1.a – Campaign for metal content measure in APPR biomass. WT1.b – To send technical information to decision agents. WT1.c – Information campaign.	- Energy agencies, Government environmental department, institutes. - Agriculture and energy sectors. - Public.	Yes (T.3.3.)
ST4 Reliable biomass potential measurement	S16: Pruning removal necessity T9: Too high expectations regarding biomass potential	ST4 – Reliable APPR biomass potential measurement: total, technical and available potential.	ST4.a – Measure t/ha in the region ST4.b – Availability analysis. ST4.c – Biomass potential maps.	- APPR producers, new entrepreneurs. - Agriculture and energy sectors. - Energy agencies.	Yes (T.6.2., T.3.2.) No
ACTION LINE: Achieving social and institutional support					
Strategies/ Targeted action type	**Items**	**Objectives**	**Actions / Activities**	**Actors engaged/ Targeted stakeholders**	**Already included in “uP_running”? (YES / NO)**
SO2 Social support to change APPR management by burning outdoors	S9: To raise awareness about burning O11: New policies influencing in wastes management	SO2 – To get social support in order to promote a friendly environmental APPR biomass management.	SO2.a – To develop and spread a statement about the necessity of measures that contribute to achieve more adequate procedures. SO2.b – Campaign of joining.	- Influential actors from the agriculture sector, the energy sector and the Administration. - Population from vineyard, olive and fruit	Yes (T2.1, T.2.2., T.2.3., T.4.3.)

				potential locations. - Political parties, members of the Government.	
ST2 Declaration of APPR biomass benefits from the Administration	S1,S2,S8: APPR advantages (jobs, GHG, burnings) S4: There is a strong agriculture sector in Aragón T3,T4: Changes in the Administration and policies against APPR	ST2 – To achieve an agreement on the part of the agriculture and the energy sectors with the Administration that includes the socioeconomic benefits related to the APPR management and the necessity of encouraging it.	ST2.a – To develop and spread a memorandum for APPR biomass promotion with a Declaration of Principles. ST2.b – Campaign of joining addressed to all the involved sectors.	- Influential actors from the agriculture sector, the energy sector and the Administration. - Population from vineyard, olive and fruit potential locations. - Political parties, members of the Government.	Yes (T.2.1, T.2.4., T.4.3.)
WT5 Agreement with the Administration in order to promote and support APPR	W14,W15,W16: APPR is usually not considered in Energy Plans T2,T3,T4: Changes in the Administration and support to other sectors	WT5 – To achieve an agreement on the part of the agriculture and the energy sectors with the Administration that includes the main action lines for APPR biomass promotion.	WT5.a – To develop and spread an Action Plan for APPR biomass promotion. WT5.b – Campaign of joining addressed to all the involved sectors.	- Influential actors from the agriculture sector, the energy sector and the Administration. - Population from vineyard, olive and fruit potential locations. - Political parties, members of the Government.	Yes (T.2.1, T.2.4., T.4.3.)
ACTION LINE: Promotion to entrepreneurs					
Strategies/ Targeted action type	**Items**	**Objectives**	**Actions / Activities**	**Actors engaged/ Targeted stakeholders**	**Already included in “uP_running”? (YES / NO)**
SO4 To give visibility to opportunities	S11: Proximity to heat consumers in agrarian zones	SO4 – To align local governments and companies and all the involved sectors in	SO4.a – To show the opportunity by means of application cases and demos.	- Potential biomass consumers in agrarian zones.	Yes (T6.3, T.3.3.)

of using APPR biomass for covering heating needs	S17: Short Payback periods O4, O10: Heat from biomass is increasing (plans and district heating)	order to promote APPR biomass energy utilization.	SO4.b – To spread the feasibility of APPR by information campaigns in high potential locations.	- Population from agrarian zones with high APPR potential.	(T7.4, T7.5)
WO1 To give visibility to APPR potential	W7: APPR opportunities unknown O1: Aragón has high APPR potential	WO1 – To show to the entrepreneurs the high APPR potential.	WO1.a – Visibility actions (workshops, application cases, etc.). WO1.b – Public technical reports.	- Potential biomass consumers. - Public.	Yes (T.2.1., T.7.4.) No
WO6 To give visibility to financial mechanisms	W9: Scarce profitability O14: Financing for entrepreneurs	WO6 – To encourage APPR projects by easing their economic feasibility.	WO6.a – To give visibility to available funding mechanisms to entrepreneurs. WO6.b – Financing Guideline addressed to APPR entrepreneurs. WO6.c – Influence campaign addressed to the Public Administration in order to get APPR projects promotion.	- Entrepreneurs. - Government of Aragón. - Political parties, members of the Government.	Yes (T.2.2., T.2.3.) (T3.2, T3.3) No (T4.3)
WO9 To encourage the success cases replicability	W6: Few facilities using APPR O9: There exist success cases using APPR	WO9 – To supply to the agriculture and energy sectors the success business models in order to encourage their replicability.	WO9 – To document success business models. WO9.b – To document cases running and the keys of success. WO9.c – To spread the information to the potential entrepreneurs.	- Entrepreneurs. - Consumers. - Agriculture sector. - Energy sector.	Yes (T2.2, T3.4, T.6.3) (T6.3) (T7.2, T7.4, T7.5)
WO10 Promotion of new initiatives in Aragón	W6: Few facilities using APPR O2: There exist locations with high potential in Aragón	WO10 – To promote pioneering initiatives in Aragón using APPR biomass.	WO10.a – To advice to entrepreneurs on the development of APPR projects. WO10.b – To advice on the projects economic feasibility.	- Entrepreneurs.	Yes (T.3.1.)

SO5 Promotion of new facilities in high potential locations	S17: Short Payback periods. O14, O15: Financing (entrepreneurs/local governments / innovation)	SO5 – Promotion of new facilities in high potential locations.	SO5.a – To advice on feasibility and financing opportunities for new projects. SO5.b – Campaign of information in high potential agrarian locations (agrarian development groups).	- ESCOs and potential consumers in agrarian zones. - Agrarian development groups.	Yes (T3.2, T3.3, T3.4, T4.2,T5.4) No
SO10 To promote the fuel switch from gas/oil to biomass	S17: Short Payback periods O6: Oil price is rising	SO10 – To promote the fuel switch from diesel oil to biomass for electricity and/or heating generation.	SO10.a – To show success fuel switching cases. SO10.b – To develop project feasibility studies.	- Potential APPR consumers - ESCOs	Yes (T.7.4., T.3.2., T.3.4., T6.3) No
SO7 To give visibility to ESCOs and the work they carry out	S18: There exist ESCOs with APPR using experience O8: Quality accreditation for ESCOs	SO7 – To give visibility to the machinery companies and ESCOs with APPR using and management experience.	SO7.a – To encourage the visibility of good quality ESCOs. SO7.b – To show and spread ESCOs success cases. SO7.c – To create a seal of quality for agro-biomass installator.	- ESCOs. - Potential APPR consumers.	No
SO8 To encourage APPR biomass utilization in the agriculture sector	S4: There is a strong agriculture sector in Aragón O4, O10: Heat from biomass is increasing (plans and district heating)	SO8 – To promote APPR biomass utilization in the agriculture sector.	SO8.a – To prepare suitable business models for the agriculture sector. SO8.b – Campaign of information on these business models. SO8.c – To give visibility to the financial mechanisms.	- Farms, agro-industry, farmers. - ESCOs	Yes (T3.2, T3.4, T6.3) (T7.4) No
WO8 To group APPR producers	W10, W11: High collection costs O2: There exist locations with high potential in Aragón	WO8 – To group and to align APPR producers with the aim of achieving costs reduction.	WO8.a – To promote the creation of a cluster as a good practice. WO8.b – To show how the cooperative business models work. WO8.c – To promote new actions for agriculture cooperatives	- APPR producers. - Cooperatives.	Yes (T7.4) (T.3.2, T.6.3)

			creation.		No (minor cases in T3.2)
ACTION LINE: Proposal of measures and tools to the sector					
Strategies/ Targeted action type	**Items**	**Objectives**	**Actions / Activities**	**Actors engaged/ Targeted stakeholders**	**Already included in “uP_running”? (YES / NO)**
SO3 To promote a new regulation for APPR burning	S4: There exist a strong agriculture sector in Aragón O12: More restrictive environmental policies	SO3 – To promote a special consideration for the outdoors wastes burning in the following regulation.	SO3.a – To analyse the current regulation regarding burning. SO3.b – Influence campaign addressed to the Public Administration in order to point the regulation that must be changed.	- Agriculture unions and associations. - Environmental department, agriculture department, Administration. - Political parties, members of the Government.	Yes (T2.3, T.4.3.)
WT10 To include and to consider APPR biomass in Plans and CAP	W4: APPR is not regulated T18: Alternative uses and environmental restrictions.	WT10 – To promote APPR biomass consideration and inclusion in Plans and CAP.	WT10.a – Review of cross-compliance measures of CAP and proposal of new ones. WT10.b – To transfer to the agriculture sector and the Administration.	- Agriculture associations. - Agriculture department. - Influential European organisms. - DG-AGRI, MEPs	Yes (T.4.3.)
SO9 To elaborate a Good Practice Guideline	S16: There exist a need of pruning removal O11: New policies influencing in wastes management (Aragón/EU)	SO9 – To encourage the elaboration of a Good Practice Guideline by the Administration in order to be included in future wastes regulation.	SO9.a – To prepare a Good Practice report for APPR biomass utilization. SO9.b – To transfer this report and its main conclusions to the Administration.	- Agriculture sector, R+D centres. - Political parties and Administration.	Yes (T.4.3., T.2.3.)
SO8 Plans of APPR use promotion	S4: There is a strong agriculture sector in Aragón	SO8 – To develop promotion plans in order to increase APPR biomass use in the agrarian	SO8.a – Preparation of the proposal for a Strategic Plan to promote APPR (funding,	- Environmental department, agriculture department,	Yes

	O4, O10: Heat from biomass is increasing (plans and district heating)	sector.	promotion, etc.). SO8.b – Campaign of information and transfer to the sector and Administration.	Administration. - Political parties, members of the Government.	(T.4.3.)
WO5 Increasing the APPR presence in Plans and Regulations	W4: PARP is not regulated W14,W15,W16: PARP is usually not considered in Plans O4, O10: Heat from biomass is increasing (plans and district heating)	WO5 – To promote APPR in order to be considered in Energy Plans and regulations.	WO5.a – To review Renewable Energy policies and regulation that actually define biomass use (to make specific reference to APPR biomass) WO5.b – To transfer regulation and policies that could include specific references to APPR biomass.	- Environmental department, agriculture department, Administration. - Political parties, members of the Government. - Energy sector.	Yes (T.4.3.)
WO7 Control measures to avoid bad practices using APPR biomass	W14: Few control measures O12: More restrictive environmental policies O13: More restrictive GHG emissions regulations	WO7 – To avoid bad practices using APPR biomass that could increase pollutants emissions.	WO7.a – To identify bad practices in order to increase control Administration (outdoors burning, varnish wood burning, particle emissions, etc.). WO7.b – To transfer to the Administration and authorities.	- Environmental department, agriculture department, Administration. - Political parties, members of the Government. - Energy sector.	Yes (T.4.3.)
WT4 To promote fair competition in the agriculture sector	W9: Scarce profitability W14: Few control measures T14: Black economy	WT4 – To promote a fairer framework for the agriculture works companies in order to assure competition in APPR collection.	WT4.a – To identify bad praxis in APPR collection. WT4.b – To prepare a report with the main measures for the Administration.	- Agriculture department, Administration. - Political parties, members of the Government. - Agriculture sector.	No
WT2 APPR own regulation	W4: APPR is not regulated T5,T6: More restrictive emissions Directive for boilers	WT2 – To achieve APPR own measures and regulations (no as forest biomass)	WT2.a – To identify directives and regulations that can affect APPR utilization and classification. WT2.b – To transfer potential problems regarding APPR biomass	- IDAE - Industry department - EU Energy sector - DG-EN	Yes (T2.4, T.4.3.)

	T7: No regulation, no standardization		use if it is not considered in a proper way in the new regulation.		
ACTION LINE: To overcome technology and biomass market barriers					
Strategies/ Targeted action type	**Items**	**Objectives**	**Actions / Activities**	**Actors engaged/ Targeted stakeholders**	**Already include in "uP_running"? (YES / NO)**
WO3 Development of new collection and treatment technologies	W1: No specialized collection machinery W2: Scarce experience in the agriculture pruning chipped O16: Available financing for innovation	WO3 – To promote the development of new treatment technologies according to suitable APPR business models.	WO3.a – To identify the main technical lacks in the current collection and treatment machinery. WO3.b – To promote innovative initiatives.	- Grinders, chippers, balers manufacturers - Research centres and universities.	No No
WO11 Development of new APPR biomass combustion technologies	W5: Scarce APPR biomass combustion technology O16: Available financing for innovation	WO11 – To promote the development of new APPR biomass combustion technologies.	WO11.a – To identify the requirements of the combustion facilities in order to use APPR biomass in an adequate way. WO11.b – To promote innovative initiatives.	- Boiler manufacturers - Research centres and universities.	No
WT9 Development of new flue gas cleaning systems	W5: Scarce APPR biomass combustion technology T5,T6: More restrictive emissions Directive for boilers	WT9 – To promote the development of new flue gas cleaning systems.	WT9.a – To promote R+D WT9.b – To encourage funding for new flue gas cleaning systems installation.	- Boiler and cleaning system manufacturers - Research centres and universities	No
ST3 Promotion of multi-fuel boilers	S12: Flexible boilers using different biomass fuels T18: Alternative uses and environmental restrictions	ST3 – To promote the installation of multi-fuel boilers in order to energy use of APPR	ST3.a – State-of-the-art boiler technology. ST3.b – Campaign of promotion for multi-fuel boilers utilization.	- Manufacturers. - ESCOs, APPR potential consumers. - Society in high potential locations.	No Yes (T.7.4.)

WT8 To promote the use of APPR biomass in large facilities	W3: APPR biomass quality is lower and more variable T5,T6: More restrictive emissions Directive for boilers	WT8 – To promote the use of APPR biomass to large consumers in order to create a steady demand.	WT8.a – To show APPR biomass properties to the large consumers. WT8.b – To promote demos for APPR utilization in large combustion facilities.	- Large biomass consumers. - Society. - Wastes producers.	Yes (T3.1, T3.2) (T.3.3)
WO4 To develop an APPR market	W12: There is not enough biomass market O6: Oil price is rising O4, O10: Heat from biomass is increasing (plans and district heating)	WO4 – To activate a steady APPR market.	WO4.a – Searching for potential APPR biomass consumers. WO4.b – To create a network including APPR biomass suppliers and consumers.	- Biomass consumers with an interest in APPR biomass. - Biomass suppliers. - Agriculture sector (waste producers) - Chamber of Commerce	Yes (T.3.1., T.3.2.)
WT3 Promotion of agriculture services with a seal of quality for APPR distribution	W9: Scarce profitability T14: Black economy	WT3 - Promotion of agriculture services with a seal of quality for APPR distribution	WT3.a – To identify companies making APPR collection or new companies with an interest. WT3.b – To give visibility to these companies in order to promote competition.	- Agriculture services companies. - Agriculture sector (waste producers) - APPR biomass consumers.	Yes (T.7.4., T.7.3)

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Person/Department	Company/Institution	Current role in respect APPR biomass
Department of Biomass and Wastes	IDAE - Institute for Energy Diversification and Saving (Madrid).	Funding schemes. Vision of Government
Mr. Pablo Rodero Masdemont	AVEBIOM – Spanish Bioenergy Association (Valladolid)	Represent the interest of biomass stakeholders and sector
Ms. María José Murciano	REDR – Spanish Network for rural Development (Madrid)	Third sector, interest of rural areas
Mr. Juan de Dios Escolar / Responsible of Energy Crops	Forestalia Renovables (Zaragoza)	Potential consumer of APPR biomass
Mr. Sergio Breto Asensio / Responsible of Energy planning service	Government of Aragón (Zaragoza)	Regulation (energy plans Aragón)
Mr. Hector Filloy Viver	Filloy-Viver agricultural service (Mazaleón)	Agriculture service company
Mr. Chema Alquézar Alquézar / Vicepresidente	CERAI Aragón (Centro de Estudios Rurales y de Agricultura Internacional)	Sector productivo / Tercer sector
Beyond the above mentioned stakeholders, the CIRCE and ASAJA do thank all the ideas contributed from the stakeholders consulted, among them special mention to the participants in the Workshops held in Aragón and to the pioneers (potential beneficiaries) who kindly expressed their view during the interviews carried out in the framework of the task 3.1 " Selection of beneficiaries".		

ANNEX A2

TAREA 2.2 de uP_running

Desarrollo de un análisis del sector de biomasa de PARP (podas agrícolas y renovación de plantaciones), y desarrollo de un plan de acción para la región demostrativa de ARAGÓN (ESPAÑA).

INDICE DE CONTENIDOS

Contenido

A. Marco regional para la biomasa de PARP

Aragón es una Comunidad Autónoma de España ubicada en la zona noreste y que comprende el tramo central del valle del Ebro, los Pirineos centrales y las Sierras Ibéricas (ver figura 1). Está situada en el norte de España, y limita por el norte con Francia (Languedoc-Rosellón-Mediodía-Pirineos), por el oeste con las comunidades autónomas de Castilla-La Mancha, Castilla y León, La Rioja, Navarra y por el este con Cataluña y la Comunidad Valenciana. La superficie de Aragón es de 47.719,2 km² de los cuales 15.636,2 km² pertenecen a la provincia de Huesca, 17.274,3 km² a la provincia de Zaragoza y 14.808,7 km² a la provincia de Teruel. El total representa un 9,43 % de la superficie de España, siendo así la cuarta comunidad autónoma en tamaño.

Aragón cuenta con 1.308.563 habitantes (2016) siendo una de las cuatro comunidades con menor densidad de población. El 73% de la población aragonesa se concentra en la provincia de Zaragoza. Su economía tradicional perteneciente al sector primario con predominio de los cultivos de cereales y forrajeros, apoyados por una cabaña ovina importante, se ha visto muy modificada en los últimos años por el ascenso imparable del sector industrial, de servicios y comercio, seguido del turismo. A estos efectos resulta destacable el papel de Zaragoza y su capacidad comercial y logística en el sector noreste peninsular.

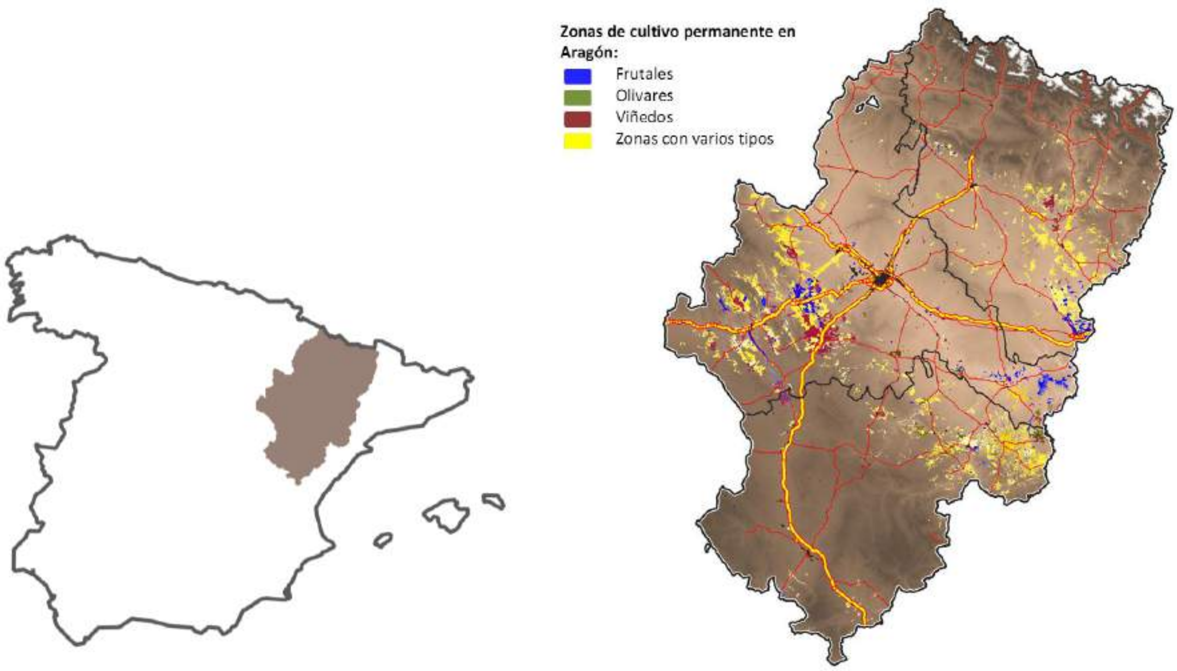

Figura 1. Aragón. Izda: Localización geográfica de la región de Aragón. Dcha: Localización geográfica de las principales zonas de cultivo permanente de Aragón

La figura 1 muestra la distribución geográfica de los principales cultivos leñosos en Aragón (conforme a la distribución de usos del suelo de Corine Land Cover, publicado por EEA, 2014) Dentro de la comunidad autónoma de Aragón, la mayor superficie de cultivo permanente pertenece al almendro, con 63.833 hectáreas de secano y regadío. Seguidamente, el olivo ocupa más de 44.000 hectáreas y el viñedo 32.000. Respecto al frutal, de las 36.000 hectáreas cultivadas, 12.000 pertenecen al melocotonero y 7.000 al cerezo, siendo éstas las especies más representativas. La Tabla 1 recoge los datos de superficie de cultivo conforme a las declaraciones PAC (promedio de superficies en el periodo 2009-2013), así como la tendencia, si se ha producido un aumento de la superficie cultivada (tendencia positiva) o una disminución (tendencia negativa). La tabla 2 muestra el resumen por grupos de cultivo.

Tabla 1. Superficies por grupo de cultivos permanentes en Aragón conforme a declaraciones de superficies cultivadas de la PAC (promedios 2009-2013)

Superficies (hectáreas)			
	Secano	**Regadío**	**TOTAL**
Olivo	37.704	6.766	44.470
Viñedo	28.075	4.034	32.109
Frutal seco	60.303	3.778	64.081
Frutal dulce	6.827	29.459	36.286
TOTAL	**132.910**	**44.037**	**176.948**

Tabla 2. Superficies por especie de cultivos permanentes en Aragón conforme a declaraciones de superficies cultivadas de la PAC (promedios 2009-2013), y tendencias detectadas.

Superficies (hectáreas)					
	ESPECIE	**SECANO**	**REGADIO**	**TOTAL**	**Tendencia 5 años**
OLIVAR	Olivo	37.705	6.766	44.470	+5,0%
VIÑEDO	Viña vino	28.040	3.968	32.008	-9.2%
	Uva de mesa	35	67	102	+32,7%
FRUTAL SECO	Almendro	60.221	3.612	63.833	Estable
	Nogal	82	166	248	+13,6%
FRUTAL DULCE DE HUESO	Melocotonero	1.317	10.703	12.019	+12,6%
	Nectarina	481	6.132	6.613	+20,9%
	Albaricoquero	123	1.302	1.425	+46,8%
	Cerezo	4.110	3.072	7.182	+2,1%
	Ciruelo	290	852	1.142	-8,9%
FRUTAL DULCE DE PEPITA	Peral	245	3.981	4.226	-20,9%
	Manzano	169	3.329	3.498	-11,1%
OTROS	Otros frutales	93	88	181	+8,4%
	TOTAL	**132.911**	**44.038**	**176.948**	**Estable**

Al observar la tabla 2 por especies, se puede apreciar importantes superficies de olivar, viñedo y almendro principalmente. Cabe destacar el aumento en la superficie declarada de olivar, en contraposición a un retroceso en la de vid. Los frutales de hueso presentan una tendencia a la expansión, mientras que los de pepita están en un periodo de contracción. El almendro, estable conforme muestra la tabla, está siendo objeto de un aumento en estos últimos años en Aragón, con nuevas plantaciones de almendro en regadío entrando en producción. Conforme muestra la tabla, la superficie de cultivos permanentes 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 al tamaño de las parcelas, se hace patente una atomización de las mismas al realizar un análisis de las parcelas agrícolas declaradas según el sistema SIGPAC (FEGA, 2016). En este sentido CIRCE realizó un análisis del tamaño de parcela de los cultivos permanentes en Aragón (S2Biom, 2016) observándose que el 11% de las parcelas son de menos de 0,25 ha, el 34% entre 0,25 y 1ha, el 25% entre 1 y 2,5 ha y tan solo el 30% de más de 2,5 ha. El tamaño de parcela tiene importantes implicaciones en la organización de la recogida mecanizada, así como en la organización de los agricultores de cara a realizar recogidas coordinadas del residuo.

En cuanto a las formas de cultivo en Aragón, existen varios trabajos de estadística agraria realizados por el Ministerio de Agricultura y Pesca, Alimentación y Medioambeiente (MAPAMA, 2016), que proporcionan datos sobre la distribución de formas de cultivo y variedades de frutales, vid y olivo en España. Se trata de los informes ESYRCE (Encuesta sobre Superficies y Rendimientos Cultivos), que además de aportar datos estadísticos de superficies y rendimientos, provee algunos informes sectoriales: para vid y olivo en 2012, para frutales en 2007, y para fruto seco en 2005. Incluye datos según variedades, tipo de regadío, densidad de plantación, edad entre otros.
Lo más relevante, una tendencia en aumento de la espaldera en vid, que ya supera en Aragón en 2012 el 30% de la superficie. Así mismo un mantenimiento de la cubierta generalmente por laboreo mínimo o tradicional. No se aplica cubierta vegetal, o en todo caso, vegetación espontanea. Reseñable porcentajes en producción del 90% de la superficie total en general.

B. Potencial regional y disponibilidad de biomasa de PARP

Potencial de biomasa de PARP en ARAGÓN
La biomasa potencial teórica de PARP consiste en la cantidad total de residuos de podas y arranques que se generan en un territorio. Dicho potencial teórico ha sido hallado por múltiples estudios, tal y como se presentan en la tabla 3. Generalmente se basan en estimar una cifra de potencial a partir de la superficie cultivada (hectáreas). Para ello se utilizan índices de producción de biomasa, también llamados "ratios", que se expresan en unidades de t/ha/año. Multiplicando la superficie de un cultivo por el valor del ratio se obtiene el potencial teórico.

Se han encontrado múltiples fuentes de información. Por un lado, estudios realizados en Aragón, basados n estadísticas de los servicios regionales de estadística o información geográfica, y con ratios obtenidos en de campo o a través de una consulta a gentes del sector. Por otro lado, estudios que se realizan para toda España (con resultados desagregados por región), generalmente basados en datos de superficies publicados por los servicios de estadística del ministerio de agricultura o del instituto nacional de estadística, y que usan un único ratio de producción de residuo para toda la geografía. Y finalmente estudios de ámbito Europeo, basados en estadísticas de Eurostat o Faostat, y generalmente (excepto el caso de EuroPruning), con un único valor de ratio por especie para toda Europa. Los resultados se muestran en la Tabla 3 expresados en toneladas de materia seca (peso del residuo sin humedad).

Tabla 3. Potenciales teóricos de biomasa de podas en Aragón de acuerdo a diferentes fuentes de información (t m.s./año)

Potenciales de biomasa de podas agrícolas (t de materia seca anuales)								
	Estudio	**Ref***	**Viñedo**	**Olivo**	**Frutal seco**	**Frutal dulce**	**Cítricos**	**TOTAL**
Estudios basados en datos de la región	Atlas biomasa 1997	[1]	36.724	19.854	13.825	14.907	0	85.310
	Lignostrum/Felix de Azara	[2]	60.084	47.557	34.029	59.529		201.199
	Luis Roldan 2007	[3]	61.874	137.164	32.940	154.825	0	386.803
	SUCELLOG	[4]	86.022	78.761	27.323	83.739	0	275.845
Estudios con potenciales específicos por país	ACVCOCO	[5]	63.281	54.235	69.315	93.249	0	280.079
	Bionline	[6]	n.d.	n.d.	n.d.	n.d.	n.d.	780.507
	Bioraise	[7]	40.109	9.650	92.855	n.d.	n.d.	142.614
Estudios con carácter europeo	S2biom	[8]	101.000	58.000	n.d.	69.000	35.000	263.000
	Biomass Futures	[9]	99.324	83.723	181.416		78.230	442.693
	EuroPruning 2016	[10]	34.987	55.601	38.555	73.981	0	203.124

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

A la vista de la tabla se pueden apreciar importantes desviaciones entre estudios. La desviación s algo esperado dado que los datos de partida de cada estudio son diferentes, si bien se esperaría una cierta concentración alrededor de un valor promedio. Este valor, si se descartan los valores de los dos estudios más divergentes, está en unas 274.000 t de materia seca de podas agrícolas anualmente. También es posible apreciar que en algunos estudios a escala europea las estadísticas bases son poco exactas, ya que definen superficies de cítricos para la región, siendo que son inexistentes, lo que pude ser debido a un inadecuado tratamiento de los datos y de su clasificación.

Debe tenerse en cuenta que estos valores corresponden al potencial de podas anuales. Sin embargo no contabilizan la biomasa de re-estructuración de copa, los topping (poda en altura) o la madera de podas de injerto. El único que tiene una estimación de dichos tratamientos es el proyecto Biomass Futures, cuyo potencial, como se ve, es mayor que la mayoría de estudios. Por ello el potencial puede ser mayor que el que se estima como promedio en los estudios presentados.

La biomasa de renovación de plantaciones no ha sido estimada por ninguno de los estudios anteriores para Aragón. De hecho no se ha encontrado ningún inventario o estimación al respecto. La dificultad radica en dos factores. El primero que la cantidad de biomasa que se puede obtener por hectárea cuando se arranca una plantación depende no sólo de la especie, su vigor, la zona, el clima, etc., sino también de su edad y de la preferencia del propietario en mantener el tamaño del árbol/pie en una manera adecuada para facilitar la recolección del fruto. Por otra parte los ensayos para pesar la producción son mucho más intensivos en esfuerzo que los de medición de podas, y de allí que existan escasos datos. Finalmente la tendencia al arranque de plantaciones está sujeto a políticas de reconversión varietal y a tendencias del mercado. Y estas pueden variar de un periodo a otro (varios años con tendencia a arranque y cambio de variedades, y periodos de menor ritmo de arranque). El proyecto S2Biom realizó un trabajo centrado en el análisis del potencial teórico en Aragón (S2Biom, 2016) cuyo resultado indica un potencial equivalente a unas 100.000 t anuales de materia seca de la parte aérea de los árboles, y unas 50.000 t/año de la parte de tocón y raíces (sólo madera, sin tierra).

<u>Disponibilidad de biomasa de PARP en ARAGÓN</u>

Actualmente la biomasa de podas agrícolas no presenta tan apenas ningún uso alternativo definido. Sólo destacable el uso de la rama gruesa para leña en algunos casos, y principalmente en podas bienales o en podas de estructuración de copa o de altura, que se llevan a cabo cada cierto años, y que descargan el árbol de madera con diámetros de interés para uso como leña. Es por ello que de las podas anuales varios de los estudios citados previamente (SUCELLOG, ACVCOCO, Lignostrum/FELIX Azara, S2biom y EuroPruning) proponen para las podas una escasa competitividad por el recurso. Se considera que apenas entre el 2 y el 10% de las podas anuales está siendo utilizado para otros usos.

Se trata por tanto de un recurso sin un aprovechamiento claro pero que debe ser retirado de las plantaciones agrícolas para facilitar el tránsito de los tractores en la aplicación de fitosanitarios, o bien con la finalidad de evitar la proliferación de plagas (olivo y vid principalmente). Es por ello que la práctica habitual suele ser la retirada del campo para la quema del mismo, una vez obtenidos los permisos pertinentes por parte de la autoridad medioambiental local. Este hecho choca con la situación en otros países, como Francia, Alemania, Holanda, Eslovaquia, Eslovenia o Polonia, donde la quema es una práctica muy marginal, como constatan datos de EuroPruning (Referencia D3.1). En concreto en Francia lleva prohibida la quema agrícola desde hace cinco años, pero se va prorrogando la transitoriedad de la medida, ya que no es posible darle salida a la poda.

Una práctica bastante extendida es el picado de la poda a suelo. Esta puede integrarse con la tierra a través de arados superficiales, junto con la hierba que crece en superficie con el objeto de mejorar la estructura del suelo y su contenido en materia orgánica. Sin embargo no siempre se practica con este ánimo, sino como medio de eliminar el residuo de una manera sencilla, y que permite cumplir con la condicionalidad de las medidas ambientales de la PAC.

En cuanto a la biomasa de arranques, el tronco es habitual que se use para leña, mientras que ramas y tocón se dejan en campo y se queman en montones. En algunas zonas ni siquiera se aprovecha la leña, ya que se prefiere amontonar el árbol completo para la quema, ya que así se favorece una quema más competa, pues las raíces pueden dar problemas y no terminar de quemar por completo. Arrojar cifras de disponibilidad es aventurado y debe observarse las prácticas en cada zona, ya que en Aragón se ha constatado diferentes prácticas según la zona.

Una problemática asociada a la gestión de las podas y arranques es el pequeño tamaño de las parcelas, tal como se comentaba en el apartado anterior. A través del estudio de la logística para biomasa de arranques realizada por CIRCE en el proyecto S2Biom para Aragón (S2Biom, 2016) se observó que el establecimiento de servicios de recogida de arranque, y que precisa la movilización de máquinas de gran tamaño, no puede aplicarse a la mayoría de la superficie de cultivos permanentes, y que por ello la movilización de una parte importante del potencial requeriría esquemas alternativo, como puntos locales para que el agricultor deposite tronco o raíces arrancadas, y que a partir de estos puntos se establezca la organización del triturado y transporte

Una problemática que ha podido constatarse para obtener el material es la dificultad de cambiar el modo de gestión de las podas y arranques por parte de una parte importante de los agricultores, así como una dificultad en el entendimiento con posibles empresas que se dediquen a darle una salida comercial al residuo. Siendo las operaciones de recogida y tratamiento costosas, existe una disputa por obtener rentas por parte del agricultor, y por cobrar una tasa de servicio por parte de la empresa prestadora del servicio.

En cualquier caso merece la pena revisar el apartado de barreras, donde se entre en detalle en las barreras organizacionales y estructurales para el aprovechamiento de la poda en Aragón.

<u>La biomasa de PARP en planes energéticos en Aragón</u>

De los planes energéticos en Aragón, sólo el de 1992 cuenta con un análisis de biomasa que incluye el potencial de podas agrícolas. Sin embargo en los planes posteriores de 2004 y 2013 no se realizó ningún inventario, por considerar más apropiado centrar objetivos acordes a los planes nacionales, estado de avance y madurez de los sectores, y no tanto basados en disponibilidad de recursos.

En cuanto a los planes de Energías renovables para España, allí sí que se ha considerado la biomasa de podas agrícolas en el plan 2000-2010 (IDAE, 1999), en su revisión de 2004 (IDAE, 2005) y el plan actual para el periodo 2011-2020 (IDAE, 2010). Sin embargo no se considera la madera de residuos agrícolas de arranques. En estos planes aparece la poda agrícola como un recurso con cierto potencial pero difícilmente aprovechable, debido al carácter estacional y heterogéneo de los residuos, la elevada dispersión de las explotaciones generadoras del recurso y la ausencia de pretratamientos específicos adecuados. No obstante, se hace ya mención a la necesidad de normativas más restrictivas respecto a la permanencia de estos residuos en los cultivos o a su quema en el campo. Se proponen además medidas de fomento para el desarrollo del recurso en los próximos años como la mejora en la mecanización de la recogida de la biomasa, programas de ayudas a la adquisición de maquinaria de recogida, transporte y tratamiento y el establecimiento de contratos tipos para la adquisición de la biomasa. En cuanto a los objetivos energéticos que se propusieron en el plan de fomento de 2005-2010, se preveía un aporte en energía primaria de las podas agrícolas de 670 ktep y de 100 MW de potencia eléctrica instalada para 2010. Estos objetivos fueron actualizados en el Plan de 2011-2020, si bien no se desglosa el objetivo para la biomasa de residuos agrícolas de podas, y se presenta un objetivo conjunto de incrementar el uso de 3,5 millones de toneladas de residuos agrícolas al año (incremento 2006-2020).

C. Potencial regional para conseguir un aprovechamiento de la biomasa de PARP

Actores de la cadena de PARP

En Aragón la situación marco en la producción de vid, olivo y frutal es muy variable entre zonas. A pesar de que sea difícil establecer una visión agregada de conjunto, la siguiente tabla muestra los principales tipos de actores que pueden participar en la configuración de nuevos aprovechamientos de biomasa de PARP.

Generadores del residuos de PARP	Agentes que pueden participar en la movilización de biomasa	Consumidores finales de biomasa (o a quienes involucrar en el uso de biomasa de PARP)	Otros agentes transversales necesarios
• Pequeños agricultores • Agricultores con mayor extensión de tierra • Cooperativas • Agroindustrias	• Gestores de residuos • Empresas de servicios agrícolas • Empresas forestales	CALOR • Granjas • Ayuntamientos • Agro-industria • Particulares • ESEs ELECTRICIDAD • Futuras plantas	• Ayuntamientos • Servicios de desarrollo de las comarcas • Grupos de desarrollo rural • Asociaciones agrícolas
Sin ser generadores del residuo, las empresas de servicios agrícolas, u otros agentes podrían involucrarse en tareas de recogida de la biomasa en campo	Adicionalmente consumidores finales así como productores del residuo podrían involucrarse	Particulares y agro-industria podrían consumir, generando iniciativas de ciclo cerrado	

La mayor carencia en Aragón está del lado del consumo. No hay grandes ni medianas plantas de aprovechamiento de energía. Existen tres grandes plantas en tramitación (Grupo Forestalia) pero su operación no se espera a corto plazo, por lo que no se puede contar con un gran consumidor capaz de integrar múltiples tipos de biomasa en sus instalaciones.

Más aún, las instalaciones existentes son de pequeña y mediana potencia, preparadas para combustibles de fácil trasiego como la astilla forestal, la cáscara de almendra, el orujillo seco o los pellets. Por este motivo el lado de la demanda es un aspecto débil en Aragón, y por tanto es preciso que cualquier iniciativa nueva asegure la parte de la demanda.

En este sentido la demanda por parte de agro-industria puede ser una clave para desbloquear la situación inicial, a través de instalaciones existentes en Aragón como secaderos de maíz o deshidratadoras de alfalfa. El sector ganadero tiene una alta actividad en Aragón, y por ello puede ser un actor estratégico, alineando al sector ganadero para que en zonas frutícolas, vitivinícolas u olivareras se comience a consumir biomasa de PARP. Industrias como las almazaras, los cremogenados, el procesado de almendra o las bodegas y destilerías, son también piezas claves para desbloquear la situación.

Los ayuntamientos de poblaciones ubicadas en zonas de alta producción de biomasa de PARP, pueden actuar como dinamizadores y agentes integradores, promoviendo las primeras calderas alimentadas con este tipo de biomasa.

Otra carencia es la existencia de empresas de servicios especializadas en la recogida de madera de PARP. En Aragón se está en una situación “cero” en cuanto al uso de este tipo de biomasa. Así que cualquier iniciativa implica que todos los actores de la cadena parten de cero (sin experiencia previa).

Se considera que los actores más influyentes pueden ser los ayuntamientos, si dan el paso ejemplar de comenzar a usar la madera de podas y arranques. Así mismo, partiendo de una situación “cero” de producción y consumo de biomasa de PARP, las ESEs pueden tener un rol fundamental, si ofrecen suministro estable y nuevas instalaciones adaptadas a biomasa de PARP a sus nuevos clientes. Pueden deshacer el círculo vicioso de la carencia de demanda y oferta.

<u>Estado de la red de actores. Visión.</u>

Actualmente no existe en Aragón una red que aglutine a los agentes interesados en la utilización de la biomasa de PARP. Crear una red operativa va más allá de crear una red de contactos, y precisaría por un lado un esfuerzo en su creación y mantenimiento, y por el otro, dotarla de una forma que resulte adecuada y de interés a todos sus participantes, no siempre acostumbrados a trabajar en red. Hoy por hoy el despegue de la biomasa de PARP en Aragón parece que pueda requerir primero del establecimiento de varias relaciones bilaterales o pequeñas redes en zonas donde se comience, por primera vez, a utilizar la biomasa de PARP. Y a partir de entonces la creación de una red de promoción de uso de biomasa de PARP puede comenzar a tener sentido operativo. Esto no quita para que pueda generarse un grupo de interés en el tema, gestionado a través del canal de comunicación del proyecto uP_running.

No hay una visión unificada, pero lo que se ha visto es un alto escepticismo en cuanto al aprovechamiento de la madera de PARP. De manera general, y salvando algunas excepciones, el sector agrícola considera difícil y costoso el aprovechamiento de PARP, viendo demasiadas complicaciones en su gestión como recurso energético respecto a otras prácticas habituales de gestión del residuo. No obstante, durante los talleres llevados a cabo en el marco del proyecto uP_running, se contó con empresas con experiencia en el tratamiento y valorización de la biomasa de PARP. En tales talleres se ha conseguido que el diálogo no se centre tanto en los problemas para valorizar la biomasa de PARP, sino en los mecanismos necesarios para desbloquear la situación actual.

No se puede hablar de visión de conjunto, o de una visión y misión por parte de los agentes consultados, ya que ni siquiera se ha constituido una red. Ahora bien, queda patente que hay una importante labor de sensibilización que debe basarse en hechos prácticos, en nuevas experiencias, para generar un cambio en la actual percepción del uso de biomasa de PARP.

<u>Modelos de negocio</u>

Desde un punto de vista del actor principal en la cadena de valor de la biomasa de PARP, los modelos de negocio principales que pueden aplicarse en Aragón son:

ACTOR	Modelos aplicables	Desestimado
Productores de PARP	Autoconsumo: tanto de un pequeño agricultor como de una cooperativa o agro-industria. En general, realizando todas las operaciones, o en todo caso, subcontratando alguna parte como la recogida o el tratamiento de la biomasa.	La recogida y venta libre. Al no haber cadenas establecidas por el momento, ni grandes consumidores que acepten perfiles de biomasa variados, no se contempla viable que por ejemplo, una cooperativa recoja la biomasa para intentar venderla a un posible consumidor.
Recogida biomasa en campo	Servicio de recogida de poda: una empresa de servicios, o una empresa/cooperativa del sector (fruta, uva, oliva) establece un nuevo servicio para recoger las podas. Este servicio se presta al agricultor bajo un acuerdo previo en la cesión de la biomasa y pago por el servicio (al menos de una parte de su coste) Servicio de arranque: se ofrece al agricultor / propietario de la finca el arranque y la restauración de la parcela, con una rebaja respecto a un servicio habitual de arranque, gracias a la renta que se pueda obtener de la biomasa. Alquiler de maquinaria: para reducir la incertidumbre, que previene nuevas iniciativas, que dependen de adquirir nueva maquinaria. Que los propios fabricantes tengan líneas de alquiler, puede permitir el avance del sector. Es un modelo a trasladar al sector de maquinaria.	Empresas que se dediquen al alquiler de maquinaria de PARP. Existe una alta incertidumbre al comenzar una recogida de biomasa de PARP. El riesgo podría asumirse por parte de los fabricantes. O bien empresas con gran volumen de alquiler de maquinaria, que inicien una nueva línea asociados con un fabricante.
Transferencia	Vertedero verde (punto intermedio de recogida): establecido por ayuntamientos, requeriría de unos días de apertura, en los que un alguacil pudiera gestionar un control en las zonas de descarga y del tipo de material acarreado. Como centros de acopio, permiten el desplazamiento de gestores logísticos o de residuos para transformar y dar salida al material. Alternativamente podría ser privado, pero implicando costes de manejo y quizá solicitando una tasa de depósito. Centro logístico multipropósito: promovido por entidad pública, por un gestor de residuos (en sus instalaciones) o a través de UTEs, se encargarían de recoger/aceptar múltiples tipos de biomasa. Podrían hacer tratamientos de afino y mezcla para obtener biomasa adecuada según el tipo de cliente.	Establecimiento de un centro logístico que reciba la biomasa de PARP. En Aragón ni siquiera existen centros logísticos de biomasa. Existen distribuidores de mediano tamaño, o gestores de residuos. Pero aún en instalaciones existentes, requiere una alta implicación de los actores locales que lleven al centro su biomasa. En el momento actual no es factible. Una vez arranque el uso de biomasa de PARP podría ser un modelo a considerar.
Consumidores	Oferta de calor: las ESEs pueden ofrecer servicios de calor, no de suministro de biomasa. Es así que una vez aceptados los términos, el cliente solo paga la cuota, y la ESE se encarga de instalación y mantenimiento. En ese caso la ESE puede asumir la instalación de calderas policombustibles, alimentadas parcialmente con biomasa de PARP. Consumo dedicado de biomasa de PARP: solo al alcance de los ayuntamientos. Precisa de una seguridad de suministro, y afrontar unos costes y riesgos que una entidad privada posiblemente no asumiría.	Crear una instalación de consumo exclusivo de biomasa de PARP y que no provenga de autoconsumo no es una opción en el momento actual. Tampoco lo es que el consumidor organice las tareas de recogida y transferencia de la biomasa de PARP hacia sus instalaciones (que controle la cadena como parte de su negocio).

En la situación actual aragonesa, sin apenas consumidores preparados y/o concienciados para el uso de biomasa de PARP, los modelos de negocio tienen que incluir el mínimo número de agentes en la cadena, y tener siempre el consumo bien asegurado. Es por ello que cualquier modelo de negocio que se instaure debe incluir como una actividad clave la apertura y fidelización de la demanda de la biomasa generada. Es por ello que el modelo de autoconsumo es, de lejos, el que puede ser más fácil promover e instaurar.

Iniciativas como las de empresas que prestan servicios de recogida de podas o de arranque de plantaciones solo tienen sentido si la iniciativa es llevada a cabo por agentes locales que tienen buenas conexiones con el sector de la agroindustria y/o ganadero, y pueden trabajar durante el lanzamiento de su iniciativa en dos direcciones: atar contratos de servicio, y apalabrar consumos.

Respecto al caso de modelos de negocio para consumidores, se desestima que un gran consumidor pudiera organizar toda la cadena de aprovisionamiento de importantes cuantías de biomasa de PARP hacia una nueva instalación. Aunque esta iniciativa puede ser afrontada por grandes empresas con experiencia e interés en un tipo determinado de biomasa, existen muchas barreras no técnicas, y mientras no se demuestre al sector que la biomasa de PARP es factible, poniendo en marcha algunos aprovechamientos, este esquema es inviable por aspectos más bien de carácter social. Podría funcionar, en todo caso, con una planta en operación basada en otro tipo de biomasa, y comenzando a alinear a empresas intermediarias que organizaran el suministro desde zonas concretas, estableciendo así una red de suministro basada en múltiples proveedores zonales.

Se estima que no hay realmente una carencia real de actores para poner en marcha nuevas cadenas de biomasa. Lo que ocurre es que no están preparados, o concienciados de la oportunidad, o de cómo comenzar una iniciativa. Sin embargo, se ha apuntado alguna figura como grandes centros logísticos de múltiples tipos de biomasa, empresas dispuestas a pasar a recoger residuos de pequeños agricultores, consumidores con interés en la biomasa de PARP, ESEs con garantías para instalar biomasa de PARP, Uniones Temporalees de Empresas (sector agro + sector energía), o empresas de maquinaria que no solo vendan, sino que alquilen .

<u>Principal producto a obtener de la biomasa de PARP</u>

El principal producto identificado en los modelos de negocio es la astilla, a competir en precio con la astilla forestal. La astilla de PARP tiene algunas componentes en su valor que la astilla forestal no tiene: la biomasa de PARP genera riqueza local, no añade presión a la explotación de recursos forestales, evita problemas locales de contaminación (quemas incontroladas). Desde un punto de vista, el consumidor local puede entender que tiene un valor emocional, o intangible respecto a la astilla forestal. En términos prácticos, salvo instalaciones demostrativas (p.ej. lideradas por un ayuntamiento) la biomasa de PARP debe ser competitiva en precio respecto a la astilla forestal.

Se ha valorado por algunos pioneros la producción de briquetas o pellets. Aportan un combustible más estandarizado y más fácilmente manejable por los consumidores. Sin embargo, añade unos costes que hacen que el producto no sea competitivo en precio con la astilla forestal. Entra entonces a competir con el pellet y la briqueta forestal. En el ámbito del pellet puede integrarse en mercados de pellet industrial, ya que en el doméstico puede dar problemas a los usuarios. En el caso de las briquetas puede ser competitivo en estufas domésticas frente a la briqueta de serrín de aserradero, y en el ámbito industrial y de mediana potencia, competir con pellets o briquetas forestales.

La integración de etapas de peletizado y briqueteado conlleva una incertidumbre y coste adicional al sistema. Así que debe sólo afrontarse en el caso único de que se haya identificado y asegurado el consumo de los pellets o briquetas producidos. No se considera por ello como un producto clave para Aragón por el momento, lo cual no quita para que puedan tener lugar iniciativas singulares que se basen en la briqueta o el pellet de PARP.

D. Barreras para comenzar a utilizar la biomasa de PARP

Barreras técnicas

- Biomasa de PARP tiene características muy variables de calidad (humedad, tierra) según cómo se ha obtenido y gestionado.
- La calidad de la biomasa obtenida está sujeta a una mayor variación y a una menor calidad que la astilla forestal.
- Cantidad producida por hectárea muy variable, y/o desconocida.
- Modelos para recogida de poda: muchos inmaduros (costes O&M, impactos en motor del tractor).
- Parte de la maquinaria de recogida y/o tratamiento no específica para PARP (ramas, tocones).
- La manipulación y tratamiento de los tocones para obtener astilla resulta complejo, costoso y además existe una ausencia de modelo de referencia.
- La combustión de la biomasa de PARP en calderas de biomasa convencionales necesita algunas adaptaciones previas (alimentador de tornillo, válvula rotatoria, movimiento de la rejilla, etc.) y dispositivos más robustos.
- La combustión de biomasa de PARP en instalaciones ya existentes requiere la adaptación de los parámetros de operación de la instalación.
- No existe modelo específico de calderas o equipos para madera de PARP. En todo caso algunas calderas flexibles para varios combustibles.

Barreras culturales

- Resistencia al cambio en la gestión de residuos de PARP: actualmente, si no se fuerza el cambio, se seguirán realizando prácticas de quema.
- Los agricultores quieren pocas complicaciones con la gestión de podas, lo que limita la organización de la recogida coordinada por parte de un tercer agente.
- Existe un desconocimiento acerca del uso que puede tener la biomasa de PARP, o cómo aplicarlo.
- Desconocimiento de lo que está ocurriendo en el resto de España y Europa con respecto a la biomasa y particularmente a los residuos de PARP.
- Se percibe por parte de los pequeños agricultores principalmente, que es difícil sacar las podas del campo.
- Hay una creencia de que este tipo de biomasa (especialmente la madera de podas) nunca será más barata que las astillas de madera forestal.
- Tendencia a no contabilizar el coste actual de gestión de la poda (triturado, o empuje, amontonado y quema). Cuando se plantea una extracción para energía sí que se empieza a pensar en cada coste originado, no en los evitados.
- Los agricultores no consideran los costes incurridos por ellos mismos para el manejo de la poda, de manera que en algunas zonas prefieren incurrir en esos costes, que pagar a un tercero una parte de los mismos (generando un ahorro al agricultor).
- Percepción de que si se vende la madera de PARP, alguien está ganando dinero. El agricultor puede pretender no sólo ahorrar sus costes de gestión, sino que le paguen por la madera.
- La creencia de que la poda tiene que ser integrada en el suelo por defecto como mejor uso (sin considerar otros aspectos como el contenido actual de materia orgánica del suelo, su potencial impacto como vector para la propagación de enfermedades, tendencia a retener nitrógeno temporal, etc.).
- Falta de conciencia al respecto de las quemas como una mala práctica a evitar desde punto de vista ambiental.
- En ocasiones, no se da valor a lo local de manera que no se entiende el valor intangible que genera la economía circular y de proximidad.
- Falta de conciencia ciudadana.

- La creencia de que "en España estamos en la cola de Europa" (de alguna manera se asume que la mala gestión de residuos es una consecuencia de ello).
- La creencia de que la biomasa es demasiado nueva y no suficientemente probada: sospechosos, demasiados riesgos, experiencias fallidas.
- Presencia de técnicos de la administración escépticos ante el uso de biomasa de PARP e incluso reticentes a cualquier posible cambio e innovación. En muchas ocasiones, los actores políticos se basan en las indicaciones de los técnicos de la administración.
- La falsa creencia de que la biomasa dará un “calor" peor que el gasoil. Pero la realidad demuestra que no es en absoluto cierto.
- Opinión de que el mercado de biomasa no está desarrollado.
- Algunos consumidores todavía piensan que las calderas de biomasa requieren mucho mantenimiento manual (limpieza de cenizas, alimentación).
- Tendencia a pensar que la biomasa de PARP no funciona a pesar de presentar casos de éxito con números reales.
- La creencia de que la biomasa de PARP es un mal combustible (peor que la biomasa forestal) por su bajo poder calorífico y su mayor contenido en cenizas.
- Se piensa que Incluso con tratamientos de criba, y separación de gruesos y finos, la calidad de la astilla de PARP nunca será adecuada.
- La creencia de que el uso de PARP requiere de un gran consumidor para activar el mercado. Tendencia a pensar que un gran consumidor puede pagar más por la madera de PARP que un pequeño o mediano consumidor local.
- Instaladores de calderas / ESEs experimentados con biomasa convencional (pellets o astillas de madera forestal) consideran que la biomasa de PARP no es una opción en comparación con otras biomasas.
- Existe la creencia de que los tocones o raíces de árboles no pueden ser utilizados como fuente de energía puesto que presentan una pésima calidad.

<u>Barreras regulatorias</u>

- La biomasa de PARP no está considerada en los planes de fomento de las EERR de Aragón.
- La legislación vigente permite quemar PARP en hogueras al aire libre (previa obtención de una licencia).
- No existe ninguna sanción para quien quema y contamina.
- La existencia de un marco regulatorio variable genera un alto grado de seguridad causada por las instituciones (e.g. primas a renovables).
- Política incierta o no clara: gobierno regional a veces hace apuestas en sentidos contrarios al uso de PARP (promoción de uso de picadoras) o que pueden ser competitivas con nuevos negocios de PARP.
- No existe una comunicación clara y fluida entre los diferentes departamentos de la administración pública, lo que puede llegar a dar origen a regulaciones contradictorias.
- Directiva europea para calderas de biomasa limita el uso de residuos agrícolas en calderas con alta eficiencia y bajas emisiones. Esto hace casi imposible utilizar la biomasa de PARP en electrodomésticos.
- Existen subsidios para dejar la poda como cobertura del suelo en los campos. Existen programas locales que apoyan a los agricultores para que adquieran trituradoras.
- Las medidas de condicionalidad de la Política Agrícola Común, en particular las prácticas agrícolas y medioambientales, incluyen el uso de madera de poda como una enmienda al suelo (no importa si es necesario, positivo o simplemente inapropiado).
- Si el montón de poda de madera o árboles se deja demasiado tiempo en el campo (esperando a que la empresa de servicios lo recoja), el propietario se expone a inspecciones / sanciones.

Especialmente importante en el caso de los olivares. Limita la capacidad de recogida en zonas con alta densidad de cultivos.

Barreras estructurales

- No se conoce que el uso de biomasa de PARP es posible.
- No se conocen las soluciones prácticas para llevar a cabo una nueva experiencia con éxito.
- Hay múltiples incógnitas e incertidumbres para el actor que desea emprender un negocio de biomasa de PARP.
- Hay mucha economía sumergida en el ámbito rural. Hay agricultores que prestan servicios sin cobrar IVA, con gasóleo agrícola y con subvenciones al tractor. Esto limita las iniciativas de empresas de servicios para recoger biomasa de PARP.
- Hay ausencia de casos de referencia que puedan servir como réplica.
- Baja proporción de material por km^2 de territorio.
- En muchos casos, se trata de fincas pequeñas o propietarios con hectáreas distribuidas en varias zonas.
- La biomasa de PARP está muy dispersa en el territorio. Eso hace su gestión más cara y complicada
- No hay un marco claro por parte del ejecutivo que provea las condiciones necesarias para el desarrollo del sector de la biomasa.
- En Aragón hay acumulación de madera en los bosques, precisando muchos de ellos actuaciones selvícolas que no se realizan. Esto hace pensar que si no hay capacidad para mover biomasa acumulada en tales cantidades, tampoco lo haya, o sea factible el uso de los residuos forestales.
- En la línea con lo anterior, en Aragón el sector forestal ha ido a menos en los últimos años, y la biomasa no arranca. Esta situación hace pensar que haya escaso interés por la biomasa (sector público y privado), falta de salida comercial (para sector privado), y falta de facilitación/promoción por el sector público.
- No hay un ejemplo por parte de las instituciones en apostar por la biomasa en edificios públicos.
- No hay estrategia regional para priorizar la utilización de los residuos agrarios.
- Existen concursos públicos que se llevan a cabo conforme a procedimientos antiguos y no permiten ofrecer sistemas de aprovisionamiento con biomasa (por ejemplo, en pliego para concurso se pide empresa con 5 camiones de reparto de gasóleo, lo cual cierra puertas a empresas de servicios energéticos que deseen proporcionar soluciones basadas en biomasa)
- Falta de grupos de presión que motiven a los políticos a instaurar criterios como "quien contamina - paga".
- Influencia del sector del petróleo, gas y electricidad en las políticas actuales.
- La administración a veces puede tener voluntad de cambio, pero se encuentra con limitado presupuesto para poder poner en marcha sistemas de incentivos.
- En otras ocasiones, son los propios ayuntamientos los que generan trabas administrativas (por ejemplo, para el expedición de permisos).
- Las empresas de calefacción basadas en gasóleo y gas ofrecen instalaciones gratuitas para la calefacción residencial. A cambio, solicitan la contratación de gas a largo plazo / suministro de gasóleo (contrato de 10-20 años). Particulares y empresas inicialmente interesadas en la biomasa pasan rápidamente al gas, ya que evitan la inversión en la instalación inicial.

Barreras de mercado

- No existe mercado y los distribuidores especulan. Es necesario más seguridad y transparencia en los precios.
- Falta de confianza por parte de los potenciales consumidores e instaladores al respecto del distribuidor de biomasa de PARP (garantías de calidad). Sucede con la madera forestal. Con PARP podría ocurrir lo mismo, o ser aún peor al tratarse de un nuevo producto que no todavía no se ha comercializado.

- Ausencia de grandes consumidores que pudieran empezar a utilizar primeros lotes de biomasa de PARP.
- Falta de consumidores de biomasa.
- Ausencia de ESEs que apuesten por instalaciones híbridas de astilla o pellet forestal, pero capaces de adaptar a otros tipos de biomasa.
- Temor a que el precio de la biomasa pueda variar. Difícil cerrar contratos con estabilidad de precios a medio y largo plazo. No obstante, nadie garantiza el precio del gasóleo o del gas natural, lo cual se le exige a la biomasa.
- Ante un mercado de biomasa localizado, basado en escasos distribuidores, puede aparecer una potencial especulación por parte de los distribuidores.
- Los consumidores piensan que todas las biomasas son iguales, y cuando prueba una biomasa diferente de precio más bajo, la caldera sufre un fallo en alimentación, o la combustión se vuelve inestable.
- Falta de plataformas de biomasa que podrían tratar los residuos de PARP y asegurar cierta calidad.
- Falta de ejemplos válidos en la forma de organizar el aprovechamiento (roles y ganancias de cada actor).
- Incertidumbre del consumidor final ante la propuesta de una ESE: se desconfía del nuevo combustible aunque se detalle la capacidad de la tecnología y de propongan ahorros interesantes.

<u>Barreras organizacionales</u>

- La logística de la PARP es compleja.
- A veces la gestión de la poda o el arranque requiere por los agricultores / empresas tiempos muy cortos para que desaparezca el residuo de sus fincas.
- Es preciso compartir maquinaria, o dejar que una tercera empresa o sector se haga cargo de la recogida de biomasa de PARP.
- Falta de coordinación entre los agricultores cuando se precisa una recogida organizada de biomasa de PARP en una zona para generar un volumen interesante.
- Falta de coordinación entre los diferentes actores y sectores (primario e industrial) para acordar la transferencia del residuo de PARP de manera que sea de interés para ambas partes.
- Cuando hay múltiples agentes involucrados (varios agricultores, una empresa de servicios, varios consumidores) es difícil llegar a un acuerdo con todos los actores potenciales de la cadena.
- Las partes interesadas piensan en modelos limitados, como los esquemas bilaterales (uno vende y uno compra).
- Dificultad de atar suministro y fidelizar antes de la inversión.
- Zonas de minifundio o de parcelas muy pequeñas, la organización de la recogida de PARP es más compleja.
- En muchos casos, acceso por carretera difícil lo que hace imposible utilizar un camión con piso móvil.

<u>Barreras económicas</u>

- Precio petróleo actual a la baja (últimos años): limita la rentabilidad y margen de beneficio
- Margen de beneficio muy justo.
- Derivado del escaso margen, iniciativas regidas por interés de beneficio empresarial requiere un volumen de negocio grande para compensar el escaso margen (conecta con varias barreras organizacionales).
- Hay empresas y casos que ya han cerrado, haciendo ver que el aprovechamiento de PARP no parece ser rentable.
- Precios variables de la biomasa (derivado de barrera de mercado → escasos distribuidores hacen que se pueda estar sujeto a subidas por especulación).

- No existen precios del servicio de recogida de biomasa de PARP o en cualquier caso son muy variables (no hay un marco). No hay precios de servicio de arranque estables.
- El agricultor que cede la poda o arranque puede querer obtener rentas mayores al observar que un tercero hace negocio con su residuo.
- La amortización de maquinaria requiere suficientes toneladas por hectárea, y suficientes hectáreas por año (conecta con el volumen de negocio y las barreras organizacionales).
- Las instalaciones que pueden quemar PARP son más caras que las instalaciones que operan con astilla forestal o de pellets.

<u>Barreras financieras</u>
- Alta incertidumbre: al tratarse la biomasa de PARP de nuevo negocio/actividad, sujeto a muchas incertidumbres, la inversión es arriesgada. El promotor puede quedarse a las puertas de iniciar la actividad.
- Pequeños propietarios se lo piensan mucho.
- Las entidades de préstamo e inversión perciben la incertidumbre y limitan o se abstienen de financiar nuevas iniciativas basadas en biomasa de PARP.
- El IVA sobre la biomasa es del 21% en España (mientras que es del 10% en otros países europeos).
- La biomasa no aparece en la "Estrategia para el Desarrollo Rural" de algunas regiones de Aragón. Difícil acceso a fondos Leader.
- No existen incentivos para obtener PARP como fuente de energía.

<u>Fuerzas impulsoras</u>
- OPORTUNIDAD <u>(fuerzas impulsoras sobre las que no se puede influir)</u>
  - Gran potencial en Aragón de biomasa de PARP.
  - Mercado (precio de la biomasa al alza).
  - Aumento del precio del petróleo.

- CONSUMO
  - Generar un primer gran consumidor.
  - 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 tirar del consumo, integrando así los residuos de PARP en conceptos de autoconsumo y km0.
  - Apuesta por parte de los ayuntamientos.
  - Mecanismos que fomenten el consumo de biomasa local.
  - Tecnologías que sean capaces de valorizar los residuos con más tierra para su uso como biomasa (p.ej, torrefacción)

- 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, gasoleo 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)
  - Incentivos al uso de biomasa de PARP (segmentación o discriminación por tipo de renovable o biomasa).

- Exigir por parte de la administración una calificación energética para las instalaciones agroindustriales, de manera que tenga una determinada eficiencia y no puedan además, quemar cualquier combustible.
- Proveer de los medios necesarios para controlar y asegurar el cumplimiento de los planes energéticos.
- Ciertos sectores agrícolas (vino, oliva, frutal) cada vez son más exigentes en la aplicación de buenas prácticas a sus procesos productivos con el objetivo de exportar a mercados extranjeros con mayores restricciones medioambientales y de eficiencia (p.ej., certificado CO_2 o huella de carbono)
- Determinar la huella de carbono en ecoetiquetado o en la propia actividad agrícola.

- REGULACION QUEMAS
  - Catálogo de prácticas agro-ambientales para Aragón: promover uso ecológico de madera de PARP como materia orgánica o como energía (incluyendo las condiciones para aplicarlas, forma de picado, época, incorporación a suelo, etc.).
  - Otorgar ventajas a aquellos que llevan a cabo buenas prácticas y evitan la quema al aire libre.
  - Política ambiental más restrictiva (quemas solo cuando haya problemas reales de plagas), y que no resulte una práctica cómoda.
  - Condicionar la financiación o ayudas agrícolas para la adquisición de picadoras de poda autocargantes.
  - Tasa de CO_2 para los que queman (ocurre en países como Suecia)

- DESARROLLO DE MERCADO ESTABLE PARA BIOMASA DE PARP
  - Apoyo a profesionales que demuestren solvencia (evitar instaladores o vendedores oportunistas).
  - Garantizar la calidad de la biomasa (por medio de sellos, etiquetas, marca).
  - Estabilidad a largo plazo del rendimiento económico (depende de marco estable político y de mercado).
  - Creación o facilitación de centros logísticos de importante tamaño, capaces de conseguir y distribuir biomasas de diferentes tipos (uno por provincia).
  - La agrupación de agricultores para compartir gastos, maquinaria, y crear una movilización de biomasa de mayor cuantía
  - Nuevas iniciativas que sean replicables.
  - Actividades de promoción para apoyar el intercambio de conocimientos y proyectos piloto.
  - Promoción del acercamiento entre sector agrícola e industrial.
  - Apoyo a innovación empresarial e I+D aplicada (para uso de biomasa de PARP).
  - Apoyo al I+D en tecnologías de transformación de restos agrícolas, en bio-commodities o vectores energéticos (torrefacción, gasificación, licuefacción hidrotermal, etc.)
  - Entendimiento entre los proveedores de maquinaria. Que accedan a alquilar, no a vender.

- SENSIBILIZACIÓN:
  - Subvenciones para cambiar la mentalidad.
  - Acción global de sensibilización, no solo desde arriba (administraciones, regulaciones, etc.) sino también desde abajo (agricultores, cooperativas, sociedad, ayunatmientos locales, etc.)
  - Sensibilización (para promover los beneficios para las partes interesadas y los consumidores finales).
  - Sensibilizar acerca de la generación de empleo local.
  - Sensibilizar acerca del carácter de autosuficiencia de la biomasa de PARP, al aprovechar los propios residuos para cubrir nuestras demandas energéticas.

- Sensibilizar a los consumidores sobre las opciones existentes.
- Sensibilización de los directivos de la empresa.
- Incluir mayor peso de la gestión de residuos en la educación escolar ambiental.

Conexiones sector PARP que puedan ir en favor de los modelos de negocio propuestos

No existe un sector de producción o consumo de PARP, sino más bien un sector frutícola, oleícola y vitivinícola, y por el otro lado, un sector potencialmente consumidor de dicha biomasa. En ambos casos son dos sectores (productores y consumidores) muy alejados el uno del otro. Otros actores como intermediarios, o empresas de servicios, o no están informados, o ya han intentado movilizar biomasa de PARP, sin haber tenido éxito.

No se puede hablar de que haya una forma de realizar u obtener beneficio de la biomasa de PARP en Aragón. El único beneficio que puede contabilizarse actualmente serían las leñas, generalmente para autoconsumo, o para distribución local. Tampoco es posible hablar de un sector mejor posicionado que otro, ya que por un lado, el sector vitivinícola, frutícola y olivarero no tienen, unos frente a los otros, una marcada predominancia (la tienen zonalmente, pero no en el conjunto de la región). En todos ellos hay además agricultores, cooperativas, y agro-industrias de procesado. Es así que los comentarios siguientes son aplicables a los tres sectores. En el modelo de autoconsumo, o de aprovisionamiento a centros logísticos, la agro-industria tiene un papel clave, al poder convertirse en productor y consumidor de biomasa de PARP. Además pueden establecer nuevas líneas como centros logísticos integrados en la agro-industria.

Existe una importante conexión con el sector agrícola de empresas de servicio, que pueden ser agentes clave para desarrollar nuevas cadenas. Así mismo, los fabricantes de maquinaria que sí acceden al alquiler de dicha maquinaria, pueden establecer una nueva forma de negocio y generar más confianza con el sector productor de biomasa de PARP.

La alta cabaña ganadera en Aragón y las necesidades de energía para calefacción hacen que el sector ganadero pueda ser clave para crear demandas de consumo de PARP en zonas rurales. Así mismo, en Aragón los secaderos de maíz y las deshidratadoras de alfalfa pueden ser una de las claves para que la biomasa de PARP tenga un consumo en el entorno agrícola.

La existencia de gestores de residuos en zonas rurales con alto potencial de PARP hace que la conexión de ambos pueda ser clave para desarrollar nuevas plantas de distribución de biomasa de PARP en Aragón. Finalmente, las ESEs, sin estar actualmente apenas conectadas al sector de PARP, tienen un alto potencial de sinergia, ya que podrían asumir la venta de calor, y elegir tecnologías de combustión preparadas para PARP, sin que sea el usuario final el que tenga que asumir el riesgo.

E. marco regulatorio e instrumentos disponibles para promover el uso de PARP

Regulación que pueda afectar directamente al uso de la biomasa de PARP

No hay apenas ninguna legislación específica para residuos de PARP. Todo lo que le afecta se ciñe a legislación de carácter agrícola, ambiental o de gestión de residuos, o de corte energético, y que no suele tener ninguna especificidad para la biomasa de PARP, sino para la misma entendida como residuo agrícola o como biomasa.

En cuanto al sector eléctrico, la regulación actual le afecta totalmente de cara a su uso en plantas de energía eléctrica. Mientras que en el marco del anterior RD 661/2007 se proporcionaban primas eléctricas por tipo de energía renovable, y en función del tipo de biomasa utilizada, en la actualidad en las nuevas subastas de energía eléctrica en régimen especial ni la biomasa, ni la biomasa de PARP tienen diferenciación respecto al resto de energías renovables.

Actualmente en España se está persiguiendo llegar a los objetivos del PANER para 2020, pero no por tipo de fuente de energía, sino con el total. A tal fin ya se subastaron 700 MWe en 2015, de los cuales 200 fueron adquiridos por proyectos de generación eléctrica a partir de biomasa y los otros 500 MWe a partir de energía eólica. La nueva subasta, a celebrarse en el primer trimestre de 2017 licitará incentivos para una potencia de hasta 3.000 MWe.

Desde Europa se están preparando directivas que unen las energías renovables y el clima, tal y como muestra el "Marco sobre clima y energía para 2030"[1] que publica en su página la Unión Europea. Se hace hincapié en la eficiencia energética, y en el avance de la producción de calor a partir de biomasa como una de las técnicas eficientes en su conjunto. La Directiva indica que el sector eléctrico ha avanzado mucho, y que la parte térmica requiere mayor atención. La trasposición de la directiva parece que podría promover avances en conjunto, sin indicar objetivos vinculantes por país o tipo de energía. Para 1 de Enero 2018 cada país deberá presentar un borrador del plan integrado de energía y clima.

Actualmente se encuentra en periodo de trasposición (hasta el 19 de Diciembre de 2017) la directiva 2015/2193 de limitación de emisiones a la atmósfera de instalaciones medianas (de 1 a 50 MW térmicos). En ella se contempla la madera de podas y arranques como biomasa. Si bien será la trasposición en forma de Real Decreto el que determine los niveles de emisiones y las actividades industriales y combustibles a las que aplica, en ningún caso las restricciones pueden ser menos exigentes que las incluidas en la Directiva o incluir menos combustibles. Asimismo, la Directiva no hace distinción según la actividad industrial, sino simplemente por potencia de la caldera, así que se prevé que la trasposición tampoco podrá hacer distinción según actividad industrial.

Los reglamentos de ecodiseño de la Unión Europea 2015/1189 y 2015/1185 para calderas y aparatos de calefacción local (estufas, cocinas, etc.) que usen combustibles sólidos establecen los límites de emisiones a cumplir en partículas, COV, CO y NOx. Estos reglamentos se aplican a combustibles de madera, por lo que en principio la biomasa de PARP queda incluida. Esta situación tiene como efecto positivo, que la biomasa de PARP queda regulada, y por ello nuevas instalaciones que usen la biomasa de PARP, quedan recogidas por el marco regulatorio, frente a otros tipos de biomasa, que pueden quedar sin regulación aplicable. Por el contrario, se le hace cumplir a la biomasa de PARP con los mismos requisitos que la madera de astilla forestal o pellets, lo que puede complicar altamente que las calderas cumplan los límites de emisiones al utilizar la biomasa de PARP generalmente menos homogénea, con mayor cantidad de cenizas y finos. Se espera una revisión en 2019, en la que posiblemente se incluyan otros tipos de combustibles, y en la que la biomasa de PARP podría seguir quedando englobada en el conjunto genérico de "madera", o bien pasar a formar parte de otros grupos de biomasas.

Independientemente de la regulación actual de emisiones, o de la normativa europea sobre ecodiseño, el estado actual en España y Aragón se caracteriza por la limitada aplicabilidad de medios de control para asegurar su aplicación, existiendo cierta permisividad o incapacidad para alcanzar a todas las instalaciones; se echa en falta mecanismos de control y sanción que hagan que los reglamentos se apliquen y cobren sentido.

En cuanto a la gestión de los residuos agrícolas, hay una carencia de legislación que indique qué se puede hacer con los mismos, según se ha podido percibir a través de los talleres y entrevistas desarrollados. En España, cada Comunidad Autónoma establece los procedimientos oportunos para regular y ordenar la quema de residuos agrícolas y forestales. En Aragón la quema de restos forestales y agrícolas se enmarca

[1] Resumen disponible en castellano en: http://ec.europa.eu/clima/policies/strategies/2030_es

en la Ley 15/2006, de 28 de diciembre, de Montes de Aragón. La autorización para el empleo del fuego en superficies agrícolas o forestales se regula a través de órdenes anuales, que describen los procedimientos para la obtención de permisos y la realización de la práctica (por ejemplo, la orden DSR/1380/2016 que modifica la orden de 20 de Febrero de 2015).

En este sentido se observa que existe una regulación que enmarca la forma de realizar las quemas, así como órdenes para facilitar la gestión de permisos, si bien hay una carencia de regulaciones o políticas cuyo objeto sea limitar la quema de residuos agrícolas al aire libre.

La directiva 2008/50/CE relativa a la calidad del aire ambiente y a una atmósfera más limpia en Europa introduce regulaciones para nuevos contaminantes, como las partículas de tamaño inferior a 2,5 µm, así como nuevos requisitos en cuanto a la evaluación y los objetivos de calidad del aire, teniendo en cuenta las normas, directrices y los programas correspondientes a la Organización Mundial de la Salud. Dicha Directiva fue traspuesta en España mediante Real Decreto 102/2011, relativo a la mejora de la calidad del aire. Sin embargo, no refiere a las prácticas de quema al aire libre, sino a las actividades reguladas que emiten contaminantes. Tanto la actual ley en vigor en España, (Ley 34/2007 de calidad del aire y protección de la atmósfera) como el RD 102/2011, no lo considera.

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 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).

<u>Existencia de coordinación entre departamentos de organismos públicos</u>

Se ha podido constatar en los talleres así como en conversaciones con agentes del sector, una casi unánime opinión en cuanto a que, ya sea a nivel regional o estatal, no hay suficiente coordinación entre los organismos competentes en la gestión y uso de residuos agrícolas como fuente de energía. En Aragón, salvo casos particulares, no existe un órgano interno o una praxis que promueva o exija dicha coordinación.

En el ámbito estatal, por destacar algún caso de buena práctica, ha habido propuestas de comisiones interministeriales. Para la biomasa podría tener mucho sentido. En general en España no hay intersectorialidad, por tradición, o a veces por exceso de celo (competencias de cada ministerio o departamento). Existen casos de buenas praxis como los programas de desarrollo rural sostenible, en el que se ha contribuido desde comunidades autónomas y varias consejerías.

En la promoción del uso de los residuos agrícolas, pueden chocar intereses, tal y como se ejemplifica a continuación. Se podría promover el uso de la agro-biomasa, o en concreto de los residuos agrícolas por parte de los departamentos o ministerios de industria, pero podría suponer un solape o injerencia en las competencias de departamentos o ministerios encargados de agricultura y/o desarrollo rural. Y viceversa, la promoción de usos energéticos por parte de organismos con competencias en agricultura podría suponer un solape o injerencia en las competencias de los homólogos en energía.

Subvenciones para uso de biomasa de PARP

Los instrumentos que se han generado para promover el avance de las energías renovables hacia los objetivos del PANER en 2020 no favorecen por lo general la biomasa, ni la biomasa de PARP. Esta es la coyuntura para la biomasa eléctrica. Para la generación térmica con biomasa existen algunos instrumentos gestionados desde el IDAE, como BIOMCASA, etc. si bien no segmentan por tipo de origen. Es decir, la biomasa de PARP puede ser objeto de subvención, pero no está específicamente apoyada respecto al resto de tipos de biomasa o de EERR en general.

Una alternativa para obtener apoyos a la generación de energía a partir de biomasa de PARP son los fondos FEADER o LEADER. Existen ayudas en temas de eficiencia energética, pero la aplicabilidad a la biomasa y a los agro-residuos depende totalmente de las prioridades marcadas por los Grupos de Acción Local en sus estrategias de desarrollo territorial. Estas subvenciones pueden aplicarse a proyectos de carácter productivo (nuevas actividades empresariales) o de carácter no productivo (ayuntamientos, mancomunidades).

Por otra parte, los fondos FEADER provistos a través del reglamento 1305/2013 de la Unión Europea para ayudas al desarrollo rural, se gestionan en Aragón a través del Programa de Desarrollo Rural de Aragón 2014-2020. Entre las medidas existentes cabe resaltar las medidas de cooperación (medida 16), en la que existe una convocatoria para 2017 para "Suministro sostenible de biomasa destinada a la elaboración de alimentos y la producción de energía y procesos industriales".

Algunas acciones subvencionables podrían encuadrarse en el desarrollo de nuevos productos o servicios basados en el uso, transformación y comercialización de la biomasa de PARP. Hay mecanismos muy adecuados para la promoción de la I+D en empresas como los proyectos CDTI, IMPACTO, u otros marcos de apoyo regionales a la innovación. En cuanto a la gestión de la biomasa de PARP como residuo, no hay mecanismos que premien las buenas prácticas frente a prácticas a evitar como la quema al aire libre. Acciones que vayan en la dirección de premiar las buenas prácticas podrían ser una clave. Y para ello se precisa una guía de buenas prácticas en el manejo de los residuos agrícolas marcados desde el Gobierno de Aragón. Considerando la PARP como residuo agrícola, una reflexión consiste en plantear si debe ser el sector energético el que premie su valorización, dotando de incentivos a la generación energética con residuos agrícolas, o si se debe promover desde el punto de vista de la buena práctica ambiental o agrícola. Parece lógico que ambas medidas puedan estar coordinadas y balanceadas, de manera que se promueva el uso por cuestiones ambientales, y que desde el ámbito energético se facilite o se premie dicha vía.

Otro programa interesante es el recogdo en los Proyectos Clima. El objeto de estos proyectos promovidos por el MAPAMA (Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente) y financiados por el Fondo de Carbono FES-CO2 es la reducción de las emisiones de CO_2 en el sector difuso (climatización, residuos, transporte,...) en España. El mecanismo es la compra de créditos de carbono verificados, es decir, el pago por cada tonelada de CO_2 que se ha dejado de emitir y que se verifique por un organismo acreditado. En definitiva se compran toneladas de CO_2 calculadas a partir de las toneladas de biomasa consumidas (y si hay una caldera previa, en función del consumo de dicha caldera). Si la caldera es alimentada con biomasa de PARP, puede ser elegible y beneficiarse económicamente por las emisiones de CO_2 evitadas una vez cuantificadas.

Los residuos de PARP: ¿se consideran biomasa o residuo?

En el marco estatal los residuos de madera de PARP se consideran biomasa, no residuo. Y por tanto su uso energético queda regulado por lo que atañe a instalaciones de combustión, no incineración. En el marco regional de Aragón también se considera biomasa. En concreto la Ley 22/2011y del Real Decreto 815/2013 de emisiones industriales.

¿Barreras regulatorias/legislativas que desanimen a los inversores?

No se ha detectado ninguna normativa concreta que limite directamente el uso de la biomasa de PARP como fuente de energía en Aragón. Ahora bien, existen ciertas medidas que comprometen el uso energético. Desde el Gobierno de Aragón se promovieron en años pasados programas de subvenciones para adquisición de picadoras de poda (para dejar picada sobre el suelo), incluyendo como requisitos que los agricultores realizaran mejoras en los atomizadores de fitosanitarios. Esto inclina la balanza hacia el picado a suelo, frente al uso energético.

Las medidas de condicionalidad de la PAC pueden hacer que para especies de cáscara, especialmente almendro, avellano y algarrobo (RD 1075/2004), el agricultor esté condicionado a dejar la poda como aporte orgánico. Esto ocurre para algarrobo y almendro en secano, y para avellano, sea secano o regadío.

Otra posible limitación para el uso de la biomasa de PARP proviene de un marco regulatorio poco claro para la biomasa de PARP como fuente de energía. Dado que hoy por hoy se regula para combustibles estandarizados, esto puede hacer que instalaciones que quieran utilizar combustibles diferentes del pellet, o de la astilla forestal, como los agro-residuos, puedan encontrarse con trabas en la adquisición de permisos. Esto genera incertidumbre en el emprendedor. En general la lentitud y la burocracia puede ser un problema añadido.

¿Está suficientemente regulado y apoyado el uso o gestión de la biomasa de PARP?

La sensación captada a través de talleres y entrevistas es que la gestión y uso de la biomasa de PARP está suficientemente regulado, pero no como recurso energético. Asimismo, se ha detectado que no se encuentra suficientemente promovido o apoyado en este aspecto. En cada ámbito existe algún tipo de regulación que le aplica a los residuos de PARP. Sin embargo, lo que no hay son regulaciones que favorezcan su uso energético.

Lo que se concluye es que hay una regulación genérica para la biomasa. Que la biomasa de PARP se considera biomasa, no residuos. Pero que no es objeto de ninguna regulación específica en el plano energético. En el ámbito agrícola las regulaciones tienen que ver con la quema, que sigue estando permitida, o con mecanismos de apoyo para que la poda se pique y se deje en el campo, o para que se evite su acumulación (por ejemplo para evitar la expansión del barrenillo en plantaciones de olivo). En otras palabras, hay una regulación marco, pero ninguna favorece el uso de la biomasa de PARP con fines energéticos o industriales, sino más bien, lo contrario.

F. Financiación, mercado de la biomasa y consumidores de energía

¿Necesidades de financiación para implementar los modelos de negocio más prometedores? ¿Existen dichos mecanismos?
La adquisición de maquinaria, o la preparación de un parque logístico o plataforma de tratamiento requiere inversiones importantes. Ante la alta incertidumbre que cubre muchos aspectos de la biomasa de PARP, y la ausencia de un mercado de oferta y demanda estable, las ayudas a la inversión pueden ser necesarias hasta que la biomasa de PARP esté más avanzada en Aragón y España, y estas incertidumbres desaparezcan.

La incertidumbre es tan alta, que, en el caso de la maquinaria de recogida en campo, algunos potenciales pioneros se plantean operar solo si encuentran maquinaria en alquiler, para no asumir los gastos de inversión. Dado que hay una muy limitada oferta de alquiler de este tipo de maquinaria, la iniciativa se queda bloqueada. En este sentido, puede ser preciso fomentar/apoyar la actividad de alquiler por parte de los fabricantes, o de empresas de alquiler de maquinaria, para que asuman el riesgo de dicha actividad, y que no repercuta en el emprendedor. Otra posibilidad es apoyar mediante subvenciones a las empresas de servicios: mientras que hay muchas ayudas a la adquisición de maquinaria por agricultores, no las suele haber para este tipo de empresas.

En cuanto a la adquisición de maquinaria por parte de agricultores, no tiene sentido salvo que tengan una cantidad de hectáreas importante. No es una cuestión de financiación sino del precio habitual de la maquinaria y el reducido volumen de podas o arranques que genera un único agricultor. Los mecanismos de compartición o de alquiler son más adecuados y eficientes económicamente. Que la maquinaria de astillado resulte cara en ciertos modelos de pequeño autoconsumo no debería traducirse en ayudas para adquisición de maquinaria.

Para centros logísticos de gran dimensión, centralizando múltiples residuos, sería preciso apoyos concretos en la financiación, ya que pueden ser claves en resolver la problemática de la gestión de residuos en una zona. Además incurren en múltiples riesgos. Por ello para la promoción de dichos centros es preciso no únicamente apoyar la financiación, sino promover proyectos territoriales capaces de integrar los intereses de múltiples agentes.

En cuanto a financiación de las instalaciones consumidoras de biomasa, algunos mecanismos para instalaciones de calefacción se gestionan desde el IDAE, tales como BIOMCASA y BIOMCASA II (aplicables a biomasa en edificaciones, tanto sector doméstico o ganadero), PAREER-CRECE (instalaciones térmicas en edificios objeto de rehabilitación) y GIT (para instalaciones de calor de gran tamaño en el sector residencial, servicios e industria). Son en cualquier caso programas que pueden apoyar nuevas iniciativas de uso de biomasa de PARP, pero que no son específicos para la misma.

Por otra parte la alta incertidumbre de la biomasa, más aún de la biomasa de PARP, hace que sea complejo conseguir financiación por parte de las entidades bancarias o de sociedades de inversión. Algo que se ha constatado es la incertidumbre por parte de todos los actores de nuevos aprovechamientos de biomasa de PARP. En muchos casos la incertidumbre, unido a la ausencia de mecanismos de financiación y subvención hacen que no se termine de dar el paso adelante.

Precio de la biomasa
Existen algunos tipos de residuos de biomasa que se comercializan a muy bajo precio, o por los que ni siquiera hay que pagar. El problema es que en ocasiones se permite su uso, o no se ponen en marcha los

mecanismos de control para evitar su uso en instalaciones cuya eficiencia y sistemas de limpieza de gases de combustión no son adecuados.

En el marco actual, la mayor parte de las biomasas tienen un margen de beneficio muy estrecho. Es así que la biomasa forestal precisa de gran cantidad de operaciones, subasta, etc. que limitan la viabilidad de las explotaciones. La paja de cereal, que ha sido muy demandada por el sector ganadero, se encuentra hoy día muy ajustada en precio. Salvo residuos agro-industriales con cierta demanda local, la mayoría de biomasa tiene márgenes de beneficio muy limitados.

El gasóleo es un factor clave para algunos tipos de biomasa utilizados en la cobertura de calor doméstico, residencial o industrial. Así, por ejemplo, el precio del gasóleo ha afectado fuertemente al precio de hueso de melocotón y aceituna en Aragón en los últimos años. El petróleo y con ello el pecio del gasóleo, bajó desde 2015, de manera que en precio por unidad de energía, los pellets EN-Plus no generaban apenas un ahorro respecto al gasóleo (ver Figura 2). Ahora bien, ya se comienza a notar un repunte desde finales de 2016. Así mismo parece que se marcan tendencias al alza para los siguientes años. El gas parece que vuelve a tener una subida, sujeta a la alta demanda, y una menor disponibilidad.

En cuanto a la astilla forestal, resulta interesante apuntar la escalada de precios que hubo hasta 2012, coincidiendo con una fase de alta demanda por el sector de la madera y del pellet. Sin embargo desde entonces, el precio ha ido a la baja, causando también parte de reducción de la oferta, e incluso la quiebra de alguna empresa del sector.

La revisión del boletín de precios IDAE (periodicidad trimestral, ver Figura 2) indica una caída en la mayoría de precios de biomasa en España. Parece que hay ahora expectativas de que este precio pueda estabilizarse, y se inicie en 2017 cierto cambio de tendencia. Es cierto que, salvo que se repitan condiciones especiales como las que se dieron en 2012, no habría de esperarse una gran subida, sino una estabilización, pero en precios superiores a los actuales.

Las entrevistas llevadas a cabo a través de uP_running muestran que los pioneros que han revisado el marco Aragonés encuentran realidades muy diferentes según la zona en que se pretende operar. Hay zonas en las que la cáscara de almendra es abundante, alcanzando precios muy bajos, como 40 o 50 €/t. Coincide con las apreciaciones recogidas a través de EuroPruning, en la que grandes consumidores refieren una bajada de precio de 120 €/t en 2011 a 60-70€/t en 2015. Actualmente, y cruzando datos con estudios de factibilidad de SUCELLOG en Aragón para agro-industrias, el precio varía en Aragón en una horquilla de 60 a 130 €/t. Las variaciones de un año a otro, o por estación pueden ser altas, llegando a percibirse por el consumidor oscilaciones del $\pm$40%.

El precio de la biomasa de leña depende también de la zona y origen. Precios de leña usuales pueden estar entre 120 y 150 €/t, llegando hasta 220 €/t, tal como apuntan agentes consultados, o el proyecto greenGain.

El hueso de aceituna tiene un coste más alto, encontrándose en Aragón entre 120 y 150 €/t habitualmente. Según estación este precio puede bajar puntualmente a 90 €/t, siendo este precio escasamente habitual.

En lo que se refiere a precios de astilla, se han recabado de varios agentes a través de entrevistas, así como de consultas previas realizadas en SUCELLOG, EuroPruning y greenGain. Se observa que el precio de adquisición depende altamente del perfil del consumidor final y de la calidad (granulometría, humedad y cenizas). Es así que grandes consumidores de residuos usados como fuente de energía pueden adquirir la astilla a precios de hasta 30€/t, sin ser la calidad un requisito. Estas instalaciones pueden consumir, por ejemplo, madera de demolición, con precios de adquisición de 15 €/t.

Por el contrario, se aprecia que la mayoría de comercializadores y consumidores apuntan precios actuales (2015-2016) entre 60 y 70 €/t para astilla seca en formato G30. Astilla con mayor humedad, o formato G50, puede reducir su precio a 40-50 €/t.

Ahora bien, todo depende de la cercanía de un suministrador, y del contrato establecido. Se han constatado variaciones de precios de adquisición entre 45 €/t y 90 €/t. Estos casos son extremos, el menor estando sujeto a un caso de contratos de importante volumen (a grandes plantas, o puesta en puerto para exportación), y el máximo para una instalación en la que se ha tenido problemas con varios suministradores, y pagan por encima del precio habitual para asegurar calidad en granulometría y humedad. Consumos industriales de astilla de clase A tienen capacidad de pago a precios de 60 a 75 €/t.

La biomasa de paja sí que tiene un mercado consolidado, y el precio en Aragón se mantiene estable en 36-40 €/t en los últimos años, de acuerdo a las apreciaciones de agentes del sector, y también recabadas a través de proyectos como S2Biom, EuroPruning y SUCELLOG. En concreto se aprecia que la paja de baja calidad puede adquirirse a muy bajo precio, entre 10-20€/t puesta en planta. Mientras tanto, el cañote de maíz empacado puede adquirirse a precios ligeramente inferiores a la paja de cereal, pudiendo ser 33 €/t un valor adecuado.

Otros tipos de biomasa son el orujillo, la granilla de uva o los pellets de madera. Algunos precios que se han recabado a través de SUCELLOG y EuroPruning en 2015 son de 80 a 130 €/t, siendo muy variable, especialmente en zonas en las que el orujillo seco de orujera es abundante. Para la granilla de uva se han registrado precios de 60 a 85 €/t.

En cuanto al pellet, su precio depende de la calidad. Puestos en planta a granel se habla en Aragón de 190 €/t como un posible precio de referencia. Ahora bien el formato de suministro afecta totalmente dicho precio.

La evolución de precios en los últimos años en España marca una ligera tendencia a la baja para algunos tipos de biomasa, mientras se aprecia un precio del gasóleo que decrece en mucho mayor grado. Aunque el gasóleo no parece haber afectado al precio de la biomasa en gran medida (aunque pueda haber ocurrido en zonas concretas), lo que sí es cierto es que el margen de beneficio de usar biomasa respecto a gasóleo se ha reducido mucho, y de allí que las iniciativas para instalar biomasa hayan quedado en muchos casos congeladas.

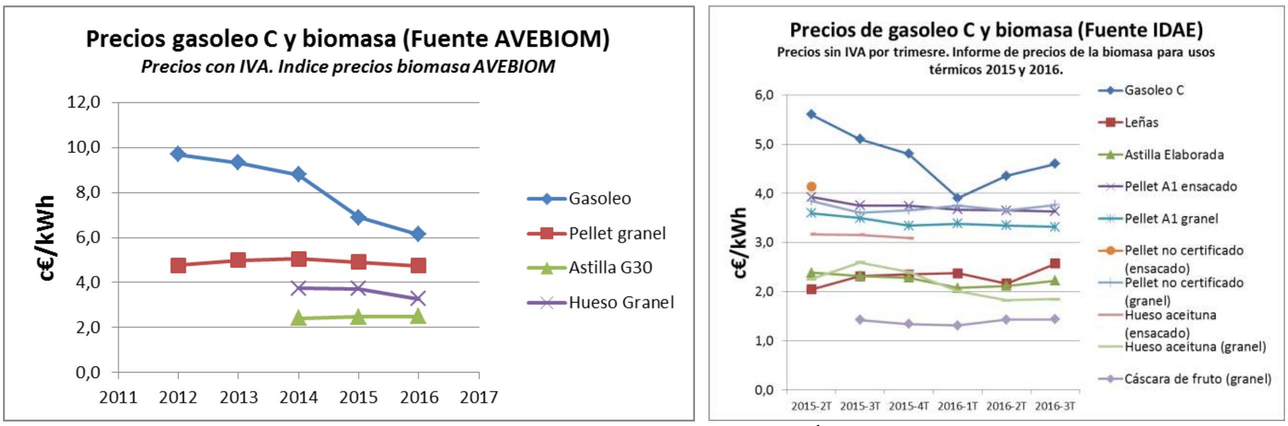

Figura 2. Precios del gasóleo C y de la biomasa. Izda: Precios con IVA de acuerdo al Índice de precios de AVEBIOM; Dcha: precios sin IVA, de acuerdo al informe trimestral de precios de la biomasa publicados por IDAE.

Forma de comercializar. ¿Productos alternativos?

Conforme a la visión de la mayoría de los agentes consultados, la comercialización de biomasa de PARP tiene más sentido hacerse como astilla y leña. La astilla puede precisar de cribado y secado para generar productos de diferente calidad a medida de los diferentes consumidores. El perfil de consumidor en Aragón está actualmente compuesto por: granjas, agro-industria e industria, y quizá en el futuro, la generación eléctrica en una o varias plantas (Grupo Forestalia).

La biomasa de PARP no parece adecuada en usos domésticos ni en pellets. Los pellets mezcla pueden ser una salida para la biomasa de PARP en el sector ganadero o industrial, precisando en cualquier caso de operaciones de limpieza para disminuir la cantidad de tierra que puedan portar.

Como estrategia de comercialización, y considerando el uso de PARP de proximidad (no para exportación a otras zonas, regiones o países), el precio a alcanzar debe ser competitivo con el combustible de referencia en la zona. En Aragón hay zonas de escasa disponibilidad de astilla, y que por el contrario cuentan con otros agro-residuos como el orujillo, la cáscara de almendra o el hueso de aceituna o melocotón. En otras zonas la biomasa consumida son astillas de pellet. En principio el precio de venta tiene que ser competitivo con los combustibles disponibles en cada zona.

Otro aspecto a destacar es el posible uso competitivo de los residuos de PARP para otros fines. Los usos actuales ya se han discutido en el apartado B del presente documento. A futuro, no es evidente que puedan surgir otras actividades competitivas para este recurso. El uso de la biomasa de PARP como biomateriales (para construcción) o como fuente de bioquímicos no está nada claro. Hay, en el caso de la poda de vid, ensayos para utilizar los sarmientos como sustitutivo de los sulfitos añadidos en la elaboración del vino. En cualquier caso de momento la biomasa de PARP tiene más bien el reto de penetrar en el mercado de la biomasa para energía, no tanto en poder alcanzar en el corto plazo otros mercados de mayor valor añadido.

Mercado: grado de desarrollo (tamaño comercializado) y fragmentación

El mercado de la biomasa se debe dividir en varios apartados. Por un lado el mercado de pellets, que se encuentra más asentado, y con precios más estables, pudiéndose encontrar diferentes proveedores. Así mismo, está sujeto a mayor estandarización, y competencia. En un plano intermedio se encuentra la astilla forestal, con un mercado parcialmente estable, aunque según la zona se puede estar sujeto no al precio de mercado, sino al precio que pueda establecer un proveedor único asentado en la zona.

Por otra parte otros combustibles como la cáscara de almendra, el hueso de aceituna o el hueso de melocotón tienen un mercado competitivo, pero a la vez que sujeto a la estacionalidad y a la bondad de las campañas agrícolas, están sujetos a variaciones, en función del rendimiento del producto principal. En años de baja producción agrícola (de oliva, por ejemplo), los residuos de hueso y orujillo pueden sufrir fuertes inflaciones. Es posible encontrar pequeñas empresas y ESEs que distribuyen pellets, hueso, orujillo, etc. en el territorio aragonés. Sin embargo, se percibe por parte de algunos consumidores, una visión de escasa transparencia en el precio, al ver las importantes variaciones de precio que se pide de un año a otro, o incluso en diferentes momentos del año.

El mercado de la paja también es estable, aunque sujeto a estacionalidad, y a incrementos de precio en años de baja pluviometría. Existen distribuidores, muchos de ellos asociados a la asociación nacional de industriales de la paja (ANIP), que representa al 50% del sector de la paja actualmente.

Por último, existen biomasas más marginales, para las que no hay mercado apenas, o se encuentra muy localizado. En tal caso el precio no existe y depende del coste de oportunidad para sustituir otros combustibles. La biomasa de PARP entraría en este segmento. No existe un mercado, y por tanto la venta o uso es poco habitual. La leña de madera de arranques agrícolas se usa localmente. Sin embargo, no existen usos como astilla, ni se oferta como un producto alternativo. En otras palabras, la nueva producción de biomasa de PARP implica la penetración en un mercado, para el que precisa fidelización del cliente, un buen coste de oportunidad, o alternativamente, basarse en esquemas de autoconsumo.

<u>Precepción de la calidad. Percepción de la trazabilidad y la sostenibilidad</u>
No se puede generalizar sobre cuál es la percepción “del consumidor” acerca de la calidad. Hay consumidores para los que, por su percepción personal, o por las necesidades de su instalación, la calidad es fundamental. En tales casos la calidad es un factor clave, y, siendo que la biomasa de PARP tiene peores características en contenido de cenizas y en granulometría que la astilla forestal, se genera una importante incertidumbre tanto para el consumidor como para el suministrador.

En algunos casos, instalaciones de gran consumo, o pequeñas calderas en zonas rurales, los usuarios pueden estar dispuestos a utilizar biomasa de cualquier tipo, buscando el precio más bajo de la misma. En tales circunstancias, las peores características de la biomasa de PARP no son un hándicap, pudiendo ser que se pueda usar la biomasa incluso tras un simple triturado (sin necesidad de afino posterior).

Ahora bien, las políticas y el control de las emisiones tienen una tendencia a ser más restrictivas. La calidad va a ser crítica para cumplir con las emisiones, especialmente en instalaciones que no estén dotadas de sistemas activos de limpieza de gases. Así mismo, la quema de biomasas de baja calidad en calderas rudimentarias parece que tendrá que ir desapareciendo, dando paso al uso de calderas con mejor rendimiento, y quizá, que precisen combustibles de cierta calidad. Estos aspectos se han descrito en el apartado E, acerca de directiva 2015/2193 de limitación de emisiones a la atmósfera de instalaciones medianas (de 1 a 50 MW térmicos), y de los reglamentos de ecodiseño de la Unión Europea 2015/1189 y 2015/1185 para calderas y aparatos de calefacción local (estufas, cocinas, etc.) que usen combustibles sólidos.

En cuanto a la trazabilidad, los usuarios que reciban lotes de biomasa pueden querer conocer que, por ejemplo la mitad de la madera proviene de explotaciones forestales, y la otra mitad de residuos de PARP. La trazabilidad puede ser un factor clave de confianza cuando se comercialicen mezclas de diferentes tipos de astillas. Así mismo hay una preocupación y conciencia creciente, y los usuarios no desean adquirir lotes que provengan de explotaciones forestales no sostenibles. Los sellos PEFC pueden ser una clave para penetrar y ganar confianza del mercado, se pueden aplicar a la biomasa de PARP igualmente que a la forestal. En cualquier caso, dados los estrechos márgenes de beneficio, la trazabilidad debe basarse en sistemas sencillos (se habla como referencia que el sello EN-plus puede costar 1 €/t).

La sostenibilidad se percibe en general como un valor añadido. Sin embargo, por el momento es el precio, la confianza y la calidad, los criterios que marcan al consumidor a la hora de elegir un suministrador y un tipo de biomasa.

G. 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 e l 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 en cambio de uso de tierras, ni en producción de la biomasa).
- F2. Permite cerrar ciclos del residuo en economía circular y de proximidad (de "kilómetro cero").
- F3. Los agricultores pueden ahorrar en sus tareas de gestión de residuos de PARP.
- F4. El sector agrícola es fuerte en Aragón, y sus representantes tienen capacidad de diálogo y negociación con el Gobierno de Aragón.
- F5. La agro-industria del vino, procesado de fruta y de aceite de oliva pueden tirar del consumo, integrando así los residuos en conceptos de autoconsumo y km0.
- F6. Compartir o contratar alquileres de picadoras de poda es habitual. La maquinaria de recogida o procesado de PARP puede seguir esquema parecido y ser compartida.
- F7. 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 (mayor tiempo de operación a lo largo del año).
- F8. Puede ser un motor de empleo rural, al ser los residuos de PARP generados en zonas rurales (en línea con objetivos de desarrollo rural).
- F9. Algunas zonas rurales están ya muy concienciadas con los impactos de la quema.
- F10. Sentido de proximidad para la biomasa de PARP, mejor entendida en el entorno local, al ser su uso como fuente de energía una buena práctica respecto a la quema al aire libre.
- F11. Cercanía de consumidores como granjas o fábricas de piensos y ayuntamientos del entorno rural a la biomasa de PARP.
- F12. Calderas preparadas para PARP pueden consumir otros tipos de biomasa (aumenta flexibilidad seguridad de suministro del usuario).
- F13. La astilla de PARP puede usarse en medianas y grandes calderas preparadas para astillas de baja calidad o calidad variable.
- F14. Hueso de aceituna y orujillo ya se comercializa. Para poda de olivo dichos canales pueden ser utilizados.
- F15. Hay zonas o cultivos (olivo y viñedo) que tienen más presión en eliminar la poda (para evitar la propagación de enfermedades y plagas).
- F16. Periodos de retorno de las instalaciones de biomasa muy cortos (depende de precio gasóleo y gas).
- F17. Existencia de empresas de servicios energéticos capaces de realizar instalaciones de garantías con biomasa de PARP.

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. Escasa experiencia en el astillado de madera de arranques y tocones.
D3. Calidad en general menor y más variable que la astilla forestal, hueso de aceituna, melocotón u orujillo.
D4. La biomasa de PARP no está apenas regulada, ni estandarizada → incertidumbre para el emprendedor a la hora de obtener licencias de actividad.
D5. Menor cantidad de tecnologías de combustión disponibles que para otros tipos de biomasa
D6. No existen instalaciones orientadas a consumo de biomasa de PARP.
D7. Desconocimiento del sector agrícola, energético y público del potencial y de que el uso de la biomasa de PARP puede ser viable.
D8. Dificultad de conseguir financiación privada debido a que no son inversiones standard, y suelen verse como arriesgadas (incertidumbre).
D9. Costes de la cadena altos, que pueden llevar a un margen de rentabilidad muy ajustado.
D10. La biomasa de PARP está muy dispersa en el territorio. Eso hace su gestión más cara y complicada.
D11. Cantidad de biomasa por hectárea menor que en explotaciones forestales, mayor riesgo de incurrir en sobrecostes (los costes por tonelada se disparan en seguida si la recogida y transporte no rinden).
D12. No hay suficiente mercado de la biomasa, los precios varían estacionalmente, y pueden estar sujetos a especulación.
D13. 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).
D14. En Aragón otras energías renovables han sido consideradas prioritarias frente a la biomasa
D15. Otras renovables mejor posicionadas para entrar en las nuevas subastas del sistema eléctrico (por ejemplo la nueva licitación en 2017 de 3000 MWe de potencia eléctrica).
D16. No se tiene en cuenta en los planes energéticos de Aragón, y no existe una agencia de la energía que pueda estudiar en detalle y proponer planes específicos.

OPORTUNIDADES

O1. Existe un gran potencial en Aragón de biomasa de PARP (más de 270.000 t de materia seca por año de podas y arranques).
O2. En zonas concretas de Aragón hay un altísimo potencial local de biomasa de PARP.
O3. Algunos técnicos de ayuntamiento en zonas rurales muy concienciados con el medio ambiente.
O4. Aumento de redes de calor en España (se espera que siga la tendencia promovida principalmente desde ayuntamientos).
O5. Sector vino emite CO_2. Demostrar que se es eficiente y que se buscan soluciones km0 contribuye a la imagen de la marca y del sector.
O6. Precio petróleo al alza según previsiones (de finales de 2016).
O7. Existencia de ESEs que pueden asumir la inversión y vender calor a precio competitivo respecto al gasóleo o el gas (evitan incertidumbre del usuario, que paga por el servicio, y se desentiende de la instalación).
O8. Existencia de sellos de calidad de ESEs con garantía de profesionalidad, que pueden visualizar a instaladores con experiencia en PARP.
O9. 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.
O10. Nuevos planes de desarrollo rural o de política agrícola que regularicen el uso de residuos.
O11. Políticas ambientales cada vez más restrictivas que puedan limitar en el futuro las quemas al aire libre.

O12. Aumento de exigencia en reducción de emisiones de las energías renovables (80% hasta 2025 y del 85% a partir de 2026).
O13. Financiación y subvención disponible para proyectos productivos en el medio rural a través de fondos Leader (aplicables a empresas de servicios que recojan y transformen biomasa de PARP).
O14. Financiación y subvención disponible para acciones de eficiencia energética en ayuntamientos a través de fondos Leader.
O15. Financiación a través de fondos Feader en Aragón por medio de proyectos de mejora de la actividad agraria e industrial (ejemplo de la medida 16 de grupos operativos para suministro sostenible de biomasa).
O16. Existencia de financiación para desarrollo de productos y servicios innovadores a nivel regional y nacional.
O17. Desarrollo en la actualidad de las especificaciones para generar un estándar de biomasa de podas agrícolas (viñedo y olivar) a través del proyecto Biomasud (permite obtener un sello Biomasud de calidad; puede derivar en redacción de estándares para 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 o aragonesa por otros sectores competidores: ejemplo del desarrollo de la red gasística en los 90's y 2000, u otras renovables.
A3. Forma de actuar de la administración inestable según legislatura. Una inversión inicialmente viable puede dejar de serlo si hay cambios en el gobierno, y se promueven políticas que limitan la rentabilidad, o que entran en competencia.
A4. Cambios de gobierno en ayuntamientos: limita aparición de iniciativas ejemplares
A5. 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).
A6. Límites a las emisiones en instalaciones de pequeña potencia (< 500 kWt) por directiva de ecodiseño, si 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).
A7. Legislación lo puede dejar la biomasa de PARP fuera si no se considera combustible típico (falta de estandarización o de referencia).
A8. 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).
A9. Generación de expectativas demasiado altas (si se confunde potencial de biomasa teórico, con la cantidad disponible, económica y contratable).
A10. Sequías y cambio climático, que reduzcan las tierras en regadío y la viabilidad de la vid, olivo, frutal.
A11. Recortes en las ayudas a producción agrícola. Pérdida de competitividad.
A12. Deslocalización de producción de fruta, uva y olivo a mercados con menores costes (Turquía, Magreb).
A13. Precio de otros agro-residuos de baja calidad o de biomasas contaminadas (que pueden ser muy baratos): PARP no competitiva si no se establecen clases, o se limita uso de dichos residuos en instalaciones pequeñas y medianas.
A14. Economía sumergida en la prestación de servicios por parte de particulares sin permisos: puede limitar la iniciativa privada.
A15. Entrada de nuevos instaladores sin experiencia que realicen instalaciones inapropiadas (mala prensa y mala experiencia para la biomasa de PARP).
A16. Boca a boca de malas experiencias y del escepticismo.

A17. Rechazo a lo novedoso o incierto (solo se piensa en astilla, pellet, etc.).

A18. Usos alternativos (dejar como enmienda orgánica en el suelo, uso para atrapar barrenillo con el olivo, uso de poda de vid para re-emplazar sulfitos, etc.) y medidas agro-ambientales para condicionalidad de la PAC (picado a campo).

Tras el análisis una de las dudas fue si incorporar la incertidumbre y el riesgo como una de las debilidades o de las amenazas. Sin embargo, se ha decidido no incluirla, al resultar ser una consecuencia de as múltiples incertidumbres, debilidades y amenazas. Es por ello que el lector no debe extrañarse por su ausencia. Se decidió reflejarla como una barrera estructural que impregna actualmente todos los aspectos del uso de la PARP.

Tabla del plan de acción

LINEA DE ACCIÓN: Acciones orientadas a promover la aceptación de la biomasa de PARP					
Acción objetivo (nombre corto)	**Elementos que la impulsan**	**Objetivos**	**Acciones / Actividades**	**Actores involucrados / objetivo**	**Incluida ya en uP_running? (SI / NO)**
SO6 Visualización bondades PARP	S8: PARP genera empleo en zona rural O1: Aragón tiene alto potencial de PARP O2: Hay zonas de alto potencial en Aragón	SO6 - Presentar y dar a conocer los beneficios para la sociedad del uso de la biomasa de PARP.	SO6.a – Campaña general en Aragón. SO6.b – Campaña específica dirigida a las zonas con alto potencial.	- Público general - En zonas rurales de alto potencial: ayuntamientos, granjas, agro-industria	Sí (T.7.4, T.2.1, T.3.1)
SO4 Visualizar oportunidad en entorno rural	S11: Consumo de calor zona rural (granjas, etc.) O4: Expansión redes de calor en España O10: Aumento de objetivos de calor con biomasa (planes EERR)	SO4 - Sensibilizar a los ayuntamientos, empresas y en general, a todos los sectores implicados, para promover el aprovechamiento de PARP.	SO4.a – Promover demostraciones prácticas e invitar a los distintos sectores objetivo. SO4.b – Diseminar casos de éxito existentes y las claves de éxito.	- Potenciales consumidores de biomasa en zonas rurales - Público general	Sí (T.7.4, T.7.5, T.3.3, T6.3)
WT7 Campaña: biomasa PARP es posible	W7: Desconocimiento oportunidades PARP T16: Mala prensa T17: Rechazo a lo nuevo	WT7 – Ensalzar la oportunidad que permite la biomasa de PARP, y acallar rumores negativos no fundamentados.	WT7.a – Campaña de noticias promoción del uso de la poda y arranques. WT7.b – Videos demostrativos en youtube. WT7.c – Mensaje durante presentaciones en eventos públicos.	- Sector agrícola - Público general	Sí (T.7.4., T7.5, T7.6, T7.7)

LINEA DE ACCIÓN: Acciones orientadas a defender las ventajas del uso de biomasa de PARP como fuente de energía					
Acción objetivo – Nombre corto	Elementos que la impulsan	Objetivos	Acciones / Actividades	Actores involucrados / objetivo	Incluida ya en uP_running? (SI / NO)
WT6 Asesorar y prevenir frente a malas prácticas en el uso de PARP	W7: Sector agro desconoce biomasa T5,T6: Directivas emisiones calderas más restrictivas T15: Instaladores sin experiencia oportunistas T16: Malas experiencias	WT6 - Asesorar, concienciar y prevenir al sector agrícola de los posibles riesgos por futuras legislaciones y de asegurar el uso de esta biomasa en instalaciones adecuadas.	WT6.a – Campaña de sensibilización: publicación periódica de noticias. WT6.b – Desarrollo de monográficos. WT6.c – Presentación de informes técnicos.	- Sector agrícola - Potenciales consumidores de biomasa de PARP en zonas rurales - Público general	Sí (T7.4, T7.5, T3.4)
SO1 – Regulaciones GEI más estrictas	S1: GEI de biomasa de PARP son bajas O13: Regulaciones más estrictas en emisiones de GEI	SO1 - Demostrar y visualizar públicamente que las emisiones de GEI de biomasa de PARP son bajas en comparación con combustibles fósiles y otros tipos de biomasa.	SO1.a – Realizar cálculos a partir de casos reales. SO1.b – Divulgación de los resultados y conclusiones.	- Pioneros o casos de uso de biomasa de PARP en marcha - Agentes públicos y privados. Público general	Sí (T3.4, T6.3) (T7.4,T7.5)
SO10 – Precio del gasóleo y del gas	S17: Periodos de retorno bajos en calor con biomasa O6: Precio petróleo al alza	SO10 - Demostrar que el uso de la biomasa de PARP es viable respecto a precios del gasóleo, si se obtiene de una manera adecuada.	SO10.a – Visualización pública de casos de éxito. SO10.b – Seguimiento de precio petróleo y periodos de retorno típicos implícitos.	- Potenciales consumidores de PARP: ayuntamientos, granjas y agro-industria en zona rural.	Sí (T6.3) No
ST5 Fomento de la calidad de PARP como combustible	S14: Biomasa de PARP calidad no mucho peor frente a otras biomasas T13: Otros agro residuos más baratos y peor calidad	ST5 - Demostrar que la calidad de PARP no es mala y en cualquier caso puede ser superior a otros combustibles alternativos.	ST5.a - Campaña informativa que promocione la PARP como combustible. ST5.b - Estudios técnicos comparativos con otros tipos de residuos.	- Consumidores (aytos, granjas, agro-industria). - Sector agrícola, energético y ESEs	Sí (T.7.4.) No
WO2 Estándar de	W3: Biomasa de PARP de calidad menor y variable	WO2 – Desarrollar un estándar de calidad de biomasa de PARP	WO2.A – Obtener datos de la calidad de PARP: campaña de	- ESEs y fabricantes - Productores de PARP,	Sí (T.3.2., T.6.3.)

calidad biomasa PARP	O17: Estandarización podas a través Biomasud	basado en datos típicos de composición.	recogida de muestras y bibliografía. WO2.B – Desarrollar un estándar que certifique la calidad de la biomasa de podas.	nuevos emprendedores - Consumidores (ayunta-mientos, granjas, agro-industria) - Autoridades y órganos reguladores.	No
WT1 Biomasa de PARP no es tóxico	W3: Biomasa de PARP de calidad menor y variable T7: no regulada, sin estandarización T8: PARP considerada como residuo, no biomasa	WT1 - Evitar que PARP se considere residuo dentro de la legislación.	WT1.a – Campaña de medición de contenido de metales en la madera de PARP. WT1.b – Trasmisión de la información a agentes de decisión. WT1.c – Campaña información.	- Departamentos medio ambiente del Gobierno, institutos oficiales, agencias de la energía. - Público general, sector agrícola y energético.	Sí (T.3.3.)
ST4 Medición fiable del potencial de biomasa	S16: Necesidad de sacar poda T9: Expectativas de potenciales infladas	ST4 - Medidas fiables del potencial teórico, técnico y sostenible de biomasa de podas y arranques.	ST4.a – Medición de rendimientos por hectárea. ST4.b – Análisis de disponibilidad. ST4.c – Generación de mapas de potencial.	- Productores de biomasa, emprendedores y consultores - Sector agrícola, energético, agencias de energía	Sí (T.6.2., T.3.2.) No
LINEA DE ACCIÓN: Acciones orientadas a obtener respaldo social o institucional					
Acción objetivo (nombre corto)	**Elementos que la impulsan**	**Objetivos**	**Acciones / Actividades**	**Actores involucrados / objetivo**	**Incluida ya en uP_running? (SI / NO)**
SO2 Respaldo social para cambiar gestión PARP con quemas	S9: Conciencia quemas O11: Nuevas políticas que influyan en la gestión de residuos (Aragón / EU)	SO2 - Obtener el apoyo de la sociedad para promover una gestión de la biomasa de PARP ambientalmente adecuada.	SO2.a – Redactar y distribuir una declaración de la necesidad de medidas que favorezcan prácticas más adecuadas. SO2.b – Campaña de adhesión.	- Actores influyentes del sector agrícola, energético y la administración - Población en zonas de concentración de cultivo de vid, olivo y frutal - Partidos políticos, diputados	Sí (T2.1, T.2.2., T.2.3., T.4.3.)

ST2 Declaración de beneficios de la biomasa de PARP con la administración para	S1,S2,S8: Ventajas de la PARP (empleo, GEI, quemas) S4: Sector agrícola fuerte en Aragón T3,T4: Administración cambiante y políticas en contra	ST2 - Conseguir un acuerdo entre sector agrícola/energético y administración sobre los beneficios socioeconómicos de la gestión de PARP y la necesidad de incentivarla.	ST2.a – Redactar y distribuir un memorando con una declaración de principios para la promoción de la biomasa de PARP. ST2.b – Campaña de adhesión entre los distintos sectores.	- Actores influyentes del sector agrícola, energético y la administración - Población en zonas de concentración de cultivo de vid, olivo y frutal - Partidos políticos, diputados	Sí (T.2.1, T.2.4., T.4.3.)
WT5 Acuerdo con administración y para el apoyo de la PARP	W14,W15,W16: PARP generalmente no considerada en planes T2,T3,T4: Administración cambiante / apoyo a otros sectores	WT5 - Conseguir un acuerdo entre sector agrícola/energético y administración sobre las líneas de acción necesarias para promocionar el uso de la biomasa de PARP.	WT5.a - Redactar y distribuir un plan de acciones precisas para la promoción de la biomasa de podas. WT5.b - Campaña de adhesión entre los distintos sectores.	- Actores influyentes del sector agrícola, energético y la administración - Población en zonas de concentración de cultivo de vid, olivo y frutal - Partidos políticos, diputados	Sí (T.2.1, T.2.4., T.4.3.)
LINEA DE ACCIÓN: Acciones orientadas a promover el emprendimiento					
Acción objetivo (nombre corto)	**Elementos que la impulsan**	**Objetivos**	**Acciones / Actividades**	**Actores involucrados / objetivo**	**Incluida ya en uP_running? (SI / NO)**
SO4 Visualizar oportunidades de biomasa de PARP para calor	S11: Proximidad consumidores calor rural S17: Periodos retorno biomasa cortos O4, O10: Calor con biomasa en ascenso (planes y nuevas redes de calor)	SO4 - Alinear a los ayuntamientos, empresas y en general, a todos los sectores implicados, para promover el aprovechamiento de PARP.	SO4.a – Visualizar la oportunidad a través de casos de estudio y demostraciones SO4.b – Difundir la factibilidad por medio de campañas en zonas de alto potencial.	- Potenciales consumidores de biomasa en zonas rurales. - Población zonas rurales con alto potencial PARP.	Sí (T6.3, T.3.3.) (T7.4, T7.5)
WO1 Visualización del potencial de PARP	W7: Desconocimiento oportunidad PARP O1: Aragón tiene alto potencial de PARP	WO1 - Mostrar a los emprendedores la elevada cantidad de PARP que existe.	WO1.a – Acciones de visualización mediante talleres, workshops, casos de éxito, etc. WO1.b – Informes técnicos públicos.	- potenciales consumidores de biomasa de PARP - público general	Sí (T.2.1., T.7.4.) No

WO6 Visualización de mecanismos de financiación	W9: Rentabilidad ajustada O14: Financiación a emprendedores	WO6 - Fomentar la realización de proyectos facilitando la viabilidad económica de las distintas iniciativas.	WO6.a – Visualizar los mecanismos de subvención disponibles a los emprendedores. WO6.b – guía de financiación para emprendedores en PARP. WO6.c – Incidencia a la administración pública para fomento de apoyos a iniciativas de PARP.	- Emprendedores y potenciales emprendedores. - Gobierno de Aragón - Partidos políticos, diputados	Sí (T.2.2., T.2.3.) (T3.2, T3.3) No (T4.3)
WO9 Fomentar la réplica de modelos exitosos	W6: Escasas instalaciones que usen PARP O9: Existen casos de éxito que utilizan PARP	WO9 - Poner en manos del sector agrícola y energético los potenciales modelos de negocio y casos de éxito para fomentar su réplica.	WO9 – Documentar modelos de negocio aplicables. WO9.b – Documentar casos en funcionamiento y claves de éxito. WO9.c – Difundir a los potenciales emprendedores.	- Emprendedores - Potenciales consumidores - Sector agrícola y energético	Sí (T2.2, T3.4, T.6.3) (T6.3) (T7.2, T7.4, T7.5)
WO10 Promoción de nuevas iniciativas pioneras en Aragón	W6: Escasas instalaciones que usen PARP O2: Hay zonas de alto potencial en Aragón	WO10 - Promover nuevas iniciativas pioneras en Aragón que utilicen biomasa de PARP.	WO10.a – Asesorar a los nuevos emprendedores en el desarrollo de proyectos de aprovechamiento de PARP. WO10.b – Asesorar sobre viabilidad económica de los proyectos.	- Emprendedores	Sí (T.3.1.)
SO5 Promoción instalaciones en zonas de alto potencial	S17: Periodos bajos de retorno. O14, O15: Financiación (emprendedores / ayuntamientos / innovación)	SO5 - Promover nuevas instalaciones en zonas de alto potencial de PARP.	SO5.a –Asesoramiento acerca de la viabilidad y oportunidades de financiación de proyectos. SO5.b – Campaña de información en zonas rurales de alto potencial y a través de grupos de desarrollo rural.	- ESEs y potenciales consumidores de biomasa en zonas rurales. - Grupos de desarrollo rural y territorial	Sí (T3.2, T3.3, T3.4, T4.2,T5.4) No

SO10 Promover el cambio de gas/gasóleo a biomasa	S17: Periodos bajos de retorno O6: Precio petróleo al alza	SO10 - Promover el cambio de gasóleo a biomasa como combustible para la generación de calor y/o electricidad.	SO10.a – facilitar ejemplos de factibilidad del cambio de gas/gasóleo a biomasa de PARP. SO10.b – Elaboración de planes de viabilidad de proyecto.	- potenciales consumidores de biomasa de PARP - ESEs	Sí (T.7.4., T.3.2., T.3.4., T6.3) No
SO7 Visualización ESEs y su trabajo	S18: Existen ESEs con experiencia en uso de PARP O8: Sellos calidad ESEs	SO7 - Visualizar a las empresas de maquinaria, servicios agrícolas y energéticos con experiencia en el uso y la gestión de la biomasa de PARP.	SO7.a – Fomentar la visualización de las ESEs con garantías para uso de PARP. SO7.b – Presentar los mejores casos de éxito de dichas ESEs. SO7.c – Desarrollar un sello de calidad como instalador de agro-biomasa	- ESEs - potenciales consumidores de biomasa de PARP	No
SO8 Fomento del uso de biomasa de PARP en sector agrícola	S4: Sector agrícola fuerte en Aragón O4, O10: Calor con biomasa en ascenso (planes y nuevas redes de calor)	SO8 – Promover el uso de la PARP en el sector agrícolas.	SO8.a - Preparación de modelos de negocio aplicables al sector agrícola. SO8.b - Campaña de diseminación de los modelos de negocio aplicables. SO8.c – Visualización de oportunidades de financiación.	- Granjas, agro-industria, agricultores - ESEs	Sí (T3.2, T3.4, T6.3) (T7.4) No
WO8 Agrupar a productores de PARP	W10, W11: Costes recolección altos O2: Hay zonas de alto potencial en Aragón	WO8 - Agrupar y alinear a los productores de residuos de las zonas de alto potencial de PARP a fin de permitir reducciones de costes.	WO8.a – Mostrar la necesidad y ventajas de asociarse para reducir costes. WO8.b – Ilustrar cómo funcionan los modelos de negocio cooperativos para recogida de PARP. WO8.c – Promover acciones de agrupación de agricultores.	- productores de residuos de PARP - Cooperativas	Sí (T7.4) (T.3.2, T.6.3) No (excepto algún caso T3.2)

LINEA DE ACCIÓN: Acciones orientadas a proponer medidas o instrumentos para el sector					
Acción objetivo (nombre corto)	**Elementos que la impulsan**	**Objetivos**	**Acciones / Actividades**	**Actores involucrados / objetivo**	**Incluida ya en uP_running? (SI / NO)**
SO3 Promover nuevas regulaciones para quemas de residuos de PARP	S4: Sector agrícola fuerte en Aragón O12: Políticas ambientales más restrictivas	SO3 – Promover una consideración especial para la quema de residuos al aire libre en siguientes políticas ambientales y reglamentos.	SO3.a – Análisis de las regulaciones que actualmente regulan o permiten las quemas. SO3.b – Campaña de incidencia de leyes o regulaciones que deben ser tratadas.	- Asociaciones y sindicatos agrícolas - Departamentos de medio ambiente y agricultura de la administración - Partidos, diputados	Sí (T2.3, T.4.3.)
WT10 Consideración de biomasa de PARP en planes y PAC.	W4: PARP no regulada T18: Usos alternativos y medidas ambientales PAC	WT10 - Promocionar que la PARP como biomasa se considere en los planes de residuos y de prácticas agro-ambientales de la PAC.	WT10.a – Revisión de medidas de condicionalidad de la PAC, y propuesta de nueva condicionalidad. WT10.b – Transferencia a sector agrícola, administración y actores políticos.	- Asociaciones de lobby agrícola - Ministerio de agricultura - Agentes de influencia en Bruselas - DG-AGRI, eurodiputados	Sí (T.4.3.)
SO9 Elaboración de un Manual de Buenas Prácticas	S16: Necesidad sacar poda O11: Nuevas políticas que influyan en la gestión de residuos (Aragón / EU)	SO9 - Fomentar la elaboración de un Manual de Buenas Prácticas por parte de la administración para ser incluido en futuros planes /normativas de residuos.	SO9.a – Redactar de un informe de buenas prácticas en el uso de biomasa de PARP. SO9.b – Trasladar dicho informe y sus principales conclusiones a la administración competente.	- Agentes el sector agrícola, institutos de I+D - Administración pública y partidos políticos	Sí (T.4.3., T.2.3.)
SO8 Planes de fomento de uso de PARP	S4: Sector agrícola fuerte en Aragón O4, O10: Calor con biomasa en ascenso (planes y nuevas redes de calor)	SO8 - Elaboración de planes de fomento de uso de PARP en el entorno rural.	SO8.a – Preparación de la propuesta de plan estratégico para fomentar el uso de biomasa de PARP (subvenciones, mecanismos de promoción, etc.). SO8.b – Campaña de transferencia a sector y actores políticos.	- Departamentos de medio ambiente y agricultura de la administración - Partidos, diputados - Sector agrícola y energético	Sí (T.4.3.)
WO5 Mayor	W4: PARP no regulada W14,W15,W16: PARP	WO5 - Promocionar PARP para que sea considerada en los	WO5.a – Revisión de políticas y reglamentos de EERR que	- Departamentos de industria y energía de la	Sí (T.4.3.)

consideración de PARP en planes y normas	generalmente no considerada en planes O4, O10: Calor con biomasa en ascenso (planes y nuevas redes de calor)	planes energéticos y regulaciones del sector.	condicionan el uso de la biomasa, y referencia a biomasa de PARP. WO5.b – Transferencia de reglamentos y políticas que podrían contener referencias específicas a la PARP.	administración - Partidos, diputados - Sector energético	
WO7 Medidas de control para evitar malas prácticas en el uso de PARP	W14: Escasas medidas de control O12: Políticas ambientales más restrictivas O13: Regulaciones más estrictas en emisiones de GEI	WO7 - Evitar malas prácticas en el uso de PARP susceptibles de elevar los niveles de contaminación.	WO7.a – Identificación de malas prácticas que la administración debe vigilar (quemas al aire libre, quema de maderas con barniz, emisiones de partículas, etc.) WO7.b – Transmisión a las autoridades competentes y agentes políticos	- Departamentos de industria y energía de la administración - Partidos, diputados - Sector energético	Sí (T.4.3.)
WT4 Promover competencia justa en la prestación de servicios agrícolas	W9: Rentabilidad ajustada W14: Escasas medidas de control T14: Economía sumergida	WT4 - Promover un marco de competencia más justa para las empresas de servicios agrícolas que asegure competitividad en recogida de PARP	WT4.a – Identificar malas praxis en la prestación de servicios a terceros en la recogida de biomasa de PARP. WT4.b – Preparación de informe para administración con medidas aplicables.	- Departamentos de agricultura - Autoridades competentes - Partidos, diputados - Sector agrícola	No
WT2 Regulación propia para la biomasa de podas y arranques	W4: PARP no regulada T5,T6: Directivas emisiones calderas más restrictivas T7: No regulada, sin estandarización	WT2 - Conseguir medidas y regulación propias para la PARP (no como madera forestal)	WT2.a – Identificación de directivas y normativas que pueden afectar el uso y clasificación de la PARP. WT2.b – Transmisión de alarma de elementos que pueden condicionar el uso futuro de la biomasa de PARP si no se recoge apropiadamente en nuevas normativas.	- IDAE - Ministerio Industria - Agentes sector energético en Bruselas - DG-EN	Sí (T2.4, T.4.3.)

LINEA DE ACCIÓN: Acciones orientadas a aplacar barreras de tecnología y del mercado de la biomasa					
Acción objetivo (nombre corto)	Elementos que la impulsan	Objetivos	Acciones / Actividades	Actores involucrados / objetivo	Incluida ya en uP_running? (SI / NO)
WO3 Desarrollo de nuevas tecnologías de recogida y tratamiento de PARP	W1: Maquinaria de recogida poco especializada W2: Escasa experiencia en el astillado de podas agrícolas O16: Financiación a la innovación	WO3 - Promover el desarrollo de tecnologías de tratamiento adecuadas a los modelos de negocio para uso energético de la biomasa de PARP.	WO3.a – Identificar carencias técnicas en la maquinaria de recogida y tratamiento existente. WO3.b – Promover la iniciativa innovadora en empresas del sector.	- Fabricantes de trituradoras, astilladoras o empacadoras - Centros tecnológicos y universidades	No No
WO11 Desarrollo de nuevas tecnologías de combustión de PARP	W5: Tecnologías de combustión de PARP escasas O16: Financiación a la innovación	WO11 - Promover el desarrollo de tecnologías de combustión preparadas para el uso de PARP.	WO11.a – Identificar necesidades de desarrollo en los equipos de combustión para uso adecuado de biomasa de PARP. WO11.b – Promover la iniciativa innovadora en empresas del sector.	- Fabricantes de calderas - Centros tecnológicos y universidades	No
WT9 Desarrollo de nuevos sistemas de limpieza de gases	W5: Tecnologías de combustión de PARP escasas T5,T6: Directivas emisiones calderas más restrictivas	WT9 - Promover el desarrollo de nuevos sistemas de limpieza de gases.	WT9.a – Fomentar y promover la I+D. WT9.b – Fomentar las subvenciones a la instalación de dichos sistemas.	- Fabricantes de calderas y de equipos de limpieza de gases - Centros tecnológicos y universidades	No
ST3 Promoción de calderas policombustible	S12: Calderas flexibles pueden usar PARP y otras biomasas T18: Usos alternativos y medidas ambientales PAC	ST3 - Promocionar la instalación de calderas policombustible para aprovechamiento energético de PARP.	ST3.a – Recopilar las tecnologías de caldera disponibles. ST3.b – Campaña de promoción del uso de calderas policombustible.	- Fabricantes. - ESEs, potenciales consumidores de PARP - Sociedad en general en zonas de alto potencial	No Sí (T.7.4.)

WT8 Promover del uso de PARP en grandes instalaciones	W3: Biomasa de PARP de calidad menor y variable T5,T6: Directivas emisiones calderas más restrictivas	WT8 - Acercar biomasa de PARP a grandes consumidores a fin de generar una demanda permanente.	WT8.a – Acercar a los grandes consumidores las propiedades de la biomasa de PARP. WT8.b – Promover pruebas demostrativas de uso de biomasa de PARP en grandes equipos de combustión.	- Grandes consumidores de biomasa. - Sociedad. - Productores de residuos.	Sí (T3.1, T3.2) (T.3.3)
WO4 Desarrollo de un mercado para uso de PARP	W12: No hay suficiente mercado de biomasa O6: Precio petróleo al alza O4, O10: Calor con biomasa en ascenso (planes y nuevas redes de calor)	WO4 – Activación de un mercado estable para el aprovechamiento de PARP.	WO4.a – Búsqueda de potenciales consumidores de biomasa de PARP. WO4.b – Creación de una red de suministradores y consumidores de biomasa de PARP.	- Consumidores de biomasa interesados en usar biomasa de PARP - Proveedores de biomasa - Sector agrícola (productores del residuo) - Cámaras de comercio	Sí (T.3.1., T.3.2.)
WT3 Promoción de servicios agrícolas con sello de garantía para distribución de PARP	W9: rentabilidad ajustada T14: Economía sumergida	WT3 - Promoción de servicios agrícolas con sello de garantía para distribución de PARP	WT3.a – Identificar empresas de servicios interesadas o ya prestando servicios de recogida de biomasa de PARP. WT3.b – Visualización de las empresas que realizan dichos trabajos bajo las condiciones de competitividad adecuadas.	- Empresas de servicios agrícolas - Sector agrícola (productores del residuo) - Intermediarios y consumidores de biomasa de PARP	Si (T.7.4., T.7.3)

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Un total de 4 talleres han sido realizados en Fraga, Barbastro y Valjunquera entre abril y junio de 2016. En dichos talleres se contó con la presencia de agricultores, cooperativas y agroindustria del sector oleícola, vitivinícola y frutícola, empresas de servicios agrícolas, fabricantes de maquinaria de procesado de biomasa, instaladores de calderas y empresas de servicios energéticos, ayuntamientos, responsables de desarrollo y medio ambiente de las comarcas, grupos de acción local, y potenciales consumidores de biomasa (agroindustria, ganaderos y empresas integradoras de porcino, administraciones públicas, entre otros). A todos ellos queremos dar nuestro agradecimiento por su participación activa.

A lo largo de la Tarea T3.1 (selección de beneficiarios)se han mantenido múltiples contactos con agricultores, empresas y ayuntamientos emprendedores, así como con otros agentes del sector. Si bien el propósito de dichos encuentros ha sido analizar las condiciones para lanzar nuevas cadenas de aprovechamiento de biomasa de PARP, el diálogo ha servido para recabar ideas y datos que se han incorporado al presente documento. Se agradece aquí la visión aportada por todos ellos.

A fecha de 23 de Febrero se realizó una visita a Vilafranca del Penedés, junto con varios agentes del sector aragoneses, con el fin de conocer mejor dicha iniciativa. Se agradece al Ayuntamiento de Vilafranca del Penedés, en concreto a D. Jordi Cuyás (responsable de Proyectos Estratégicos) y a Dña Laura Carbo (Técnico de Medioambiente) la acogida. Sus impresiones, así como las de los asistentes, se han tenido en cuenta para el presente análisis. Agradecemos además a Bodegas Torres, Nou Verd, y Monreser S.L. por compartir sus puntos de vista.

Así mismo se han desarrollado una serie de entrevistas con agentes concretos que han facilitado su visión sobre las barreras, oportunidades, marco regulatorio y financiero, y necesidad de acciones para promover el uso de la biomasa de PARP. A todos ellos queremos dar las gracias, y hacemos mención explícita en la siguiente tabla de agradecimientos.

Agradecimientos		
Persona/Departamento	Entidad	Rol actual respecto a la biomasa de PARP
Departamento de Biomasa y Residuos	IDAE - Instituto para la Diversificacion y Ahorro de la Energía (Madrid).	Financiación, visión de la administración central
Pablo Rodero Masdemont	AVEBIOM - Asociación Española de Valorización Energética de la Biomasa (Valladolid)	Representación de agentes del sector biomasa
María José Murciano	REDR - Red Española de Desarrollo Rural), Madrid (Madrid)	Tercer sector, intereses de zonas rurales.
Juan de Dios Escolar / Responsable de cultivos energéticos	Forestalia Renovables (Zaragoza)	Potencial consumidor de biomasa
Sergio Breto Asensio / Jefe de Servicio de Planificación Energética	Gobierno de Aragón (Zaragoza)	Redacción planes energéticos Aragón
Hector Filloy Viver	Servicios agrícolas Filloy-Viver (Mazaleón)	Empresa de servicios agrícolas

ANNEX B1

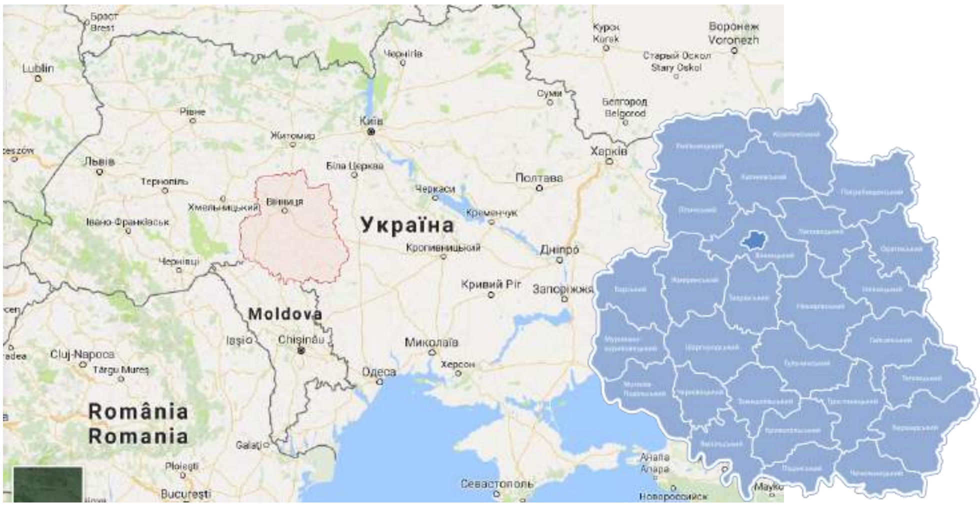
WP2 - TASK T2.2

Performing an APPR Sector Analysis and Developing an Action Plan for the Demo Regions Vinnytsa (UKRAINE)

Contents of the document

A.General Information on Vinnytsa Region (Regional framework on APPR)

Vinnytsa region is located in the center of Ukraine and has population of 1.6 mln people (2016 p.). It occupies almost 4.5% of the territory of Ukraine and has 27 districts (Picture 1). Vinnytsa region belongs to forest-steep climatic zone. The soil is mostly podzolic (near 65%). In the northern east of the region, there is mostly black soil, in the central part – grey, dark-grey, light grey, in the southern east – deep black soil and podzolic soil. Arable land occupies over 70% of whole region. Climate is continental, average temperature of January−5°C, of July +20°C; annual rainfall: 520–590 mm, 80% of them fall in the warm season [1].



Picture 1. Vinnytsa region of the map of Ukraine

Gardening has important role for the region, it is the leader in growing pomaceous fruit: in 2015, agricultural enterprises produced 152.71 th. t on 11.4 th. ha which is almost 41% of the gross collection in the country (table 1) [2], whereas the share of plantations in production phase was 27%. Majority of the plantations are under apple trees (94% of pomaceous), among stone fruits they have plum, cherry and sweet cherry. About 300 enterprises involved into fruits growing represent 56% of agricultural enterprises of the region with over 10 th. employees [3].

Companies in majority plant intensive orchards using rootstock (dwarf and semi-dwarf type) due to its higher productiveness and growth temp. Households mostly operate with old fashion technology characterized by high wooden mass of a tree and lower pruning frequency.

Sheet 1. Overall indicators of horticulture in Vinnytsia region, Ukraine

	Ukraine	Vinnytsia region	% of Vinnytsia region
All types of producers			
Area of fruit plantations in productive phase, th. ha, including:	186,2	22,9	12,3 %
pome fruits	111,2	19,5	17,5 %
stone fruits	62,4	2,8	0,05 %
Gross yield of fruits, th. tons, including:	2022,7	283,4	14,0 %
pome fruits	1360	254,3	18,7 %
stone fruits	547,6	23,3	4,3 %
Agriculture legal entities (producers except households)			
Area of fruit plantations in productive phase, th. ha, including:	54,5	12,0	22 %
pome fruits	42,2	11,4	27 %
stone fruits	11,5	0,6	5 %
Gross yield of fruits, th. tons, including:	400,0	157,4	39,4 %
pome fruits	374,6	152,7	40,7 %
stone fruits	25,4	4,6	18,1 %

B. Regional potential of the APPR availability (in Vinnytsia region)

For the moment, any precise research on APPR fuel biomass perspective has not been done in the region. Both companies and farming households never had done any measurements due to a lack of demand. Theoretically, considering intensive technology among enterprises, fruit orchards produce 4.76 t of APPR in average [4], estimated potential amount of APPR, which applicable for energy purpose may be valued at 51.4 th. t per year[1]. Complementary, APPR biomass potential in households counted for some 21.6 th. t (pruning residues evaluated at the level of 2.2 t/ha [5]).

Overall theoretical potential of APPR residues from pome and stone cultures in Vinnytsia region accounts for 73 th. t per year that is equal to 25 ktce[2]. For comparison, energy potential of other types of wooden fuels (firewood for heating, forestry residues and wood processing residues) accounts to 68.9 ktce (2014) [6].

Certain part of plantations requires uprooting due to decreased productivity level of trees. However, there is no data on amount of ha with plantations to be uprooted.

Energy saving and bioenergy is one of the priorities mentioned in the Strategy for sustainable development of Vinnytsia region till 2020 (proved by the Council of Vinnytsia region on 24th of June, 2015) [1]. Nowadays, 370 boilers on solid biofuel with 125 MW are in operation in Vinnytsia region providing heating power to municipalities, households, industry and public sectors [7]. APPR biomass is not highlighted separately in the Strategy.

Companies and farmers do not consider APPR biomass as commercial product. Such type of biomass mainly burned on open air or stored on border sides of the plantations. In some cases farmers use APPR wooden biomass as fuel for theirs own energy purposes, as farmers believe that supply chains of such biofuel is too complicated and has low return considering cost of processing.

[1] The coefficient of technical availability for residues accepted at the level of 0.9

[2] Conversion to the coal equivalent by the LHV of residues 10 MJ/kg (natural moisture)

C. Vinnytsia region prospect of APPR wooden biofuel usage implementation in energy industry

Different types of companies may be involved into new APPR biofuel supply chain: agriculture companies, farmers, producers and distributors of equipment for horticulture and energy industry, biofuel boiler facilities servicing one client, municipal boiler facilities supplying energy to municipal organizations. The region has lack of service companies providing harvesting, cutting and transportation of APPR residues (they practically do not exist). There are just a few companies, which offer services in uprooting.

Due to commonly small areas under fruit plantations, successful development of service business in APPR residues supply chain using economic basis of agriculture companies (farmers) possible in form of service cooperation for making real mutual investments in machineries and equipment.

Some municipal companies already possess required equipment and machineries for chipping and transportation complemented with storage facilities for APPR biomass logistics. Such companies operate in processing of other types of wooden biomass, and thus, able to expand theirs business models to APPR biomass sub-segment. Produced biomass can be commercialized in wooden chips, granules/briquettes.

These models of APPR biomass value chain organization (building a service company based on farmers' cooperation or expanding of municipal companies) are most expected in the nearest perspective. Recently, usage of APPR biomass becomes popular among farmers for their own energy purposes due to obvious cost saving benefits [8].

D. Barriers, obstacles and factors of APPR's wooden biofuel usage development in energy industry

Main barriers and obstacles in starting new business in harvesting, sales and usage of APPR's residues for energy production purpose:

Technical and organizational

- Farmers need in additional machineries;
- Poor practice of APPR residues harvesting considering landscape dimensions and parcel size;
- Complexity of efficient supply chain organizations in aspect of sufficient returns;
- Necessity in technology compliance considering APPR's residues harvesting process to meet moisture and ash requirements;
- Poor volumes of wooden residues in hands of one farmer or company;
- Lack of expertise in organization and management of APPR's residues logistics chain in local areas;
- Poor infrastructure in regions (storage and transportation facilitates).

Economic and financial

- High price of technological machineries for harvesting and APPR's residues processing;
- Lack of own finance among farmers to invest in new machineries;
- High credit cost;
- High prices of ready biofuel.

Legal

- Administrative barriers of APPR originated wooden chips sales;
- Monitoring and prevention of APPR's fires caused by arson;
- Lack of public standards for hard fuels.

Cultural

- Lack of common vision and collaboration, complexity of activities coordination among all actors in APPR's value chain;
- Lack of will among farmers to develop service cooperatives due to poor transparency;
- Conservative mentality of farmers and poor will to build up new business;
- Fears of farmers about high complexity in storing , logistics and processing of APPR's biofuel;
- Lack of information in local communities about prospect cost saving benefits;
- Poor knowledge about commercialization of APPR's residues among farmers;
- Lack of information on fuel characteristics of APPR's residues; refusal among certain customers to use soft types of trees due to information about its low quality as fuel;
- Myth that harvesting of APPR's residues is costly operation due to high price of diesel;
- Lack of knowledge among farmers on market price for theirs own APPR's residues and its volumes produced in orchards.

Structural

- Underdeveloped and not transparent market of biofuel;
- Competition with black firewood market demolishing any price competition in the industry;
- Poor knowledge among local authorities, lack of quality in planning and execution of development projects for local areas;
- Lack of servicing companies which provide assistance in harvesting, grinding and transportation of biomass;
- Public monopoly in supply of wooden biofuel to existing customers;
- Competition for biofuel customers among SMEs producers and public municipal companies.

In accordance to survey conducted in form of interview among different categories of beneficiaries, major barriers that prevent effective supply chains development in APPR's residues logistics are:
farmers marked lack of own finances and poor access to external capital; lack of demand for wooden biofuel; complexity of supply chain in energy industry; poor infrastructure and regulatory policy (to motivate usage of local types of fuels and support farmers to utilize own wooden residues for energy purposes). Other perspective stakeholders (in particular, experts in bioenergy industry) add to mentioned above list factor of poor local planning for energy development and agricultural industry the same as lack of local expert communities.

Main drivers may be:

- Optimization costs for biofuel originated from APPR's residues;
- High level of returns both in meeting own demand and in sales of ready wooden biofuels;
- Stable prices and demand for biofuels on market, long term contracts;
- Existence of customers for biofuels originated from APPR's residues;
- Existing of pilot projects and successful examples;
- Increase of knowledge on prospect benefits from usage of APPR's among interested sides and potential customers;
- Communities' interest in implementation of energy systems on local biofuel;
- Supporting policy of regional development;
- Attracting service companies in the beginning of market development;
- Discounts for acquisitions of new machineries;
- Coordination in cooperation among actors APPR's supply chains;
- Building up of new jobs.

Most value adding drivers able to stimulate development of efficient chains, in accordance with potential actors, are economic benefits: short-term returns; market incentives – high margins for biomass, stable prices for biofuels and long-term contracts. Additionally, based on valued added factor, knowledge sharing is important one. Experts in bioenergy add development supporting regulatory policy.

E. Regulation and promoting initiatives from the side of policy makers

Wooden biomass, originated from uprooting of orchards' plantations, classified as residues of fruits productions in agricultural industry [9]. Legal regulatory framework for them is provided by laws of Ukraine: "On residues", "On provision of sanitary and epidemiological wellbeing among people", "On environmental safety" and others. Certain list of regulatory acts regulates responsibility of inappropriate APPR's biomass management, particularly in aspects of open air burning of wooden horticulture residues, e.g. Administrative Code of Ukraine and Criminal Code of Ukraine. APPR's biomass utilization in energy industry regulated by laws of Ukraine, such as: "On alternative fuels" and "On alternative sources of fuels". All legal regulatory acts build complex judicial structure with diversified legal power [10].

Law of Ukraine "On residues" [11] imposes legal duties of wastes production and increase prevention on agriculture law's subjects; conduct bookkeeping, determine content and properties of produced horticulture residues, provide overall storing, proper storing conditions and prevention of damaging or destruction; provide utilization or removal; prevention of storing, utilization or processing in not prescribed specially equipped places, exchange information on producing residues and wastes with a government, to request and to obtain permit, limits for generation and localization of residues and other duties. Imposing long list of duties on subjects of business cause misbalanced comply with requirements, whereas current law execution control duties division among local, regional and special governmental bodies causes overlaps and gaps in control.

According to definitions of such terms as biomass and biofuel mentioned in Law of Ukraine "On alternative fuel types" [12], wooden biomass may be used as biofuel. Producers and distributors of bio-typed fuels, according to existing law, required to possess confirming documents of at least: a protocol of testing /comply certificate of biofuel; technical requirements of biofuel production.

Under certain circumstances buyer of biofuel may request from a distributor Confirmation certificate on biofuel comply with requirements to alternative fuels (for example, in future, in case of enforcement of stimulating mechanisms of alternative fuels usage to produce heating power). Such certificate may be issued by the State Agency of energy efficiency and energy saving of Ukraine (the Agency). To obtain such a certificate applicant (fuel producer) has to obtain expert summary by testing laboratory which accredited certificate issued by the Certification System UKRSEPRO [13]. Based on such expert summary, the Agency issues mentioned above certificate.

Due to poor market organization and even under circumstances of existing laws of Ukraine "On residues and wastes" and "On alternative fuels" creating legal framework for residues utilization, farmers and companies often choose to manage produced wastes and residues on their own way which often also illegal.

F. Finance, market and final energy users

Development of energy purposed utilization of APPR’s biomass requires large investments originated from actors of potential value chain (look at point C) which are farmers, municipal companies and service business. Investments value highly depends on each individual logistical solution, chosen machineries and mechanization level. Agricultural company or farmer able to invest in such machineries as disc grinder with middle capacity or to invest in movable grinder installed on vehicle with a bunker and transportation machine, for example a tractor. In this case, investments may be valued at 1100-1500 thousand UAH. In case of service company development via funding new business and investments in new grinder, an investment value may be estimated at 13000 thousand UAH [14].

In general, the region of Vinnytsia possess a potential of organization highly efficient value chains in supply of APPR’s biomass as residues almost don’t utilized by farmers and storing volumes constantly increase, infrastructure of the region is developed enough for APPR’s subsector growth, thermal energy subsector grows. As for remark, numerous list of wooden chips and granules exporters located in the region of Vinnytsia caused by localization of large number of wood processing companies. The region is a third one in Ukraine in exporting straw granules [15].

Major types of biofuels that producible out from APPR’s wooden residues, are chips, pellets and briquettes (value of such biofuels increases caused by inflation and demand growth). Thus, in average, a price for wooden chips ranged within 300-1000 UAH per a ton for five years passed, pellets’ prices changed 990-2440 UAH per a ton (with VAT tax and no logistics cost added). Price of pellets and briquettes’ prices varied from 1000 to 2000 UAH per a ton. Price of pellets and briquettes produced out from wooden biomass highly depends on foreign exchange rates due to export orientation [16].

Prospect suppliers and distributors of biofuels originated from APPR located within the region in large number and evenly (300 agricultural entities presented in the region and operate in horticulture [3]).

Existing boiler facilities operating on biofuels, servicing individual clients and municipal objects, also presented evenly in the region (image 2). Thus, under condition of service business development, competitive market may be created. Currently major suppliers of biofuels in form of firewood and chips are public state owned forestry management companies (subordinated to the State Agency of forestry resources) and specialized forestry management company “VINOBLAGROLIS” (subordinated to the Supreme Council of Vinnytsia Region). These companies supply wooden fuels for municipal company “VINNYTSIAOBLENERGO” (27 boiler houses) and “VINNYTSIAMISKTEPLOENERGO” causing oligopoly in market. Boiler houses supplying heating energy to industrial facilities operate mostly with own wooden residues originated from wood processing companies, oil and fat industry and other). Certain customers of wooden biofuel possess equipment to test quality (moisture and weight testing), others require a certificate from a laboratory. Mainly, due to direct commercial agreements, origination of raw and biomass are not controlled, whereas existing law does not require sustainable development [17].

Firewood is one of types of wooden fuels used widely among households (14.4 thousand tons of firewood utilized in the region of Vinnytsia during 2014 and 11.8 out of 14.4 utilized by households) [2]. As for today, certain part of APPR residues supplying to households as firewood. An average price for firewood originated from state owned companies range within 420-600 UAH per a ton for soft types of tree, and 495-650 for hard types of trees [16].

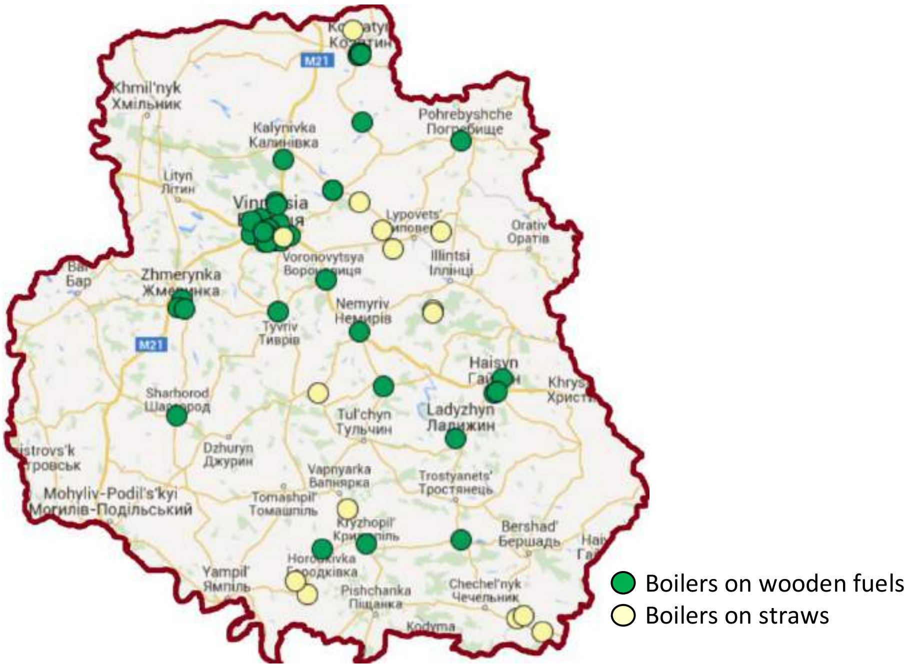


Рис. 2. Distribution of biofuel consumers in the region of Vinnytsia

G. Overall SWOT analysis

SWOT analysis

	Positive factors	Negative factors	
Internal factors	**Strenthes** Agriculture • Large potential of APPR in the region; • Availability of own raw resources; • Availability of large amount of customers. Bioenergy • Lack of competition in the market of biofuel's raw; • Sufficient experience in utilization of wooden chips as biofuels; • Positive dynamics of bioenergy industry development devoted to local authorities' efforts. Machineries producers • Access to national producers of equipment for wooden biofuels utilization; • Access to national and international producers of equipment for harvesting and accumulation of APPR's biomass. Commerce • Developed infrastructure in the region; • Experience of biomass fuels supplies to existing wooden fuel boiler facilities; • Large list of wooden chips and briquettes producers; • Access to large amount of potential suppliers of wooden APPR's biomass.	**Weaknesses** Agriculture • Complexity of value chain organization; • Low willingness to start new business; • Poor experience in logistics of residues, knowledge required in value chain development; • Additional machineries required; • Lack of access to external capital; • Required legalization of APPR's residues commercialization in form of wooden biofuels. Bioenergy • Lack of long-term contracting practice in biofuels supplies; • Lack of proved methodologies for biofuels qualities testing; • Lack of required equipment for raw quality monitoring. Machineries producers • High prices for machines with fully automated collecting and harvesting of APPR's residues biomass. Commerce • State monopoly for biofuel supplies to municipal and regional boiler houses; • Lack of knowledge in efficient value chain organization; • Lack of expertise community; • Insufficient volumes of raw biomass in individual company; • Competition with black market of firewood; • Competition for existing customers.	Internal factors

External factors	**Opportunities** Agriculture • Business diversification via building up new business in APPR management; • Service business coop building; • Provide services on firewood management; • Provide services on wastes management; • Wooden residues utilization for own energy purposes. Bioenergy • Supplies channels diversification; • Competition with other types of wooden biofuels to cut costs. Machineries producers • Increase of machineries offer on Ukrainian market. Commerce • Development of internal biofuels market; • Development of sub and cross industries in the region; • Creating new jobs in the region; • Biofuels market development based on service business development.	**Threats** Agriculture • Provide stable deliveries of biofuels; • High cost of ready fuels. Bioenergy • Instable quality of biofuel originated from APPR's biomass; • Reorientation of biomass suppliers from biomass production to biomass utilization, or to another more routine activities; • Sharp price changes. Machineries producers • Lack of experience in management of energy machineries, machineries for harvesting and processing, grinding of APPR. Commerce • Underdeveloped market of biomass as fuels with poor transparency; • Competition for biofuels consumers among small producers and state owned monopolies; • Lack of biomass resource near boiler facilities.	External factors
	Positive factors	Negative factors	

2.2 ACTION PLAN

ACTION PLAN TABLE

* Time framework to implement actions and measures (short term: up to the end of a project; middle term: in the end of a project; long term: soon after the end of a project)

Strategies/ Aimed type actioins	SWOT analysis components	Goals	Actions / measures	Stakeholders	Included to action plan "uP_running" (yes / no)	Time frames*
SO = Strenghts + Opportunities **Organization of new value chain based on existing companies**	**S:** • Sufficient experience in utilization of wooden chips as biofuels; • Availability of large amount of customers **O:** Supplies channels diversification.	Involvement of existing customers and companies operating in processing of other types of wooden biofuels to new supply chain of APPR	Founding and development of demo supply chain of APPR's biofuels utilization based on existing customers and state owned companies that nowadays operate in processing of other types of wooden biofuels. (state owned forestry agencies, municipal companies).	Farmers, boilers operating on biofuels, biofuels suppliers.	yes (in the project's framework)	Short-term
SO = Strengths + opportunities Organization of new value chain of APPR supply	**S:** Large potential of APPR in the region; **O:** Diversification of businesses' models via founding new businesses in APPR's value chains.	Founding new examples of cooperation among farmers and agri holdings. Incentives for implementation and development of full supply chain. Research for new solutions for widely known commitments.	Exchange of innovative projects results, new business ideas, and R&D results via practical cooperation. To look for potential partners of the project, best practices to follow, and financing options.	Key actors within stakeholder's network + prospect allies + external allies in aspect of APPR's value chain.	yes	Mid-term
WO = Weaknesses + Opportunities **Organization of**	**W:** • Complexity of supply chain organization; • Poor experience in logistics of residues, knowledge re-	Choose the best business model and its optimization (harvesting, processing, logistics, storing) from a	Valuation of business tech-business indicators of new supply chain introduction. Marketing researches for founding new business.	All interested sides linked to the project. The aim is to switch an idea into successful practice.	yes	Short-term

Strategies/ Aimed type actioins	SWOT analysis components	Goals	Actions / measures	Stakeholders	Included to action plan “uP_running” (yes / no)	Time frames*
new value chain of APPR supply	quired in value chain development. **O:** Business diversification via building up new business in APPR management.	field to a customer.	To build up efficient communication linkages among actors of supply chain.			
SO = Strengths + Opportunities Increase of information access and trust;	**S:** Availability of large amount of customers; Positive dynamics of bioenergy industry development devoted to local authorities’ efforts. **O:** Development of internal biofuels market; Development of sub and cross industries in the region.	Strengthening of awareness, understanding and trust among all actors of APPR’s biofuels supply chain (farmers, companies, policy makers).	Founding real and perspective stakeholders network and its development to a form operational group that would cooperate on regional level.	Key actors within stakeholders network	yes (partially)	Mid-term
WO = Weaknesses + Opportunities **Building up expertise community**	**W:** • Poor experience in logistics of residues, knowledge required in value chain development; • Lack of expertise community. **O:** • Business diversification via building up new business in APPR management; • Biofuels market	To conduct trainings of professionals on technical subjects of APPR’s biofuels utilization (technical, business and organizational aspects). A group of trained individuals has to remain active also after finalization of the project.	To shape technical team that will produce services to companies operating in APPR’s biomass management.	Professionals and consultants, who aimed to obtain knowledge and experience in increase of value added of APPR’s residues biofuel products.	yes (partially)	Short term

Strategies/ Aimed type actioins	SWOT analysis components	Goals	Actions / measures	Stakeholders	Included to action plan “uP_running” (yes / no)	Time frames*
	development based on service business development.					
ST = Strengths + Threats **Teaching farmers**	**S:** • Access to national producers of equipment for wooden biofuels utilization; • Sufficient experience in utilization of wooden chips as biofuels; • Access to large amount of potential suppliers of wooden APPR’s biomass, the same as customers. **T:** • High cost of ready fuels; • Instable quality of biofuel originated from APPR’s biomass; • Lack of experience in management of energy machineries, machineries for harvesting and processing, grinding of APPR.	Increase a level of knowledge on organization and technical aspects of APPR’s biofuels supply chains development. Incentives of biofuels production with strictly comply to technological requirements.	To shape training materials on aspects of harvesting organization, initial processing of APPR’s wooden biomass to further commercialization. Sharing and explaining benefits originated from long-term contracts and models of obtaining permissions for production of biofuels (technical requirements).	Farmers, agri companies willing to start business in harvesting, processing and commerce of APPR’s residues	yes (partially)	Mid-term
ST = Strengths + Threats **Lobbying and advocacy**	**S:** Positive dynamics of bioenergy industry development devoted to local authorities’ efforts. **T:**	Involvement of regional and municipal authorities that influence decision process at policy level to promote actions and	Public and transparent lobbying intended to overcome barriers and circumstances that harm founding of new APPR’s supply chains.	Most influential actors of stakeholders network via local / regional opinion leaders	yes	Short term

Strategies/ Aimed type actioins	SWOT analysis components	Goals	Actions / measures	Stakeholders	Included to action plan "uP_running" (yes / no)	Time frames*
	• Reorientation of biomass suppliers from biomass production to biomass utilization, or to another more routine activities; • Competition for biofuels consumers among small producers and state owned monopolies.	measures of APPR's biofuels utilization development lobbying. Measures have to be directed to overcome barriers related to obtaining permissions, poor administrative processing, and stable supply guaranties.	Actions called to obtain support and approval of policy makers and public opinion: Aid in replacement of fossil resources in locations of APPR's biofuels concentration, administration burden facilitation for farmers and potential customers for biofuels. Prevention and demolishment of wooden biofuels black market.			
WO = Weaknesses + Opportunities **Informational campaign**	**W:** • Low willingness to start new business; • State monopoly for biofuel supplies to municipal and regional boiler houses. **O:** • Business diversification via building up new business in APPR management; • Biofuels market development based on service business development.	Increase of informational transparency on prospect benefits in energy-purposed utilization of APPR's biomass as among farmers, the same among potential customers.	Wide spread of information on the project to build up positive image among all interested stakeholders, potential actors and local communities' members. Development of information on fuel properties and its distribution	Key actors within stakeholder's network.	yes	Short term
WO = Weakness + Oppor-	**W:** • Lack of required equip-	To research opportunities for development of limited	To shape aid group of key actors of APPR's together	Key actors of APPR's industry + financial	no	Mid-term

Strategies/ Aimed type actioins	SWOT analysis components	Goals	Actions / measures	Stakeholders	Included to action plan "uP_running" (yes / no)	Time frames*
tunities **Financing**	ment for raw quality monitoring; • Lack of access to external capital. **O:** • Founding service cooperative; • Services on APPR's residues management.	investment capacities that observed among farmers and entrepreneurs in APPR's biofuel subsector.	with consultants possessing an experience in involvements of state financing, privileged credits and others. Information of entrepreneurs about financing options will allow an increase of chances to invest at least with partial exploitation of privileged products.	consultants + authorities.		
ST = Strengths + Threats **Development of commodity exchange or logistics/trade centers**	**S:** • Lack of competition for APPR's biomass; • Positive dynamics of bioenergy industry development devoted to local authorities' efforts. **T:** • Instable quality of biofuel originated from APPR's biomass; • Underdeveloped market of APPR's biomass and lack of trust.	Founding of logistics centers network and regulated commodity exchange as trade platform for all types of wooden biofuels.	To shape target group including key actors of APPR's industry. Involvement of state authority that regulates bioenergy and heating energy production industries. Research and development of commodity exchange model (involving all stakeholders). Implementation in the region.	Key actors of APPR's industry + consultant + authorities.	no	Long term

Strategies/ Aimed type actioins	SWOT analysis components	Goals	Actions / measures	Stakeholders	Included to action plan "uP_running" (yes / no)	Time frames*
WT = Weakness + Threats **Alternative production**	**W:** Lack of long-term contracting practice in biofuels supplies. **T:** High cost of ready wooden biofuels.	Research and development of innovative technical solutions to increase economic value added for APPR's biofuels.	Research of perspectives in APPR's biomass utilization to produce alternative products as bio composites, bio filters, manure and others.	All actors interested in joining the project. The aim is to switch an idea into successful practice.	no	Long term

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NAME	COMPANY	APPR's supply chain role
Havryshok Serhii Vasylovych	SVAROG	Agri company (fruit horticulture)
Kekuh Sviatoslav Ivanovych	Farmer, entrepreneur	Farmer (fruit horticulture)
Harchuk Lilia Ivanivna	COOPERATYVNYI SAD «UROZHAI»	Agri company (fruit horticulture berries production)
Inna Semerog	Farmer, entrepreneur	Farmer (fruit horticulture)
Viktor Kobetc	UKRANISKYI PELETNYI SOUZ	Association of pellets and granules producers
Danylova Nikol Viktorivna	UKRANISKYI PELETNYI SOUZ	Association of pellets and granules producers
Heletuha Georgii Georgiiovych	NGO «BIOENERGETYCHNA ASSOTSIATSIA UKRAINY»	Bioenergy association
Matveev Jurii Borysovych	NGO «RENEWABLE ENERGY AGENCY»	NGO in renewable energy
Volodymyr Kramar	LLC «BIOMASA-KARBON»	Bioenergy engineering company
Evgeny Oleynik	NGO «BIOENERGETYCHNA ASSOTSIATSIA UKRAINY»	Bioenergy association
Iryna Gnap	LLC «Salics Energi»	Service company operating in growing energy crops
Serhii Zibcev	National University of life and environmental sciences of Ukraine	Bio resource scientist
Bilous Andrii Myhailovych	National University of life and environmental sciences of Ukraine	Sustainable bio resources scientist
15 responders representing diversified sub sectors as agriculture, bioenergy and science have took its party in conducted sector analysis to develop action plan.		

ANNEX B2

АНАЛІЗ СЕКТОРУ ВИКОРИСТАННЯ ВІДХОДІВ ВІД ОБРІЗКИ ТА ВИДАЛЕННЯ БАГАТОРІЧНИХ НАСАДЖЕНЬ (ОВБН) В ЕНЕРГЕТИЧНИХ ЦІЛЯХ У ВІННИЦЬКІЙ ОБЛАСТІ

A. Загальна інформація про Вінницьку область (Регіональні особливості утворення відходів ОВБН)

Вінницька область — область у Центральній Україні з населенням 1,6 млн. осіб (2016 р.). На заході межує з Чернівецькою та Хмельницькою, на півночі — з Житомирською, на сході — з Київською, Кіровоградською та Черкаською, на півдні — з Одеською областями України та з Республікою Молдова. Область займає майже 4,5% території України та поділяється на 27 районів (Рис. 1). Вінницька область лежить у межах лісостепової зони. Ґрунт в основному опідзолений (близько 65%). На північному сході області переважають чорноземи, в центральній частині — сірі, темно-сірі, світло-сірі, на південному сході — глибокі чорноземи і опідзолені ґрунти. Понад 70% території області зорано. Клімат Вінниччини помірно континентальний, середня температура січня: −5°C, середня температура липня: +20°C; річна кількість опадів: 520–590 мм, з них 80% випадають в теплий період [1].

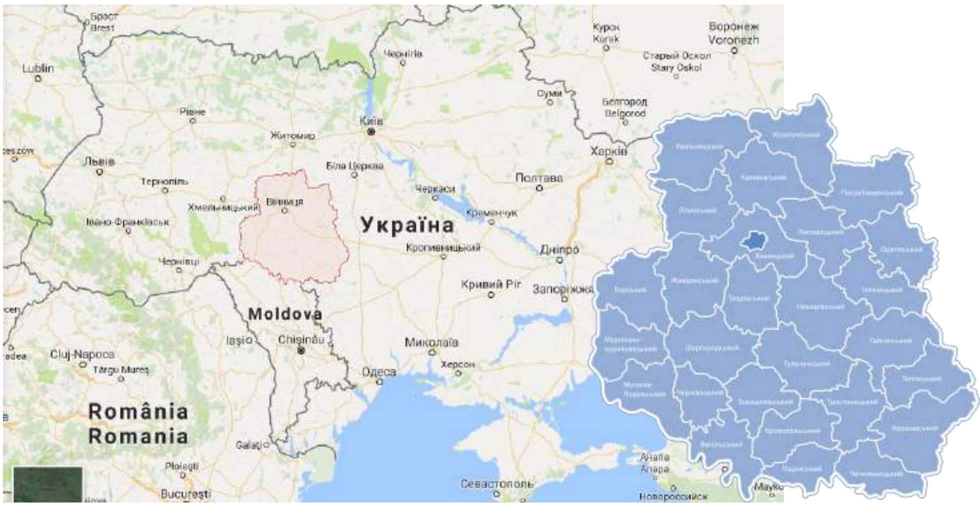

Рис. 1. Вінницька область на карті України

У сільському господарстві області важлива роль належить садівництву. Область лідирує у вирощуванні зерняткових: сільськогосподарськими підприємствами у 2015 р. з 11,4 тис. га було зібрано 152,71 тис. т плодів, що складає майже 41% від валового збору країни (Таблиця 1) [2], тоді як частка площ насаджень у плодоносному віці регіону становила 27%. У видовій структурі зерняткових переважають площі насаджень яблуні (94% площі зерняткових насаджень), у кісточкових найбільше представлені слива, вишня та черешня. Частка сільськогосподарських підприємств (яких налічується близько 300) у виробництві плодових в області становить 56%. Кількість людей, зайнятих у садівництві на сільськогосподарських підприємствах, становить понад 10 тис. чоловік [3].

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 щедро плодоносять. Населення переважно використовує сильнорослу технологію садівництва, що характеризується більшим запасом деревини та меншою частотою обрізки дерев.

Таблиця 1. Основні показники садівництва у Вінницькій області

	Україна	Вінницька область	% Вінницької області
Усі категорії господарств			
Площа плодових насаджень у плодоносному віці, тис. га у тому числі	186,2	22,9	12,3 %
зерняткових насаджень	111,2	19,5	17,5 %
кісточкових насаджень	62,4	2,8	0,05 %
Валовий збір плодових, тис. т у тому числі	2022,7	283,4	14,0 %
зерняткові	1360	254,3	18,7 %
кісточкові	547,6	23,3	4,3 %
Сільськогосподарські підприємства			
Площа плодових насаджень у плодоносному віці, тис. га у тому числі	54,5	12,0	22 %
зерняткових насаджень	42,2	11,4	27 %
кісточкових насаджень	11,5	0,6	5 %
Валовий збір плодових, тис. т у тому числі	400,0	157,4	39,4 %
Зерняткові	374,6	152,7	40,7 %
Кісточкові	25,4	4,6	18,1 %

B. Потенціал утворення відходів ОВБН у Вінницькій області

На сьогоднішній день не було виконано точної оцінки потенціалу біомаси, що утворюється від обрізки та викорчовування плодових насаджень у Вінницькій області. Сільськогосподарські підприємства та населення не виконували необхідних вимірювань, не маючи потреби. Теоретично, за умови, що сільськогосподарськими підприємствами використовується інтенсивна технологія вирощування, та на гектарі утворюється в середньому 4,76 тони обрізків дерев [4], теоретичний потенціал біомаси, що може бути використана для виробництва енергії, становитиме 51,4 тис. тон на рік[1]. Додатково потенціал деревної біомаси у господарствах населення становитиме 21,6 тис. т (утворення обрізків оцінюється на рівні 2,2 т/га [5]).

Загалом, теоретичний потенціал деревних відходів від обрізки насаджень зерняткових та кісточкових культур у Вінницькій області становить ***73 тис. тон на рік***, що становить в перерахунку на умовне паливо ***25 тис. т у.п***[2]***.*** Для порівняння: енергетичний потенціал інших видів деревного палива (дрова для опалення, відходи рубок, відходи деревообробки) у Вінницькій області за оцінками 2014 року становить 68,9 тис. т у.п. [6]

Деяка частина насаджень наразі потребує розкорчовування через зменшення продуктивності рослини. Деревина викорчуваних рослин є, переважно, низькосортною, тому таку біомасу майже повністю можна застосувати для виробництва біопалив та енергії. Наявність насаджень, що підлягають викорчовуванню, підвищить загальний потенціал деревної біомаси Вінницької області. Наразі точної інформації щодо площі садів, які потребують викорчовування, немає.

Одним з пріоритетів Стратегії збалансованого регіонального розвитку Вінницької області на період до 2020 року (затверджена Рішенням обласної Ради від 24 червня 2015 року) є енергозбереження та відновлювана енергетика [1]. Біомасі, як інструменту заміщення викопних видів палива, в першу чергу природного газу, відводиться активна роль. Вже сьогодні у Вінницькій області працює більше 370 котелень на твердому біопаливі загальною потужністю 125 МВт, що забезпечують тепловою енергією комунальну, бюджетну сферу та промисловість [7]. З огляду на обмеженість традиційних видів деревного біопалива в області [6], питання диверсифікації його поставок є нагальним. Деревина від обрізання та викорчовування плантацій не розглядається Стратегією окремо, проте її використання може зробити істотний вклад до сталого розвитку регіону.

Сільськогосподарські підприємства та окремі фермери загалом не розглядають відходи, що утворюються в наслідок обрізки та викорчовування аграрних плантацій, в якості товарного продукту. Даний вид біомаси переважно зберігається або спалюється на краю поля. Існують поодинокі випадки їх подрібнення та розкидання по полю, або енергетичного використання на власні потреби. Серед фермерів існує переконання, що ланцюжок енергетичного використання даних відходів є дуже складним, а їх збір та переробка дуже затратним (з точку зору витрати трудових та енергоресурсів).

[1] *Коефіцієнт технічної доступності для відходів прийнято на рівні 0,9*

[2] *Перерахунок в умовне паливо через теплоту згоряння $Q_н^р$ = 10 МДж/кг (природня вологість)*

C. Потенціал області у запровадженні нових схем використання відходів ОВБН в енергетичних цілях. Опис виробничого сектору

У Вінницькій області присутні наступні типи виробничих організацій, які можуть бути гравцями в ланцюжку енергетичного використання біомаси обрізків та видалення сільськогосподарських насаджень (ОВСН): с/г 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). Сервісні компанії, що надають послуги зі збору, подрібнення та транспортування відходів від обрізки чи викорчовування для використання в якості біопалива, в регіоні відсутні. Існує лише декілька компаній, які надають послуги з викорчовування. Важливою передумовою започаткування ринку енергетичної утилізації біомаси від ОВСН є поява таких сервісних компаній. 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 області 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 ОВСН. Вироблена біомаса може бути реалізована як у вигляді тріски так і у вигляді гранул/брикетів.

Саме такі схеми організації вартісного ланцюжка використання біомаси ОВСН (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 ОВСН в енергетичних цілях фермерами є економічно вигідним [8], та, за умови запланованого розвитку сектору виробництва теплової енергії з твердого біопалива в Вінницькій області, буде створено умови для організації бізнесу з продажу біопалива з ОВСН.

Нижче наведено бачення учасників ланцюжку енергетичного використання відходів ОВСН 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 поля;
- 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 та її паливних характеристик;
- Наявність достатнього об'єму енергетичної біомаси з садів в регіоні 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 регіонів та ріст економіки за рахунок диверсифікації поставок енергоресурсів, використання місцевих видів палива.

D. Бар'єри, перешкоди та рушійні сили для розвитку сектору енергетичного використання відходів від обрізки та видалення сільськогосподарських насаджень

Основними бар'єрами та перешкодами на старті нової діяльності зі збору/продажу/використання відходів ОВСН в енергетичних цілях є наступні:

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 обрізок задля забезпечення низької зольності палива;
- Невелика кількість деревних відходів у одного постачальника (с/г підприємства чи фермера);
- Відсутність експертів з організації та управляння логістичного ланцюжку на базі ОВСН 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 ОВСН як палива;
- Відсутність відстеження та перешкоджання відкритому спалюванню деревини від ОВСН;
- 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;
- Побоювання фермерів щодо складності додаткових операцій із заготівлі деревини ОВСН та можливих накладок, які не дозволять виконати вчасно та якісно роботи догляду за садами;
- Відсутність інформації у громадах про можливості енергетичного використання деревини ОВСН;
- Нерозуміння фермерами економічних переваг від продажу власних відходів;
- Відсутність інформації щодо паливних характеристик біомаси ОВСН; 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 тіньовим 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 регіоні сервісних компаній, які надають послуги зі збору, подрібнення та транспортування біомаси;
- 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 ОВСН 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; та регуляторна політика (по заохоченню використання місцевих видів палива та стимулюванню фермерів до енергетичної утилізації власних відходів). Інші категорії зацікавлених сторін (зокрема, експерти в сфері біоенергетики) додають до даного переліку фактор недостатнього місцевого планування для розвитку енергетичного та агропромислового сектору та відсутність експертного середовища на місцях.

Основними рушійними силами, на думку зацікавлених сторін, можуть бути:

- Зменшення собівартості біопалива з відходів ОВСН;
- 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 ОВСН серед зацікавлених сторін та потенційних споживачів;
- Зацікавленість громад у впровадженні енергетичних систем на місцевому біопаливі (енергетична незалежність регіону);
- Стимулююча політика регіонального 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 ОВСН (спільне бачення переваг);
- Створення нових робочих місць.

Найбільш значущими стимулами, що можуть сприяти побудові ефективних ланцюжків, на думку зацікавлених сторін, є економічні переваги: швидка окупність витрат, стимули з боку ринку – 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.

E. Регулювання сектору та сприяння ініціативам з боку осіб, що визначають політику

Деревина від обрізки та викорчовування багаторічних насаджень відноситься до відходів виробництва продукції сільського господарства [9]. Правове регулювання поводження з такими відходами здійснюється законами України: «Про відходи», «Про забезпечення санітарного та епідемічного благополуччя населення», «Про охорону навколишнього середовища» та іншими. Окрема група нормативно-правових актів регулює відповідальність за неправильне поводження з даними відходами, зокрема відкрите спалювання: «Кодекс України про адміністративні правопорушення», «Кримінальний кодекс України». Енергетичне використання деревини ОВБН регулюється законами України: «Про альтернативні види палива», «Про альтернативні джерела енергії». Всі нормативно-правові акти утворюють складну структуру різної юридичної сили [10].

Закон України «Про відходи» [11] покладає обов'язки на суб'єктів аграрного права запобігати утворенню та зменшувати обсяги утворення відходів; вести облік, визначати склад і властивості утворюваних ними сільськогосподарських відходів; забезпечувати повне збирання, належне зберігання та недопущення знищення й псування відходів; забезпечувати їх утилізацію чи видалення; не допускати зберігання та видалення відходів у несанкціонованих місцях або об'єктах; надавати відповідним державним органам інформацію про утворювані ними сільськогосподарські відходи; отримати дозвіл і ліміти на утворення та розміщення відходів та багато інших обов'язків. Покладення великої кількості обов’язків на суб’єкти господарювання призводить до неповного їх виконання, а розподілення обов’язків з контролю дотримання вимог чинного законодавства між органами місцевої влади та спеціальними уповноваженими органами виконавчої влади призводить до прогалин у здійсненні такого контролю.

Згідно визначень термінів ***біомаса та біопаливо***, що містяться в Законі «Про альтернативні види палива» [12], деревина ОВСН може бути використана в якості біопалива. Суб’єкти господарювання, які безпосередньо виробляють та/або реалізують біологічні види палива (біопаливо), відповідно до законодавства повинні мати пакет підтверджуючих документів, до якого, щонайменше, входять: протокол випробувань/сертифікат відповідності якості біопалива; технічні умови на виробництво біопалива.

У деяких випадках покупець біопалива може запросити у продавця ***Свідоцтво про віднесення біопалива до альтернативного*** (наприклад, в майбутньому, при появі стимулюючих механізмів використання альтернативних видів палива для виробництва теплової енергії). Таке свідоцтво видається Державним агентством з енергоефективності та енергозбереження України (ДАЕЕ). Для отримання свідоцтва заявник (виробник біопалива) повинен отримати експертний висновок від випробувальної лабораторії, що має атестат акредитації в Системі сертифікації УкрСЕПРО (сертифіковані) [13]. На основі даного експертного висновку ДАЕЕ видає вищезазначене свідоцтво.

І хоча Закони України «Про відходи», «Про альтернативні види палива» створюють всі необхідні передумови для енергетичного використання відходів ОВСН (декларація можливості утилізації відходів як енергетичних ресурсів, віднесення сільськогосподарських відходів до енергетичної біомаси згідно визначення), фермери (с/г підприємства) надають перевагу іншим схемам поводження з відходами, зокрема й таким, що заборонені законодавством.

F. Фінанси, ринок та кінцеві споживачі

Широкомасштабний розвиток ринку енергетичного використання деревини ОВСН потребує, в першу чергу, інвестицій з боку можливих ініціаторів створення ланцюжку доданої вартості (див. пункт С) – фермерів (с/г підприємств), комунальних підприємств, сервісних компаній. Розмір інвестицій залежить від кожного конкретного логістичного рішення, обраної техніки та рівня механізації. Сільськогосподарське підприємство/фермер може інвестувати у дискову деревоподрібнюючу машину невеликої потужності чи у причіпний подрібнювач з бункером, та здійснювати перевезення готового біопалива на невеликі відстані за допомогою трактора. У такому випадку обсяг інвестицій буде становити 1100-1500 тис. грн. У випадку створення сервісної компанії на базі існуючого комунального підприємства чи нового підприємства, та закупки самохідної подрібнюючої машини, обсяг інвестицій становитиме близько 13000 тис. грн [14].

Загалом Вінницька область володіє значним потенціалом організації високоефективних ланцюжків постачання біомаси ОВСН: відходи майже не утилізуються фермерами, а накопичуються у великій кількості; інфраструктура регіону достатньо розвинена; сектор виробництва теплової енергії розвивається швидкими темпами. Варто зазначити, що у Вінницькій області зареєстровано найбільшу кількість експортерів деревних гранул в Україні (за рахунок розміщення великих деревообробних підприємств). Область також займає третє місце за кількістю експортерів гранул з соломи [15].

Основними типами біопалива, що можуть бути вироблені з деревини ОВСН, є тріска, гранули та брикети. Вартість даних видів палива змінюється на ринку в сторону збільшення (що пов’язано, як з коливанням курсу долара, так і підвищенням попиту на внутрішньому ринку). Так, в середньому, вартість деревної тріски за останні 5 років коливалась в діапазоні 300-1000 грн./т, гранул 990-2440 грн./т, брикетів 1000-2000 грн./т (вартість з ПДВ без транспортування). Вартість гранул та брикетів з деревини, на противагу трісці, залежить від змін курсу іноземних валют, через орієнтованість даного ринку на експорт [16].

Потенційні постачальники/продавці біопалива з відходів ОВСН поширені по території району рівномірно та у великій кількості (в регіоні присутні мінімум 300 агро-формувань, що займаються садівництвом [3]). Існуючі котельні на біопаливі, що як обслуговують окремі об’єкти, так і забезпечують централізоване теплопостачання окремих міст (або їх частин), розташовані по території області також досить рівномірно (Рис. 2). Тому, за умови появи сервісних компаній чи започаткуванні фермерами бізнесу з продажу власних відходів, конкурентний ринок біопалива може бути створено. Наразі основними постачальниками біопалива у вигляді дров та тріски є державні лісогосподарські підприємства області (підпорядковані Державному агентству лісових ресурсів) та спеціалізоване лісогосподарське підприємство «Вінноблагроліс» (підпорядковане Вінницькій обласній раді). Дані підприємства забезпечують паливом котельні комунального підприємства «Вінницяоблтеплоенерго» (27 котельних) та «Вінницяміськтеплоенерго», та, по суті, створюють олігополію на ринку. Котельні, що забезпечують тепловою енергією промислові об’єкти, працюють, як правило на власних відходах (деревообробна, масложирова промисловість та ін.). Деякі з споживачів біопалива володіють обладнанням для перевірки його якості та паливних характеристик (вологомір, автовагова), інші вимагають наявності сертифікату від професійної лабораторії. Через, в основному, закупку біопалива безпосередньо через домовленість між покупцем та виробником палива (прямі контракти), походження сировини ніяк не відслідковується, а дотримання критеріїв сталого розвитку на законодавчому рівні не вимагається [17].

Одним з видів деревного палива, яке активно використовується для виробництва теплової енергії, в першу чергу населенням, є дрова (всього в області за даними 2014 року спожито 14,4 тис. т н.е., з них 11,8 – населенням) [2]. На сьогоднішній день деяка частина відходів деревини від ОВСН реалізується фермерами у вигляді дров населенню, проте точної інформації щодо її кількості в відкритих джерелах не знайдено. Середня вартість дров для опалення, що реалізуються державними лісогосподарськими підприємствами становить: 420-600 грн./т для м’яких сортів дерева, 495-650 грн./т для твердих сортів [16].

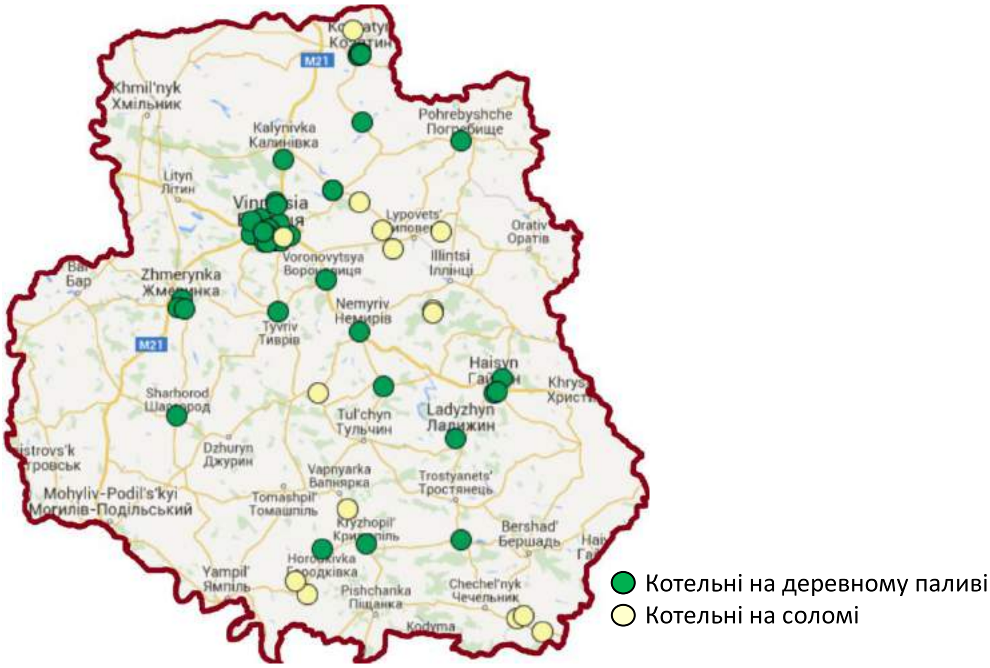

Рис. 2. Розподілення споживачів біопалива на території Вінницької області

G. Базовий SWOT - аналіз

SWOT - аналіз

	Позитивні фактори	Негативні фактори	
Внутрішні фактори	**Сильні сторони (для посилення)** С/Г • Великий незадіяний потенціал відходів ОВСН в області; • Наявність власної сировини та економічних стимулів використання біомаси ОВСН на власні енергетичні потреби; • Наявність в області великої кількості споживачів біопалива. БІОЕНЕРГЕТИКА • Відсутність конкуренції за даний вид сировини як палива; • Великий досвід використання деревної тріски в якості палива; • Позитивна динаміка розвитку сектору біоенергетики в зв'язку з підтримкою місцевих органів влади. ВИРОБНИКИ ОБЛАДНАННЯ • Наявність вітчизняного обладнання для спалювання деревини на ринку України; • Наявність на ринку виробників та дистриб'юторів обладнання для збору та подрібнення відходів ОВСН як українського так і закордонного виробництва. КОМЕРЦІЯ • Розвинена інфраструктура в області; • Досвід організації постачання деревної біомаси на існуючі енергетичні об'єкти; • Велика кількість виробників гранул з деревини та інших видів біомаси в області. • Наявність великої кількості потенційних постачальників та споживачів біомаси в області.	**Слабкі сторони (для вирішення та подолання)** С/Г • Складність в організації логістичного ланцюжка; • Неготовність аграрних підприємств до початку нового бізнесу з продажу відходів ОВСН; • Відсутність досвіду з логістики постачання відходів, необхідних знань з організації ланцюжка доданої вартості; • Потреба в додатковому обладнанні; • Відсутність власних коштів для інвестицій; • Потреба в легалізацій бізнесу з продажу відходів як біопалива. БІОЕНЕРГЕТИКА • 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 ОВСН. КОМЕРЦІЯ • Державна монополія на постачання біопалива на існуючі котельні комунального господарства; • Відсутність знань з правильної організації логістичного ланцюжка; • Відсутність експертного середовища; • Невеликі об'єми сировини у одного постачальника; • Конкуренція з тіньовим ринком дров; • Конкуренція за існуючих споживачів.	Внутрішні фактори

Зовнішні фактори	**Можливості** **(для використання)** С/Г • Диверсифікація діяльності за рахунок започаткування бізнесу з продажу біопалива; • Створення сервісних кооперативів; • Надання послуг із заготівлі відходів; • Використання відходів в власних енергетичних цілях. БІОЕНЕРГЕТИКА • Диверсифікація шляхів постачання біопалива; • Конкурування з іншими видами деревного біопалива за рахунок зменшення собівартості. ВИРОБНИКИ ОБЛАДНАННЯ • Розширення парку обладнання, що виробляється та поступає на продаж на ринку України. КОМЕРЦІЯ • Розвиток внутрішнього ринку біопалива; • Розвиток суміжних галузей в регіоні; • 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)** С/Г • Забезпечення стабільності поставок біопалива; • Висока собівартість готового біопалива. БІОЕНЕРГЕТИКА • Нестабільна якість біопалива з відходів ОВСН; • 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 ОВСН. 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	

2.2 ПЛАН ДІЙ

Підготовка плану дій для прискорення розвитку сектору енергетичного використання деревини ОВСН є результатом аналізу ситуації в регіоні та консультування з великою кількістю зацікавлених сторін шляхом проведення інтерв'ю, зустрічей та семінарів.

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 аграрних 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 ОВБН. План дій, таким чином, визначає комплекс заходів, які мають бути реалізовані.

Нижче наведено підходи, що використані при підготовці Плану дій. За основу взято SWOT – аналіз, що наведений в попередньому розділі (Рис. 3). Згідно методики SWOT-аналізу, під основними його елементами розуміють наступні зовнішні та внутрішні фактори:
S*trengths (Сильні сторони)* – те, що наразі є позитивним. Потрібно підтримувати їх, спиратися на них і використовувати в якості важеля.
W*eaknesses (Слабкі сторони)* – те, що наразі є поганим, та потребує виправлення, зміни чи зупинки.
O*pportunities (Можливості)* – Те, що є позитивним для майбутнього розвитку. Потрібно визначити їх пріоритетність, спиратися на них і оптимізувати.
T*hreats (Загрози)* – Те, що є поганим для майбутнього, потрібно спланувати управління чи боротьбу з ними.
Шляхом поєднання внутрішніх та зовнішніх факторів, наступні стратегії можуть бути отримані:

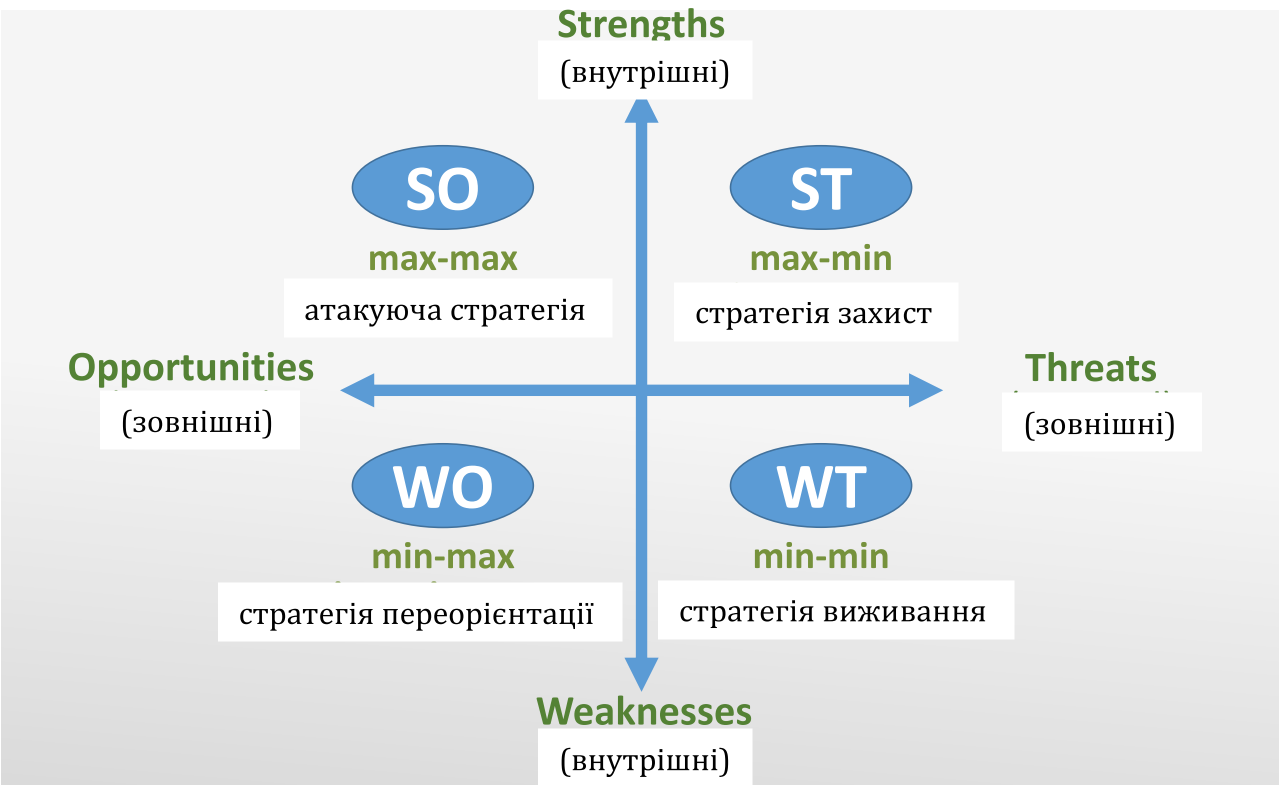

Рис. 3. Підхід до побудови стратегії розвитку сектору ОВСН

SO Стратегії (Стратегії застосування СИЛЬНИХ СТОРІН з метою отримання вигоди від МОЖЛИВОСТЕЙ). Ці стратегії типу Max-Max, 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 Min-Max, 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 Max-Min, в тому сенсі, що вони використовують сильні сторони для того, щоб уникнути або зменшити зовнішні загрози (*захист*).

WT Стратегії (Стратегії, які полегшують СЛАБКІ СТОРОНИ і прагнуть зменшити вплив ЗАГРОЗ). Вони являють собою стратегії типу Min-Min, тобто прагнуть звести до мінімуму слабкі сторони, якщо зовнішні загрози можна уникнути (*виживання*).

Нижче у таблиці наведено перелік запропонованих стратегій для досягнення підвищення сталого постачання деревини ОВСН в енергетичних цілях.

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 в області. **O:** Диверсифікація шляхів постачання біопалива.	Залучення існуючих споживачів та компаній, що наразі виконують заготівлю інших видів деревного біопалива до нового ланцюжку постачання деревини ОВСН	Побудова демонстраційного ланцюжку використання деревини ОВСН 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 ОВСН в області. **O:** Становлення ринку біопалива за рахунок створення сервісних компаній, що надають повний спектр послуг зі збору, подрібнення та перевезення готового біопалива на енергетичний об'єкт.	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 наслідування, і можливостей фінансування.	Ключові гравці всередині мережі зацікавлених сторін+потенційні союзники за межами сектору ОВСН (пошук та долучення)	так	Середньо-строкова
WO =	**W:**	Визначення найкращої	Оцінка техніко-	Всі сторони	так	Коротко-

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту “uP_running” (так / ні)	Часові рамки*
Слабкі сторони + Можливості **Організація нового ланцюжку постачання біопалива з ОВБН**	• Складність в організації логістичного ланцюжка; • Відсутність досвіду з логістики постачання відходів. **O:** Диверсифікація діяльності за рахунок започаткування бізнесу з продажу біопалива.	бізнес-моделі та оптимізація її функціонування (збір, попередня обробка, транспортування, зберігання) від поля до споживача.	економічних показників впровадження нового ланцюжка. Маркетингове дослідження запровадження нового бізнесу. Створення ефективних зв'язків уздовж ланцюжка доданої вартості.	зацікавлені в приєднанні до проекту. Метою є перетворення ідеї в успішне застосування		строкова
SO = Сильні сторони + Можливості **Підвищення інформованості та довіри**	**S:** • Наявність великої кількості потенційних постачальників та споживачів біомаси в області; • Позитивна динаміка розвитку сектору біоенергетики в зв’язку з підтримкою місцевих органів влади. **O:** • Розвиток внутрішнього ринку біопалива; • Розвиток суміжних галузей в регіоні.	Підвищення загального розуміння та довіри між гравцями ланцюжка постачання біомаси ОВСН (аграрії, підприємці, особи, що визначають політику та ін.)	Налагодження та об’єднання «мережі зацікавлених сторін» та її розвиток в напрямку до "оперативної групи", яка бути співпрацювати між собою на регіональному рівні	Ключові гравці всередині мережі зацікавлених сторін	так (але лише частково)	Середньо-строкова
WO =	**W:**	Тренування професіоналів	Формування технічної	Професіонали та	так	Коротко-

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту “uP_running” (так / ні)	Часові рамки*
Слабкі сторони + Можливості **Підготовка експертного середовища**	• 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 енергетичний об’єкт.	щодо особливостей сектору використання деревини ОВСН (технічні, економічні та організаційні питання). Група підготовлених осіб повинна залишитись активною навіть після закінчення проекту.	команди проекту, що буде надавати підтримку компаніям, які працюють в сфері управління відходами ОВСН (розробка проектів, пошук інвесторів та ін.)	консультанти, які прагнуть здобувати знання і досвід по підвищенню цінності ОВСН	(але лише частково)	строкова
ST = Сильні сторони + Загрози **Навчання фермерів**	**S:** • Наявність на ринку виробників та дистриб’юторів обладнання для збору та подрібнення відходів ОВСН як українського так і закордонного виробництва; • Досвід організації	Підвищення рівня знань щодо правильної організації технологічного ланцюжка зі збору, попередньої обробки та підготовки відходів ОВСН для виробництва біопалива. Стимулювання	Формування навчального посібника для фермерів щодо особливостей організації збору, попередньої обробки та підготовки деревини що утворюється від ОВСН. Пояснення переваг	Фермери, с/г підприємства, які бажають розпочати діяльність зі збору/реалізації відходів ОВСН	Так (частково)	Середньо-строкова

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту “uP_running” (так / ні)	Часові рамки*
	постачання деревної біомаси на існуючі енергетичні об'єкти; • Наявність великої кількості потенційних постачальників та споживачів біомаси в області. **T:** • Висока собівартість готового біопалива. • Нестабільна якість біопалива з відходів ОВСН; • Відсутність досвіду експлуатації як енергетичного обладнання так і обладнання для збору/подрібнення з відходами ОВСН.	виробництва біопалива з дотриманням технологічних вимог.	заключення довгострокових контрактів та схеми отримання дозволів на виробництво біопалива (технічні вимоги).			
ST = Сильні сторони + Загрози **Лобіювання та адвокасі**	**S:** Позитивна динаміка розвитку сектору біоенергетики в зв’язку з підтримкою місцевих органів влади. **T:** • Переорієнтація постачальників біомаси з її продажу на власне споживання, або на іншу, більш прибуткову діяльність;	Залучення обласних/ регіональних/ місцевих осіб, що впливають на прийняття рішень на політичному рівні для сприяння заходам з пропагування та захисту сектору енергетичного використання ОВСН. Заходи мають бути спрямовані на подолання	Публічне та прозоре лобіювання з метою подоланню бар'єрів і перешкод, що заважають створенню інноваційних ланцюжків доданої вартості на базі ОВСН. Дії спрямовані на отримання допомоги та схвалення від політиків і лідерів громадської	Найбільш впливові гравці в мережі зацікавлених сторін з допомогою місцевих / обласних лідерів думок	так	Коротко-строкова

Стратегії/ Цільовий тип дії	Складові SWOT-аналізу	Цілі	Дії / Заходи	Цільові зацікавлені сторони	Включено до дій проекту "uP_running" (так / ні)	Часові рамки*
	• Конкуренція за споживачів біопалива між невеликими виробниками та державними комунальними підприємствами.	бар'єрів, пов'язаних з отриманням дозволів, повільними адміністративними процедурами, гарантування стабільності постачання/споживання.	думки: сприяння заміщення викопних видів палива в місцях концентрації відходів ОВСН, полегшення адміністративного 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 ОВСН; • 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 ОВСН як серед фермерів/агарних підприємств, так і серед потенційних споживачів, компаній, що можуть розширити свою діяльність на заготівлю/постачання біопалива ОВСН та громади	Широке розповсюдження інформації щодо проекту задля створення позитивного іміджу серед всіх зацікавлених сторін, потенційних гравців в ланцюжку постачання та членів громади. Підготовка та розповсюдження в рамках проекту інформації щодо паливних характеристик, об'ємів та кількості відходів ОВСН.	Ключові гравці всередині мережі зацікавлених сторін	так	Коротко-строкова

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.					
WO = Слабкі сторони + Можливості **Фінансування**	**W:** • Потреба в додатковому обладнанні; • Відсутність власних коштів для інвестицій. **O:** • Створення сервісних кооперативів; • Надання послуг із заготівлі відходів.	Пошук можливостей для стимулювання обмеженої готовності інвестувати, що виявлена в цілому серед підприємців, що працюють в секторі ОВСН	Формування "цільової групи" з ключових учасників сектора ОВСН разом з консультантами, які мають досвід в залученні "державного фінансування", пільгових кредитів та інших. Ознайомлення підприємців з додатковими можливостями фінансування дозволить підвищити шанси підприємців до інвестування щонайменше, за рахунок часткової підтримки таких пільгових механізмів.	Ключові гравці сектору ОВСН + фінансові консультанти + співробітники державних адміністрацій	ні	Середньо-строкова
ST = Сильні сторони +	**S:** • Відсутність конкуренції за	Створення мережі логістичних центрів та	Формування "цільової групи" з ключових	Ключові гравці сектору ОВСН +	ні	Довго-строкова

Стратегії/ Цільовий тип дії	**Складові SWOT-аналізу**	**Цілі**	**Дії / Заходи**	**Цільові зацікавлені сторони**	**Включено до дій проекту "uP_running" (так / ні)**	**Часові рамки***
Загрози **Створення біржі/логістичних центрів з продажу біопалива**	даний вид сировини як палива; • Позитивна динаміка розвитку сектору біоенергетики в зв'язку з підтримкою місцевих органів влади **Т:** • Нестабільна якість біопалива з відходів ОВСН; • Несформований та непрозорий ринок біомаси як палива.	регульованої біржі з продажу біопалива різних видів з моніторингом якості та гарантією надійності постачання.	учасників сектора ОВСН. Залучення державних органів, що здійснюють регулювання в сфері використання біопалива для виробництва теплової енергії. Розробка схеми функціонування біржі (за участю всіх зацікавлених осіб). Впровадження в області	консультанти + співробітники державних адміністрацій		
WT = Слабкі сторони + Загрози **Альтернативне виробництво**	**W:** Відсутність практики довгострокових контрактів на постачання біопалив. **Т:** Висока собівартість готового біопалива.	Розробка нових технічних можливостей для досягнення економічної цінності сировини ОВСН у випадку, коли перетворення енергії є економічно недоцільним або важким у застосуванні з кількох причин	Вивчення можливості використання біомаси ОВСН для виробництва альтернативних продуктів, таких як біокомпозити, біофільтри, компост і т.д.	Всі сторони зацікавлені в приєднанні до проекту. Метою є перетворення ідеї в успішне застосування	ні	Довго-строкова

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Подяки

Нижче перераховані експерти, які прийняли участь в опитуванні та допомогли авторам в підготовці Аналізу сектору та Плану дій. Проект up_Running вдячний за співпрацю, та з публікує імена даних експертів з їх згоди.

ПІБ	Компанія	Роль в ланцюжку постачання ОВСН
Гавришок Сергій Васильович	СВАРОГ	с/г підприємство (вирощування фруктів)
Кекух Святослав Іванович	Фермер-підприємець	Фермер (вирощування фруктів)
Харчук Лілія Іванівна	Колективний сад «Урожай»	с/г підприємство (садівництво та ягідництво)
Інна Семерог	Фермер-підприємець	Фермер (вирощування фруктів)
Віктор Кобець	Український пелетний союз	Асоціація виробників гранул та брикетів
Данилова Ніколь Вікторівна	Український пелетний союз	Асоціація виробників гранул та брикетів
Гелетуха Георгій Георгійович	ГС «Біоенергетична асоціація України»	Асоціація , що об'єднує біоенергетичні компанії
Матвєєв Юрій Борисович	ГО «Агентство з відновлюваної енергетики»	Громадська організація в сфері відновлювальної енергетики
Володимир Крамар	ТОВ «Біомаса-Карбон»	Інжиніринг в сфері біоенергетики
Євген Олійник	ГС «Біоенергетична асоціація України»	Асоціація , що об'єднує біоенергетичні компанії
Ірина Гнап	ТОВ «Салікс Енерджі»	Сервісна компанія, мають власні плантації енергетичних культур
Сергій Зібцев	Національний університет біоресурсів та природокористування України	Наука в сфері сталого використання біоресурсів
Білоус Андрій Михайлович	Національний університет біоресурсів та природокористування України	Наука в сфері сталого використання біоресурсів
Загалом в рамках виконання аналізу сектору та розробки плану дій було опитано більше 15 респондентів, що представляють різні сектори: як аграрний, біоенергетичний, так і науковий. Деякі з них побажали залишиться анонімними.		

ANNEX C1

WP2 – TASK T2.2

Performing an APPR Sector Analysis and Developing an Action Plan for the Demo Regions Peloponnese and Macedonia / Thrace (Greece)

Contents of the document

2.1 SECTOR ANALYSIS

A.Regional framework on APPR

The APPR sector analysis in Greece focuses on two different and quite dissimilar geographical regions: Peloponnese, the southernmost part of the Greek mainland, and Macedonia and Thrace, a wide geographical area extending from east to west of the Greek north. Administratively, Peloponnese includes the Region of Peloponnese (corresponding to the NUTS2 region EL65) and the NUTS3 region EL633 Elis of the Region of Western Greece. Administratively, Macedonia and Thrace includes three distinct regional authorities: West Macedonia (corresponding to NUTS2 EL53), Central Macedonia (NUTS2 EL52) and East Macedonia and Thrace (NUTS2 EL51).

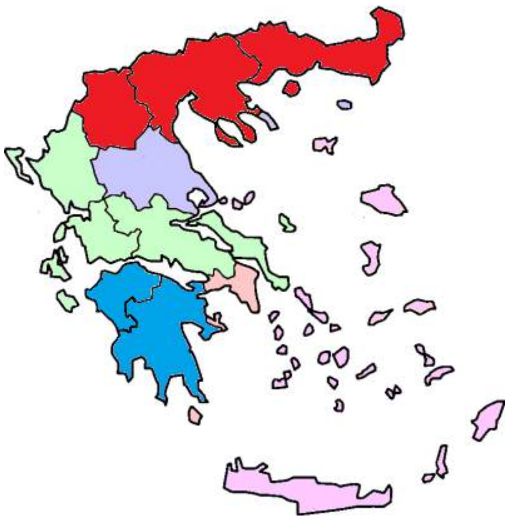


Figure 1: Location of Peloponnese (blue colour) and Macedonia / Thrace (red) in Greece

Table 1 below presents some basic information about the surface area used for permanent crop cultivations[1] and the total production for the five basic categories of trees [1]. Some general remarks can be made that affect the APPR biomass potential in the two investigated regions:

- The drier, Mediterranean climate of Peloponnese makes it more suitable for the cultivation of olive trees and citrus trees, corresponding to 38.5% and 66.5% of the total Greek production in those crops.
- Macedonia and Thrace climate is more suited to the cultivation of fruit trees; 86.9% of the Greek fruit production volume is coming from this geographical area.
- Vineyards are widespread in both areas; Macedonia and Thrace has a lower surface area but the yield is higher compared to Peloponnese.

	Olive trees		Citrus trees		Fruit trees		Nut and dried fruit trees		Vineyards	
	ha	t	ha	t	ha	t	ha	t	ha	t
Macedonia and Thrace	56,680	284,250	9	39	58,396	729,955	8,621	26,847	12,620	157,735
Peloponnese	260,302	996,151	26,866	646,718	5,312	74,955	7,527	18,613	34,051	157,735
Greece (total)	823,518	2,590,688	43,370	972,430	74,017	839,868	39,282	97,854	93,845	799,238

[1] The area provided by ELSTAT considers only trees from compact plantations, while the yield includes the total number of trees. It is noted however that the trees from compact plantations usually are more than 92% of the total trees in an area, with few exceptions for the cases considered (e.g. 69% and 84% of the nuts/dried fruit trees and fruit trees in Peloponnese respectively).

Table 1: Surface areas of permanent crops in compact plantations and total production (ELSTAT, 2014)

B. Regional potential of the APPR availability

There are no recent surveys based on field data regarding the availability of APPR biomass in the investigated areas. The standard reference for prunings is a study from 1987 [2] which presents residue-to-product ratios (RPRs) for the prunings generated from different types of permanent crops in Greece. More recently, the FP7 S2Biom project has estimated the pruning potential from permanent crops down to a NUTS3 level 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 [3, 4]. A comparison of these two approaches is presented below. The differences for the results of the two methods provide a clear illustration to the large uncertainties associated with the estimations of biomass potential from prunings in general. In any case, the large potential of olive tree prunings in Peloponnese is apparent. Fruit trees prunings appear to be most important in Macedonia and Thrace, while vineyards are a significant biomass resource in both regions. One approach (RPRs) highlights a large potential of prunings from citrus trees in Peloponnese, while the S2Biom approach indicates a minimal potential. Unless further data are collected, the first indication is that regional policy makers in those two regions should strategically focus on the major biomass resources from prunings, e.g. olives in the South and fruit trees in the North and vineyards in both locations. Other pruning resources may have a localized importance and present opportunities for the development of APPR value chains but are less important on a regional level.

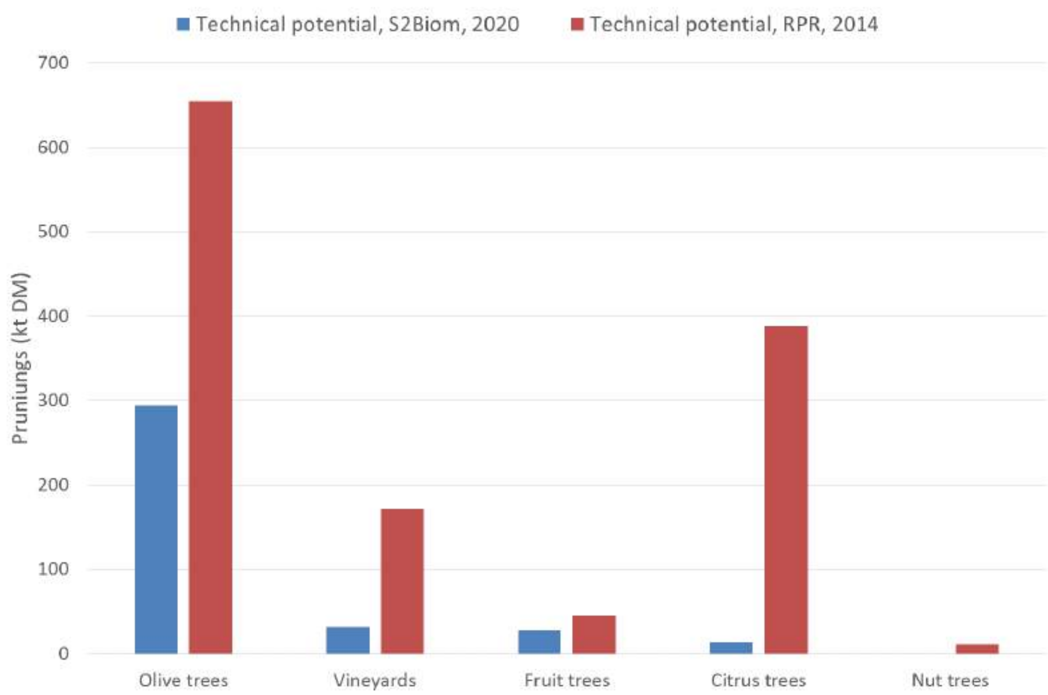


Figure 2: Comparison of calculated pruning biomass potential in Peloponnese from two approaches

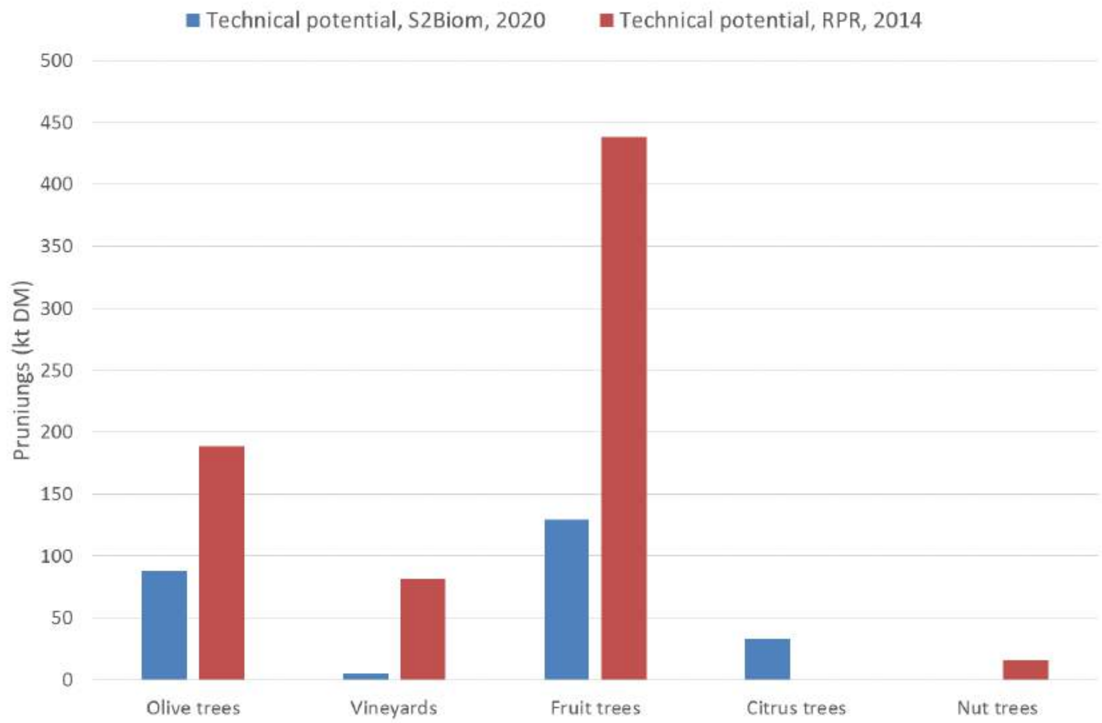


Figure 3: Comparison of calculated pruning biomass potential in Macedonia and Thrace from two approaches

Regarding the potential of uprooted biomass, there are no published surveys. Some indications are given by the amount of firewood from agricultural plantations produced in the two regions, as given by ELSTAT [5]. Peloponnese produced 261,747 t of “agricultural” firewood in 2014 (41.5% of the total Greek production), while the equivalent amount for Macedonia and Thrace was only 56,870 t (9% of the Greek total). Such firewood includes larger branches from pruning operations (especially from olive trees) as well as uprooted material.

It is difficult to have a more detailed assessment of the APPR biomass availability taking into account technical or economic constraints due to the lack of statistics. It is expected that – especially in Peloponnese and for the case of olive groves – it will be difficult to mobilize part of the potential due to the high slope of fields. However, the exact extend of these restrictions is not known.

The regional authorities of the areas in investigation have not come up with a detailed energy plan. Waste management plans (which are often a “burning” issue) may make mention of the potential of APPR – especially pruning biomass, but - apart from mentioning management possibilities such as composting along with urban waste streams – they do not delve into economics or other details.

Apart from larger pruning branches and uprooted treed used as firewood, farmers are usually unaware or uninterested in the collection of APPR residues for energy production. The current management practices are as follows:

- In most cases, prunings are burned in open fires on the field.
- In a minority of cases, mulching in the ground has been observed as a practice. The main limiting factor seems to be the mulcher purchasing costs and the fact that this management practice appears to have only a small cost saving compared to the manual collection and burning of prunings.

- For vineyard prunings, use in barbeques, grills and the traditional Easter cooking on spits was also detected as a practice.

C. Regional potential in the setting up of an APPR value chain: describe the productive sector

The first links in an APPR value chain in every region are the farmers. An important characteristic relevant to the APPR sector is the small average size of permanent crop holdings. In Peloponnese, the average size per holding is 1.87 ha for olive trees, around 1.3 ha for vineyards and a little over 1.07 ha for other tree types. In Macedonia and Thrace, the average size per holding is 0.77 ha for vineyards and 1.96 ha for tree types other than holdings [6]. This indicates that the average amount of biomass an individual farmer can mobilize is fairly low.

The next important link is the agricultural cooperative. Through the cooperative, farmers can share resources, negotiate better prices with buyers and utilize the knowledge of experts (e.g. agronomists). Cooperatives can play a major role in the development of APPR value chains in both investigated regions by providing training to their members (farmers) and investing on equipment (e.g. mechanized harvesters) and infrastructure (e.g. storage spaces) required for the effective mobilization of APPR biomass.

Local agro-industries are also potential important links in APPR value chains. In Peloponnese, major agro-industries are the numerous olive mills as well as the limited number of secondary (pomace) mills. These industries are directly connected with the olive growers and could provide useful services for the development of an APPR value chain (e.g. storage space or drying at pomace mills); it should be noted however that since pomace mills are already biomass producers, they may see APPR biomass initiatives as antagonistic.

In Macedonia and Thrace, fruit canning industries are major agro-industries. In previous years, they were important local biomass producers (e.g. peach kernels). The current trend is that they self-consume the biomass they produce for heating purposes. Thus, due to their links with the primary producers and cooperatives, they could also be involved in other APPR initiatives as final end-users.

Wineries are present in both regions; however, an initial assessment suggests that their size does warrant as an important role in mobilizing APPR biomass as the other agribusiness mentioned, with the exception of the bigger units.

Finally, it is worth mentioned local greenhouses as potential APPR biomass end-users.

“Intermediates” actors in the APPR sector are currently lacking. The current management of APPR biomass is mostly based on the utilized of unskilled labour under the supervision of farmers. Companies involved specifically in the management of pruning or uprooted material seem to be lacking. In some cases, farmers owning mulchers may offer “cleaning” services to their colleagues.

The business model that seems most relevant for the APPR market development in the investigated regions involves the agricultural cooperative as the main entity mobilizing a large number of farmers to share their residues as well as the main investor in equipment and infrastructure in the first steps of the value chain. Final products offered to the market depend on the local end-users, but it seems that the most acceptable one is pelletized biomass.

D. Barriers or constraints to enter into the APPR value chain or to start up the value chain

Based on several interviews, bilateral meetings and opinions voiced in workships, as well as our own understanding of the biomass market structure in the targeted regions, the following main barriers and constraints have been identified:

Lack of awareness and mistrust: farmers are usually unaware of the possibilities to mobilize APPR biomass for energy production (other than firewood). Often, they do not realize the amount of biomass that pruning operations yield on a regular basis. For farmers, the disposal of prunings is a running cost that needs to be considered for the economics of the plantation, but not a source of revenue. We have seen that if the energy potential is brought to the farmers' attention, sometimes the reaction is mistrust: they fear that an external company will force them to pay for the "disposal" of their prunings. Additionally, if they are dissatisfied with their revenues from their main agricultural product, they cannot be persuaded that the energetic utilization of APPR biomass can provide sufficient economic rewards or saving to make it worth the effort.

Competing biomass fuels: exhausted olive cake[2] is a biomass fuel produced by pomace mills and used widely in olive oil producing areas such as Peloponnese. It has a quite high ash content (5% dry basis or more) and odours and exhibits fluctuations of its production level (depending on the olive yield of the season) as well as of its price (as a function of production level and price of heating oil). However, it is very competitive in terms of price (around 70 €/t in the last years) and has a quite high heating value. In Macedonia and Thrace, it is fairly easy to find pellets made from sunflower husk, usually imported from Bulgaria or Ukraine. Their price is reported as being below 100 €/t which make them very competitive for industrial use, despite their high ash content. In both areas, biomass end-users can be quite satisfied with these fuels and unwilling to start an APPR biomass initiative on their own.

Technical constraints for end-users: the main end-users of biomass in Peloponnese and Macedonia / Thrace have installed heating systems suitable for fine material (such as exhausted olive cake) or pellets and other fairly uniform biomass types (e.g. peach kernels). Chips made from APPR biomass would cause feeding issues; unless they are willing to invest in new feeding systems, the use of APPR pelletized biomass would be required.

Financial crisis: the general economic situation in Greece is affecting all investment opportunities. Although biomass can be considered as an exception to the general trend – since the sector has developed in the last years on the basis of offering cheaper alternatives to heating oil – the overall economic situation makes potential investors very reluctant to put efforts in developing new initiatives that they see as more difficult to bring to life – and APPR biomass appears to be one of them.

E. Regulation and promoting initiatives from the side of policy makers

Up to now, relatively few regulations and initiatives on a regional (or national) level directly affect the APPR biomass sector development in the investigated regions.

A general trend is that the open field burning of prunings is not encouraged (although it is accepted by the Code of Good Agricultural Practices) and actively prohibited during the summer months in order to avoid fire risks. Mulching is seen as a more appropriate alternative; funding of such initiatives is foreseen by the

[2] In Greece, pomace mills rarely perform a separation of the olive stones from the olive pulp. All fractions of the olive cake treated by the pomace mill (after the secondary extraction) end up in a single fraction usually called "kernel wood" (Greek: pirinoksilo). In the text above, we refer to this material as "exhausted olive cake".

Agricultural Development Programme for 2014 – 2020, although it is expected that it will be received by a limited number of beneficiaries through the country.
Other than the above, APPR biomass is not really differentiated by other biomass types in regulations offering incentives for the bioenergy production, e.g. the new feed-in premium scheme implemented in Greece since summer 2016.

F. Finance, market and final energy users

Currently, there is practically no APPR biomass market in Peloponnese or Macedonia and Thrace, other than the traditional use of larger branched and uprooted material as firewood (see below). Therefore, the analysis in this section is based mainly on our own estimates and vision of a potential market.

Capital requirements for APPR biomass value chains: focusing mostly on the prunings, it seems that the main business model for a biomass to market scenario includes the mechanized harvesting of prunings and their upgrading to a pellet form. The capital requirements for a mechanized harvester are estimated in the range of 20,000 – 40,000 €. This amount would be ideally "shared" for the biomass production of several different farmers and the equipment could be purchased by a cooperative. Funding through agricultural development programmes could entice prime movers who would face bigger risks. In an established APPR markets, this could not be required. A more significant capital barrier would be the construction of a pellet plant for APPR biomass. The total investment depends on the production capacity; public funding or bank loands with favourable terms are generally favoured by such investments. On the side of APPR final end users, the purchase of a new biomass combustion system or the modification of an existing one in order to deal with APPR biomass is the main capital requirement. The investment level depends on the total energy use of the end-user; for pioneers in the area of APPR utilization, some public funding would again help to mitigate the risks associated with such an investment.

Market trend in sales and price of APPR biomass: this is quite difficult to assess due to the lack of a market, but considering the range of biomass fuel prices in the investigated regions (between 80 – 100 €/t for fuels such as exhausted olive cake and sunflower husk pellets and 230 €/t for ENPlus A2 wood pellets), fuels from (dry) APPR could be marketed in the range of 100 – 200 €/t. Thus, they would have to fill in the gap between low quality, cheap fuels and higher quality, cleaner biomass fuels. As with other biomass fuels in the regions, the price of heating oil is a major factor that could affect the potential price of APPR biomass.

Market structure: potential APPR biomass prime movers in the investigated regions would find themselves in a position where they could be a local monopoly or oligopoly on APPR biomass; however, they would have to compete with other biomass types already established (e.g. firewood, forest wood pellets, exhausted olive cake) and / or fossil fuels. Final energy users would need to see that APPR biomass can be competitive and easier to use than the low-cost alternatives (e.g. in terms of ash cleaning frequency, emissions, etc.). Stricter fuel quality criteria and emission control from biomass boilers could have a dual impact on APPR biomass: on the one hand, it could put pressure in the antagonistic, low cost fuels but on the other hand, it could promote the use of cleaner, lower-ash forest biomass.

Alternative use for APPR biomass: the main alternative use is firewood from larger pruning branches and stems / tree parts from plantation removal material. The price that such fractions can obtain in the domestic fuel market are in the range of 100 €/t; this is already quite high and it is unlikely that it will be competitive to use these materials as feedstocks for other energy projects, e.g. biomass to electricity applications.

G. Basic SWOT analysis

The following table summarizes a basic SWOT analysis for the APPR biomass in the regions of Peloponnese and Macedonia and Thrace.

Each factor is categorized as follows:

- AGR: Agricultural sector
- IND: Industrial sector
- ENR: Energy sector and end-users
- COM: Commercial sector
- FIN: Financial

SWOT TABLE

	Positive factors	Negative factors	
Internal Factors	**Strengths** (to be enhanced) AGR: large areas cultivated with permanent crop plantations; significant potential of APPR biomass in the investigated regions IND: agro-industries working close to the farming sector are present (olive mills, pomace mills, canning plants)	**Weaknesses** (to be addressed and overcome) AGR: small holdings limit the amount of APPR biomass an individual farmer can bring in the market AGR / IND / ENR / COM: little to no previous experience in the utilization of APPR biomass other than firewood IND: no major manufacturers of APPR biomass harvesting equipment were located in the regions ENR: several boilers and other heating systems not adapted to the use of biomass chips COM: intermediate actors in APPR biomass logistics are lacking	Internal Factors
External Factors	**Opportunities** (to be seized) AGR: farmers interested to explore new sources of income (or reduce costs) and investigate biomass opportunities ENR: high cost of fossil fuels for heating and interest in biomass fuels ENR: industries are interested in reducing costs and turning to biomass fuels COM: the biomass trading network is expanding	**Threats** (to be neutralized) ENR: development of a market that focuses on wood pellets limits the opportunities of APPR biomass chips ENR: cheap biomass fuels available on the market and limited control or knowledge about impact of fuel properties FIN: financial crisis limits investments and makes market conditions insecure	External Factors
	Positive factors	Negative factors	

2.2 ACTION PLAN

The following Action Plan intends to record a series of actions to promote the APPR biomass sector in the two investigated demo regions in Greece (Peloponnese, Macedonia and Thrace).

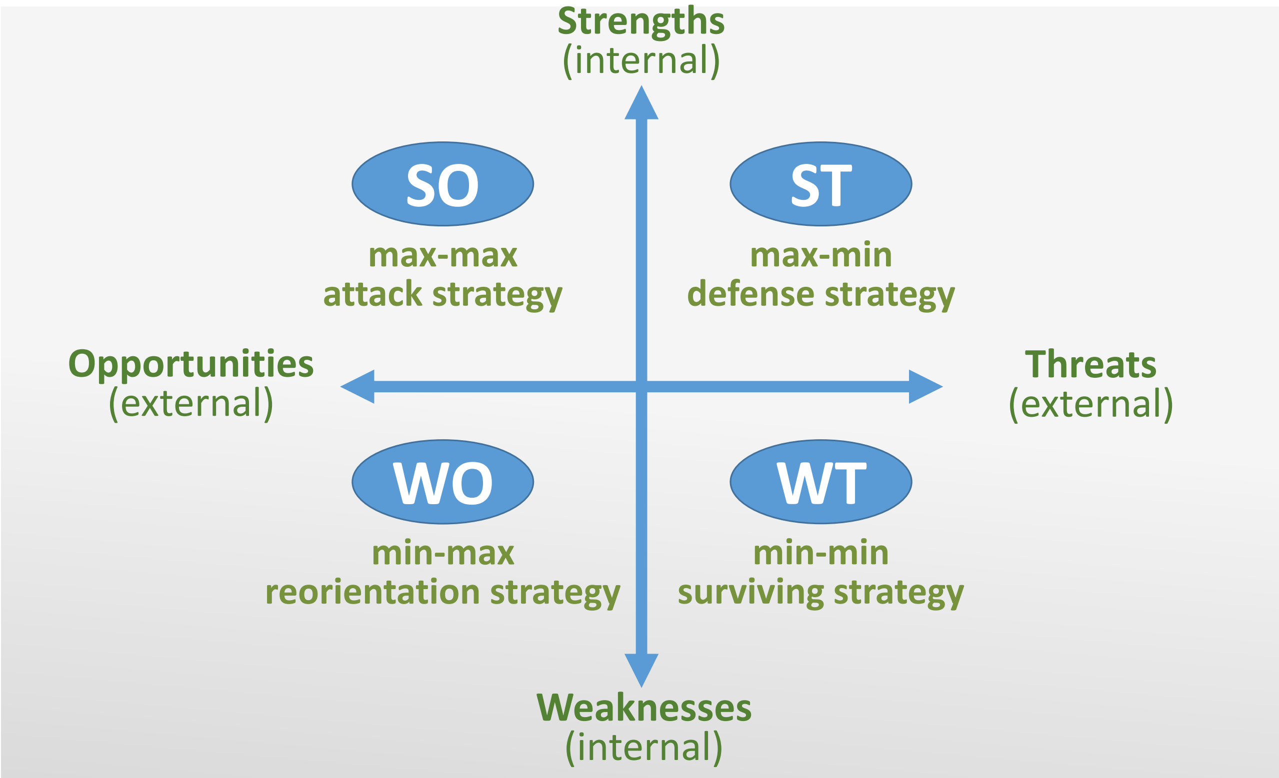
The Action Plan is based on the SWOT analysis and identifies the following main strategic options:

SO Strategies (Strategies employing strengths in order to profit by opportunities). These are the max-max type 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*).

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*).



ACTION PLAN TABLE

* Time frame to implement the action or action prioritization (**short**: within the project end; **medium**: at the end of the project; **long**: short after the project end)

Strategies / Targeted action type	Items	Objectives	Actions / Activities	Actors engaged / Targeted stakeholders	Already included in "uP_running" (yes / no)	Time frame *
SO = Strengths + Opportunities **Farmer training**	S: large areas with permanent plantations (AGR) O: farmers interested in exploring new sources of income (AGR)	Convince farmers of the economic benefits that APPR utilization can bring	• Organize workshops, training events, etc. • Set-up permanent support (e.g. through training of consultants) to farmers / cooperatives interested in developing APPR value chains	Farmers, Agricultural Cooperatives	Yes	Short / medium term
SO = Strengths + Opportunities **Value chain structuring**	S: agro-industries working close to the farming sector (IND) O: farmers interested in investigating biomass opportunities (AGR)	Create real forms of cooperation between agriculture and agro-industries.	• 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	Farmers, agricultural cooperatives and agro-industries	Yes	Short / medium term

Strategies / Targeted action type	Items	Objectives	Actions / Activities	Actors engaged / Targeted stakeholders	Already included in “uP_running” (yes / no)	Time frame *
WO = Weaknesses + Opportunities **Demonstrations of APPR biomass value chains**	W: limited to no experience with APPR biomass utilization (AGR / IND / ENR / COM) O: farmers and end-users interested in reducing costs (AGR & ENR)	Overcome lack of knowledge by executing and promoting “hands-on” examples and demonstrations	• Implement demonstrations of APPR biomass utilization • Promote results	uP_running AP/TP, all value chain actors	yes (but should be expanded)	Short / medium term
WO = Weaknesses + Opportunities **Promote cooperative spirit between farmers**	W: small size of agricultural holdings (AGR) O: farmers interested in new sources of income (AGR)	Convince farmers to pool resources through agricultural cooperatives in order to make APPR value chains possible	• Cooperation through cooperatives in order to mobilize sufficient quantities of APPR biomass that can sustain new initiatives • Promote cooperative ownership of relative expensive harvesting machines that can serve the needs of several farmers	Farmers, Agricultural Cooperatives	Yes (partly)	Medium / long term

Strategies / Targeted action type	Items	Objectives	Actions / Activities	Actors engaged / Targeted stakeholders	Already included in "uP_running" (yes / no)	Time frame *
WO = Weaknesses + Opportunities **Finance retrofits / replacement of energy conversion systems**	W: boilers and heating systems not adapted to APPR chips (ENR) O: industries and households interested in reducing energy costs (ENR)	Develop the APPR biomass consumption for the end users by financing the replacement or retrofit of existing energy conversion systems	• Set up funding schemes and support mechanisms to retrofit or replace existing energy conversion systems to "APPR-compatible" ones	Regional / public authorities, end users	no	Medium / long term
WT = Weaknesses + Threats **Fuel training / awareness**	W: boilers and heating systems not adapted to APPR chips (ENR) T: cheap, alternative fuels available on the market, limited knowledge on impact of fuel properties (ENR)	Make APPR biomass fuels an acceptable alternative for the operation of boilers and heating systems	• Disseminate information about the impact of fuel properties on emissions, efficiency and overall behaviour of combustion systems • Promote good examples of APPR biomass utilization as alternatives	Research and academic sector, policy makers, domestic sector, industrial users of solid biofuels	no	Medium / long term

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The following are the stakeholders that have been contacted and interviewed in elaborating the Sector Analysis and the Action Plan. We are very grateful for their cooperation and they have agreed to be cited.

Name - Surname	Company and Address	Role in the APPR value chain
Mr. Panagiotis Chatzaras	**Winery Cooperative of Nemea** Papakonstantinou Av. 130, Nemea Korinthias, 27460, Greece	Cooperative member, farmer, APPR biomass producer
Dr. George Stratakos	**Union of Agricultural Cooperatives of Lakonia** Leonidiou 113, 23100, Sparti, Lakonia, Greece	Cooperative agronomist
Mr. Golemis Nikos	**Agricultural Cooperative of Palaiopanagia Lakonias** Palaiopanagia Lakonias, 23054, Lakonia, Greece	Cooperative member, farmer, APPR biomass producer
Mr. Nikos Prokovakis	**Union of Agricultural Cooperatives of Lakonia** Leonidiou 113, 23100, Sparti, Lakonia, Greece	Cooperative member, farmer, APPR biomass producer
Mr. George Foudoulis	**Agricultural Vines and Wine Cooperative VAENI Naoussa** Episkopi Naousa, 59200, Greece	Cooperative member, farmer, APPR biomass producer
Mr. Pantelis Mpermperis	**Agricultural Fruit Cooperative of Almopia "The Union"** 1st klm Aridaias-Tsakon, Aridaia, 58400, Pella, Greece	Cooperative member, farmer, APPR biomass producer
Mr. Nikos Xidianos	Self-employed / Skydra Edessas, Pella, Greece	Farmer, APPR biomass producer

Name - Surname	Company and Address	Role in the APPR value chain
Dr. Dimitris Sampanis	**BioAlten** 20th km National Road Tripoli – Megalopoli, 22027 Athinaion, Arcadia, Greece	Pellet producer

Additionally, we would like to thank several agro-industries (canning factories, olive mills, pomace mills, etc.) as well as the numerous farmers that have attended the workshops organized by the uP_running project.

Ethics and personal data protection

Personal data means data such as name, contact data, email, phone, etc. Therefore we shall commit with some procedures in order to comply with EU-H2020 rules in activities like the workshops which involve personal data management.

- Informed consent procedures: There is a minimum content that the documentation should include. This information should be included in all the documents where personal data is gathered. The text should be translated to your original national language so that the stakeholders filling data understand what will be the use.
  If any partner creates new docs to gather data, e.g. a list of attendant for the returning workshop, then the text in the box below should be incorporated.

The purpose of the research is related to the objectives of the project "uP_running - Take-off for sustainable supply of woody biomass from agrarian pruning and plantation removal".
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691748.
Personal data will be treated in accordance to the EU Directive 95/46/EC. Data exchange between the project partners via project intranet or encrypted document. Data will be stored in the project intranet during the projetc lifetime. The information will be used only for the project purposes.
With the signature I confirm that my participation is voluntary.

- Sending personal data: documentation including personal data (list of attendees, interviews, etc.) will be uploaded and transferred via intranet of the project. Meanwhile please avoid sending this documentation via email, in case you need to send these materials before please use encrypted documents.

ANNEX C2

Ενότητα Εργασίας 2 – Δραστηριότητα 2.2

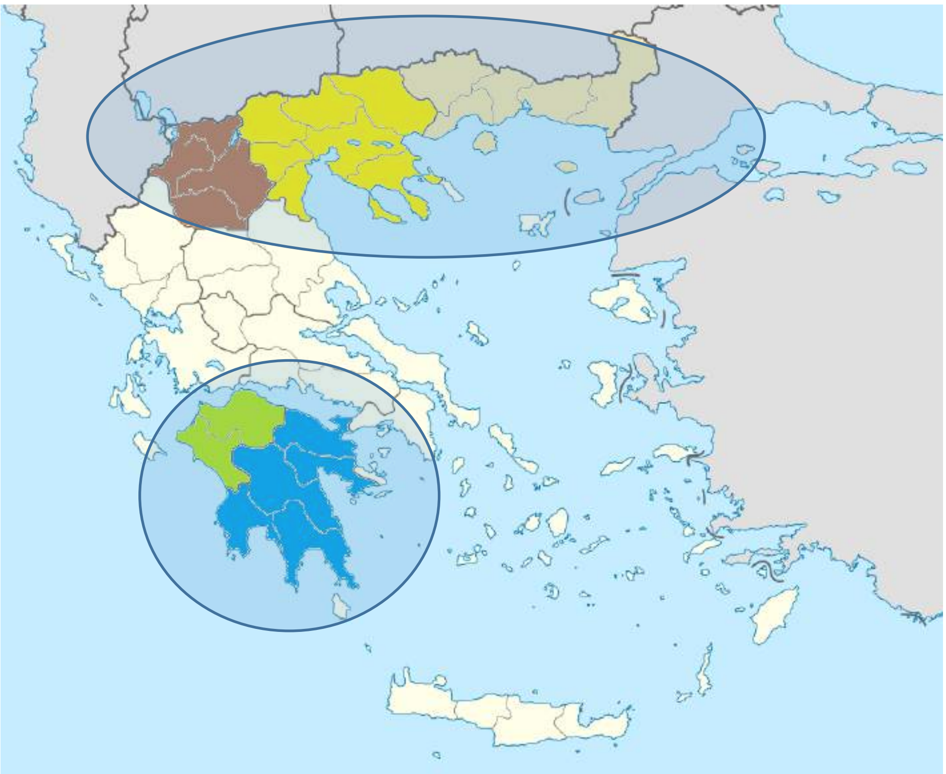
Ανάλυση του τομέα της βιομάζας από μόνιμες και Σχέδιο Δράσης για τις Ελληνικές Περιφέρειες «Επίδειξης»: Πελοπόννησος και Μακεδονία/Θράκη

Περιεχόμενα του Εγγράφου

2.1 ΑΝΑΛΥΣΗ ΤΟΜΕΑ

Α. Βασικά στοιχεία τομέα μόνιμων καλλιεργειών

Η ανάλυση του τομέα των αγροτικών κλαδεμάτων και εκριζώσεων στην Ελλάδα εστιάζεται σε δυο διαφορετικές και αρκετά ανόμοιες γεωγραφικές περιοχές: στην Πελοπόννησο, το νοτιότερο τμήμα της ελληνικής ηπειρωτικής χώρας, και στην Μακεδονία και τη Θράκη, μια ευρεία γεωγραφική περιοχή που εκτείνεται από τα ανατολικά προς τα δυτικά του ελληνικού βορρά. Διοικητικά, η Πελοπόννησος περιλαμβάνει την Περιφέρεια Πελοποννήσου (NUTS2 EL65) και τις Περιφερειανές Ενότητες της Ηλείας (EL633) και Αχαΐας (NUTS3 EL632) της Περιφέρειας Δυτικής Ελλάδας. Διοικητικά, η Μακεδονία και η Θράκη περιλαμβάνουν τρεις διακριτές περιφερειακές αρχές: την Δυτική Μακεδονία (NUTS2 EL53), την Κεντρική Μακεδονία (NUTS2 EL52) και την Ανατολική Μακεδονία και Θράκη (NUTS2 EL51).



Εικόνα 1: Οι περιοχές ενδιαφέροντος για τη μελέτη: Περιφέρεια Πελοποννήσου (μπλε), Ηλεία και Αχαΐα (πράσινο), Δυτική Μακεδονία (καφέ), Κεντρική Μακεδονία (κίτρινο), Ανατολική Μακεδονία και Θράκη (ανοιχτό καφέ) στο χάρτη της Ελλάδας.

Ο Πίνακας 1 παρουσιάζει μερικές βασικές πληροφορίες για τις εκτάσεις που χρησιμοποιούνται για τις μόνιμες καλλιέργειες και την συνολική παραγωγή από τις πέντε βασικές κατηγορίες των δένδρων. Μερικές βασικές παρατηρήσεις που μπορούν να γίνουν και επηρεάζουν το δυναμικό της βιομάζας από μόνιμες καλλιέργειες στις δύο περιοχές που ερευνήθηκαν είναι οι εξής:

- Το ξηρότερο, Μεσογειακό κλίμα της Πελοποννήσου, το καθιστά πιο κατάλληλο για την καλλιέργεια της ελιάς και των επεριδοειδών, που αντιστοιχεί στο 38.5% και 66.5% της συνολικής ελληνικής παραγωγής σε αυτές τις καλλιέργειες.
- Το κλίμα της Μακεδονίας και της Θράκης είναι πιο κατάλληλο για την καλλιέργεια οπωροφόρων δένδρων, 86.9% του όγκου της ελληνικής παραγωγής φρούτων προέρχεται από αυτήν την γεωγραφική περιοχή.

- Η καλλιέργεια του αμπελιού είναι διαδεδομένη και στις δυο περιοχές, η Μακεδονία και η Θράκη έχουν μικρότερη καλλιεργειτική επιφάνεια όμως η απόδοση τους είναι υψηλότερη συγκριτικά με αυτή της Πελοποννήσου.

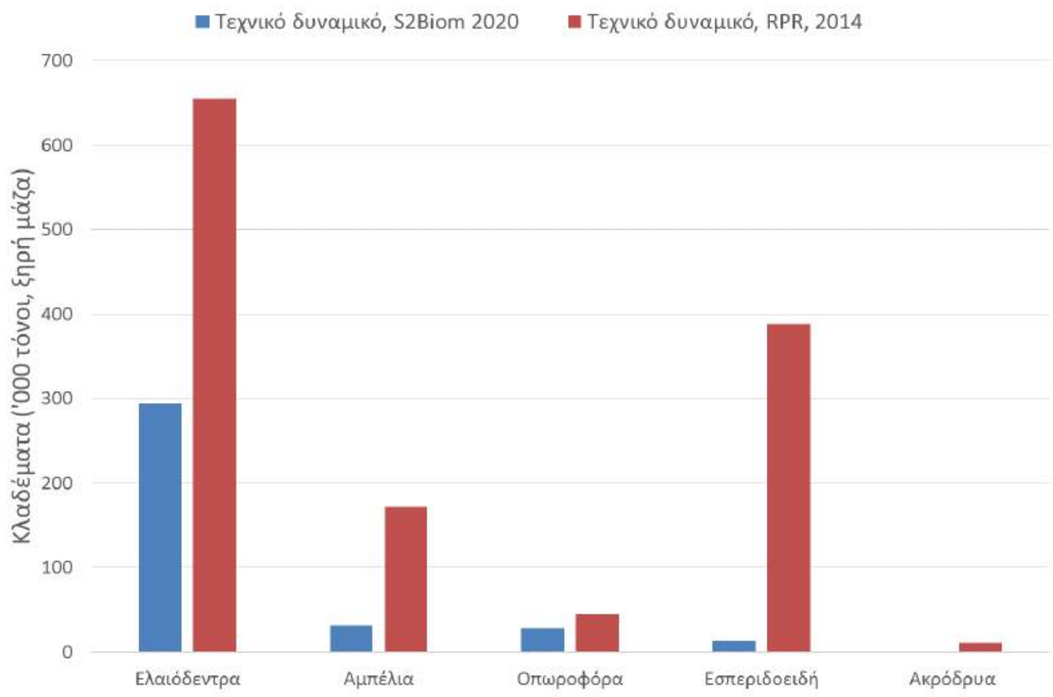
	Ελαιόδενδρα		Εσπεριδοειδή		Οπωροφόρα		Ακρόδρυα και οπωροφόρα για αποξήρανση		Αμπέλια	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Μακεδονία και Θράκη	566.8	284.2	0.1	0.0	584.0	730.0	86.2	26.8	126.2	147.9
Πελοπόννησος	2,603.0	996.2	268.7	646.7	53.1	75.0	75.3	18.6	340.5	295.2
Ελλάδα (συνολικά)	8,235.2	2,590.7	433.7	972.4	740.2	839.9	392.8	97.9	938.5	799.2

(1): χιλιάδες στρέμματα
(2): χιλιάδες τόνοι

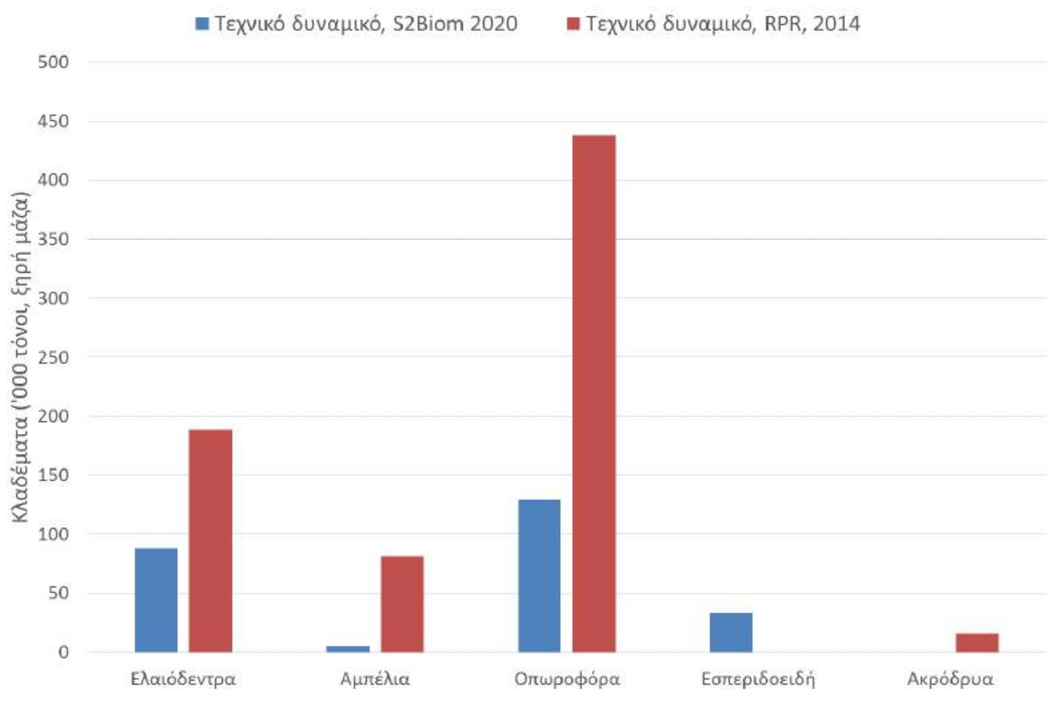
Πίνακας 1: Εκτάσεις μόνιμων καλλιεργειών σε πυκνές φυτείες και συνολική παραγωγή αυτών (ΕΛΣΤΑΤ, 2014)

Β. Περιφερειακό δυναμικό βιομάζας από μόνιμες καλλιέργειες

Δεν υπάρχουν πρόσφατα στοιχεία που να βασίζονται σε δεδομένα πεδίου σχετικά με το δυναμικό της βιομάζας από μόνιμες καλλιέργειες στις υπό εξέταση περιοχές. Η μελέτη αναφοράς για τα κλαδέματα στην Ελλάδα χρονολογείται από το 1987 [2] και παρουσιάζει το λόγο υπολείμματος-προιόντος (RPRs) για τα κλαδέματα που παράγονται από τα κυριότερα είδη των μόνιμων καλλιεργειών στην Ελλάδα. Πιο πρόσφατα, το ερευνητικό έργο του 7ου Προγράμματος Πλαισίου S2Biom πραγματοποίησε μια εκτίμηση του δυναμικού κλαδεμάτων από μόνιμες καλλιέργειες σε γεωγραφικό επίπεδο NUTS3 επίπεδο για το έτος 2020 και για ένα πλήθος Ευρωπαϊκών χωρών. Η αξιολόγηση βασίστηκε στην χρήση, συγκεκριμένων για κάθε χώρα, λόγων υπολείμματος-προς-επιφάνεια (RSRs) για συγκεκριμένους τύπους καλλιεργειών (ελιές, αμπέλια, εσπεριδοειδή και οπωροφόρα δένρα) με τις εκτιμήσεις των μελλοντικώνεπιφανειών που θα χρησιμοποιηθούν για τις καλλιέργειες αυτών των ειδών, όπως λαμβάνονται από το μοντέλο CAPRI [3, 4]. Μια σύγκριση αυτών των δυο προσεγγίσεων παρουσιάζεται παρακάτω. Οι διαφορές για τα αποτελέσματα των δυο μεθοδών παρέχουν μια σαφή εικόνα για τις μεγάλες αποκλίσεις που σχετίζονται γενικά με τις εκτιμήσεις του δυναμικού βιομάζας από τα κλαδέματα. Σε κάθε περίπτωση, είναι ξεκάθαρο το μεγάλο δυναμικό κλαδεμάτων από ελαιόδενδρα στην Πελοπόννησο. Τα κλαδέματα των οπορωφόρων δένδρων φαίνεται να είναι εξίσου σημαντικά στην Μακεδονία και τη Θράκη, ενώ τα αμπέλια είναι μια σημαντική πηγή βιομάζας και στις δυο περιφέρειες. Η πρώτη προσέγγιση αναδεικνύει ένα μεγάλο δυναμικό κλαδεμάτων από οπορωφόρα δένδρα στην Πελοπόννησο, ενώ τα αποτελέσματα του S2Biom δείχνει ένα σχετικά χαμηλό δυναμικό. Η πρώτη ένδειξη είναι πως οι περιφερειακοί φορείς και στις δυο αυτές περιοχές θα πρέπει να επικεντρωθούν στρατηγικά στις κύριες πηγές βιομάζας από τα κλαδέματα, π.χ. ελιές στο Νότο, οπορωφόρα δένδρα στο Βορρά και αμπέλια και στις δυο περιοχές. Τα κλαδέματα από άλλες μόνιμες καλλιέργειες πιθανόν να έχουν τοπική σημασία και να παρουσιάζουν ευκαιρίες για την ανάπτυξη εφοδιαστικών αλυσίδων βιομάζας αλλά είναι λιγότερο σημαντικά σε περιφερειακό επίπεδο. Φυσικά, η διενέργεια πρόσθετων μετρήσεων για τη δυναμικότητα των κλαδεμάτων μπορεί να δώσει πρόσθετες πληροφορίες για το πραγματικό δυναμικό στις περιφέρειες αυτές.



Εικόνα 2: Σύγκριση του εκτιμώμενου δυναμικού βιομάζας από κλαδέματα στην Πελοπόννησο από δυο προσεγγίσεις.



Εικόνα 3: Σύγκριση του εκτιμώμενου δυναμικού βιομάζας από κλαδέματα στην Μακεδονία και τη Θράκη από δυο προσεγγίσεις.

Όσον αφορά το δυναμικό της βιομάζας από τις εκριζώσεις δεν υπάρχουν δημοσιευμένες έρευνες. Ορισμένες ενδείξεις δίνονται από το ποσό των καυσόξυλων που παράγονται από τις γεωργικές καλλιέργειες στις δυο περιφέρειες όπως δίνεται από την ΕΛΣΤΑΤ [5]. Η Πελοπόννησος παρήγαγε 261,747 t από "αγροτικά" καυσόξυλα το 2014 (41.5% της συνολικής ελληνικής παραγωγής), ενώ το αντίστοιχο ποσό για τη Μακεδονία και τη Θράκη ήταν μόλις 56,870 t (9% της συνολικής ελληνικής παραγωγής). Σε αυτά τα καυσόξυλα συμπεριλαμβάνονται μεγαλύτερα κλαδιά από τις διεργασίες του κλαδέματος (κυρίως από τα ελαιόδενδρα) όπως επίσης και υλικό από εκριζώσεις.

Είναι δύσκολο να έχουμε μια πιο λεπτομερή αξιολόγηση της διαθεσιμότητας της βιομάζας από τις μόνιμες καλλιέργειες λαμβάνοντας υπόψη τεχνικούς ή οικονομικούς περιορισμούς λόγω της έλλειψης των στατιστικών στοιχείων. Αναμένεται ότι – ειδικά στην Πελοπόννησο και για την περίπτωση των ελαιόδενδρων – θα είναι δύσκολο να κινητοποιηθεί μέρος του δυναμικού λόγω της υψηλής κλίσης που παρουσιάζουν τα αγροτεμάχια. Ωστόσο, η ακριβής έκταση αυτών των περιορισμών δεν είναι γνωστή.

Συνήθως, οι Περιφερειακές Αρχές των περιοχών στις οποίες επικεντρώνεται η παρούσα έρευνα δεν έχουν καταστρώσει ένα λεπτομερές ενεργειακό πλάνο. Τα σχέδια διαχείρισης αποβλήτων (τα οποία είναι συχνά ένα «φλέγον» ζήτημα) μπορεί να κάνουν αναφορές στο δυναμικό βιομάζας από αγροτικά υπολείμματα (ιδίως στο δυναμικό βιομάζας από κλαδέματα) αλλά, εκτός από την επισήμανση διάφορων δυνατοτήτων διαχείρισης όπως είναι η κομποστοποίηση μαζί με τα αστικά ρεύματα αποβλήτων, δεν υπεισέρχονται σε οικονομικές ή άλλες λεπτομέρειες.

Εκτός από τα μεγαλύτερα κομμάτια ξύλου που προέρχονται από το κλάδεμα και από εκριζωμένα δένδρα και χρησιμοποιούνται σαν καυσόξυλα, οι αγρότες συνήθως αγνοούν ή αδιαφορούν για την συλλογή των υπολειμμάτων από τις μόνιμες καλλιέργειες για την παραγωγή ενέργειας. Οι ισχύουσες πρακτικές διαχείρισης έχουν ως εξής:

- Στις περισσότερες περιπτώσεις, τα κλαδέματα καίγονται σε ανοιχτές φωτιές στο χωράφι.
- Σε ορισμένες περιπτώσεις, εφαρμόζεται ο θρυμματισμός στο έδαφος ως πρακτική διαχείρισης. Ο κύριος περιοριστικός παράγοντας φαίνεται να είναι το κόστος αγοράς του θρυμματιστή και το γεγονός ότι αυτή η τεχνική διαχείρισης φαίνεται να έχει μόνο μια μικρή εξοικονόμιση κόστους συγκριτικά με τη χειρωνακτική συλλογή και το κάψιμο των κλαδεμάτων.
- Όσον αφορά τα κλαδέματα από τα αμπέλια, η χρήση τους σε ψησταριές και στον παραδοσιακό τρόπο μαγειρέματος το Πάσχα σε σούβλες έχει επίσης παρατηρηθεί ως πρακτική.

Γ. Περιφερειακές δυνατότητες για έναρξη αλυσίδων αξίας βιομάζας από μόνιμες καλλιέργειες: περιγραφή του παραγωγικού τομέα

Οι πρώτοι σύνδεσμοι σε μια αλυσίδα αξίας των αγροτικών κλαδεμάτων και εκριζώσεων σε οποιαδήποτε περιοχή είναι οι αγρότες. Ένα βασικό χαρακτηριστικό σχετικό με τις υπό εξέταση περιοχές είναι το μικρό μέσο μέγεθος των μόνιμων εκμεταλλεύσεων. Στην Πελοπόννησο, το μέσο μέγεθος ανά εκμετάλλευση είναι 18.7 στρ. για τα ελαιόδενρα, γύρω στα 13 στρ. για τα αμπέλια και λίγο πάνω από 10.7 στρ. για τους υπόλοιπους τύπους δένδρων. Στη Μακεδονία και τη Θράκη, το μέσο μέγεθος ανά εκμετάλλευση είναι 7.7 στρ. για τα αμπέλια και 19.6 στρ. για άλλους τύπους δένδρων [6]. Αυτό δείχνει πως η μέση ποσότητα βιομάζας που ένας μεμονωμένος γεωργός μπορεί να κινητοποιήσει έναι εξαιρετικά χαμηλή.

Ο επόμενος σημαντικός σύνδεσμος είναι ο αγροτικός συνεταιρισμός. Μέσω του συνεταιρισμού, οι αγρότες μπορούν να μοιράζονται πόρους, να διαπραγματεύονται καλύτερες τιμές με τους αγοραστές και να αξιοποιούν τη γνώση των ειδικών (π.χ γεωπόνων). Οι συνεταιρισμοί μπορούν να παίξουν σημαντικό ρόλο στην ανάπτυξη των αλυσίδων αξίας βιομάζας από μόνιμες καλλιέργειες και στις δυο περιοχές που ερευνήθηκαν με την παροχή εκπαίδευσης στα μέλη τους (αγρότες) και την επένδυση σε εξοπλισμό (π.χ. μηχανοκίνητες μηχανές συγκομιδής) και υποδομές (π.χ. αποθήκες) που απαιτούνται για την αποτελεσματική κινητοποίηση βιομάζας.

Οι τοπικές αγροβιομηχανίες αποτελούν επίσης εν δυνάμει σημαντικούς συνδέσμους στις αλυσίδες αξίας βιομάζας. Στην Πελοπόννησο, σημαντικές αγροβιομηχανίες είναι τα πολυάριθμα ελαιοτριβεία καθώς επίσης και τα λιγότερα σε αριθμό πυρηνελουργεία. Αυτές οι βιομηχανίες συνδέονται απευθείας με τους ελαιοπαραγωγούς και θα μπορούσαν να παρέχουν χρήσιμες υπηρεσίες για την ανάπτυξη μιας αλυσίδας αξίας από βιομάζα μόνιμων καλλιεργειών (π.χ. αποθηκευτικό χώρο ή ξηραντήρια πυρηνελουργείων). Θα πρέπει ωστόσο να σημειωθεί ότι από τη στιγμή που τα πυρηνελουργεία είναι ήδη παραγωγοί βιομάζας, πιθανόν να δουν τις πρωτοβουλίες αξιοποίησης βιομάζας από μόνιμες καλλιέργειες ως ανταγωνιστικές.

Στη Μακεδονία και τη Θράκη, οι κονσερβοποιείες φρούτων είναι ιδιαίτερα σημαντικές αγρο-βιομηχανίες. Τα προηγούμενα έτη, οι βιομηχανίες αυτές ήταν σημαντικοί τοπικοί παραγωγοί βιομάζας (π.χ. πυρήνες από ροδάκινο). Η σημερινή τάση είναι η ιδιοκατανάλωση της βιομάζας που παράγουν για σκοπούς θέρμανσης. Πάντως, λόγω της σύνδεσης τους με τους πρωτογενείς παραγωγούς και τους συνεταιρισμούς, θα μπορούσαν επίσης να συμμετέχουν και σε πρωτοβουλίες αξιοποίησης βιομάζας από μόνιμες καλλιέργειες ως τελικοί χρήστες.

Οινοποιεία είναι παρόντα και στις δυο περιοχές, ωστόσο μια πρώτη εκτίμηση δείχνει πως το μέγεθος τους δεν τους δίνει εξίσου σημαντικό ρόλο στην κινητοποίηση της βιομάζας από μόνιμες καλλιέργειες σε σύγκριση με τις άλλες αγροβιομηχανίες που αναφέρθηκαν, με την εξαίρεση ίσως των μεγαλύτερων μονάδων του κλάδου.

Τέλος, αξίζει να αναφερθούν τα τοπικά θερμοκήπια ως εν δυνάμει τελικοί καταναλωτές της βιομάζας από μόνιμες καλλιέργειες.

Μέχρι στιγμής, απουσιάζουν «ενδιάμεσοι» φορείς διαχείρισης της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις. Η σημερινή διαχείριση της βιομάζας από τις μόνιμες καλλιέργειες βασίζεται ως επί το πλείστον σε ανειδίκευτους εργάτες υπό την επίβλεψη των αγροτών. Οι εταιρίες που αναλαμβάνουν τη διαχείριση των κλαδεμάτων ή το υλικό των εκριζώσεων φαίνεται να λείπουν. Σε ορισμένες περιπτώσεις, αγρότες που έχουν στην ιδιοκτησία τους θρυμματιστές πιθανόν να προσφέρουν υπηρεσίες «καθαρισμού» στους συναδέλφους τους.

Το επιχειρηματικό μοντέλο που φαίνεται πιο κατάλληλο για την ανάπτυξη της αγοράς βιομάζας από κλαδέματα και εκριζώσεις στις περιοχές που ερευνήθηκαν, περιλαμβάνει τον αγροτικό συνεταιρισμό ως τη κύρια οντότητα κινητοποίησης ενός μεγάλου αριθμού γεωργών προκειμένου να διαθέσουν τα υπολείμματα τους όπως επίσης τον κύριο επενδυτή για τον εξοπλισμό και τις υποδομές στα πρώτα στάδια της αλυσίδας αξίας. Τα τελικά προιόντα που διατίθενται στην αγορά εξαρτώνται από τους τοπικούς τελικούς χρήστες, όμως φαίνεται πως η πιο ευρέως αποδεκτή μορφή είναι η πελλετοποιημένη βιομάζα.

Δ. Εμπόδια ή Περιορισμοί για την έναρξη ή την είσοδο σε μια αλυσίδα αξίας βιομάζας από μόνιμες καλλιέργειες

Με βάση τις διάφορες συζητήσεις, τις διμερής συναντήσεις και τις απόψεις που έχουν εκφραστεί στις ημερίδες του έργου uP_running, αλλά και σύμφωνα με τη δική μας κατανόηση της δομής που θα πρέπει να έχει η αγορά βιομάζας στις στοχευμένες περιοχές, εντοπίστηκαν τα ακόλουθα κύρια εμπόδια και οι περιορισμοί:

Έλλειψη ενημέρωσης και δυσπιστία: οι αγρότες συνήθως αγνοούν τις δυνατότητες για την κινητοποίηση της βιομάζας για την παραγωγή ενέργειας (εκτός από τα καυσόξυλα). Συχνά, δεν αντιλαμβάνονται την ποσότητα της βιομάζας που παράγεται σε τακτική βάση από τις διεργασίες του κλαδέματος. Για τους αγρότες, η διάθεση των κλαδεμάτων είναι ένα λειτουργικό κόστος το οποίο χρειάζεται να ληφθεί υπόψη για την οικονομία της καλλιέργειας, αλλά δεν μπορεί να θεωρηθεί πηγή εσόδων. Έχουμε δει ότι τονιστεί στους αγρότες το ενεργειακό δυναμικό των κλαδεμάτων, μερικές φορές η αντίδραση είναι η δυσπιστία: φοβούνται ότι μια εξωτερική εταιρεία θα τους επιβάλει να πληρώσουν για την «διάθεση» των κλαδεμάτων τους. Επιπλέον, αν είναι δυσαρεστημένοι με τα έσοδα των κύριων αγροτικών τους προιόντων, δεν μπορούν να πεισθούν ότι η ενεργειακή χρήση της βιομάζας από τα αγροτικά κλαδέματα ή τις εκριζώσεις μπορεί να τους παρέχει επαρκείς οικονομικές απολαβές, ή εξοικονόμηση χρημάτων ώστε να αξίζει τελικά τον κόπο.

Ανταγωνιστικά καύσιμα βιομάζας: ο εκχυλισμένος ελαιοπυρήνας είναι ένα καύσιμο βιομάζας το οποίο παράγεται από τα πυρηνελουργεία και χρησιμοποιείται ευρέως σε ελαιοπαραγωγικές περιοχές όπως είναι η Πελοπόννησος. Έχει αρκετά υψηλή περιεκτικότητα σε τέφρα (5% σε ξηρή βάση ή πεερισσότερο) και οσμές και παρουσιάζει διακυμάνσεις στο επίπεδο παραγωγής του (ανάλογα με την απόδοση της ελιάς την κάθε σεζόν) καθώς επίσης και στην τιμή του (ως συναρτήση του επιπέδου παραγωγής του και της τιμής του πετρελαίου θέρμανσης). Παρόλα αυτά, είναι αρκετά ανταγωνιστικό όσον αφορά την τιμή (γύρω στα 70 €/t τα τελευταία χρόνια) και έχει αρκετά υψηλή θερμαντική ικανότητα. Στη Μακεδονία και τη Θράκη είναι αρκετά εύκολο να βρεί κανείς πελλέτες από φλοιό ηλίανθου, που συνήθως εισάγονται από τη Βουλγαρία ή την Ουκρανία. Η τιμή τους αναφορικά κυμαίνεται στα 100 €/t γεγονός που τα κάνει πολύ ανταγωνιστικά για βιομηχανική χρήση, ανεξάρτητα από την υψηλή περιεκτικότητα τους σε τέφρα. Και στις δύο περιοχές, οι τελικοί χρήστες βιομάζας μπορεί να είναι αρκετά ικανοποιημένοι με αυτά τα καύσιμα και απρόθυμοι να ξεκινήσουν μια πρωτοβουλία βιομάζας από τα αγροτικά κλαδέματα και τις εκριζώσεις από μόνοι τους.

Τεχνικοί περιορισμοί για τους τελικούς χρήστες: οι κύριοι τελικοί χρήστες της βιομάζας στη Πελοπόννησο και τη Μακεδονία /Θράκη έχουν εγκαταστήσει συστήματα θέρμανσης κατάλληλα για καύσιμα μικρής κοκκομετρίας (όπως το πυρηνόξυλο) ή πελλέτες και άλλους αρκετά ομοιόμορφους τύπους βιομάζας (π.χ.πυρήνες ροδάκινων). Το τεμαχισμένο ξύλο από κλαδέματα και αγροτικές εκριζώσεις είναι πιθανό να προκαλούσε προβλήματα τροφοδοσίας, εκτός και αν οι χρήστες αποφασίσουν να επενδύσουν σε μετασκευές του συστήματος τροφοδοσίας.

Οικονομική κρίση: Η γενική οικονομική κατάσταση στην Ελλάδα επηρεάζει όλες τις επενδυτικές ευκαιρίες. Αν και η βιομάζα μπορεί να θεωρηθεί ως μια εξαίρεση από τη γενική τάση – δεδομένου ότι ο τομέας έχει αναπτυχθεί τα τελευταία χρόνια με βάση την προσφορά φθηνότερων εναλλακτικών λύσεων για το πετρελαίο θέρμανσης - η συνολική οικονομική κατάσταση κάνει τους πιθανούς επενδυτές πολύ απρόθυμους να προσφέρουν στην ανάπτυξη νέων πρωτοβουλιών θεωρώντας ότι είναι πιο δύσκολο να υλοποιηθούν. Η βιομάζα από τις μόνιμες καλλιέργειες φαίνεται να είναι μια από αυτές.

Ε. Νομοθετικές ρυθμίσεις και πολιτικές πρωτοβουλίες προώθησης

Μέχρι τώρα, σχετικά λίγες ρυθμίσεις και πρωτοβουλίες σε περιφερειακό (ή εθνικό) επίπεδο εμποδίζουν άμεσα την ανάπτυξη του τομέα της βιομάζας από τα αγροτικά κλαδέματα και τις εκριζώσεις στις περιοχές που ερευνήθηκαν.

Η γενική τάση είναι ότι η ανοικτή κάυση στο χωράφι δεν ενθαρρύνεται (παρόλο που είναι αποδεκτή από τον κώδικα Ορθής Γεωργικής Πρακτικής) και ενεργά απαγορεύεται κατά τη διάρκεια των καλοκαιρινών μηνών προκειμένου να αποφευχθούν κίνδυνοι πυρκαγιάς. Ο θρυμματισμός θεωρείται ως μια πιο κατάλληλη εναλλακτική λύση; η χρηματοδότηση τέτοιων πρωτοβουλιών προβλέπεται από το Πρόγραμμα Αγροτικής Ανάπτυξης για το 2014-2020, αν και αναμένεται ότι θα γίνει αποδεκτό από περιορισμένο αριθμό δικαιούχων στη χώρα.

Εκτός από τα παραπάνω, η βιομάζα από τις μόνιμες καλλιέργειες δε διαφοροποιείται σε σχέση με τα άλλα είδη βιομάζας στη νομοθεσία που αφορά την επιδότηση της ηλεκτροπαραγωγής από ΑΠΕ (π.χ. ο Νόμος 4414/2016).

Ζ. Χρηματοδότηση, αγορά και τελικοί χρήστες ενέργειας

Επί του παρόντος, πρακτικά δεν υπάρχει αγορά βιομάζας από μόνιμες καλλιέργειες στην Πελοπόννησο ή στη Μακεδονία και τη Θράκη, πέρα από τη παραδοσιακή χρήση των μεγαλύτερων κλαδιών και του εκριζωμένου υλικού ως καυσόξυλα (βλέπε παρακάτω). Ως εκ τούτου, η ανάλυση σε αυτή την ενότητα βασίζεται κυρίως στις δικές μας υποθέσεις και και στο όραμα μιας δυνητικής αγοράς.

Κεφαλαιουχικές απαιτήσεις για την αλυσίδα αξίας βιομάζας από μόνιμες καλλιέργειες: Εστιάζοντας κυρίως στα κλαδέματα, φαίνεται ότι το κύριο επιχειρηματικό μοντέλο για τη διάθεση βιομάζας στην αγορά περιλαμβάνει τη μηχανοποιημένη συγκομιδή των κλαδεμάτων και την αναβάθμιση τους σε μορφή πελλετών. Οι κεφαλαιουχικές απαιτήσεις για μια μηχανοποιημένη συλλεκτική μηχανή εκτιμάται στο εύρος των 20,000 - 40,000 €. Το ποσό αυτό ιδανικά μοιράζεται για την παραγωγή βιομάζας από διαφορετικούς αγρότες και ο εξοπλισμός θα μπορούσε να αγοραστεί από έναν συνεταιρισμό. Η χρηματοδότηση μέσω των προγραμμάτων αγροτικής ανάπτυξης θα μπορούσε να δελεάσει τους πρωτοπόρους, οι οποίοι θα αντιμετωπίσουν μεγαλύτερα ρίσκα. Σε μια καθιερωμένη αγορά των βιομάζας από μόνιμες καλλιέργειες, η υποστήριξη αυτή θα ήταν μικρότερης σημασίας. Ένα πιο σημαντικό κεφαλαιουχικό εμπόδιο θα ήταν η κατασκευή μιας μονάδας πελλετοποποίησης για τη βιομάζα από μόνιμες καλλιέργειες. Η συνολική επένδυση εξαρτάται από την ικανότητα παραγωγής. Η δημόσια χρηματοδότηση ή τα τραπεζικά δάνεια με ευνοικούς όρους γενικά ευνοούν αυτες τις επενδύσεις. Από την πλευρά των τελικών χρηστών της βιομάζας από μόνιμες καλλιέργειες, η αγορά ενός νέου συστήματος καύσης της βιομάζας ή η τροποποίηση του ήδη υπάρχοντος προκειμένου να χρησιμοποιείται η βιομάζα από τα κλαδέματα ή εκριζώσεις είναι η κύρια κεφαλαιουχική απαίτηση. Το επίπεδο επένδυσης εξαρτάται από τη συνολική χρήση ενέργειας των τελικών χρηστών. Για τους πρωτοπόρους στον τομέα της αξιοποίησης των ΚΛΕΚ, κάποια δημόσια χρηματοδότηση θα βοηθούσε και πάλι για να περιορίσει τους κινδύνους που συνδέονται με μια τέτοια επένδυση.

Τάση της αγοράς στις πωλήσεις και τιμή της βιομάζας από μόνιμες καλλιέγειες: Αυτό είναι αρκετά δύσκολο να εκτιμηθεί λόγω της έλλειψης μιας αναπτυγμένης αγοράς, αλλά λαμβάνοντας υπόψη το εύρος των τιμών των καυσίμων βιομάζας στις περιοχές που ερευνήθηκαν (μεταξύ 80-100 €/t για καύσιμα όπως ο εκχυλισμένος ελαιοπυρήνας και οι πελλέτες από φλοιό ηλίανθου και 230 €/t για πελλέτες ξύλου τύπου ENplus A2), καύσιμα από (ξηρά) κλαδέματα ή εκριζώσεις θα μπορούσαν να διατεθούν στο εμπόριο στο εύρος των 100-200 €/t. Συνεπώς, θα πρέπει να καλύψουν το κενό μεταξύ των χαμηλής ποιότητας, φτηνών καυσίμων και των καθαρότερων, υψηλότερης ποιότητας καυσίμων βιομάζας. Όπως και με άλλα καύσιμα βιομάζας, η τιμή του πετρελαίου θέρμανσης είναι ένας σημαντικός παράγοντας που θα μπορούσε να επηρεάσει τη πιθανή τιμή της βιομάζας από τις μόνιμες καλλιέργειες.

Δομή Αγοράς: Οι πρωτεργάτες της αξιοποίησης βιομάζας από μόνιμες καλλιέργειες στις περιοχές που ερευνήθηκαν θα βρεθούν σε μια θέση όπου θα μπορούσαν να αποτελούν ένα τοπικό μονοπώλιο ή ολιγοπώλιο. Ωστόσο, θα πρέπει να ανταγωνίζονται με άλλους τύπους καυσίμων βιομάζας που έχουν ήδη καθιερωθεί (π.χ. καυσόξυλα, πελλέτες από δασική βιομάζα, εκχυλισμένο ελαιοπυρήνα) και/ή τα ορυκτά καύσιμα. Οι τελικοί καταναλωτές ενέργειας θα πρέπει να δούν ότι η βιομάζα από τις μόνιμες καλλιέργειες μπορεί να είναι ανταγωνιστική και ευκολότερη στη χρήση από τις εναλλακτικές λύσεις χαμηλού κόστους (π.χ. όσον αφορά τη συχνότητα καθαρισμού τέφρα, εκπομπές, κλπ). Τα αυστηρότερα κριτήρια ποιότητας των καυσίμων και ο έλεγχος των εκπομπών από λέβητες βιομάζας θα μπορούσαν να έχουν διπλή επίδραση στην βιομάζα από τα αγροτικά κλαδέματα και εκριζώσεις: από τη μία πλευρά, θα μπορούσαν να ασκήσουν πίεση στον ανταγωνισμό, καύσιμα χαμηλού κόστους, αλλά από την άλλη πλευρά, θα μπορούσαν να προωθήσουν τη χρήση καθαρότερων καυσίμων από δασική βιομάζα, που χαρακτηρίζονται από χαμηλότερα ποσοστά τέφρας.

Εναλλακτική χρήση της βιομάζας από μόνιμες καλλιέργειες: Η κύρια εναλλακτική χρήση είναι τα καυσόξυλα από τα μεγαλύτερα κλαδιά που προέρχονται από το κλάδεμα και οι κορμοί/μέρη του δένδρου που προέρχονται από διάφορες εκριζώσεις. Η τιμή που μπορούν να αποκτήσουν τέτοιου είδους υλικά στην εγχώρια αγορά των καυσίμων κυμαίνεται στα 100 €/t; Αυτό είναι ήδη αρκετά υψηλό και είναι απίθανο ότι θα είναι ανταγωνιστικό για να χρησιμοποιήσετε αυτά τα υλικά ως πρώτη ύλη για άλλα ενεργειακά έργα, π.χ. βιομάζα για εφαρμογές ηλεκτρικής ενέργειας.

Η. Βασική SWOT ανάλυση (δυνατά σημεία, αδύνατα σημεία, ευκαιρίες, απειλές)

Ο παρακάτω πίνακας συνοψίζει τη βασική SWOT ανάλυση για τη βιομάζα των ΚΛΕΚ στις περιφέρειες της Πελοποννήσου και της Μακεδονίας και Θράκης.

Ο κάθε παράγοντας κατηγοριοποιείται ως εξής:

ΑΓΡ: Αγροτικός Τομέας
ΒΙΟ: Βιομηχανικός Τομέας
ΕΝΡ: Ενεργειακός Τομέας και Τελικοί χρήστες
ΕΜΠ: Εμπορικός Τομέας
ΧΡΜ: Χρηματοοικονομική

Πίνακας SWOT

	Θετικοί Παράγοντες	Αρνητικοί Παράγοντες	
Εσωτερικοί Παράγοντες	**Ισχυρά Σημεία** (που πρέπει να ενισχυθούν) ΑΓΡ: μεγάλες εκτάσεις που καλλιεργούνται με μόνιμες καλλιέργειες; σημαντικό δυναμικό της βιομάζας από μόνιμες καλλιέργειες στις περιοχές που ερευνήθηκαν ΒΙΟ: αγρο-βιομηχανίες που εργάζονται κοντά στον γεωργικό τομέα είναι παρούσες (ελαιοτριβεία, πυρηνελουργεία, κονσερβοποιίες)	**Αδυναμίες** (που πρέπει να αντιμετωπιστούν και να ξεπερασθούν) ΑΓΡ: οι μικρές εκμεταλλεύσεις περιορίζουν το ποσό της βιομάζας από μόνιμες καλλιέργειες που ένας μεμονωμένος γεωργός μπορεί να φέρει στην αγορά ΑΓΡ / ΒΙΟ / ΕΝΡ / ΕΜΠ: ελάχιστες γνώσεις σχετικά με την αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες ΚΛΕΚ λόγω έλλειψης προηγούμενων εμπειριών (με την εξαίρεση των καυσόξυλων) ΒΙΟ: Απουσιάζουν σημαντικοί κατασκευαστές μηχανημάτων συλλογής βιομάζας από μόνιμες καλλιέργειες στις περιοχές ΕΝΡ: αρκετοί λέβητες και άλλα συστήματα θέρμανσης δεν είναι προσαρμοσμένα για τη χρήση τεμαχισμένου ξύλου ΕΜΠ: Οι ενδιάμεσοι παράγοντες στην αλυσίδα της βιομάζας από μόνιμες καλλιέργειες απουσιάζουν	Εσωτερικοί Παράγοντες
Εξωτερικοί Παράγοντες	**Ευκαιρίες** (που πρέπει να αξιοποιηθούν) ΑΓΡ: οι αγρότες που ενδιαφέρονται να εξερευνήσουν νέες πηγές εισοδήματος (ή μείωση του κόστους) και να διερευνήσουν τις ευκαιρίες της βιομάζας ΕΝΡ: υψηλό κόστος των ορυκτών καυσίμων για τη θέρμανση και το ενδιαφέρον για καύσιμα βιομάζας ΕΝΡ: οι βιομηχανίες ενδιαφέρονται για τη μείωση του κόστους και τη στροφή σε καύσιμα βιομάζας ΕΜΠ: το δίκτυο εμπορίας βιομάζας επεκτείνεται	**Απειλές** (που πρέπει να εξουδετερωθούν) ΕΝΡ: ανάπτυξη μιας αγοράς που εστιάζει σε πελλέτες ξύλου περιορίζει τις δυνατότητες των θρυμμάτων βιομάζας από τις μόνιμες καλλιέργειες ΕΝΡ: φθηνά καύσιμα βιομάζας διατίθονται στην αγορά με περιορισμένο έλεγχο ή γνώση για τις επιπτώσεις των ιδιοτήτων αυτών των καυσίμων ΧΡΜ: οικονομική κρίση περιορίζει τις επενδύσεις και καθιστά τις συνθήκες της αγοράς ανασφαλής	Εξωτερικοί Παράγοντες
	Θετικοί Παράγοντες	Αρνητικοί Παράγοντες	

2.2 ΣΧΕΔΙΟ ΔΡΑΣΗΣ

Το ακόλουθο Σχέδιο Δράσης στοχεύει να καταγράψει μια σειρά δράσεων για την προώθηση της χρήσης βιομάζας από μόνιμες καλλιέργειες (αγροτικά κλαδέματα και εκριζώσεις) στις δυο γεωγραφικές περιοχές που μελετήθηκαν (Πελοπόννησος, Μακεδονία και Θράκη).

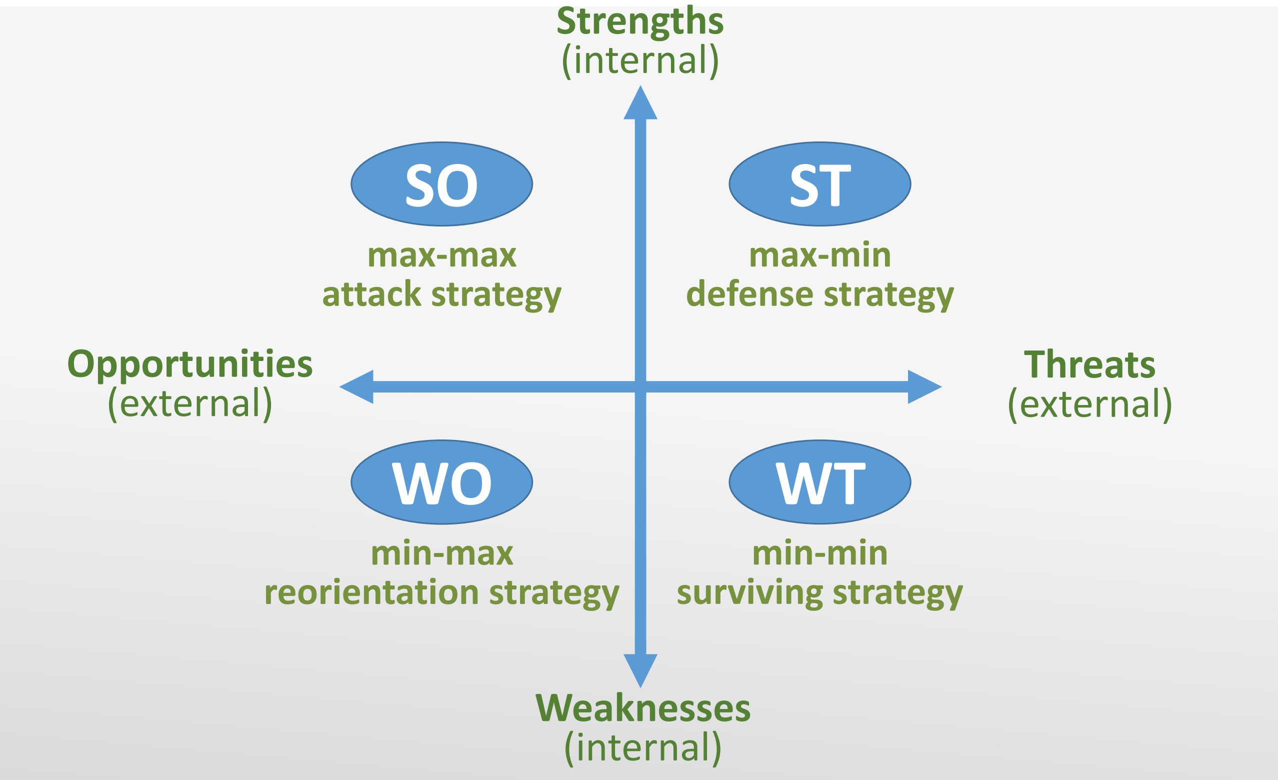
Το σχέδιο δράσης βασίζεται στην ανάλυση SWOT και προσδιορίζει τις ακόλουθες κύριες στρατηγικές επιλογές:

SO Στρατηγικές (Στρατηγικές που χρησιμοποιούν τις δυνάμεις, 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).

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).

ST Στρατηγικές (Οι στρατηγικές που χρησιμοποιούν τις δυνάμεις 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).

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).



Strengths
(internal)
SO
max-max
attack strategy
ST
max-min
defense strategy
Opportunities
(external)
Threats
(external)
WO
min-max
reorientation strategy
WT
min-min
surviving strategy
Weaknesses
(internal)

ΠΙΝΑΚΑΣ ΣΧΕΔΙΟΥ ΔΡΑΣΗΣ

* Χρονικό πλαίσιο για την υλοποίηση ή την ιεράρχηση της δράσης (σύντομο: μέσα από το τέλος του έργου; μέσο: στο τέλος του έργου; μακρό: λίγο μετά το τέλος του έργου)

Στρατηγικές / Τύπος στοχευμένης δράσης	Αντικείμενα	Στόχοι	Ενέργειες/Δραστηριότητες	Παράγοντες που εμπλέκονται / Στοχευμένοι ενδιαφερόμενοι	Συμπεριλαμβάνονται ήδη στο “uP_running” (ναι / όχι)	Χρονικό Πλαίσιο *
SO = Δυνάμεις + Ευκαιρίες **Εκπαίδευση αγροτών**	S: μεγάλες εκτάσεις με μόνιμες καλλιέργειες (ΑΓΡ) O: οι αγρότες που ενδιαφέρονται για τη διερεύνηση νέων πηγών εσόδων (ΑΓΡ)	Να πεισθούν οι αγρότες από τα οικονομικά οφέλη που μπορεί να φέρει η αξιοποίηση των κλαδεμάτων και εκριζώσεων	• Οργάνωση εργαστήρια, εκπαιδευτικές εκδηλώσεις, κ.α. • Έναρξη μόνιμης υποστήριξης (π.χ. μέσω της κατάρτισης των συμβούλων) στους αγρότες / συνεταιρισμούς που ενδιαφέρονται για την ανάπτυξη των αλυσίδων αξίας των κλαδεμάτων και εκριζώσεων	Αγρότες, Αγροτικοί συναιτερισμοί	Ναι	Σύντομο / Μεσοπρόθεσμο πλαίσιο

Στρατηγικές / Τύπος στοχευμένης δράσης	Αντικείμενα	Στόχοι	Ενέργειες/Δραστηριότητες	Παράγοντες που εμπλέκονται / Στοχευμένοι ενδιαφερόμενοι	Συμπεριλαμβάνονται ήδη στο "uP_running" (ναι / όχι)	Χρονικό Πλαίσιο *
SO = Δυνάμεις + Ευκαιρίες **Δόμηση αλυσίδας αξιών**	S: αγρο-βιομηχανίες που εργάζονται κοντά στον τομέα της γεωργίας (ΒΙΟ) Ο: οι αγρότες που ενδιαφέρονται για τη διερεύνηση δυνατοτήτων της βιομάζας (ΑΓΡ)	Να δημιουργηθούν πραγματικές μορφές συνεργασίας μεταξύ της γεωργίας και των αγρο-βιομηχανιών	• Διερεύνηση των επιχειρήσεων και των μοντέλων των εφοδιαστικών αλυσίδων που κάνουν χρήση της παρουσίας των αγρο-βιομηχανίες σε γεωργικές εκτάσεις με μόνιμες καλλιέργειες • Χρήση ευκαιριών και υπάρχουσων υποδομών των αγρο-βιομηχανιών (π.χ. αποθήκη, στεγνωτήρια, συστήματα μετατροπής ενέργειας) σε αλυσίδες αξίας των κλαδεμάτων και εκριζώσεων	Αγρότες, Αγροτικοί συναιτερισμοί και αγρο-βιομηχανίες.	Ναι	Σύντομο / Μεσοπρόθεσμο πλαίσιο

Στρατηγικές / Τύπος στοχευμένης δράσης	Αντικείμενα	Στόχοι	Ενέργειες/Δραστηριότητες	Παράγοντες που εμπλέκονται / Στοχευμένοι ενδιαφερόμενοι	Συμπεριλαμβάνονται ήδη στο "uP_running" (ναι / όχι)	Χρονικό Πλαίσιο *
WO = Αδυναμίες + Ευκαιρίες **Επιδείξεις των αλυσίδων αξίας της βιομάζας των ΚΛΕΚ**	W: περιορίζεται σε καμία εμπειρία με την αξιοποίηση της βιομάζας από τα κλαδέματα και τις εκριζώσεις (ΑΓΡ / ΒΙΟ / ΕΝΡ / ΕΜΠ) O: αγρότες και τελικοί χρήστες που ενδιαφέρονται για τη μείωση του κόστους (ΑΓΡ & ΕΝΡ)	Να καλυφθεί η έλλειψη γνώσης εκτελώντας και προωθώντας «hands-on» παραδείγματα και επιδείξεις	• Εφαρμογή επιδείξεων για την αξιοποίηση της βιομάζας από τις μόνιμες καλλιέργειες • Προώθηση αποτελεσμάτων	uP_running AP/TP, όλοι οι παράγοντες της αλυσίδας αξίας	Ναι (αλλά θα πρέπει να επεκταθεί)	Σύντομο / Μεσοπρόθεσμο πλαίσιο

Στρατηγικές / Τύπος στοχευμένης δράσης	Αντικείμενα	Στόχοι	Ενέργειες/Δραστηριότητες	Παράγοντες που εμπλέκονται / Στοχευμένοι ενδιαφερόμενοι	Συμπεριλαμβάνονται ήδη στο "uP_running" (ναι / όχι)	Χρονικό Πλαίσιο *
WO = Αδυναμίες + Ευκαιρίες **Προώθηση του πνεύματος συνεργασίας μεταξύ των αγροτών**	W: μικρό μέγεθος των γεωργικών εκμεταλλεύσεων (ΑΓΡ) O: οι αγρότες που ενδιαφέρονται για νέες πηγές εσόδων (ΑΓΡ)	Να πεισθούν τους αγρότες να συγκεντρώσουν πόρους μέσω των γεωργικών συνεταιρισμών, προκειμένου να καταστεί δυνατή η αλυσίδα αξίας των κλαδεμάτων και εκριζώσεων	• Συνεργασία με τους συνεταιρισμούς, προκειμένου να κινητοποιηθούν επαρκείς ποσότητες βιομάζας από μόνιμες καλλιέργειες που μπορούν να στηρίξουν τις νέες πρωτοβουλίες • Προώθηση της συνεταιριστικής ιδιοκτησίας των σχετικά ακριβών μηχανημάτων συγκομιδής τα οποία μπορούν να εξυπηρετήσουν τις ανάγκες πολλών αγροτών	Αγρότες, Αγροτικοί συναιτερισμοί	Να ι(εν μέρει)	Μεσοπρόθεσμο / Μακροπρόθεσμο πλαίσιο

Στρατηγικές / Τύπος στοχευμένης δράσης	Αντικείμενα	Στόχοι	Ενέργειες/Δραστηριότητες	Παράγοντες που εμπλέκονται / Στοχευμένοι ενδιαφερόμενοι	Συμπεριλαμβάνονται ήδη στο “uP_running” (ναι / όχι)	Χρονικό Πλαίσιο *
WO = Αδυναμίες + Ευκαιρίες **Χρηματοδότηση ανακατασκευών / αντικατάσταση των συστημάτων μετατροπής ενέργειας**	W: λέβητες και συστήματα θέρμανσης τα οποία δεν είναι προσαρμοσμένα στα θρύμματα των κλαδεμάτων και εκριζώσεων (ENP) O: βιομηχανίες και οικιακές μονάδες που ενδιαφέρονται για τη μείωση του ενεργειακού κόστους (ENP)	Ανάπτυξη της κατανάλωσης βιομάζας των κλαδεμάτων και εκριζώσεων για τους τελικούς χρήστες, χρηματοδοτόνταας την αντικατάσταση ή την επανακατασκευή των ήδη υπάρχοντων συστημάτων μετατροπής ενέργειας	• Δημιουργία μηχανισμών χρηματοδότησης και μηχανισμών στήριξης για να ανακατασκευούν ή να αντικατασταθούν τα υπάρχοντα συστήματα μετατροπής ενέργειας με αυτά που ειναι συμβατά στη βιομάζα από μόνιμες καλλιέργειες.	Περιφερειακές / δημόσιες αρχές, τελικοί χρήστες	Όχι	Μεσοπρόθεσμο / Μακροπρόθεσμο πλαίσιο

Στρατηγικές / Τύπος στοχευμένης δράσης	Αντικείμενα	Στόχοι	Ενέργειες/Δραστηριότητες	Παράγοντες που εμπλέκονται / Στοχευμένοι ενδιαφερόμενοι	Συμπεριλαμβάνονται ήδη στο "uP_running" (ναι / όχι)	Χρονικό Πλαίσιο *
WT = Αδυναμίες + Απειλές **Κατάρτιση καυσίμου / ευαισθητοποίηση**	W: λέβητες και συστήματα θέρμανσης τα οποία δεν είναι προσαρμοσμένα στα θρύμματα των κλαδεμάτων και εκριζώσεων (ENP) T: φθηνά, εναλλακτικά καύσιμα που διατίθονται στην αγορά, με περιορισμένη γνώση σχετικά με τις επιπτώσεις των ιδιοτήτων αυτών των καυσίμων (ENP)	Κάντε τα καύσιμα της βιομάζας των κλαδεμάτων και εκριζώσεων μια αποδεκτή εναλλακτική λύση για τη λειτουργία των λεβήτων και των συστημάτων θέρμανσης	• Διάδοση των πληροφοριών σχετικά με τις επιπτώσεις των ιδιοτήτων αυτών των καυσίμων στις εκπομπές, την αποδοτικότητα και τη συνολική συμπεριφορά των συστημάτων καύσης • Προώθηση καλών παραδειγμάτων αξιοποίησης της βιομάζας από τα κλαδέματα και τις εκριζώσεις ως εναλλακτικές λύσεις	Επιστημονικός και Εκπαιδευτικός τομέας, πολιτοί φορείς,οικιακός τομέας, βιομηχανικοί χρήστες στερεών καυσίμων	Όχι	Μεσοπρόθεσμο / Μακροπρόθεσμο πλαίσιο

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ΕΥΧΑΡΙΣΤΙΕΣ

Οι κάτωθι αναφερόμενοι έχουν ενημερωθεί για την εκπόνηση του σχέδιου δράσης και της ανάλυσης τομέα του έργου uP_running και έχουν παράσχει πολύτιμες πληροφορίες για τη συγγραφή του. Είμαστε πολύ ευγνώμονες για την συνεργασία τους και έχουν δώσει τη συγκατάθεσή τους προκειμένου να αναφερθούν σε αυτό το κείμενο, σύμφωνα με τους κανόνες και τις αρχές προστασίας προσωπικών δεδομένων του έργου uP_running.

Όνομα-Επίθετο	Εταιρία και Διεύθυνση	Ρόλος στην αλυσίδα αξίας των ΚΛΕΚ
κ. Παναγιώτης Χατζάρας	**Οινοποιητικός Συνεταιρισμός Νεμέας** Οδός Παπακωνσταντίνου 130, Νεμέα Κορινθίας, 27460, Ελλάδα	Μέλος συνεταιρισμού, Αγρότης, Παραγωγός βιομάζας
Δρ. Γιώργος Στρατάκος	**Union of Agricultural Cooperatives of Lakonia** Λεωνιδίου 113, 23100, Σπάρτη, Λακωνία, Ελλάδα	Γεωπόνος συνεταιρισμού
κ. Γκολέμης Νίκος	**Αγροτικός Συνεταιρισμός Παλαιοπαναγιάς Λακωνίας** Παλαιοπαναγιά Λακωνίας, 23054, Λακωνία, Ελλάδα	Μέλος συνεταιρισμού, Αγρότης, Παραγωγός βιομάζας
κ. Προκοβάκης Νίκος	**Ένωση Αγροτικών Συνεταιρισμών Λακωνίας** Λεωνιδίου 113, 23100, Σπάρτη, Λακωνία, Ελλάδα	Μέλος συνεταιρισμού, Αγρότης, Παραγωγός βιομάζας

Όνομα-Επίθετο	Εταιρία και Διεύθυνση	Ρόλος στην αλυσίδα αξίας των ΚΛΕΚ
κ. Φουντούλης Γιώργος	**Αγροτικός Αμπελουργικός Οινοποιητικός Συνεταιρισμός ΒΑΕΝΙ Νάουσα** Επισκοπή Νάουσα,59200, Ελλάδα	Μέλος συνεταιρισμού, Αγρότης, Παραγωγός βιομάζας
κ. Παντελής Μπερμπερής	**Αγροτικός Συνεταιρισμός ΑΦΟΣ Αλμωπίας «ΕΝΩΣΗ»** 1st χλμ. Αριδαίας-Τσάκων, Αριδαία, 58400, Pella, Ελλάδα	Μέλος συνεταιρισμού, Αγρότης, Παραγωγός βιομάζας
κ. Νίκος Ξιδιανός	Αυτοαπασχολούμενος / Σκύδρα Έδεσσας, Πέλλα,Ελλάδα	Αγρότης, Παραγωγός βιομάζας
Δρ. Δημήτρης Σαμπάνης	**BioAlten** 20th χλμ. Εθνικής Οδού Τρίπολης-Μεγαλόπολης, 22027 Αθηναίων, Αρκαδία, Ελλάδα	Παραγωγός Πελλετών

Επιπρόσθετα, θα θέλαμε να ευχαριστήσουμε αρκετές αγρο-βιομηχανίες (εργοστάσια κονσερβοποιίας, ελαιοτριβεία, πυρηνελουργεία, κλπ.) καθώς επίσης και τους πολυάριθμους αγρότες που έχουν παρακολουθήσει τις ημερίδες που διοργανώθηκαν από το έργο uP_running.

ANNEX D1

WP2 – TASK T2.2

Performing an APPR Sector Analysis and Developing an Action Plan for the Demo Regions Apulia (Italy)

Contents of the document

1. SECTOR ANALYSIS

A. Regional framework on APPR

Apulia region is situated in the south-east of Italy. It is delimited by Molise region in the north-west, Campania end Basilicata regions in the west and it is washed by the Adriatic Sea in the east and north part and by the Ionian Sea in the south (Fig.1). The surface is 19.540,9 km². Apulia region is divided in 6 provinces: Foggia (7.008 km²), Barletta-Andria-Trani (1.543 km²), Bari (5.138 km²), Brindisi (1.839 km²), Taranto (2.437 km²) and Lecce (2.759 km²). As a whole, the Apulia region represents the 6.5% of the surface of Italy.

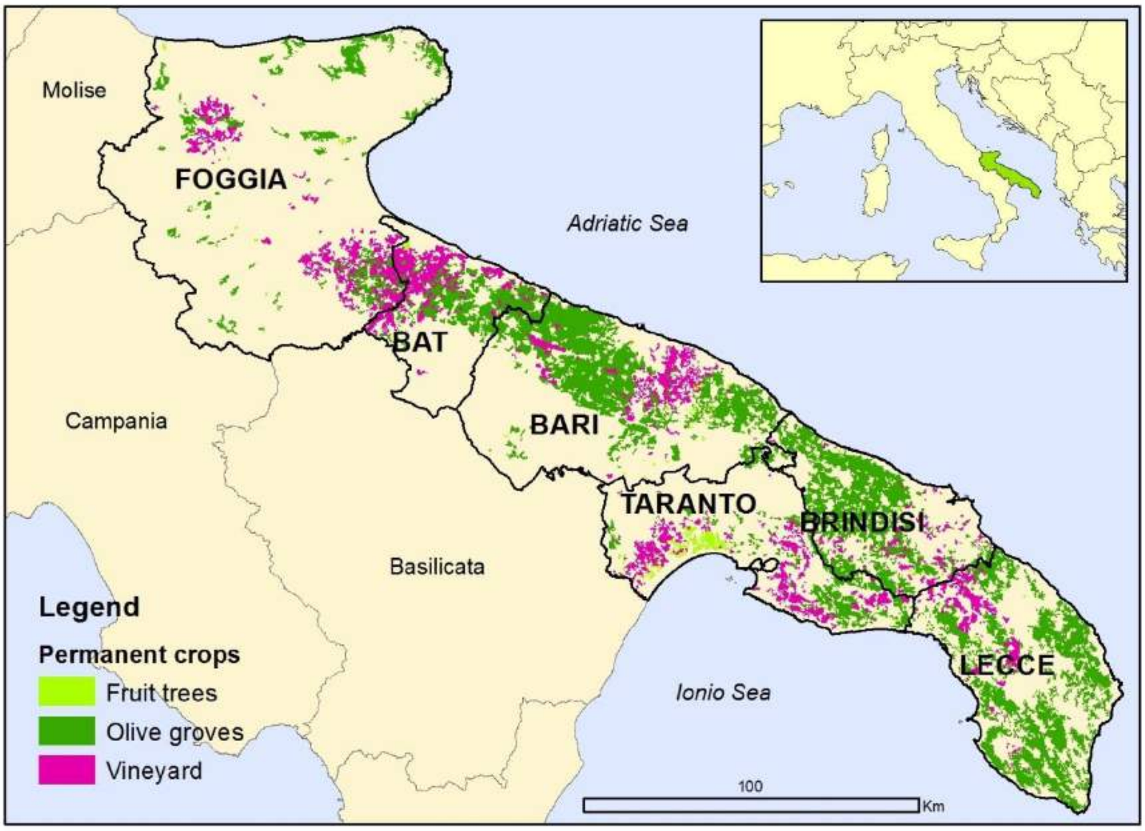

Figure 1: Location of the main areas of land cultivated with permanent crops in Apulia region and its main geographical characteristics

Apulia region has about 4 millions of inhabitants and it is among the most populated regions in Italy. Agriculture plays a prominent role in the economy of the region. It is a very intensive and modern agriculture that allows the region to be among the first in Italy for the production of several products. It is the case of durum wheat and tomato in the Foggia province, in addition to the of olive oil, with its estimated 50 million olive trees, as well as vineyards. It also holds a leading positions regarding the salad, artichokes, fennel, cabbage, celery and oats vegetables. Puglia held an ancient primacy in almond production, now gone down despite attempts to establish modern almond orchards on the Californian model. Specific areas report the success of fruit crops such as peach and kiwi.

The farm structure in the Apulia region is quite heterogeneous. Large, specialized or even super-intensive plantations (with very high plant density served by a permanent dripping irrigation system) could be placed side by side with traditional plantation (with fewer plants per hectare in a crop mixture with pasture). On average, the farm size is very limited (approx. 5 ha), and this trend is further emphasized considering tree-farms as compared to farms with herbaceous and industrial crops.

Figure 1 shows the location of permanent crops in Apulia region according to Corine Land Cover 2012 database. As regard to olive groves, Apulia has the 33% of the national surface (approx. 355,000 hectares over a total of approx. 1 million hectares at national level – 2010 Census data). As regard to vineyard, Apulia has the 15% of the national surface (approx. 100,000 hectares over a total of approx. 600,000 hectares at national level – 2010 Census data) (Table I).

Table 2: Surfaces (ha) of utilized agricultural land devoted to fruit tree crops in the Apulia region.

Geographical areas	Olive grove	Vineyard	Citrus	Other fruit trees
Italy	1,077,467	610,160	126,415	399,161
North-West of Italy	13,267	69,879	89	47,840
North-East of Italy	8,367	150,771	36	115,228
Center of Italy	185,882	90,893	665	56,064
South Italy	696,049	169,198	51,998	123,103
Apulia Region	355,446	94,585	9,015	33,279
Foggia	47,011	23,384	308	2,436
Bari	80,446	15,910	355	21,113
Taranto	33,917	21,177	7,652	1,382
Brindisi	67,029	8,854	144	3,477
Lecce	93,476	7,271	533	428
Barletta-Andria-Trani	33,567	17,987	25	4,443
Isole	173,903	129,420	73,628	56,925
Puglia / Italia (%)	33,0	15,5	7,1	8,3

B. Regional potential of the APPR availability

Numerous studies and analyses have been carried out over time, aimed at a regional quantification of biomass availability from fruit tree plantations (as well as from other cultivations and activities). Some of these assessments refer to specific and narrower geographic areas, others refer to the entire regional territory. We would like to refer, here, to a study conducted by the Agriculture Department of the Apulia Region entitled "Regional Data Bank of Biomass Potential in Apulia" published in November 2012 in the framework of the national PROBIO project "Actions to promote the use of biomass for energy. Pre-feasibility studies for the identification of agro-energy districts and for value chain projects". Specifically, a careful assessment of the most significant biomass sources on the regional territory was carried out. The potential of biomass (both crop residues and dedicated energy crops) was determined based on the specific vocation of the territories. The obtained database allows deriving quantitative information on the availability of different types of biomass. Info at municipal scale is the minimum data set. Larger scale info are obtained through aggregation. The data bank is considered a very useful information in order to accurately size the supply area and properly design the bioenergy value chain in the territory, according to the current regional legislation (Resolution of the Regional Council of 13 November 2012, No 2275).

Considering the previously introduced report, the following tables have been prepared. Table 2 refers to the amount of pruning of olive groves present in the region, divided by province; Similarly, Table 3 refers to the amount of pruning obtained from the vineyards as well as to the uprooted wood.

Table 2. Biomass quantities of pruning that can be obtained from olive groves in the Apulia region. For the distinction between gross and net value (technical and economic), refer to the text. (Source: Project Report PROBIO "Banca Dati Regionale del potenziale di biomasse in Puglia")

Districts	Unitary amounts	Gross amounts	Technical net amount	Economic net amounts
	t/ha	*t/anno*	*t/anno*	*t/anno*
Foggia	3.0	157,473	110,484	110,484
Bari	3.2	398,525	262,993	262,993
Taranto	2.4	84,540	63,423	63,423
Brindisi	2.2	145,600	105,788	95,210
Lecce	2.5	240,884	192,707	173,500
PUGLIA		**1,027,022**	**735,395**	**705,610**

Table 3. Biomass quantities of pruning that can be obtained from vineyards (both pruning and uprooted wood) in the Apulia region. For the distinction between gross and net value (technical and economic), refer to the text. (Source: Report Progetto PROBIO "Banca Dati Regionale del potenziale di biomasse in Puglia")

Province	Unitary amounts Pruning from wine grape	Unitary amounts Pruning from table grape	Gross amounts of pruning	Technical net amount of pruning	Economic net amounts of pruning	Technical net amount of uprooting wood	Economic net amount of uprooting woods
	t/ha	*t/ha*	*t/anno*	*t/anno*	*t/anno*	*t/anno*	*t/anno*
Foggia	3.6	4.3	154,902	122,918	116,772	25318	24052
Bari	3.0	4.9	147,335	103,674	98,490	25997	24697
Taranto	2.8	4.3	135,879	98,668	93,735	26442	25119
Brindisi	2.9	4.0	56,998	44,495	42,270	11113	10558
Lecce	2.9	4.0	37,920	30,336	28,819	7435	7063
PUGLIA			**533,034**	**400,091**	**380,086**	**96,305**	**91,489**

Tables show the unit values of biomass (expressed in tonnes per hectare), gross and net quantities. Net quantities are different from the gross quantities because of the reduction due to the technical efficiency assigned to the mechanization of the harvesting procedure. The field accessibility and its practicability by the harvesting machines is also assessed. Lastly, the net economic availability takes into account possible alternative uses of the same biomass feedstock, different from energy conversion.
From Tables 2 and 3, an approximate energy estimate can be made which, theoretically, would be possible to generate if the entire amount of available biomasses was directed at this purpose. Summing up the actual availability (approximately 700,000 tonnes per year of bulk, 380,000 tonnes per year of trusses and finally 90,000 vines planting), there is a total availability of 1,170,000 tonnes per year.

Assuming a (lower) calorific power of about 18.5 MJ / t, this corresponds to 5.14 MWh / t. Consequently, the gross energy production is thus 1.17 * 10^6 t / year * 5.14 MWh / t = 6 * 10^6 MWh / year. Considering an electrical generation efficiency of 30% this means an electricity production of 1.8 * 10^6 MWh / year, corresponding to an installed power of 225 MW. The obtainable electricity production would be able to cover the electrical consumption of about 700 thousand households (considering an average household consumption of 2,700 kWh / year). Differently, if we were to target biomass to thermal energy production, with an efficiency of 80%, the total energy production would amount to 4.8 * 10^6 MWh / year, or 600 MW of installed thermal power.
As it can be easily seen, the just presented numbers are remarkable and could contribute significantly to replace the use of fossil-fuels and allow the consequent reduction in GHGs emissions.
The Apulia Region in 2007 approved the Regional Environmental Energy Action Plan (PEAR) which contains strategic energy targets assuming a ten-year time horizon. Is therefore the right time to update the PEAR with respect to a subsequent programming period.
The regional energy planning pursues general goals of reconciling the demands for an economic and social development with protecting the environment and the landscape, as well as preserving natural and cultural resources. On September 18, 2010, the National Guidelines for the Authorization of Renewable Energy Plants were published. The Apulia region timely implemented these guidelines into the regional legislation. Areas not suitable for the installation of biomass plants and renewable energy installation were identified. Finally, DGR N^o. 3029 of 30 December 2010 was concerned about the rules to obtain the energy plant authorization.

C. Regional potential in the setting up APPR value chains

The APPR sector (i.e. fruit tree pruning as well as the wood from plantation uprooting) is part of the wider bioenergy sector, which, in turn, is framed in the so-called RES (Renewable Energy Sources) sector. With reference to the feedstock used, the sector can also be included within the framework of the “biobased” activities, i.e. the whole technologies focused on the use, transformation and conversion of biomass into a broad spectrum of final products (not only energy but also “biomaterials” and “bioproducts”, especially high added value final products).
The APPR biomasses here considered are “residual” feedstock; in other words, they are obtained as a waste of the processes of periodic care and maintenance of fruit tree crops. This, at least potentially, makes the supply chain much cheaper than dedicated energy crops. Starting from a “residual” rather than a “product” of cultivation, the cropping costs assigned to it are cancelled and the energy and emissive costs zeroed (because entirely charged to the “product” and not to the “residue”). In addition, addressing pruning to energy conversion enable to “avoid” the costs related to residue management operations. This increases the economic viability of cultivation. Finally, in case pruning is supplied to the market as a biofuel, this feedstock would also allow an additional income, complementary to that due to the ordinary agricultural production.
Structuring an APPR value chain consists of a plurality of operators, comprising harvesting, transporting, storing and finally converting these biomasses into energy. The economic advantage that each potential operator is retrieving along the value chain by including its specific service depends, apart the initial feedstock value, on the added value of the process or service provided by the operator, and the cost-effectiveness of the process itself (especially considering the economies of scale that could be generated). In case the unitary added value was particularly narrow, the process could only be feasible if the quantities at stake were sufficiently high, thus providing the whole operation would be economically viable, i.e. capable of generating sufficient profit margins.
The cases of supply chains centred on APPR biomass are rare in the Apulia region, although several stakeholders are highly interested and ready to take action, as it was clear by the meetings organized in

2016 in different regional areas, where a wide participation of potential actors of the value chain was always recorded.
The range of business types involved includes both the agricultural and industrial sectors, as well as the midway sector connecting the first to the second, consisting of a number of agro-industrial enterprises. Let's briefly study the composition of these sectors.
With reference to the agricultural entrepreneur, the most striking potential involvement is among the most renowned entrepreneurs, the ones that can rely on a wider business base, a larger economic growth and greater investment opportunities, predominantly inspired by the strategy of productive diversification. Agro-energy is a preference for younger, more dynamic, open-minded, economically solid, professionally developed farmers, more involved in the socio-political dynamics of the territory in which they operate.
In the region, this category of farmers is large and well represented, but certainly, it is not the most significant segment of agricultural entrepreneurs. For the most part, farmers are made of small direct growers. Very often, this category individually accounts for a too limited farmland to mobilize a significant volume of biomass feedstock to be collected and sold. Direct growers, therefore, have the chance to take part in structuring agro-energy supply chains only through the collective intermediation operated by the “category associations” or also through the “agricultural cooperatives”, the “agrarians consortiums”, or “producer organizations” the small companies are adherent. In this case, the good level of aggregation of the participating companies allows to reach the relevant quantities of biomass assigned to the collective structure.
Usually, the cooperative or consortium is pre-existing to the agro-energy initiative and it ordinarily manages the agro-food processing activity starting from the products provided by the members. Thus, for example, “social wineries” carry out the winemaking conferred by the associated farms, similarly, the “cooperative olive mills” provides for the production of extra virgin olive oil starting from the olives of adhering partners. These are the two productive realities (linked to the APPR type of biomass) which are largely spread in the region; many others, of a similar type, could be included.
Considering the agro-food transformations, significant energy consumption (both thermal and electrical) is related to the production process itself. In these cases, the supply of residual biomass (APPR) by the co-operative members may be able to fully satisfy the energy needs (self-consumption), thus allowing for substantial energy savings. Any energy surplus (usually in electrical form) could be placed and distributed on the national energy network (managed by ENEL or GSE). According to this model, therefore, each single cooperative shareholder would not only conferred the primary product to be transformed (grapes into wine, olives in oil), but also the residual pruning, the latter intended for energy conversion, in order to relieve the energy costs incurred by the associative structure (cooperative, consortium, etc.).
Differently, the consortium or cooperative may decide to make a real additional investment, parallel to its core business, by having an APPR biomass power generation plant that, by benefiting from favourable incentive in the electricity prices, generates an additional profit, to that coming from the agro-food business. In such a case, the cooperative or the consortium operates as any other economic entity that develops an investment strategy to profit from its own capital and feedstock resources.
Large and varied is also the industrial sector that could benefit from the wide availability of APPR biomass in the region. Once again, two broad categories should be those distinguished: the entrepreneurs directly operating in the energy sector, by managing a biomass plants for energy from those companies that need energy to meet their own energy requirements in carrying on their production process.
The first category is represented in the Apulia region by small, medium and high power plants. For example, the Fiusis plant in Calimera (LE), with a electrical power of 1.0 MWe, exclusively powered by pruning chips; The Enterra plant in Rignano Garganico (FG), with an electrical power of 13 MWe, predominantly fueled with olive pomace and wood chips; the plant of Tozzi Renewables Energy, with an electrical power of of 25 MWe, placed in S. Agata di Puglia (FG), predominantly powered with straws and wood chips.

These investments in the electricity sector were made at a time when tariff subsides reached an extremely high level, without comparison in Europe. These types of industrial investment on the biomass front should be considered very similar to other investments in the RES sector (i.e. wind-power and photovoltaic).

More difficult and gradual is the development of the second type of bioenergy production. In this case, the objective is not simply the production and dispatching of electricity (often without the aim of any heat recovering), but attaining a good level of energy autonomy (self-supply), thus achieving high levels of energy efficiency and self-consumption. In this case, a more developed business concept needs to be worked out, namely a concept where both energy producers and consumers are closed one another (or they are just the same entity), designing the operation of the industrial plant through the realization of an “energy island”. This objective is even more important if we consider the high degree of inadequacy of the national electricity grid and its limited performance, factors greatly emphasised by the progressive integration of irregular and discontinuous renewable sources of electricity (i.e. wind-power and photovoltaic).

There are many types of industrial firms that could self-supply energy. Industrial furnaces and kilns, boilers for steam generation, dryers, refrigerators, etc. Where these productive activities are all in the same industrial area (ASI zones or PIP areas, for example), it would be possible to carry out an ecologically equipped and energetically autonomous area. These areas may be capable of jointly managing infrastructures and a number of essential services (waste management, feedstock recycling, water treatment, emissions control, etc.), not only by obtaining maximum savings, but also by adopting the most appropriate technologies to safeguard the environment. This collective dimension should be a very important objective that should be properly promoted by the public administration.

Basically non-existent, in the Apulia region, cases of collective heating, for example on a municipal scale. Mountain communities, whose climatic zone is causing a prolonged use of thermal plants, would greatly benefit from these collective facilities, mainly directed to the thermal conditioning of public buildings such as schools, swimming pools or municipal gyms, libraries and public offices. These initiatives, quite common in the areas of the Alpine Arc and the Tosco-Emilian Apennines, today, are completely absent in our territory. A long and activity of awareness rising is needed to overcome these obstacles.

There is nothing left than to deal with the industry “connecting” the APPR biomass supply sector (agrarian pole) and the energy conversion/utilization sector (industrial pole). This sector makes up a number of companies able to provide specific and particular services, and to meet the complexity of logistical requirements related to biomass supply.

First, we have to refer to the mechanical companies operating “on behalf of third parties” (i.e. “contractors”). Regardless of the organization of pruning harvesting and conditioning, very often these companies, at least originally, are farms that progressively specialized in mechanization. They carry out farming operations for the benefit of other farms. Fruit tree pruning and the “disposal” of its residues are often accompanying this “portfolio” of mechanical and agricultural services. In some cases, this specific and particular task (fruit tree pruning and pruning management) has taken priority and dominance over others, justifying a progressive extension of the activity that may consist of storage and subsequent pruning processing to produce wood pellets or briquettes.

Today, the innovation of mechanical technologies offers a variety of collection, packing, or trimming solutions for pruning residues in the field, which greatly facilitates operations and significantly reduces costs, thus encouraging start-ups in this sector. Some mechanical companies specialized in the construction of these types of machines (an evolution of common mulchers and packers) also operate in our region and have a growing extra-regional credit. The presence of companies operating in the field of biomass storage is also gradually developing. One of the very restrictive constraints of the APPR industry is the sharp seasonality of pruning availability due to the need for a continuous and regular biomass supply throughout the year. In this respect, it is necessary to provide biomass “platforms” dedicated to the storage and conditioning of biomasses, so that they are secured (avoiding the risk of fire), well-preserved (to avoid the loss of calorific power), well dimensioned according to standard, regular and homogeneous criteria, to

ensure optimum energy use. These platforms, at least in our region, are often the result of the specialization by companies that traditionally operate in the market of olive pomace, olive kernel, almond and nuts shells, firewood, etc.
Of particular interest is also the biomass plant sector, characterized by increasing small-size plants, easy to install, more technically reliable, showing high performance and stringent emission control. It is obvious that, in the absence of reliable energy conversion technologies, the whole chain would remain without an outlet and its development would be precluded.
The creation of new biomass supply chains (and APPR biomass in particular) cannot ignore the agricultural component from which the supply of fuel is dependent. Far from considering the agricultural sector a mere feedstock supplier, one should imagine the development of an agriculture value chain that comes to the supply of a biofuel as a final product or an energy carrier or even the full energy service accomplished. This objective would allow an adequate deepening of the value chain (from a mere agricultural supply chain to a comprehensive agro-energy sector) and the internal (i.e. intra-sectorial) intake of the resulting added value. This would mean promoting a strategy in line with the objective of an integrated rural development, i.e. a socio-rural development. Apart from agriculture or forestry, it is the rural population as a whole that provides its energy needs, relying on local resources, managing them directly and locally. Agricultural cooperatives, therefore, give rise to biomass management structures that convert raw materials into final energy products, for self-consumption or energy supply of municipal public facilities or communal industrial site. This is the ideal reference model. In reality, energy investments are predominantly, if not exclusively, private, and in most cases the agricultural sector is like a mere feedstock supplier. Therefore, no advantages from the high energy tariffs are obtained by farmers, considering that such tariffs are often the only reason why the investment is carried out by private investors.

D. Barriers or constraints to enter into the APPR value chain or to start up the value chain

Focus groups with stakeholders in different areas in the Apulia region, as well as individual meetings with numerous entrepreneurs, made it possible to capture ideas, opinions and beliefs of all those potential actors of the APPR value chains. APPR chains. A comprehensive interpretative framework has been progressively defined, together with the factors that can significantly influence the structuring of APPR supply chains, the difficult in the take-off of bioenergy initiatives in the region, and the necessary conditions to make this happen.
The general evaluation is that the influence of non-technical limitations would be even more significant than the complexity of the technical constraints.
Firstly, the realization of the “focus groups” has surprisingly shown that potentially operating businesspeople do not have good knowledge of each other; therefore, often it is not possible to establish a functional relationship between businesses, aimed at structuring a bioenergy supply chain. The meetings (both collecting or bilateral) were of particular relevance in creating a previously non-existent, or very random stakeholders' network. This is a first important contribution to be drawn to the initiatives undertaken by the "*uP_running*" project in the region.

A factor that can greatly influence the ability to activate bioenergy value chains is the commercial value that APPR biomasses can achieve and therefore the willingness to buy these kind of biomass from the final consumer at an acceptable price for the farmer. In fact, if pruning collection procedures are merely considered a waste recovery or simply a “disposal” of residual material, this means that the farmer has nothing to claim in economic terms. Conversely, if the collection operation is directly linked to an activity of energy conversion, then the farmer's interest is certainly to consider pruning as a source of supplemental income. Territorial experiences are still too limited to assert that the latter hypotheses is the leading one, while, unfortunately, the former is still the current practice (apart from few significant exceptions).

However, some experiences of "short" supply chain, closely related to energy self-consumption of cooperative or consortia allow the spreading of an innovative concept of pruning-to-energy as an additional business. On the other hand, the creation of "long" supply chains, where the agricultural entrepreneur is a mere feedstock supplier, does not allow getting the right awareness about the intrinsic value of this residua material.

Considering the opinions expressed by farmers, the reluctance towards a regular pruning harvesting is based on two different approaches. On the one hand, some farmers regard pruning as a mere waste that need to be disposed, being an obstacle to the regular and timely execution of ordinary crop operations. This implies that the management of these residues is interpreted exclusively as an additional cropping cost, to be kept to a minimum. This strong belief justifies the incorrect practice of pruning burning directly in the field and on open-air. Differently, it is now unanimously recognized that this practice is completely wrong in the agronomic key, even though it is frequently tolerated, even legally. Quite often, phytosanitary reasons of plant protection are the reason why burning is a so frequent practice, even when these reasons do not have a real base or are overwhelmingly emphasised.
On the other hand, a second approach is offered by those farmers more technically advanced that are considering pruning as a resource to be valued in the ecosystem key, particularly to replenish or safeguard soil organic matter. In this sense, the technique of shredding and spreading lignocellulosic residues, thus resulting in a mulching layer, protects the soil from erosive phenomena by intense rainfall, excessive surface water evaporation, unwanted competition from weeds, preserves soil moisture and soil structure, allows a gradual humus enrichment, a good soil permeability and water conductivity. In many cases, this practice is closely associated with a "conservative" soil management, predominantly focused on minimum tillage or even no-tillage, and on soil cover by grass. In these particular cases, pruning removal and their energy use is not considered a fitting management of olive grove or vineyard. Although these latter techniques are more favourable with respect to the former (which instead imply the improper burning of pruning), it remains to be noted that a proper soil management able to simultaneously guarantee the removal of pruning and an effective safeguarding of the soil organic matter level is possible. This may happen on condition that a balance between organic supply and removal from the soil is respected, for example by performing organic fertilization as an alternative to mere mineral applications.
It could be assumed that techniques of pruning collection and first conditioning (from the field to the storage site) constitute a still complex procedure, thus limiting the organization of the supply chain. However, technological improvements were significant, especially in recent years, whereby two different organizations of the collection yard are recognized. The first model is baling, while the second one is shredding. Preliminary, windrows arrangement of pruning is requested. This operation can be fully mechanized. Deciding whether to proceed with baling or shredding does not simply have a direct logistical implications at the field scale, but is also has important consequences in the subsequent stages of conservation and pre-treatment of biomass before the energy conversion stage. In fact, it is possible to shred pruning preferably when humidity is sufficiently low (less than 25%). In this case, the storing accumulation of shred wood biomass will not meet degradative processes that are easily triggered with a still high humidity level. By contrast, baling does not press the woody material to a degree comparable to shredding and, in any case, it permits air circulation even when the bales are stacked in the storage site. This allows pruning to be harvested even when their humidity is still quite high (even at 40%). Therefore, considering shredding, pruning collection procedures are more critical but they can be faster and larger quantities of wood residues can be transported. By baling, however, it is possible to start collection operations in advance, relying on the fact that the biomass will lose humidity even during storage; however, the operations proceed more slowly and require higher handling. if compared to the simple shredding-loading combined operations in the previous case. These observations should be related, then, to the specific type of fruit tree plantation (number and distance between trees, frequency of pruning, field accessibility, etc.). These are all factors that may differently modulate the harvesting system. In the hardest

conditions, in fact, residues can be brought at the field edges, near the roadway, and harvested with a rudimentary mechanized system (bucket lifter and mechanical press, etc.).
The marked seasonality of pruning availability implies an efficient logistic organization of collection procedures (condition easily provided by companies operating on behalf of third parties), but also the possibility of a long-term storage. Therefore, the presence of a specialized platform for biomass storage is a requisite. This kind of “infrastructure” is still lacking in the region but it could be easily accomplished if some companies already operating in this sector, for example companies specialized in selling olive pomace, olive stones or pits, almond shells, etc. decided to expand their activity also including the wood biomass category.

Italy and, in particular, the Apulia region, are characterized by a high level of pellets consumption, energy products widely imported not only from north-eastern European countries, but even from Canada and United States, thus generating a large business volume. Reaching higher levels of domestic demand for pellets would therefore be a major interest in balancing the import-export ratio. Pellet is therefore a final market product of large use for which a number of agricultural entrepreneurs are investing. Being able to obtain a competitive local product compared to that of import is not an easy task, mainly considering two orders of problems. The first is to cope with the productive activity carried out in countries where woody biomass availability is very high, considering the vast forest resources they have. The large wood spatial density observed in these countries led to the establishment of highly mechanized and efficient supply chains, characterized by a very high level of commercial competitiveness (due to the maximum shrinkage in chain costs). The second reason lies in the fact that the locally available feedstock (i.e. pruning) does not have the same qualitative characteristics of wood from forestry (an increased ash, lower calorific value, more irregular pieces of the shredded wood, less wood density, etc.). This last set of factors affects, at least partially, the commercial value of the product obtained which, in theory, should be sold at a comparatively cheaper price. Some difficulties may therefore arise from the production of pellets, notwithstanding the strong interest that this productive activity is gaining in recent years. In this respect, the term “agri-pellets” indicate a lower quality pellet obtained from wood crop residues than that of forestry origin. The lower quality makes it particularly suitable for supplying industrial boilers and larger plants, rather than heating plants for domestic uses. In the latter case, in fact, the quality of the combustion (and therefore the quality of the fuel) is an essential condition for the installation of boilers inside environments where man is very frequently present.

With respect to energy conversion of biomass, and with particular reference to thermochemical processes, *combustion* is to be considered a technology that has now reached high levels of technological maturity. Differently, alternative processes such as *pyrolysis* and *gasification* are commercially less reliable and, on many occasions, they still do not offer full guarantee that a long-term investment (at least twenty years) should provide. The most critical technical aspect is the need to obtain a sufficiently “clean” syngas to feed properly the motor generating electric power. Filtration and washing processes are available, but specifically considering small-size plants, they are still costly and also require some technological improvement. In the last few years, some advantages has been detected in promoting plant “scalability”, i.e. the commercial availability of small scale installations (down to a few tens of kilowatts). A strong impetus to this evolution has been given by the modulation of the tariff subsidies to electricity that are increasing in reverse correlation to the electrical power of the plant.

Considering the last 15-20 years, the tariff advantage granted to electricity by RES has been a powerful leverage for the development of the sector. On the other hand, this has shifted a disproportionate interest on electricity generation, neglecting almost entirely the thermal sector that was not able to express its potential as desired. Moreover, an unbalanced tariff system in favour of electricity has certainly stimulated the industrial take-off of the sector, but it has also determined a very high level of discrimination between

large entrepreneurs and smaller ones. Large businesses were immediately able of operating large investments, while smaller and less organized entrepreneurs did not seize these opportunities, at least with the requested readiness, even if they were proposing smaller sized bioenergy models and better suited to the territorial context. On this front, municipal, provincial, LAGs, associations and other territorial clusters should have had a more effective organizational and coordination action, in order to better support initiatives and projects with a remarkable social characterization. Because of this discrimination (medium-high size biomass plants vs. small size plants), the resident population considered these investments in the biomass sector as extraneous and exogenous initiatives, thus seeing these projects as a kind of “aggression” to the territory. The possibility that the RES promotion measures could represent a great chance for the agricultural and agro-industrial sector was momentary lost. This vision, still to be implemented, is supporting the making of suitable non-food value chains, according to a distributed generation model, also offering services in line with the needs of local development.
At this stage, we have to deal with a “restart” (after the "frenzy" of wind-power and photovoltaic), this time focusing on energy models more responsive to the needs of the territory. By overtaking the previous pioneering phase, exclusively focussed on a few but significant large power plant installations, now is the time for a distributed renewable form of energy, very close to the demand site, integrated into the manufacturing fabric of companies, with higher levels of efficiency.

E. Regulation and promoting initiatives from the side of policy makers

The use of RES has a relatively recent genesis; only in 2002 (15 years ago) Italy has undertaken the commitment of achieving the objectives set out in the Kyoto Protocol, which entered into force on January, 2005. To attain these objectives, the national legislator enacted new lows to simplify and speed up the authorization procedures for the operation of RES installations. In particular, Legislative Decree no. 387/2003 introduced, by art. 12, a “unified” authorization procedure for the regions, to be carried out through the so-called “service conference” and to be concluded within 180 days (subsequently reduced to 90 by Legislative Decree 28/2011). The specific discipline of the procedure was defined by guidelines that would ensure the correct installation of the plants in the landscape (in particular considering wind-turbines and photovoltaic plants). The guidelines from the State were finally issued with the Ministry Decree 10 September 2010, after seven years from the launch of the Legislative Decree 387/2003, and transposed by the Apulia region by the Regulation No. 24 of 30 December 2010.
RES installations, therefore, showed a rapid expansion; this was due, on one hand, to the considerable advantage of the incentive schemes, set by the national government; on the other hand, to the lack of rules and guidelines on the localization criteria of the RES plants. In particular, what was lacking was of an adequate planning framework ensuring that the territorial carrying capacity was respected.
Shortly, it is possible to point out that the bioenergy sector (and therefore also the APPR energy sector), in the region, was strongly affected by the huge diffusion of other RES (wind-turbine and photovoltaic) according to the following characters:
- The entry of the new RES into the market and the territories was “de-regulated” and strongly encouraged by the State legislation and central institutions. This was done in the absence of any form of planning and coordination at local level.
- The existence of gaps in the State system and the lack or delayed adoption of criteria for the correct installation of the RES plants and the maintenance of the territorial carrying capacity made the interventions of the Apulia regional administration very urgent in terms of subsidiary function.
- Such interventions carried out by the Apulia regional administration concerned the RES subjects in its various aspects: from the landscape and environmental integration of the plants, to the authorization procedures, to the assurance of the reliability of the new RES operators and their industrial projects, etc.

- Despite the subsidiary function of the Apulia regional administration on the gaps in State legislation, the realization of RES plants in the territory grew at an incredible rate. Local institutions have still difficulties in preventing this “rush”, pursuing a more harmonious and coordinated development of the sector that takes into account the vocation of the territories.
This has led to a critical review of the previous regional energy plan (PEAR) and to check its original objectives, particularly in light of the intense RES development processes observed in recent years. It is therefore inevitable that there is a general need to re-calibrate the strategic development lines formerly identified, especially considering the absolute prevalence of wind-power and photovoltaic installations.
Within this critical picture, biomasses have not fully demonstrated their potential and maintained a limited development. Even in this case, investments not harmonized with the territory usually prevailed, in some cases focused on the use of imported feedstock (e.g. vegetable oils produced abroad) that have progressively eroded that originally "greenness" attributed to the sector.
The State discipline, its articulation at regional and provincial levels (especially considering the plant authorization procedures), the difficult coordination among several local offices, each referent of a particular aspects regarding the project evaluation (historical, cultural, naturalistic, environmental, landscaping, agriculture, public health, etc.) have made the procedures very complex, very uncertain, almost totally unpredictable, extremely time consuming. All this fact discourages and inhibits any investment in the sector, once again discriminating between entrepreneurs that can face a complex and risky authoring process, compared with those who, on the contrary, give up in advance, even if their investment proposal could show remarkable harmonization and respect for territorial vocations than those presented by investors that are more “aggressive”.
With reference to the framework outlined above, it would be courageous to propose a drastic regulatory simplification, capable to establish an effective dialogue among the different sectors of the public administration (economic and production activities, environment, agriculture, infrastructures, offices of administrative procedures, etc.). While the technical, environmental and public safety requirements that each new installation must satisfy should be severely checked, procedures need to be streamlined, many interpretative nodes about the rules should be solved, redundancy eliminated, contrasts and divergences between administrative offices involved finally clarified, etc. This very difficult task can be promoted only by an explicit and determined “policy”, knowing the great difficulties that such an operation will require.

F. Finance, market and final energy users

In recent years, despite the above-mentioned difficulties, a potential recovery of investment opportunities in the sector was observed. Today, both in the economic and in the technological front, we see more secure conditions and more robust prospects of investments, even though without that great tariff support which, on the other side, strongly "distorted" the energy market in recent years. After the "frenzy" that marked the first years of the RES development in the Apulia region (10-15 years ago), it is now the time for investments that are more aware, meditated, calibrated in relation to the feedstock territorial availability and to the social needs to be satisfied. As soon as possible, these conditions could actually stimulate a recovery in investments, which are now stagnating since about 4-5 years.
The current technological offerings include a wider range of generating powers, even with significantly lower generation sizes than those available only a few years ago. More attention to the combined production of electricity and heat (cogeneration), more stringent control in the environmental performance of the plants are observed. This more dynamic market condition and the severe economic recession in recent years have also favoured a significant fall in plant investment costs and a downsizing of the scale economy effects (which was responsible of a severe penalty of the small-scale installations compared to the largest ones in terms of capital investment required per power unit installed).

Regarding the cost of the fuel feedstock, unfortunately a stable and well-structured biomass market is still lacking, although commercial exchanges of different forms and types of ligno-cellulosic biomass started to grow and intensify. Therefore, the first biomass price trends and benchmarks, useful for making some economic feasibility assessment, are now unofficially available.
There are numerous energy end-products (or energy carriers) very similar to wood chips from pruning which could serve as a substitute. As a result, these products provide a comparable price reference with respect to the product of specific interest. It is quite obvious that the market penetration of bio-fuels potentially substitutes for wood chips obtained from pruning is a competitive and threatening factor, in so far as the market price of these alternative products is decreasing (that is, it is more and more cost-effective). Analogous reasoning is the comparison between local pellets and import pellets. Pellets, unlike wood chips, have very precise market references, today, and comparison (always in terms of benchmark values) is a technically coherent operation.
Hereinafter, we will refer to the indicative prices recorded in the Apulia region for the most commonly used solid biofuels. Firewood is sold at a price between 110 and 130 € per ton. Small cylindrical pruning bales (with a unit weight of about 30 kg) have a selling price of 2.5 € one, approximately, which results in a price of about 75 € per ton. The A1 pellet, on the other hand, is sold at a price ranging 230-350 € per ton. As we can see, the increase in the average price of fuel also increases the price variability, given the influence of the technological process applied.
Wood chips, therefore, have an average cost of about € 60 per ton. It is quite obvious that the quality of chippings significantly influences this evaluation. For example, its price could be affected by humidity, ash content (influenced, for example, by the presence or absence of bark), the average size of the chips and their dimensional regularity (the presence of oversized chips can greatly affect the regular use of the fuel in some biomass plants). Almond shells have an average price of about € 150 per ton, while the olive pits or stones obtained directly from olives (before milling) or from the olive pomace (after milling) have a market value of approximately € 190 per ton. Exhausted (oil free) olive pomace are sold at about € 100 per ton.
It is obvious that the most correct way to make a price comparison is to refer not to the unit biomass weight but rather to their corresponding unitary energy value, which is the ultimate purpose for which that fuel biomass is purchased.
According to this coherent comparative reference unit, wood chipsis, is by far, the cheapest fuel, both considering biomass fuels and fossil fuels. Chips B (M50), in fact, costs about half of the cost of firewood and is three times cheaper than the A1 pellet. Chips A2 (M35) is almost three times cheaper than agricultural methane and nearly five times cheaper than heating oil.
This condition of strong economic convenience is confirmed over the last decade, and even earlier. Biomass prices are particularly stable over time, unlike what has been observed with fossil fuels, which, on the other hand, are heavily affected by fluctuations in oil price, in particular because of the periodically occurring geo-political crisis.

G. Summarise a basic SWOT analysis

<u>Strengths</u>

S1. *Agriculture is a regional economic driving force*. The regional agricultural sector is a major sector of the Apulian economy, from which a significant part of regional wealth originates, despite alternate periods of crisis and a certain degree of persistent and general backwardness. There are, however, areas of excellence in which national and European conditions of primacy are shown. In the most efficient, most innovative and more developed parts of the agricultural and agro-industrial sectors, the hypothesis of meeting and satisfy the company's energy consumption by using biomass fuel from APPR could be a particularly attractive investment option. The underlying strategy is to reduce the dependence of agriculture on the use of energy resources of "fossil" origin and to increase the level of energy autonomy as well as the efficiency of energy use.

S2. *Wide availability of APPR biomass and high territorial density of pruning residues*. As mentioned in the first paragraph, Apulia is one of the Italian regions characterized by the highest concentration of olive groves and vineyards, to which other types of fruit trees (such as peaches, apricots and almonds) are also associated. This is a key pre-requisite in the development of agro-energy chains focused on the use of pruning residues. In particular, more than the total agricultural land involved, the main positive factor for biomass supply is the high spatial densities of pruning. A higher pruning spatial density, indeed, reduces the spatial radius of the supply basin and, therefore, it allows significant cost savings in the handling and hauling operations of wood residues, as well as in the GHG emission costs.

S3. *Development of olive-to-oil and grape-to-wine value chains as a "springboard" for agro-energy supply chains*. As a corollary to the previous point, among the strengths it is useful to highlight the remarkable development of the value chains downstream grape and olive production, i.e. the production of extra-virgin olive oils as well as the winery sector. It can be considered that these are agro-food sectors potentially associated with agro-energies as they allow the recovery of additional feedstock, or by-products, which integrate the availability of pruning for energy purposes. For example, olive pits, and virgin or exhausted olive pomace, are both considered very interesting biofuels, today, which may be considered complementary to pruning. Similarly, but with regard to the winemaking process, by-products such as marks and lees may also have an energy target. This integration between "contiguous" sectors and the ability to meet the energy needs of the agro-food processing itself could be an important element for leveraging new bioenergy supply chains.

S4. *Presence of mechanical "contracting" companies operating in the territory*. The presence of "contractors" offers to farmers the possibility to rely on these types of agro-mechanical companies to carry out the work of collecting and first conditioning the pruning. This allows the farmer to be released from these kind of operations because, considered the limited extent of the plantation fields or the lack of specific harvesting equipment, they are not able to carry out these operations autonomously or cost-effectively. Entrusting the cultivation operations to the service offered by contractors is a common practice in the region. This allows contracting companies to reduce the immobilization of their capital (due to the purchased machinery and equipment). Conversely, agro-mechanical companies often have a highly specialized machinery park that could also be suitable for shredding, baling, and collecting pruning, according to the harvesting model that is logistically more effective for the required operations.

S5. *Possibility to implement the "multifunctional" model of agriculture*. The concept of agro-energy system is in line with the "multifunctional" type of farming, now identified as a European reference model. The "multifunctional" objective is to diversify agricultural activities, to multiply income opportunities (also through non-conventional activities but functionally related to farming), and to deepen productive value chains, with the aim of incorporating business profits into added value products obtained from the transformation of raw materials into finished products. To this end, farms, cooperatives, consortia, producer associations may aim to convert residual biomass into an energy carrier (wood chips, pellets, briquettes, etc.). Alternatively, it would also be possible to directly handle an energy supply service (in the form of heat or electricity), for example through district heating projects at municipal scale.

S6. *Potential to strengthen the level of employment*. Unlike other types of RES, the use of biomass for energy purposes implies the structuring of an articulated supply chain with close territorial connections, which needs the participation and integration of a wide range of professional, from the agricultural and extra-agricultural sectors, capable of ensuring the mobilization, conditioning and conversion of biomass into energy. Numerous, therefore, are the workers who can participate in the supply chain and who, directly or indirectly, can offer their professional contribution. This is a guarantee of the socio-economic value of investments in agro-energy sector and the possibility that they can be a leverage of rural development.

Weaknesses

W1. *Poor knowledge about the possibilities offered by fruit tree residues*. Apart some exceptional cases, in general terms, there is no widespread awareness about the potential offered by pruning as energy carriers; therefore, there are no frequent occasions for entrepreneurs to exploit this kind of residues.

W2. *Complexity in structuring of a bioenergy value chain*. The lack of awareness about the energy potentials represented by the pruning (W1) is joint to the widespread fear that establishing a bioenergy value chain is a particularly difficult task on the organizational level. In particular, since any agro-energy project calls into question the coordination between a plurality of chain actors (each with its task to be performed), the entrepreneur's centrality is greatly diminished as well as his/her prerogative to make investment decisions. This need for a collective (or collegial) management hardly embodies the proud autonomous attitude of many agricultural entrepreneurs.

W3. *Mechanization of pruning management is a costly operation*. Despite the remarkable technological improvements recorded in recent years in the mechanization of harvesting and the first pruning conditioning, logistical operations related to the pruning collecting and mobilization are still considered to be difficult, costly, organizationally demanding and expensive (in terms of time to be devoted and labor force to be engaged). In particular, this is a problem in smaller farms, where a relatively modest surface does not justify a mechanical facility properly specialized in this type of operations. Hence, the greater propensity to entrust this type of operation to agro-mechanical firms working as “contractors”.

W4. *The unit value of pruning biomass is considered to be very modest and, therefore, economically unprofitable*. The general skepticism regarding the possibility of establishing agro-energy chains focused on the use of pruning is that the unit value of this type of biomass is too modest in comparison with other types, such as forest biomass. If this is the starting point, any further biomass processing (collection, compaction, transport, storage, etc.) is an additional cost to a low-value feedstock and to the final energy product that, however, displays a limited appreciation in the market. In other words, it is considered that the chain process must be particularly expensive to justify the availability on the market of an energy product from the sale of which it is unlikely to recover the total amount spent.

W5. *A sustainable management should require crop residues to return to the soil and therefore not be removed*. In some agricultural contexts, especially those more technically advanced, it is assumed that the systematic removal of crop residues may pose a risk to the integrity of agricultural soil quality characteristics, with particular reference to its organic substance. There are many wine growers (mostly) and olive growers (just a few) who are orienting the management of the orchard towards a system generally referred to as “conservative agriculture”. The pivotal technology is represented by the drastic reduction in the number of mechanical operations to the soil, up to the introduction of "no-tillage", coupled with cover cropping, whether temporary or permanent. This management regime is therefore unlikely to consider pruning as an energy carrier but as an ecological resource.
The implementation of an accurate soil organic matter balance, especially when farmer uses conservative techniques, as well as limited but valuable organic inputs (as partial substitute of mineral fertilizers) could

provide “win-win” solutions, i.e. the removal of pruning for energy generation and the simultaneous restoration of the soil organic content that mineralize.

W6. *Poor trust of industrialists in the commitments made by the farmer, and vice versa*. Whoever invests in the energy sector by making medium or large size plants needs to enter into supply contracts with a large number of (relatively small-farm) farmers who should guarantee the sufficient supply of biomass (both in quantity and quality). Such supplies must be ensured in the long run of the plant life cycle, i.e. at least 15-20 years. The farmer may be inclined to guarantee the supply from one year to the next; differently, a long-term contract is seen with little favor as it is too binding and uncertain about the possible market dynamics (both in the energy sector and in the agricultural sector). This is why a distrustful tendency by the farmer in engaging a so long contract is observed. Correspondingly, the industrial businessman is afraid that farmers, from their side, are not respected the commitment they have made. These suspicions generate uncertainty and can only be solved through the conclusion of contracts that provide different convenience and guarantee clauses for both parties.

W7. *Uncertainty about investments*. *Still high perception of entrepreneurial risk*. The above mentioned difficulties are further worsen by still high investment costs, administrative uncertainties, very scarce connection points to the electricity grid, frequent opposition from the resident population, etc. All this difficulties defines a still highly undetermined and therefore risky framework that do not favors investments and taking on long-term financial commitments. This happens despite frequent public capital subsidies, tax breaks and tariff incentives. This is, therefore, a very confusing framework, presenting major contradictions to be clarified.

W8. *Seasonality of collection and availability of residual biomass*. One of the most obvious limitations that may interfere with the realization of a biomass value chain is the seasonality in the operations of biomass collection in the field. In particular, the pruning of vineyards and olive groves takes place from the period following yield harvesting and can last until a period before the vegetative recovery of the fruit trees. This means that, as a rule, the winter season is available. Being the available time very limited, it could be an objective limitation to pruning collection, especially when the field size is very large or the company that performs the work operates on a “contractor”, with a tidy schedule of interventions. Pruning residues can be left on the soil, arranged in windrows, to facilitate subsequent collection, or stacked otherwise. The time of stay in the field and the weather conditions (preferably dry with no rains) can allow a more or less accentuated dehydration of wood. Collection techniques and logistics organization of the yard can influence collection times; in fact, shredding more than packing would require dehydration of biomass before harvesting.
Beyond the difficulty of pruning collection within a fairly limited time window, another difficulty is stemming from the marked pruning seasonality, and therefore the need to *manage* a centralized storage platform to act as a "buffer system" or "flywheel" between the concentrated harvest times and, on the contrary, the more "diluted" and regular times of plant supply. Frequently, the supply facility does not have adequate and sufficient space to ensure a single and centralized storage for all the required biomass all along the year. This implies, consequently, the realization of temporary storage centers, before the biomass is delivered to the final use center. This storage and supplying services could be managed by different kinds of company: an agricultural company (preferably joint in a cooperative or a consortium), an energy conversion industrial undertaking, or intermediary companies. The latter may or may not coincide with an agro-mechanical company offering the pruning service collection. As you can see, business models can be very variable in relation to socio-economic and technical conditions.

W9. *Energy products obtained from pruning may not meet certain standard quality parameters*. Common and standardized criteria for classifying the commodity characters of the final energy products obtained from biomasses are progressively established where the bioenergy market is sufficiently developed. On the one hand, it is necessary to provide a guarantee to the final consumer about the conformity to technical specifications of the product sought; on the other hand, a full or simply partial compliance with those qualitative criteria can affect the selling price of the product.

At regional level, the biomass fuel market is not yet sufficiently developed to be able to follow such evolved market-based valuation criteria, whereby the energy product is often subject to exchange without this kind of key information. Degree of moisture content, ashes, calorific value, average sizing of wood chips and its sampling variability, are at the moment not specifically determined and declared in the local market. This condition makes the actual commercial evaluation of the energy product quite uncertain.

Opportunities

O1. The "agro-energy" system adequately interprets the "multifunctional" model associated with agriculture today. Rural development strategies implemented within the framework of the Common Agricultural Policy (CAP) have become the cornerstone of the concept of "multifunctional" agriculture. With this concept we refer to the possibility that agricultural activity is not exclusively intended for productive purposes but it can intercept very broad and articulated needs that promoting social and economic development. More and more these requirements belong to the sphere of ecological-environmental and socio-cultural services. Some qualifying facets of multifunctional agricultural might be: environmental protection and biodiversity conservation, landscapes modelling, touristic and recreational places and activities, education and training of young people, health care and social assistance etc. In this wide dimension, we also include the possibility that agriculture, rather than being a strong energy consumer, aims to alleviate our energy deficit and to promote RES. Renewable agro-energy production is, in all cases, regarded as a "connected" agricultural activity when it is "not prevalent" or it remains within a lower economic dimension than the proper farming activity.

O2. *Bioenergy is a form of activity that is essential in the context of climate change mitigation measures*. In a strategically broad framework, investing the planetary scale, binding commitments (more ambitious than the ones taken in the past "Kyoto Protocol") have to be made to limit the progressive global overheating. Such a strategy should find immediate feedback at the regional scale. This is the main target, indeed, focused by the updating of PEAR (the Apulian Energy and Environmental Plan), also identifying the "burden sharing" to be adopted as a goal of the regional strategy for reducing GHG emissions. Most analysts, both governmental and non-governmental, give biomass an indispensable role in the progressive development of RES and in the capacity of local and national production systems to relieve progressively from "fossil" dependence. This absolute necessity puts the RES sector, and specifically that of biomass and APPR feedstock, in a very favorable position with respect to the measures to put in place to stimulate the production of renewable energy.

In particular, APPR biomasses are judged unanimously as "local" resources (that is, they are not biomass transferred from long distance), they are considered environmentally friendly and capable of promoting economic processes of local development. It is therefore of the utmost importance to find the most appropriate way to modulate, on a local scale, a model of progressive expansion of the bioenergy sector. The most important condition should be not to set up an "exogenous" model of "colonization" (like in past years) but, on the contrary, a model able in interpreting the needs of communities established in the territory.

O3. *Reorganize, according to sustainable criteria, the fruit-tree cultivation operations*. Considering the most likely developments in agricultural and environmental regulation (especially with regard to the need to drastically reduce climate change emissions), it is highly probable that the practice of pruning burning will no longer be tolerated. In the light of this possible evolution, the farmer still using this questionable “burning” practice will have to change the pruning management system by focusing on more innovative techniques, such the set of operations that constitute “conservative” agriculture. This new regime, better respecting soil conditions and the conservation of its organic content, could more easily allow a systematic removal of pruning residues to be used for energy use.

O4. *The bioenergy market outlook are favorable*. Although the biomass fuel market is still poorly developed at regional level, the exchange conditions are interesting and they reflect fairly accurately the conditions generally observed in more developed markets. In particular, it is worth to remark the persistent price advantage of biomass fuels with respect to fossil fuels. In addition to the price advantage of the energy unit, another advantage is the great price stability over time, namely the relative insensitivity of the price regime to those geo-political repercussions that frequently cause rapid and sudden price rises in oil prices and its derivatives ("price volatility"). This condition of consistent price stability offers a good level of reliability in defining the "business plan" of bioenergy projects and is a factor greatly favorable to the take-off of new chains.

O5. *Increasing technological improvement of biomass plants and refinement of pruning harvesting systems*. The interesting fact that is being observed in recent years is the progressive attention that biomass plant manufacturers have devoted to the need to "scale" some plant-related solutions to lower levels of power generation. This is a major technological factor as it significantly widens the potential number of entrepreneurs involved in the investment and increases the chances of intercepting, in a more flexible and more efficient way, the territorial availability of biomass, reducing the extension of the supply basin that a defined plant should control. It also follows that the investment costs are reduced. The evolution of the market and the emergence of these small or micro scale technologies further contributes to lower investment costs, a condition that creates a virtuous circuit that promotes the territorial affirmation of the industry. The resulting consequences also include a significant increase in technical-professional specializations that can provide assistance, operate the installations, monitor the normal operation of the system and perform the necessary maintenance. All this contributes to increasing the level of technology reliability and therefore promoting further investment.

O6. *Investment incentives and supporting measures for bioenergy are still significant*. Although the last few years have been characterized by a relative contraction in the tariff advantages originally put in place to strongly foster and promote RES, such benefits still persist, in particular for small installations compared to the larger ones. Frequent and numerous, however, are the opportunities to resort to public support to face heavy investment in biomass facilities. In some cases, it is even possible to use a certain amount cumulated capital grants, provided that the threshold of 40% is not exceeded. Such funding, in different ways, can cover both the agriculture sector and the industry, and may use regional, national or European initiatives. It is likely that supporting the economic and financial incentives to create bioenergy supply chains will be a "policy" strategy that can be pursued in the medium to long term, in order to achieve the result in the agenda, i.e. reductions in GHG and savings in fossil resources.

O7. *Opportunities to reduce the costs associated with energy supply in the agricultural, agro-food and industrial sectors.* Companies that can join the APPR bioenergy sector are not just those that intend to produce energy to power the national electricity grid. Increasingly important opportunities would be offered to those types of business that have to face high-energy costs in their production process. Often, this implies the simultaneous consumption of electricity, “heat” and even “cold”; therefore, a "cogeneration" regime is frequently required, that would yield a high performance, even over 80% of efficiency. This kind of APPR supply chains are considered the most effective to satisfy the needs of the territory, achieving significant savings of fossil energy, ensuring greater energy supply security and higher levels of self-consumption. In other words, this specific bioenergy model assure the replacement of old conventional energy plants with new biomass-fueled plants, offering renewable energy to be directly used in local production processes, both in industry or agro-food processing.

O8. *Activation of energy projects on a municipal scale and in the public interest.* Another important front in reducing fossil fuels consumption is collective public heating. Similarly to O7, the opportunity lies on the side of energy demand (i.e. directly meeting the energy required from civil society or industry), rather than from the side of increasing the level of a generic energy supply. Electricity, although obtained from renewable sources, is subjected to dispatching over long distances and therefore is exposed to inefficiencies, dispersions, instability, black out, etc. Manufacturing, agro-food processing, household heating, both public and private are just some demand driven energy use. Municipal administrations could promote the heating of public buildings (schools, city halls, gyms or swimming pools, etc.) by installing biomass boilers and replacing traditional boilers, inefficient and very expensive in their maintenance. In particular, those municipalities geographically located in quite high altitude areas have exellent economic advantages. "Certificati Bianchi" and "Conto Termico 2.0" are currently the national incentive measures to promote biomass transition. This kind of initiative would also have the considerable benefit of addressing a collective need, a broader and general expression of the population, and not of a specific and well-chosen category of social, professional, productive.

Threats

T1. *Authorization procedures still unclear differently interpreted and applied*. Great is the disorder under heaven! Particularly difficult is to navigate in the "magnum sea" of decrees, laws, regulations and guidelines, often overlapping and conflicting, particularly between the State and regional law. This is a great obstacle to investment and implies appealing to a team of consultants, each specialized in specific technical and regulatory aspects governing the sector. The uncertainties of the procedure and the unpredictable administrative times make the investment highly risky and economically costly. Despite the fact that law gives priority to investments in this area (considering its strategic relevance), the great amount of administrative dossiers to be carried out, the multiple statements required by so many offices in issuing the authorizations, exert a strong selection in the investment initiatives. Within a few years, the regulatory system has also been subject to frequent changes, alterations, sudden stoppages and restarts, in some cases even retrograde measures.
Such complex conditions hinder and discourage new investment. They generate a discrimination between entrepreneurs based on their greater or lesser confidence in regulatory procedures (it is well known that small farmers do not have easy access to this type of information). Indirectly, they favor “top-down” and exogenous rather than “bottom-up” and endogenous bioenergy projects.

T2. *Strong competition from exogenous biomass.* "Exogenous" biomass is intended to be a fuel feedstock acquired from markets usually distant from the regional one. Even from a regulatory point of view, a "short supply chain" is assumed when the biomass transport does not exceed a distance of 70 km from the biomass plant. Exceeding this limit, the biomass plant loses those priority and value justifying its support by public administration. In that case, it would be an ordinary investment. When local biomass supply is limited or importing biomass is rather cheaper, then competition for biomass sources is high and the internal or regional value chain di not take-off or rapidly collapse. The reasons for this effective competition may be different; it can be the result of a better logistics organization, a better collecting equipment, but, mostly, the main reason is a larger availability of the biomass resources, making more convenient all the downstream procedures.

T3. *Social opposition to the setting up of new biomass plants*. The so-called "NIMBY" ("Not In My Back Yard") syndrome has reached very worrying levels of diffusion, especially in the Apulia region, although it is now a limiting factor all across the national territory. The “frenzy” regional development of wind turbine and photovoltaic plants directly installed on cropland was experienced by civil society as an "aggression" to the territory. No consistent planning was able to regulate, timely, this phenomenon. This was the reason for an increasing resentment by the local populations who suffered these conditions without having particular advantages in terms of socio-economic development. This state of progressive hostility towards RES ended up also involving biomass plants. A specific recrimination regarding biomass plants and thermo-chemical processes is that combustion produces atmospheric emissions that can be harmful to public health. Particular importance is attributed to thin “particular matter” (PM10 and PM2.5) together with other pollutants. Moreover, a strong sense of threat remains in the suspicion that, in addition to biomass, other materials of different origin and different kind of "waste" can be "burned" inside the energy plants.

T4. *Limited knowledge of the environmental benefits of energy from biomass*. Similarly to the threat described in the previous point (T3), also this factor is mainly due to the lack of awareness by citizenship and civil society about the issues at stake. Unfortunately, purely speculative exploitation forms of energy from biomass experienced in the past and the limited importance given to criteria of ecological sustainability caused great general suspicion. According to a well-observed opinion, the bioenergy sector, far from being an effective response to the need of mitigating climate change, was even believed a predisposing factor. The general concern that some typical regional crops would be displaced by energy crops, the possible conflict between food and energy production, the fear of impacting on the agrarian landscape due to land use changes, have been magnified by the mass-media.
On the other hand, it should be clearly reaffirmed the benefits that may arise from the right implementation of project initiatives that passed strict environmental screening procedures and fully reflect all the technical and logistical requirements, for example by adopting LCA procedures "Life Cycle Assessment".

T5. Intersectoral devide. Imbalance between the powers of the industry with respect to the agricultural sector. In case a production chain is structured in a strongly bipolar way, the dominant position is performed downstream, by the single and centralized purchaser (the industrial pole) to which feedstock is supplied upstream, by a large number of small suppliers (the agricultural pole). Strongly unbalanced contractual conditions are determined in this way. The formation of the feedstock price, as well as its conditions of sale, are fully determined by the industrial component, without the plurality of contractors having a significant influence. This is what is happening today in the agro-food sector, which highlights the sharp penalties suffered by the agricultural entrepreneurs in relation to the interests of the processing and marketing components of the value chain. In other words, there is a clear "squeezing" effect that compresses the farmer's remuneration largely benefitting the processing and marketing companies. It is therefore necessary to define collective bargaining instruments and a general framework of agreement capable of transferring part of the benefits obtained downstream, by the terminal segment of the supply chain, also upstream to the agricultural component of the value chain.

2 ACTION PLAN

Table 4. Factors of the SWOT analysis

STRENGHTS	WEAKNESSES
S1. Agriculture is a regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues. S3. Development of olive-to-oil and grape-to-wine value chains as a "springboard" for agro-energy supply chains. S4. Presence of mechanical "contracting" companies operating in the territory. S5. Possibility to implement the "multifunctional" model of agriculture. S6. Potential to strengthen the level of employment.	W1. Poor knowledge about the possibilities offered by fruit tree residues. W2. Complexity in structuring of a bioenergy value chain. W3. Mechanization of pruning management is a costly operation. W4. The unit value of pruning biomass is considered to be very modest and, therefore, economically unprofitable. W5. A sustainable management should require crop residues to return to the soil and therefore not be removed. W6. Poor trust of industrialists in the commitments made by the farmer, and vice versa. W7. Uncertainty about investments. Still high perception of entrepreneurial risk. W8. Seasonality of collection and availability of residual biomass. W9. Energy products obtained from pruning may not meet certain standard quality parameters.
OPPORTUNITIES	**THREATS**
O1. The "agro-energy" system adequately interprets the "multifunctional" model associated with agriculture today. O2. Bioenergy is a form of activity that is essential in the context of climate change mitigation measures. O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations. O4. The bioenergy market outlook are favorable. O5. Increasing technological improvement of biomass plants and refinement of pruning harvesting systems. O6. Investment incentives and supporting measures for bioenergy are still significant. O7. Opportunities to reduce the costs associated with energy supply in the agricultural, agro-food and industrial sectors. O8. Activation of energy projects on a municipal scale and in the public interest.	T1. Authorization procedures still unclear differently interpreted and applied. T2. Strong competition from exogenous biomass. T3. Social opposition to the setting up of new biomass plants. T4. Limited knowledge of the environmental benefits of energy from biomass. T5. Intersectoral divide. Imbalance between the powers of the industry with respect to the agricultural sector.

Tabel 5. Summary table of the Action Plan elaborated considering the four strategies identified through the SWOT analysis

SO	STRENGHTS	STRENGHTS	ST
OPPORTUNITIES	**ATTACK STRATEGY** 1. AIMING AT AN EFFICIENT AND INTEGRATED REGIONAL APPR ENERGY SYSTEM 2. SUSTAINABLE APPR ENERGY GENERATION AS A PATH TO RURAL DEVELOPMENT 3. A MARKET ORIENTED APPR ENERGY SECTOR TO INTERCEPT AND SATISFY SOCIETY NEEDS	**DEFENCE STRATEGY** 8. PROVING THE FEASIBILITY OF THE APPR VALUE CHAINS AND ITS VALUE IN MICROGENERATION PROJECTS 9. REACTING TO AN IMPROPER AND DELIBERATELY MISLEADING INFORMATION BY PROMOTING FULL AWARENESS AND SOCIAL ACCEPTANCE	THREATS
OPPORTUNITIES	**REORIENTATION STRATEGY** 4. SUPPORTING AN INNOVATION TREND IN BIOENERGY TECHNOLOGY AND A SHIFT TO MORE EFFICIENT ENERGY USE FROM APPR BIOMASS 5. TRIGGERING SOCIAL AND POLICY INNOVATION IN THE APPR SECTOR 6. CONSOLIDATING THE ECONOMIC AFFORDABILITY OF BIOMASS USE AND THE ECONOMIC RETURN ALONG THE APPR VALUE CHAIN 7. BOOSTING APPR BIOMASS SOURCES AND SETTING UP CONDITIONS TO STRENGTHEN THE APPR SUPPLY CHAIN	**SURVIVING STRATEGY** 10. MITIGATING THE ENVIRONMENTAL BURDENS ALONG THE BIOENERGY VALUE CHAIN, FROM FARMING OPERATIONS TO ENERGY CONVERSIONS 11. WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE 12. RESISTING THE COMPLEXITY OF THE REGULATION SYSTEM ON BIOENERGY AND THE LACKING OF A FARSIGHTED VISION ABOUT THE SECTOR	THREATS
WO	WEAKNESSES	WEAKNESSES	WT

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 regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues. S3. Development of olive-to-oil and grape-to-wine value chains as a "springboard" for agro-energy supply chains.	O1. The "agro-energy" system adequately interprets the "multifunctional" model associated with agriculture today. O2. Bioenergy is a form of activity that is essential in the context of climate change mitigation measures. O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations.

Target ② SUSTAINABLE APPR ENERGY GENERATION AS A PATH TO RURAL DEVELOPMENT. **Strategy:** Strengths + Opportunities → **SO "Attack"**	
S5. Possibility to implement the "multifunctional" model of agriculture.	O1. The "agro-energy" system adequately interprets the "multifunctional" model associated with agriculture today.

Target ③ A MARKET ORIENTED APPR ENERGY SECTOR TO INTERCEPT AND SATISFY SOCIETY NEEDS. **Strategy:** Strengths + Opportunities → **SO "Attack"**	
S1. Agriculture is a regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues.	O4. The bioenergy market outlook are favorable. O6. Investment incentives and supporting measures for bioenergy are still significant. O7. Opportunities to reduce the costs associated with energy supply in the agricultural, agro-food and industrial sectors.

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. Poor knowledge about the possibilities offered by fruit tree residues. W2. Complexity in structuring of a bioenergy value chain. W3. Mechanization of pruning management is a costly operation.	O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations. O5. Increasing technological improvement of biomass plants and refinement of pruning harvesting systems.

Target ⑤	TRIGGERING SOCIAL AND POLICY INNOVATION IN THE APPR SECTOR.
Strategy:	Weaknesses + Opportunities → **WO "Reorientation"**

W1. Poor knowledge about the possibilities offered by fruit tree residues. W2. Complexity in structuring of a bioenergy value chain. W6. Poor trust of industrialists in the commitments made by the farmer, and vice versa.	O2. Bioenergy is a form of activity that is essential in the context of climate change mitigation measures. O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations. O8. Activation of energy projects on a municipal scale and in the public interest.

Target ⑥	CONSOLIDATING THE ECONOMIC AFFORDABILITY OF BIOMASS USE AND THE ECONOMIC RETURN ALONG THE VALUE CHAIN.
Strategy:	Weaknesses + Opportunities → **WO "Reorientation"**

W4. The unit value of pruning biomass is considered to be very modest and, therefore, economically unprofitable. W7. Uncertainty about investments. Still high perception of entrepreneurial risk.	O4. The bioenergy market outlook are favorable. O6. Investment incentives and supporting measures for bioenergy are still significant. O7. Opportunities to reduce the costs associated with energy supply in the agricultural, agro-food and industrial sectors.

Target ⑦	BOOSTING APPR BIOMASS SOURCES AND SETTING UP CONDITIONS TO STRENGTHEN THE APPR SUPPLY CHAIN.
Strategy:	Weaknesses + Opportunities → **WO "Reorientation"**

W2. Complexity in structuring of a bioenergy value chain. W3. Mechanization of pruning management is a costly operation. W4. The unit value of pruning biomass is considered to be very modest and, therefore, economically unprofitable. W8. Seasonality of collection and availability of residual biomass.	O1. The "agro-energy" system adequately interprets the "multifunctional" model associated with agriculture today. O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations. O5. Increasing technological improvement of biomass plants and refinement of pruning harvesting systems. O8. Activation of energy projects on a municipal scale and in the public interest.

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 regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues. S3. Development of olive-to-oil and grape-to-wine value chains as a "springboard" for agro-energy supply chains. S4. Presence of mechanical "contracting" companies operating in the territory.	T2. Strong competition from exogenous biomass. T4. Limited knowledge of the environmental benefits of energy from biomass.

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 regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues. S6. Potential to strengthen the level of employment.	T3. Social opposition to the setting up of new biomass plants. T4. Limited knowledge of the environmental benefits of energy from biomass.

Target ⑩	MITIGATING THE ENVIRONMENTAL BURDENS ALONG THE BIOENERGY VALUE CHAIN, FROM FARMING OPERATIONS TO ENERGY CONVERSION.
Strategy:	Weaknesses + Threats → **WT "Surviving"**
W5. A sustainable management should require crop residues to return to the soil and therefore not be removed.	T4. Limited knowledge of the environmental benefits of energy from biomass.

Target ⑪	WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE.
Strategy:	Weaknesses + Threats → **WT "Surviving"**
W1. Poor knowledge about the possibilities offered by fruit tree residues. W6. Poor trust of industrialists in the commitments made by the farmer, and vice versa. W7. Uncertainty about investments. Still high perception of entrepreneurial risk. W9. Energy products obtained from pruning may not meet certain standard quality parameters.	T2. Strong competition from exogenous biomass. T5. Intersectoral divide. Imbalance between the powers of the industry with respect to the agricultural sector.

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"**
W2. Complexity in structuring of a bioenergy value chain.	T1. Authorization procedures still unclear differently interpreted and applied.

ACKNOWLEDGEMENTS

The following are the stakeholders that have been contacted and interviewed in elaborating the Sector Analysis and the Action Plan. We are very grateful for their cooperation and they have agreed to be cited.

Persons	Company/Institution	Current role with respect to APPR biomass
Luigi Tarricone	CREA - Research centre	Researcher
Ivo Montedoro	AssoBio Capitanata	Agriculture service company
Luigi Trotta Anna Maria Cilardi	Agricultural Department – Apulia Region	Regulation on agriculture and rural development

Barbara Valenzano, Francesco Corvace	Ecology Department – Apulia Region	Strategic planning on environment, territory and industry
Antonio Baselice	Agritoppi Srls	Farmer and pellet producer
Andrea Iantoschi	CIA – Italian farmer confederation	Representative of the interests of farmers
Pietro Spagnoletti	Coldiretti – Farmer Association	Representative of the interests of farmers
Vincenzo Patruno, Miriam Girone, Mario de Angelis	Confcooperative –FedAgri Puglia	Representative of the interests of farmers
Maria Teresa Chiarella	GAL - Terre del Primitivo	Local Action Group
Giuseppe Bratta Riccardo Amirante	Distretto “La Nuova Energia”	Network of companies with the aim of promoting the use of renewable energy
Beyond the above-mentioned stakeholders, UFG and DARe greatly thank many other stakeholders that contributed to this work with ideas and suggestions. Special mention goes to the participants in all the workshops carried out in the Apulia region. Until then, we had no idea about the large and enthusiastic involvement this people was able to show.		

ANNEX D2

WP2 – Task T2.2

Analisi di Settore e Piano di Azione relativo alle biomasse APPR Puglia (Italia)

Contents of the document

1. ANALISI DI SETTORE

A. Quadro regionale inerente alle biomasse APPR

La regione Puglia si colloca nella parte meridionale della penisola, si affaccia sul mar Adriatico a nord-est e sul mar Ionio a sud-ovest, confina internamente con la regione Campania e Basilicata sul fronte sud-occidentale, a nord-ovest con il Molise. Presenta un'estensione territoriale complessiva di 19.540 km^2. E' amministrativamente ripartita in 6 province: Foggia (7.008 km²), Barletta-Andria-Trani (1.543 km²), Bari (5.138 km²), Brindisi (1.839 km²), Taranto (2.437 km²) and Lecce (2.759 km²). Tale estensione rappresenta circa il 6.5% della superficie nazionale complessiva.

Il settore agricolo è fra quelli più importanti nel quadro dell'economia regionale e l'uso agricolo del suolo è assolutamente predominante rispetto ad altri impieghi. Il modello di agricoltura è, in genere, assai intensivo e solo in alcune aree interne (Monti Dauni ed Alta Murgia) le limitazioni ambientali non consentono se non una cerealicoltura a carattere estensivo o il pascolo. Con riferimento ad alcune coltivazioni, la Puglia manifesta un netto primato nazionale, come ad esempio considerando il frumento duro ed il pomodoro nella provincia di Foggia. Con riferimento agli oliveti, in tutta la Puglia si stima una presenza di circa 50 milioni di piante; analogamente la coltivazione della vite, sia da tavola che da vino, rappresenta una coltura assai diffusa e di rilevante interesse economico. Numerose, infine, sono le colture ortive oggetto di larga coltivazione (carciofo, finocchio, lattuga, asparago, spinacio, cavolo broccolo, sedano, ecc.). Tradizionalmente anche il mandorlo caratterizzava largamente il paesaggio agrario, sebbene oggi la sua estensione si sia drasticamente contratta, mentre più larga diffusione hanno il pesco, l'albicocco, il kiwi e, più limitatamente, anche gli agrumi, ma solo in alcuni circoscritti areali.

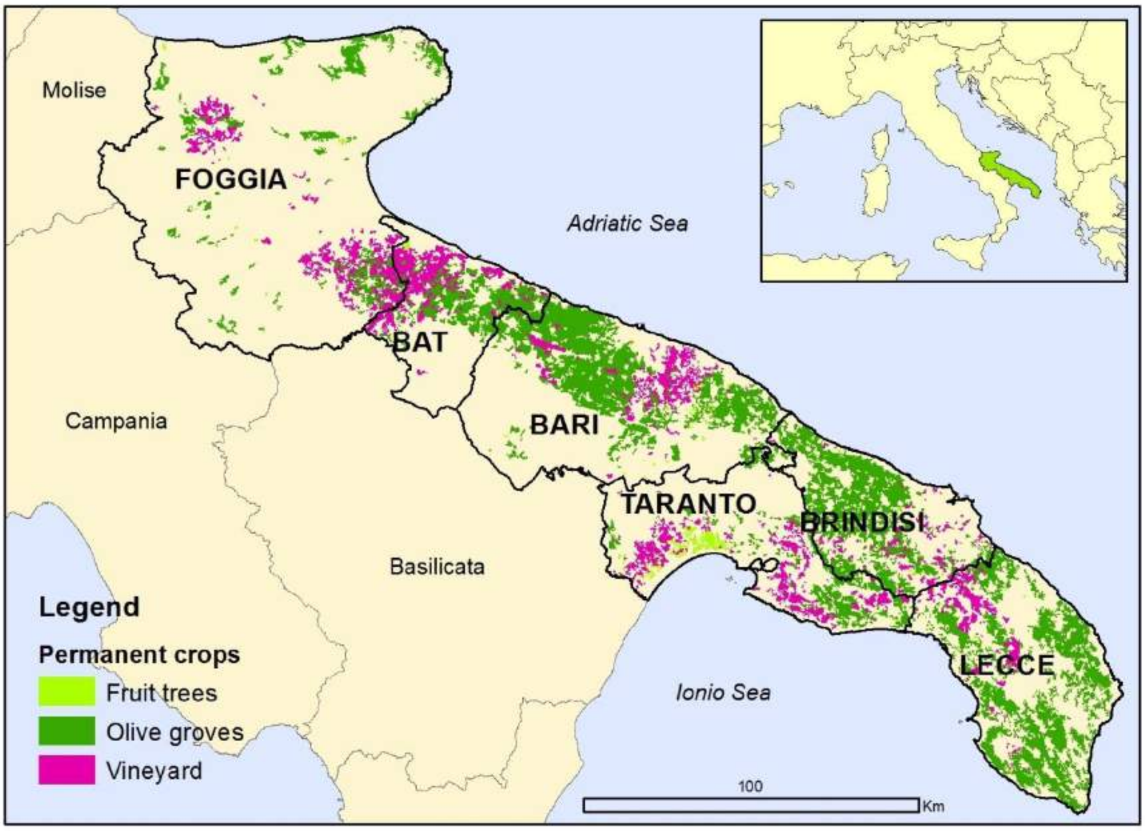

Figura 1. Localizzazione geografica delle superfici agrarie destinate alla coltivazione di specie arboree da frutto in regione Puglia

La struttura aziendale risulta abbastanza eterogenea. Impianti arborei specializzati, ad elevata intensità di piante (finanche "super-intensivi"), ampi ed estesi, pienamente meccanizzati ed irrigui (in cui si applicano sistemi irrigui a microportata di erogazione), possono essere collocati a stretto ridosso con impianti arborei tradizionali, a sesto d'impianto assai largo, o addirittura in coltivazione promiscua (come di frequente si osserva, ad esempio, negli oliveti pascolativi). La dimensione media aziendale (circa 5 ha) è assai limitata e del tutto inadeguata alla pratica di un'agricoltura moderna, meccanizzata ed intensiva. Tale ridotta dimensione media aziendale è ulteriormente accentuata nell'azienda ad indirizzo frutticolo rispetto a quella ad indirizzo erbaceo (cerealicolo od orticolo che sia).
Con riferimento al *Corine Land Cover* (2012), la *Figura 1* mostra la localizzazione delle coltivazioni permanenti di tipo arboreo, considerando gli oliveti ed i vigneti, nonché la categoria eterogenea che comprende tutti le altre specie fruttifere, compresi gli agrumeti. Considerando gli oliveti, la Puglia evidenzia circa il 33% della superficie nazionale (approssimativamente 355.000 ettari su di un totale nazionale di circa 1 milione di ettari (Censimento ISTAT, 2010). Riguardo ai vigneti, l'estensione regionale rappresenta circa il 15% della superficie nazionale (ovvero, 100.000 ettari a fronte dei 600.000 ettari in totale (Censimento ISTAT, 2010). Queste cifre e la ripartizione per province è riportata in *Tabella 1*, sempre avendo a riferimento i dati censuari del 2010.

Tabella 1. Superfici (espresse in ettari) destinate alla coltivazione di specie arboree da frutto in regione Puglia (fonte: dati censuari, ISTAT 2010).

Ambito territoriale	**Oliveti** *(ha)*	**Vigneti** *(ha)*	**Agrumeti** *(ha)*	**Altre arboree** *(ha)*
Italia	1.077.467	610.160	126.415	399.161
Nord-Ovest dell'Italia	13.267	69.879	89	47.840
Nord-Est dell'Italia	8.367	150.771	36	115.228
Centro Italia	185.882	90.893	665	56.064
Italia insulare	173.903	129.420	73.628	56.925
Sud Italia	696.049	169.198	51.998	123.103
Regione Puglia	355.446	94.585	9.015	33.279
Provincia di Foggia	47.011	23.384	308	2.436
Provincia di Bari	80.446	15.910	355	21.113
Provincia di Taranto	33.917	21.177	7.652	1.382
Provincia di Brindisi	67.029	8.854	144	3.477
Provincia di Lecce	93.476	7.271	533	428
Prov. Barletta-Andria-Trani	33.567	17.987	25	4.443
Puglia / Italia (%)	33,0	15,5	7,1	8,3

Dai dati riportati in *Tabella 1* è possibile dedurre il ruolo assolutamente preminente giocato dall'olivicoltura e dalla viticoltura nella nostra regione. Questa indicazione esprime chiaramente la notevole potenzialità che il settore delle biomasse residuali da potature ed espianti di colture arboree potrebbe svolgere come canale privilegiato di approvvigionamento di legno da destinare alla conversione energetica.

B. Disponibilità potenziali delle biomasse APPR a scala regionale

Numerosi sono gli studi e le analisi compiute nel tempo e finalizzate ad una quantificazione regionale e per province delle disponibilità di biomasse ritraibili dagli impianti arborei da frutto (così come da altre coltivazioni, siano esse colture espressamente dedicate alla conversione energetica o residui colturali). Alcune di queste valutazioni si riferiscono a specifiche e più circoscritte aree geografiche, altre prendono a riferimento l'intero territorio regionale. Ci piace, in questa sede, porre riferimento ad uno studio condotto

dall'Assessorato all'Agricoltura della regione Puglia, dal titolo "Banca Dati Regionale del potenziale di biomasse in Puglia", pubblicato nel Novembre 2012 nel quadro delle attività condotte dal progetto PROBIO "Azioni per la valorizzazione energetica delle biomasse. Studi di pre-fattibilità per l'individuazione di distretti agro-energetici e per progetti di filiera". Nello specifico, è stata effettuata un'attenta ricognizione delle fonti di biomassa più significative sul territorio regionale; sono state inoltre determinate le potenzialità di biomasse da colture dedicate sulla base della determinazione della vocazione specifica dei territori. Il database così costituito permette di reperire dati quantitativi relativi alle disponibilità delle diverse tipologie di biomassa a livello di dettaglio comunale o di macro-area, con la finalità di favorire la più corretta applicazione della normativa in vigore riguardo la gestione dei residui colturali e l'adeguata programmazione degli approvvigionamenti per gli impianti per la produzione di energia rinnovabile (Deliberazione della Giunta Regionale 13 Novembre 2012, n. 2275).
Sulla scorta del rapporto precedentemente introdotto sono state predisposte le tabelle di seguito presentate. La Tabella 2 si riferisce alle quantità di potature degli oliveti presenti in regione, articolate per provincia; analogamente, la Tabella 3 si riferisce alle quantità delle potature tratte dai vigneti così come al legno di espianto.

Tabella 2. Quantitativi di biomasse (frasche) che si possono ottenere dalle superfici olivetate nel territorio pugliese. Per la distinzione fra valore lordo e valore netto (tecnico ed economico) si rimanda al testo. (Fonte: Report Progetto PROBIO "Banca Dati Regionale del potenziale di biomasse in Puglia")

Province	**Quantità unitarie**	**Quantità (valore lordo)**	**Quantità (valore tecnico netto)**	**Quantità (valore economico netto)**
	t/ha	*t/anno*	*t/anno*	*t/anno*
Foggia	3,0	157.473	110.484	110.484
Bari	3,2	398.525	262.993	262.993
Taranto	2,4	84.540	63.423	63.423
Brindisi	2,2	145.600	105.788	95.210
Lecce	2,5	240.884	192.707	173.500
PUGLIA		**1.027.022**	**735.395**	**705.610**

Tabella 3. Quantitativi di biomasse (tralci ed espianti) che si possono ottenere dalle superfici vitate nel territorio pugliese. Per la distinzione fra valore lordo e valore netto (tecnico ed economico) si rimanda al testo. (Fonte: Report Progetto PROBIO "Banca Dati Regionale del potenziale di biomasse in Puglia")

Province	Quantità Unitarie Sarmenti uva da tavola	Quantità Unitarie Sarmenti uva da vino	Quantità Sarmenti (valore lordo)	Quantità Sarmenti (valore tecnico netto)	Quantità Sarmenti (valore economico netto)	Quantità Espianti (valore tecnico netto)	Quantità Espianti (valore economico netto)
	t/ha	*t/ha*	*t/anno*	*t/anno*	*t/anno*	*t/anno*	*t/anno*
Foggia	3,6	4,3	154.902	122.918	116.772	25318	24052
Bari	3,0	4,9	147.335	103.674	98.490	25997	24697
Taranto	2,8	4,3	135.879	98.668	93.735	26442	25119
Brindisi	2,9	4,0	56.998	44.495	42.270	11113	10558
Lecce	2,9	4,0	37.920	30.336	28.819	7435	7063
PUGLIA			**533.034**	**400.091**	**380.086**	**96.305**	**91.489**

Le tabelle riportano i valori unitari di biomassa (espressi in tonnellate ad ettaro), i quantitativi lordi e quelli netti. I secondi differiscono rispetto ai primi in quanto si considera la decurtazione ascrivibile all'efficienza tecnica assegnata alla meccanizzazione della raccolta e che tiene conto dell'accessibilità ai campi e della agibilità degli stessi al lavoro delle macchine. In ultimo, la disponibilità economica netta prende in considerazione anche l'eventuale destinazione delle biomasse medesime verso impieghi alternativi a quello energetico.

Dalle Tabelle 2 e 3 è possibile operare una stima approssimativa dell'energia che, teoricamente, sarebbe possibile generare nel caso in cui l'intero ammontare delle biomasse disponibili fosse indirizzato a tale scopo. Sommando le disponibilità effettive (approssimate a 700 mila tonnellate all'anno di frasche, 380 mila tonnellate all'anno di tralci ed infine 90 mila di legno d'espianto dei vigneti) si ottiene una disponibilità totale pari a 1.170 mila tonnellate all'anno. Assumendo un potere calorifico (inferiore) pari a circa 18,5 MJ/t, ciò corrisponde a 5,14 MWh/t. Ne consegue che la produzione energetica lorda è quindi pari a $1{,}17 \cdot 10^6$ t/anno * 5,14 MWh/t = 6 *10^6 MWh/anno. Considerando una efficienza di generazione elettrica pari al 30% ciò significa una produzione elettrica pari a 1,8*10^6 MWh/anno, corrispondenti ad una potenza elettrica installata di 225 MW. La produzione elettrica così ottenibile sarebbe in grado di coprire i consumi elettrici di circa 700 mila famiglie (considerando un consumo medio per famiglia pari a 2.700 kWh/anno). Diversamente, se si pensasse di indirizzare le biomasse alla produzione di energia termica, assumendo un rendimento dell'80%, la produzione energetica complessiva ammonterebbe a 4,8*10^6 MWh/anno, ovvero 600 MW di potenza termica installata.

Come si può facilmente constatare, quelli appena presentati sono numeri di tutto rispetto che potrebbero contribuire non poco alla sostituzione dell'uso di energia da fonte fossile ed alla conseguente riduzione delle emissioni in atmosfera di gas ad azione clima-alterante.

La Regione Puglia si è dotata di uno strumento programmatico, il Piano Energetico Ambientale Regionale (PEAR), adottato con Delibera di G.R. n.827 del 08-06-07, che contiene indirizzi e obiettivi strategici in campo energetico assumendo un orizzonte temporale di dieci anni. Il PEAR ha concorso pertanto a costituire il quadro di riferimento per i soggetti pubblici e privati che, in tale campo, hanno assunto iniziative nel territorio della Regione Puglia.

La pianificazione energetica regionale persegue finalità generali di contemperamento fra le esigenze di sviluppo economico e sociale con quelle di tutela dell'ambiente e del paesaggio e di conservazione delle

risorse naturali e culturali. In data 18 settembre 2010 sono state pubblicate sulla Gazzetta Ufficiale le Linee Guida per l'autorizzazione degli impianti alimentati da fonti rinnovabili di cui all'articolo 12, comma 10 del D.Lgs. 387/2003, alle cui disposizioni la Regione Puglia ha dato attuazione attraverso il regolamento regionale n. 24 del 30 dicembre 2010 (recante la individuazione di aree non idonee alla installazione di specifiche tipologie di impianti alimentati da fonti rinnovabili) e la DGR n. 3029 del 30 dicembre 2010, concernente la disciplina del procedimento unico di autorizzazione alla realizzazione ed all'esercizio di impianti di produzione di energia elettrica da fonti rinnovabili.
Una procedura di aggiornamento del PEAR è stata avviata e conclusa nel corso del 2015 dalla regione Puglia.

C. Potenzialità regionali per la creazione di filiere APPR: descrivere il settore produttivo

Il settore APPR (ovvero le potature delle colture arboree, come pure il legno ottenuto dall'espianto delle medesime coltivazioni a fine produzione) si inserisce nell'ambito del più ampio ed articolato settore delle bioenergie, a sua volta inquadrato nelle cosiddette FER (Fonti Energetiche Rinnovabili). Con riferimento alle materie prime che vengono impiegate, il settore può anche inscriversi nel quadro delle attività "*biobased*", ovvero il complesso delle tecnologie produttive incentrate sull'utilizzo e la trasformazione di biomasse per l'ottenimento di un ampio spettro di prodotti finali (non solo energia ma anche, in termini generali, "biomateriali" e "bioprodotti", particolarmente quelli ad elevato valore aggiunto).
Le biomasse APPR qui considerate hanno carattere "residuale". In altri termini, esse sono ottenute in qualità di scarto dei processi di periodica cura e manutenzione delle colture arboree da frutto. Ciò, almeno potenzialmente, rende la filiera di approvvigionamento assai più conveniente rispetto alle coltivazioni energetiche dedicate, ovvero quelle colture espressamente realizzate per ottenere biomassa da destinare alla conversione energetica. Partendo da un "residuo" invece che da un "prodotto" dell'attività di coltivazione si annullano i costi colturali ad esso attribuibili e si azzerano, contestualmente, anche i costi energetici ed emissivi (tutti addebitati integralmente al "prodotto" e non al "residuo"). Inoltre, l'attività di recupero del residuo ed il suo avviamento produttivo per ottenere energia consente di inserire nella parte attiva del bilancio colturale il computo dei costi "mancati" (od "evitati"), ossia quelli inerenti alle operazioni di gestione dei residui, ciò che aumenta la convenienza economica della coltivazione. Nel caso in cui i residui di potatura od il legno d'espianto rifornissero un mercato delle biomasse, a questa materia prima corrisponderebbe anche un prezzo di mercato, prefigurando la possibilità di realizzare un ricavo aggiuntivo (ed integrativo rispetto a quello della mera produzione agricola) conseguito dalla sua vendita o trasformazione.
Ciò lascia intendere la possibilità di strutturare una filiera che, nelle sue varie articolazioni, sia costituita da una pluralità di operatori in grado di provvedere al recupero, all'approvvigionamento (trasporto e stoccaggio) ed all'impiego energetico di queste biomasse residuali. La convenienza che ciascun potenziale operatore della filiera ha nell'intervenire nel processo, inserendo il suo specifico servizio, dipende dal valore della materia prima trattata, dal valore aggiunto apportato nel processo o nel servizio prestato dall'operatore medesimo, nonché dalla economicità del processo, in particolare considerando le economie di scala che si potrebbero generare. Nel caso in cui il valore aggiunto unitario fosse particolarmente ristretto (ciò che è assai frequentemente osservato), certe operazioni potrebbero essere comunque realizzabili solo se i quantitativi in gioco fossero sufficientemente elevati, condizione che renderebbe economicamente conveniente l'intera operazione, generando sufficienti margini di guadagno.
Davvero esigui sono i casi di filiere incentrate sulle biomasse APPR in regione Puglia sebbene, attraverso le occasioni d'incontro con gli *stakeholder* e le riunioni progettuali organizzate nel corso del 2016 in diverse aree geografiche regionali, si sia registrata un'ampia e ricca partecipazione di potenziali attori di filiera, tutti altamente interessati e pronti ad attivarsi.

La gamma di tipologie aziendali sensibilizzate e coinvolte abbraccia sia il settore agricolo che quello industriale, così come quel settore intermedio che collega il primo al secondo, costituito da una pluralità di imprese agro-industriali. Studiamone brevemente la composizione.
Con riferimento all'*imprenditore agricolo*, l'interesse più marcato si manifesta fra la categoria degli imprenditori più affermati, quelli che possono contare su di una più larga base aziendale, una dimensione economica tendenzialmente elevata e con maggiori possibilità ad operare investimenti, prevalentemente ispirati ad una logica di diversificazione produttiva. Si osserva che le agro-energie siano appannaggio preferenziale di quella "fetta" di agricoltori più giovani, più dinamici, più aperti alle innovazioni, più solidi economicamente, in genere più professionalizzati, maggiormente inseriti nelle dinamiche socio-politiche del territorio in cui opera la loro azienda.
Questa realtà, in ambito regionale, è sufficientemente ampia e ben rappresentata ma non costituisce di certo la fascia più significativa degli imprenditori agricoli i quali, per la massima parte, sono piccoli *coltivatori diretti*. Ciò rende conto anche delle superfici aziendali troppo spesso assai limitate perché possa mobilitarsi un volume significativo di materie prime biocombustibili oggetto di raccolta e vendita. La categoria dei coltivatori diretti, pertanto, ha la possibilità d'intervenire nei processi di strutturazione di filiere agro-energetiche solo attraverso l'intermediazione collettiva operata dalle "associazioni di categoria" od anche per il tramite delle "cooperative agricole", dei "consorzi agrari", o delle "organizzazioni dei produttori" di cui la piccola azienda è socia od aderente. In tal caso, il buon livello di aggregazione delle aziende consente di pervenire a quantitativi rilevanti di biomasse conferite alla struttura collettiva. La centrale cooperativa o consortile è preesistente alla filiera agro-energetica e, come scopo sociale, provvede alla gestione dei processi di trasformazione agro-alimentare a partire dai prodotti conferiti dai soci. Così, ad esempio, le "cantine sociali" realizzano la vinificazione o l'ammostamento delle uve conferite dai soci; analogamente il "frantoio cooperativo" provvede alla molitura delle olive conferite ed alla vendita dell'olio extra vergine. Queste sono le due realtà produttive (connesse alla tipologia APPR di biomasse) di gran lunga prevalenti nel nostro territorio. Altre, di tipo analogo, potrebbero essere annoverate.
Considerando le trasformazioni agro-alimentari, rilevanti consumi energetici (sia termici che elettrici) attengono allo svolgimento del processo produttivo stesso. In questi casi, l'approvvigionamento di biomasse residuali (APPR) da parte dei soci della cooperativa può essere in grado di soddisfare pressoché in modo integrale il consumo energetico (autoconsumo), consentendo di realizzare ingenti risparmi. L'eventuale *surplus* energetico (di norma in forma elettrica) potrebbe essere immesso in rete (ENEL / GSE) ed ivi distribuito. Secondo questo modello, quindi, il singolo socio della cooperativa conferirebbe non solo il prodotto primario da trasformare (le uve in vino; le olive in olio) ma anche il residuo o sottoprodotto degli interventi di potatura o di espianto, destinato alla conversione energetica, in grado di alleviare i costi energetici sostenuti dalla struttura associativa (cooperativa, consorzio, ecc.).
In altre circostanze, il consorzio o la cooperativa può decidere di operare un vero e proprio investimento aggiuntivo e parallelo al suo "core" business, dotandosi di un impianto di generazione elettrica alimentato a biomasse APPR che, profittando delle favorevoli tariffe elettriche d'incentivazione, produce un profitto che si aggiunge, senza integrarsi, a quello che consegue dall'attività agro-alimentare. In tal caso, la cooperativa od il consorzio opera né più né meno come un qualunque soggetto economico che elabora una strategia d'investimento per mettere a profitto i propri capitali e le proprie risorse di materie prime.
Ampio e variegato è anche il settore industriale che potrebbe avvantaggiarsi dell'ampia disponibilità di biomasse APPR in ambito regionale. Ancora una volta, è dato distinguere fra quegli imprenditori che operano od intendono operare specificamente nel settore energetico, provvedendo a realizzare impianti a biomassa per la produzione di elettricità (da immettere in rete) o di calore (per fornire un servizio del tipo "*district heating*"), rispetto ad imprese che necessitano di energia (elettricità e/o calore) per far fronte ai quantitativi energetici richiesti dall'espletamento del processo produttivo aziendale.
La prima tipologia è rappresentata in regione Puglia da impianti di piccola, media ed elevata potenza. Ad esempio: l'impianto Fiusis di Calimera (LE), della potenza di 1,0 MWe, esclusivamente alimentato da cippato di potature; l'impianto Enterra a Rignano Garganico (FG), della potenza di 13 MWe,

prevalentemente alimentato a sanse e cippato di legna; l'impianto della Tozzi Renewables Energy, della potenza di 25 MWe, a S. Agata di Puglia (FG), prevalentemente alimentato a paglie con integrazione di cippato di legno).
Questi sono investimenti operati nel settore dell'elettrico, in una fase in cui il sostegno tariffario aveva raggiunto livelli estremamente elevati, senza paragone in ambito europeo, e che hanno contraddistinto, sul fronte delle biomasse, una tipologia d'investimento industriale assimilabile a quanto parallelamente avveniva nelle altre articolazioni del settore FER (ovvero l'eolico ed il fotovoltaico).
Più difficile, lento e graduale è invece lo sviluppo della seconda tipologia di produzione energetica. In questo caso, infatti, l'obbiettivo non è semplicemente la produzione ed il dispacciamento di energia elettrica (spesso senza porsi l'obiettivo di una valorizzazione del termico potenzialmente recuperabile), bensì riuscire a conseguire un livello adeguato di autonomia energetica all'interno del proprio stabilimento, conseguendo livelli elevati di efficientamento energetico e di autoconsumo. In questo caso, occorre maturare una concezione imprenditoriale più evoluta, ovvero quella di essere al tempo stesso produttori e consumatori di energia, progettando il funzionamento dell'impianto industriale avendo a modello la realizzazione di una "isola energetica". Questo obiettivo è ancor più importante se si pensa al notevole grado di inadeguatezza della rete elettrica e le sue limitate prestazioni, fattore che si è andato accentuando con la progressiva integrazione delle fonti rinnovabili ad erogazione elettrica irregolare e discontinua (eolico e fotovoltaico).
Davvero numerose possono essere le tipologie d'impresa a carattere industriale che potrebbero auto-approvvigionarsi di energia. Forni e fornaci industriali, caldaie per la generazione di vapore, essiccatoi, celle frigorifere, ecc. In particolare, allorché queste attività produttive fossero tutte circoscritte in una medesima area industriale (zone ASI o zone PIP, ad esempio), sarebbe anche possibile procedere alla realizzazione di un'area ecologicamente attrezzata, energeticamente autonoma, in grado di gestire collettivamente le infrastrutturazioni nonché una serie di servizi essenziali (rifiuti, riciclaggio, deputazione acque, controllo delle emissioni, ecc.), non solo ottenendo il massimo risparmio ma anche adottando le più idonee tecnologie a salvaguardia dell'ambiente. Questa dimensione collettiva dovrebbe essere un obiettivo di grande rilevanza che andrebbe opportunamente incentivato dalla pubblica amministrazione.
Sostanzialmente inesistenti, in Puglia, i casi di riscaldamento collettivo, per esempio a scala municipale, per iniziativa di alcune amministrazioni. Comuni di montagna, la cui zona climatica induce ad un prolungato impiego degli impianti termici, si gioverebbero notevolmente di impianti collettivi, prevalentemente indirizzati al condizionamento termico di edifici pubblici, quali scuole, piscine o palestre comunali, biblioteche ed uffici pubblici. Queste iniziative, ormai particolarmente diffuse nelle aree dell'arco alpino e dell'Appennino Tosco-Emiliano, sono del tutto assenti nel nostro territorio. Un lungo ed estenuante lavoro di sensibilizzazione si rende necessario per superare questi ostacoli.
Non rimane che trattare il settore di connessione fra "polo" agrario di approvvigionamento delle biomasse APPR e "polo" industriale di utilizzazione energetica delle stesse. Questo settore di compone anch'esso di una pluralità di aziende in grado di fornire un servizio specifico e particolare, ovvero soddisfare il complesso delle esigenze logistiche connesse all'approvvigionamento delle biomasse.
In primo luogo dobbiamo riferirci alla categoria delle aziende che operano "in conto terzi" (ovvero dei "contoterzisti"). Prescindendo dall'organizzazione dei metodi di raccolta e condizionamento delle potature o di altre biomasse legnose, queste aziende sono spesso, almeno in origine, aziende agricole che si sono progressivamente specializzate nella meccanizzazione e svolgono lavori agricoli di coltivazione a vantaggio di altre aziende agricole. A questo "portfolio" di offerta di lavori meccanici e colturali, spesso si affianca la potatura dei fruttiferi e lo "smaltimento" dei suoi residui. In alcuni casi, questa specifica e particolare mansione ha assunto priorità e prevalenza rispetto ad altre, tanto da giustificare una progressiva estensione dell'attività che può consistere nello stoccaggio e nella successiva lavorazione per produrre *pellet* o *briquette* di legno.
L'innovazione delle tecnologie meccaniche offre oggi una pluralità di soluzioni di raccolta, imballatura o trinciatura dei residui di potatura lasciati in campo, ciò che agevola le operazioni e ne riduce sensibilmente i

costi, così da incoraggiare l'avvio di aziende che operano in questo settore. Aziende meccaniche specializzate nella costruzioni di queste tipologie di macchine (evoluzione delle comuni trinciatrici ed imballatrici) operano anche nella nostra regione ed hanno un crescente credito anche extra-regionale. Comincia anche a moltiplicarsi la presenza di aziende che operano nell'ambito dello stoccaggio delle biomasse. Una delle limitazioni assai condizionanti del settore APPR è l'accentuata stagionalità della disponibilità delle potature a fronte della necessità di un approvvigionamento continuo e regolare nel corso dell'intero anno solare. A questo riguardo, quindi, occorre provvedere alla realizzazione di "piattaforme" dedicate alla conservazione ed al condizionamento delle biomasse, in modo che siano messe al sicuro (evitando il rischio d'incendio), ben conservate (per evitare la perdita di potere calorifico), opportunamente dimensionate secondo dimensioni standard, regolari ed omogenee, per garantire un'ottima utilizzazione energetica. Queste piattaforme, almeno nella nostra regione, sono spesso il risultato di una evoluzione o specializzazione produttiva da parte di ditte che tradizionalmente operano nel settore delle sanse, del nocciolino di oliva, gusci di mandorle e noci, legna da ardere, ecc.

Di particolare interesse è anche il quadro che comincia a comporsi intorno al settore degli impianti, sempre più di piccola taglia, di facile installazione, di maggiore affidabilità tecnica, ad elevate prestazioni e controllo stringente delle emissioni. E' del tutto evidente che, in assenza di una tecnologia affidabile di conversione energetica delle biomasse, l'intera filiera rimarrebbe senza uno sbocco ed il suo sviluppo sarebbe così precluso.

La creazione di nuove filiere energetiche incentrate sulle biomasse (e sulle biomasse APPR in particolare) non può prescindere dalla componente agricola da cui dipende l'approvvigionamento di materia prima combustibile. Lungi dall'intravedere nel settore agricolo un mero fornitore di materia prima, occorrerebbe immaginare lo sviluppo di una filiera che pervenga alla fornitura di un prodotto combustibile o di un vettore energetico o, addirittura, del servizio energetico compiuto. Questo obiettivo consentirebbe un adeguato approfondimento della filiera (da semplice filiera agricola a filiera agri-energetica) e l'incameramento interno (ossia intra-settoriale) del valore aggiunto che ne consegue. Questo significherebbe promuovere una strategia in linea con il quadro generale di un obiettivo integrato di sviluppo rurale, ovvero di sviluppo socio-rurale allorché, oltre alle aziende agricole od agro-forestali, si aggiungesse anche la popolazione insediata nei medesimi territori, in grado di provvedere alle proprie esigenze energetiche attingendo dalle proprie risorse territoriali, direttamente gestite a livello locale. Dunque le imprese agricole, associate in cooperative, danno origine a strutture cooperative di gestione delle biomasse che provvedono a trasformare la materia prima in prodotto finito, per l'autoconsumo energetico o l'approvvigionamento energetico di strutture pubbliche comunali o di aree comunali ad insediamento produttivo. Questo il modello ideale di riferimento. Nella realtà, gli investimenti in ambito energetico risultano prevalentemente se non esclusivamente a carattere privato e, pertanto, nella maggior parte dei casi, il settore agricolo è alla stregua di un mero fornitore di materie prime, per cui non si ottengono quei vantaggi tariffari che sono spesso l'unica ragione per cui l'investimento viene effettuato dai privati.

D. Barriere e punti di forza nella creazione di filiere bioenergetiche APPR

Gli incontri ("*focus group*") realizzati con gli *stakeholder* in differenti aree territoriali della regione Puglia, nonché le occasioni di confronto individuale con numerosi imprenditori, hanno consentito di cogliere le idee, le opinioni ed i convincimenti di quei soggetti identificati come attori potenziali delle filiere APPR. Progressivamente, quindi, si è definito un quadro interpretativo sufficientemente completo in merito ai fattori in grado d'influire significativamente sulla strutturazione delle filiere, sul mancato decollo di iniziative bioenergetiche in ambito regionale, e sulle condizioni necessarie perché ciò possa aver luogo.

La valutazione generale è che l'influenza esercitata da limitazioni di natura non-tecnica risulterebbe addirittura più determinante rispetto al complesso dei condizionamenti di tipo tecnico.

In primo luogo, la realizzazione dei "*focus group*" ha evidenziato, sorprendentemente, che i soggetti aziendali potenzialmente operanti lungo la filiera non hanno una buona conoscenza l'uno dell'altro, per cui spesso si ignora la possibilità di stabilire una relazione funzionale fra le imprese, finalizzata alla concreta strutturazione di una filiera bioenergetica. Questi incontri sono risultati di particolare rilevanza nel creare una rete di relazioni ("*stakeholders' network*") precedentemente inesistente o assai aleatoria e vaga. E' questo un primo fondamentale contributo che occorre ascrivere alle iniziative intraprese dal progetto "*uP_running*" in ambito regionale.

Un fattore in grado d'influenzare in misura notevole la possibilità di attivare filiere APPR è rappresentato dal valore commerciale che queste biomasse possono conseguire e, pertanto, dalla disponibilità ad acquistare le biomasse da parte dell'utilizzatore finale ad un prezzo che l'agricoltore reputi sufficiente ed adeguato. Infatti, se le procedure di raccolta delle potature sono considerate una mera operazione di "recupero" di scarti e di "smaltimento" di materiale residuo, ciò implica che l'agricoltore (detentore dello "scarto") non abbia nulla a che pretendere in termini economici. Di contro, se l'operazione di raccolta è strettamente e direttamente connessa ad una attività di valorizzazione energetica, allora l'interesse dell'agricoltore è certamente quello di considerare le potature come una fonte di reddito integrativo. Le esperienze territoriali sono ancora troppo limitate per poter affermare che la seconda delle ipotesi sia quella prevalente mentre, purtroppo, risulterebbe ancora prassi corrente (salvo eccezioni assai significative) la prima. In particolare, però, l'affermarsi di esperienze di "filiera corta" e quelle più strettamente inerenti a processi di autoconsumo energetico di imprese cooperative o consortili, consente che si venga a diffondere una concezione innovativa delle potature come risorsa aziendale aggiuntiva da valorizzare. Di contro, il realizzarsi di filiere lunghe, in cui l'imprenditore agricolo è mero fornitore di materia prima combustibile, non consente di maturare la giusta consapevolezza in merito al valore intrinseco del materiale conferito.

Con riferimento alle opinioni offerte dagli agricoltori, l'atteggiamento ostativo manifestato nei riguardi della possibilità di operare un sistematico intervento di raccolta delle potature ricalca due differenti tipologie di approccio. Da un lato, alcuni agricoltori reputano le potature un mero problema di "smaltimento" di scarti, essendo quest'ultimi considerati come un intralcio alla regolare e tempestiva esecuzione delle ordinarie operazioni colturali. Ciò implica che la gestione di questi residui sia interpretata esclusivamente come un costo colturale aggiuntivo, da contenere al minimo. E' facendo appello a questo pregiudizio che, assai spesso, si giustificano, pretestuosamente, pratiche di "bruciatura" all'aperto, direttamente in campo, di frasche o sarmenti rilasciati al suolo a seguito della potatura degli arboreti. Invece, è ormai unanimemente riconosciuto che questa pratica sia del tutto scorretta in chiave agronomica, ancorché tollerata da un punto di vista normativo (con sempre maggiore difficoltà e solo a seguito di deroghe regionali alla disciplina nazionale ed europea). Spesso ragioni di ordine fitosanitario vengono addotte a motivare gli interventi di bruciatura, anche allorché queste ragioni non abbiano reale fondamento o siano marcatamente ingigantite in senso allarmistico.
D'altro canto, un secondo atteggiamento è quello manifestato da agricoltori tecnicamente più preparati ed evoluti che, diversamente dai primi, considerano le potature come una risorsa da valorizzare in chiave ecosistemica, particolarmente per ricostituire o salvaguardare la sostanza organica del suolo. In questo senso, la tecnica di trinciatura e spandimento dei residui lignocellulosici, con conseguente formazione di uno strato pacciamante, protegge il suolo da fenomeni erosivi ad opera di piogge intense, da eccessiva evaporazione idrica superficiale, da indesiderate competizioni da parte di piante infestanti, preserva l'umidità del suolo, la sua adeguata strutturazione, il graduale arricchimento in humus, la corretta permeabilità e conducibilità idrica. In molti casi questa pratica è strettamente associata ad un sistema di gestione del suolo a carattere "conservativo", prevalentemente incentrato sulla non lavorazione (*minimum tillage* od anche *no-tillage*), e sulla tecnica dell'inerbimento. In questi casi, pertanto, l'asportazione e la destinazione energetica delle potature non è ritenuta confacente al regime di cura e gestione dell'oliveto o

del vigneto. Sebbene queste circostanze appena riferite siano di gran lunga più favorevoli alle prime (che invece prevedono, impropriamente, la bruciatura dei residui colturali), rimane da evidenziare che una corretta gestione del suolo e dell'arboreto, l'esigenza di rispettare un preciso bilanciamento degli apporti e delle asportazioni di residui organici, le possibilità di eseguire una fertilizzazione organica in alternativa ad un apporto meramente minerale di nutrienti, sono condizioni che potrebbero garantire l'asportazione delle potature ed una contestuale efficiente salvaguardia del livello di sostanza organica del terreno agrario.
Si potrebbe ritenere che le tecniche di raccolta e primo condizionamento delle potature (dal campo all'area di stoccaggio) costituiscano un fattore tecnicamente ancora complesso e limitante l'organizzazione di una filiera. Notevoli, invece, sono stati i progressi tecnologici in merito, specie in questi ultimi anni, per cui oggi è dato osservare, fondamentalmente, l'affermarsi di due differenti tipologie di organizzazione del cantiere di raccolta, ed una serie di varianti rispetto a questi due modelli. Il primo modello è quello dell'*imballatura*, il secondo quello della *trinciatura* dei residui di potatura. Operazione preliminare, affinché le operazioni di raccolta siano efficienti ed anche speditive, è la disposizione dei residui in andane, in corrispondenza di ogni interfilare o in file alternate, a seconda della quantità dei residui da raccogliere. Anche questa operazione può essere completamente meccanizzata. Decidere se procedere all'imballaggio od alla trinciatura dei residui non ha semplicemente dirette implicazioni logistiche in campo ma conseguenze importanti anche nelle fasi successive di conservazione e pretrattamento della biomassa, prima della sua conversione energetica. Infatti, è possibile trinciare le potature preferibilmente allorché il loro grado di umidità sia sufficientemente basso (tendenzialmente inferiore al 25%). In tal caso, l'accumulo di materiale trinciato non andrà incontro a processi degradativi che facilmente si vengono ad innescare in presenza di un tasso d'umidità ancora elevato. Di contro, la raccolta tramite imballatura non addensa il materiale legnoso in misura comparabile alla trinciatura e, in ogni caso, permette la circolazione dell'aria anche allorché le balle siano accatastate l'una sull'altra nell'area di stoccaggio. Ciò consente che le potature possano essere raccolte anche quando il loro tasso di umidità sia ancora tendenzialmente elevato (non di rado anche al 40%). Dunque, con la trinciatura le condizioni di raccolta sono più critiche ma possono aver luogo in modo più speditivo e possono essere trasportati quantitativi maggiori di residui legnosi. Con l'imballatura, invece, si può intervenire in modo più tempestivo nelle operazioni di raccolta, confidando che la biomassa procederà a disseccarsi anche in fase di stoccaggio, le operazioni però procedono un po' più lentamente e necessitano di una movimentazione un po' più complessa rispetto alla semplice trincia-caricatrice del caso precedente. Queste osservazioni vanno poi rapportate alla specifica tipologia dell'arboreto (numero e distanza fra le piante, frequenza degli interventi di potatura, pendenza ed accessibilità del campo, ecc.). Sono tutti fattori che possono diversamente modulare il sistema di raccolta. Nelle condizioni più difficili, infatti, i residui possono essere semplicemente portati a bordo campo, in prossimità della carreggiata, e qui raccolti con un rudimentale sistema meccanizzato (elevatore a benna, pressa meccanica, etc.).
La marcata stagionalità con cui le potature si rendono disponibili implica un'efficiente organizzazione logistica delle procedure di raccolta (condizione facilmente assicurata dalle aziende che operano in conto terzi) ma anche la possibilità di realizzare uno stoccaggio di lungo periodo e, pertanto, la presenza sul territorio di piattaforme specializzate nella conservazione delle biomasse. E' questo un fattore "infrastrutturale" ed organizzativo ancora carente sul territorio regionale ma che potrebbe facilmente essere soddisfatto allorché un certo numero di aziende che già operano in tal senso, per esempio con riferimento al settore oleario (ditte specializzate nella compra-vendita di sanse e di nocciolino), decidessero di articolare ed espandere la loro attività anche al settore delle biomasse legnose.

L'Italia e, in particolare, la regione Puglia si caratterizzano per un livello elevato di consumo di *pellet*, prodotto energetico largamente importato non solo da Paesi del nord-est dell'Europa, ma perfino da Canada e Stati Uniti, generando così un volume di affari particolarmente ingente. Raggiungere livelli più elevati di soddisfacimento interno della domanda di *pellet* costituirebbe, quindi, un obiettivo di notevole interesse per meglio bilanciare il flusso *import-export*. Si tratta, pertanto, di un prodotto finale di largo consumo e di sicura collocazione commerciale in merito al quale un certo numero di imprenditori agricoli e "contoterzisti" stanno operando investimenti. Riuscire a realizzare un prodotto locale competitivo rispetto a quello d'importazione non è compito facile, ciò rispetto a due ordini di problemi. Il primo è rappresentato dalla necessità di tener testa ad un'attività produttiva che si realizza in Paesi le cui disponibilità di biomasse legnose sono elevatissime, considerando le amplissime risorse forestali di cui dispongono, ciò che ha determinato lo strutturarsi di filiere altamente meccanizzate ed efficienti, contraddistinte da un elevatissimo livello di competitività commerciale (massima contrazione dei costi di filiera). Il secondo motivo risiede nel fatto che il materiale di partenza localmente disponibile (ovvero le potature) non ha le medesime caratteristiche qualitative del legno di origine forestale (maggiore incidenza delle ceneri, più basso potere calorifico, pezzature più irregolari del trinciato, minore densità del legno, ecc.). Quest'ultimo fattore condiziona, almeno in parte, il valore commerciale del prodotto ottenuto che, in linea teorica, dovrebbe essere venduto ad un prezzo comparativamente più economico. Da ciò si originano alcune difficoltà ascrivibili alla produzione di pellet, fermo restando il fortissimo interesse che questa attività produttiva riesce a destare in questi ultimi anni. Si parla, non a caso, di agro-*pellet*, ad indicare un *pellet* di qualità (tendenzialmente ma non necessariamente) inferiore rispetto a quello di origine forestale, proprio per questo indirizzabile ad approvvigionare caldaie ed impianti produttivi a carattere industriale piuttosto che impianti di riscaldamento presso abitazioni civili. In quest'ultimo caso, infatti, la qualità della combustione (e pertanto la qualità del combustibile) è condizione essenziale per poterne realizzare l'installazione in ambienti intensamente frequentati dall'uomo.

Sul fronte della conversione energetica delle biomasse, e con particolare riferimento ai processi termochimici, la combustione è da considerarsi una tecnologia che ha ormai raggiunto livelli elevati di maturità tecnologica; diversamente, processi alternativi come la pirolisi e la gassificazione sono commercialmente meno affidabili e, in molte occasioni, non offrono ancora quella garanzia che un investimento di lungo periodo (almeno ventennale) dovrebbe fornire. Gli aspetti tecnici più cruciali sono rappresentati dalla necessità di ottenere un *syngas* sufficientemente "pulito" per alimentare nel giusto modo i motori a cui è affidata la generazione elettrica. Questi processi di filtrazione e lavaggio, riferendosi in particolare ad impianti di piccola taglia, sono ancora di costosa realizzazione e necessitano di un perfezionamento tecnologico. Sul fronte impiantistico, un sicuro vantaggio osservato in questi ultimi anni è stato quello di una favorevole "scalabilità", ovvero la disponibilità commerciale di impianti di potenza via via più ridotta (fino a poche decine di chilowatt). Un forte impulso nel favorire questa evoluzione è stato dato dalla modulazione delle tariffe elettriche d'incentivazione che risultano crescenti in rapporto inverso alla potenza elettrica dell'impianto.

In termini retrospettivi, ossia ricostruendo le vicende degli ultimi 15-20 anni, da un lato, il vantaggio tariffario attribuito all'elettricità da FER ha rappresentato un potentissimo fattore di leva per lo sviluppo del settore (anche nell'ambito delle biomasse, sebbene in misura molto inferiore rispetto ad eolico e fotovoltaico), d'altro canto, ciò ha spostato l'interesse in modo sproporzionato e quasi assoluto verso la generazione elettrica, trascurando quasi del tutto il settore termico che, possiamo dirlo, non è riuscito ad esprimere le sue potenzialità così come auspicato.

Inoltre, un sistema tariffario così sbilanciato a favore dell'elettrico ha di sicuro incentivato il decollo industriale del settore operando però una fortissima discriminazione fra grandi imprenditori, immediatamente capaci di operare investimenti di grande taglia, ed imprenditori più piccoli e meno organizzati che non hanno saputo cogliere con la dovuta prontezza queste opportunità, rispetto a modelli produttivi più limitati ma meglio ascrivibili al contesto territoriale. Su questo fronte, amministrazioni comunali, provinciali, GAL, associazioni ed altre aggregazioni territoriali avrebbero dovuto esercitare un'azione organizzativa, di stimolo e coordinamento, sicuramente più efficace, al fine di realizzare iniziative e progetti che avessero una schietta caratterizzazione sociale. Il risultato che ne è scaturito è stato quello per cui la popolazione residente nei territori ha considerato estranee, esogene ed etero-dirette le iniziative d'investimento nel settore delle biomasse, tutte prevalentemente di taglia medio-alta, maturando un'avversione diffusa verso questi progetti, considerati come una sorta di "aggressione". Al contempo, non

si sono sapute cogliere le occasioni (comunque di notevole rilevanza) che le misure di promozione delle FER potevano in ogni caso rappresentare per il settore agricolo ed agro-industriale nella creazione di filiere più confacenti ad un modello di generazione distribuita ed a servizio diretto delle esigenze dello sviluppo territoriale (marcatamente quello rurale).
Ci si trova, in questa fase, a dover fare i conti con l'esigenza di una "ripartenza" (dopo la "sbornia" dell'eolico e del fotovoltaico), questa volta incentrata su modelli più rispondenti alle esigenze del territorio e che, superando una fase pioneristica focalizzata su pochi ma rilevanti insediamenti impiantistici, sappia meglio interpretare quelle esigenze diffuse di soddisfacimento di consumi energetici di prossimità, che sia maggiormente integrata nel tessuto produttivo delle aziende, più attenta non all'offerta energetica "tout court", quanto al puntuale soddisfacimento delle richieste, lì dove esse si vengono ad originare e con livelli di efficienza più elevati rispetto al passato.

E. Regolamentazione ed iniziative di promozione sul fronte dei "policy maker"

L'impiego delle FER ha una genesi relativamente recente in quanto solo nel 2002 (dunque 15 anni addietro) l'Italia si è impegnata ad assicurare il conseguimento degli obiettivi stabiliti dal protocollo di Kyoto, entrato in vigore il successivo 16 gennaio 2005. Allo scopo di garantire il raggiungimento di detti obiettivi, il legislatore nazionale è intervenuto al fine di semplificare ed accelerare le procedure autorizzatorie all'esercizio degli impianti alimentati da FER. In particolare, il D.lgs. 387/2003 ha introdotto, all'art. 12, un procedimento autorizzatorio unificato, di competenza delle regioni, da svolgersi attraverso il modulo della conferenza dei servizi e da concludere entro 180 giorni (successivamente ridotti a 90 dal D.lgs. 28/2011).
La disciplina puntuale del procedimento è stata demandata a linee guida che assicurassero il corretto inserimento degli impianti nel paesaggio (in particolare riguardo agli impianti eolici e fotovoltaici).
Le linee guida statali sono state infine emanate con DM 10 settembre 2010, dopo sette anni dal varo del D.lgs. 387/2003, e recepite dalla regione Puglia con regolamento N. 24 del 30 dicembre 2010.
Il fenomeno insediativo di impianti FER ha quindi manifestato una rapida espansione, da un lato per la notevole consistenza dei regimi d'incentivazione fissati dal Governo nazionale e, dall'altro, per la mancanza di una regolamentazione rigorosa dei criteri localizzativi a cui le richieste autorizzatorie dovessero sottostare. In particolare, la mancanza di un adeguato quadro programmatorio idoneo ad assicurare il rispetto della capacità di carico dei territori e l'equilibrio tra l'insediamento di nuove infrastrutture energetiche e le vocazioni territoriali.
In sintesi, è possibile evidenziare che il settore delle bioenergie (e, pertanto, anche il settore della valorizzazione energetica delle biomasse APPR) ha fortemente risentito, a scala regionale, dell'impetuoso fenomeno di diffusione delle altre FER (eolico e fotovoltaico) secondo i fondamentali caratteri di seguito rappresentati:

- l'ingresso sul mercato e nei territori delle nuove FER è stato di fatto de-regolamentato e fortemente incentivato dal legislatore statale e dalle istituzioni centrali. Ciò è avvenuto in completa assenza di qualsivoglia forma di programmazione e di coordinamento delle iniziative di infrastrutturazione territoriale;
- l'esistenza di lacune nell'ordinamento statale e la mancanza o la ritardata emanazione di criteri per il corretto inserimento degli impianti e la salvaguardia della capacità di carico dei territori hanno reso indifferibili interventi della regione Puglia in funzione sussidiaria;
- detti interventi, operati dalla regione Puglia, hanno riguardato la materia nei suoi vari risvolti: dall'inserimento paesaggistico ed ambientale degli impianti alla disciplina del procedimento, alla garanzia della serietà ed affidabilità degli operatori e dei loro progetti industriali, al concorso delle imprese agli oneri istruttori sostenuti dall'amministrazione pubblica;

- nonostante l'intervento in funzione sussidiaria della regione Puglia sulle lacune della normativa statale, la realizzazione degli impianti alimentati a FER nel territorio ha assunto dimensioni considerevolissime e, tuttavia, alle istituzioni locali è tuttora preclusa ogni possibilità di perseguire un più armonico e coordinato sviluppo del settore che tenga conto della vocazione dei territori e dell'ormai rilevantissimo contributo della Puglia alla produzione energetica, sia convenzionale (di origine fossile) che da FER.

Da ciò discende anche la necessità di porre mano ad una revisione critica di un precedente strumento regionale di pianificazione energetica (il PEAR) e di verificarne gli obiettivi, particolarmente alla luce degli intensi processi di sviluppo che hanno riguardato la produzione energetica da FER negli ultimi anni. Diviene pertanto ineludibile una generale ri-calibrazione delle linee di sviluppo a suo tempo identificate, superate abbondantemente nelle previsioni quantitative precedentemente elaborate, ma non nelle specifiche articolazioni per tipologia di FER, considerando l'assoluta prevalenza assunta dalle installazioni eoliche e fotovoltaiche.

In questo quadro così congestionato e critico, le biomasse non hanno manifestato pienamente le loro potenzialità ed hanno mantenuto uno sviluppo complessivamente contenuto. Anche in questo caso, hanno prevalso, almeno di solito, investimenti poco armonizzati col territorio, in alcuni casi incentrati sull'impiego di materia prima combustibile d'importazione (per esempio oli vegetali prodotti all'estero) che hanno progressivamente eroso quel carattere "green" originariamente attribuito al settore.

La disciplina statale, la sua articolazione in ambito regionale e provinciale (soprattutto in fase autorizzatoria), la concertazione che deve determinarsi fra uffici i più disparati, ciascuno referente di particolari aspetti riguardanti il corretto inserimento di un impianto nel contesto territoriale (con riferimento ai beni storici, culturali, naturalistici, ambientali, paesaggistici, alle possibili interferenze con l'attività agricola, alla sicurezza dell'insediamento, agli impatti ambientali che esso può generare, ecc.) hanno reso le procedure molto complesse, assai incerte dal punto di vista amministrativo, del tutto imprevedibili nel loro esito finale, estremamente lunghe nei tempi di espletamento (nonostante i limiti indicati dalle norme). Tutto ciò di fatto scoraggia ed inibisce ogni investimento nel settore, ancora una volta discriminando fra i soggetti imprenditoriali che possono affrontare un iter autorizzatorio così complesso e rischioso, rispetto a quelli che, al contrario, vi rinunciano in anticipo, anche se la loro proposta d'investimento potrebbe manifestare caratteri di armonizzazione più marcati e di rispetto delle vocazioni territoriali rispetto a quelle presentati da investitori più "aggressivi".

Con riferimento al quadro così delineato, andrebbe con coraggio proposta una drastica semplificazione normativa, capace di far dialogare differenti settori della pubblica amministrazione (attività economiche e produttive, ambiente, agricoltura, infrastrutture, uffici referenti delle procedure amministrative, ecc.). A fronte di una assoluta severità delle verifiche sui requisiti tecnici, ambientali e della sicurezza pubblica che ogni nuova installazione deve necessariamente soddisfare, occorre snellire le procedure, sciogliere i numerosissimi nodi interpretativi rispetto alle modalità di espletamento delle procedure stesse, eliminare ogni ridondanza, definire la gerarchia delle titolarità e delle responsabilità amministrative, appianare ogni contrasto e divergenza fra organi amministrativi che intervengono nel pronunciamento, ecc. Tutto ciò è compito assai arduo che solo una esplicita e determinata volontà politica può traguardare, ben conoscendo le difficoltà che una tale operazione richiede.

F. Finanza, mercato ed utilizzatori finali del prodotto energetico

In questi ultimi anni, nonostante le difficoltà sopra enunciate, è dato osservare una potenziale ripresa delle possibilità d'investimento nell'ambito del settore. Sebbene siano venuti meno quei rilevanti sostegni tariffari che hanno fortemente "distorto" il mercato dell'energia negli anni scorsi, oggi, sia sul fronte economico che su quello dell'offerta tecnologica, osserviamo condizioni di maggiore sicurezza e solidità di

prospettive. Trascorsa la "frenesia" che ha contraddistinto i primi anni dello sviluppo delle FER in Puglia (a partire da 10-15 anni addietro), adesso è il tempo di scelte d'investimento più consapevoli, meditate, calibrate in rapporto alle disponibilità territoriale ed alle esigenze a cui si intende far fronte. Ci si augura che, quanto prima, queste condizioni possano di fatto stimolare una ripresa degli investimenti, ormai tendenzialmente stagnanti da circa 4-5 anni.
L'offerta tecnologica comprende una più ampia articolazione di potenze di generazione, anche a partire da taglie significativamente inferiori rispetto a quelle disponibili solo pochi anni fa, una maggior attenzione alla produzione congiunta di elettricità e calore (cogenerazione), un controllo ancor più stringente in merito alle prestazioni ambientali degli impianti. Questa più dinamica condizione di mercato e la stretta recessiva degli ultimi anni, hanno anche favorito un significativo abbassamento dei costi d'investimento degli impianti ed un ridimensionamento dell'effetto di economia di scala (che determinava una forte penalizzazione degli impianti a piccola scala rispetto a quelli più grandi in termini di capitale d'investimento richiesto per unità di potenza installata).
Sul fronte del costo della materia prima combustibile, non è dato purtroppo ancora osservare un mercato stabile e ben strutturato della biomassa, sebbene gli scambi di natura commerciale delle differenti forme e tipologie di biomasse ligno-cellulosiche comincino ad infittirsi ed è pertanto possibile cominciare a delineare i primi trend di prezzo e dei valori di riferimento, utili per operare alcune valutazioni di convenienza e fattibilità.
Numerosi sono i prodotti (vettori energetici) assimilabili al cippato di legno proveniente dalle potature i quali potrebbero fungere da possibili surrogati. Di conseguenza, essi forniscono un riferimento di prezzo assimilabile o comparabile al prodotto di nostro specifico interesse. E' del tutto evidente che la presenza di bio-combustibili potenzialmente sostitutivi del cippato ottenuto da potature rappresenti un fattore tendenzialmente competitivo, via via più minaccioso nella misura in cui il prezzo di mercato di tali prodotti alternativi sia decrescente (ossia sempre più conveniente). Analogo ragionamento riguarda il confronto fra *pellet* di produzione locale e *pellet* d'importazione. Del *pellet*, a differenza del cippato di legna, abbiamo oggi dei riferimenti di mercato assai precisi e la comparazione (sempre in termini di valori di "*benchmark*") è tecnicamente possibile in modo omogeneo.
Di seguito, quindi, riferiremo dei valori indicativi dei prezzi registrati in regione Puglia relativi ai più consueti bio-combustibili, almeno quelli più frequentemente utilizzati. La legna da ardere viene venduta ad un prezzo nell'intervallo fra 110 e 130 € per tonnellata. Le piccole balle cilindriche costituite da sarmenti o frasche (con peso unitario di circa 30 kg) hanno un prezzo di vendita di 2,5 € l'una, approssimativamente, ciò che si traduce in un prezzo di circa 75 € per tonnellata. Il *pellet* di categoria A1, invece, è venduto ad un prezzo variabile fra 230-350 € per tonnellata. Come si osserva, all'aumentare del prezzo medio del combustibile, aumenta anche la variabilità di prezzo, in considerazione dell'influenza delle differenti modalità di realizzazione del processo tecnologico a carico della materia d'origine.

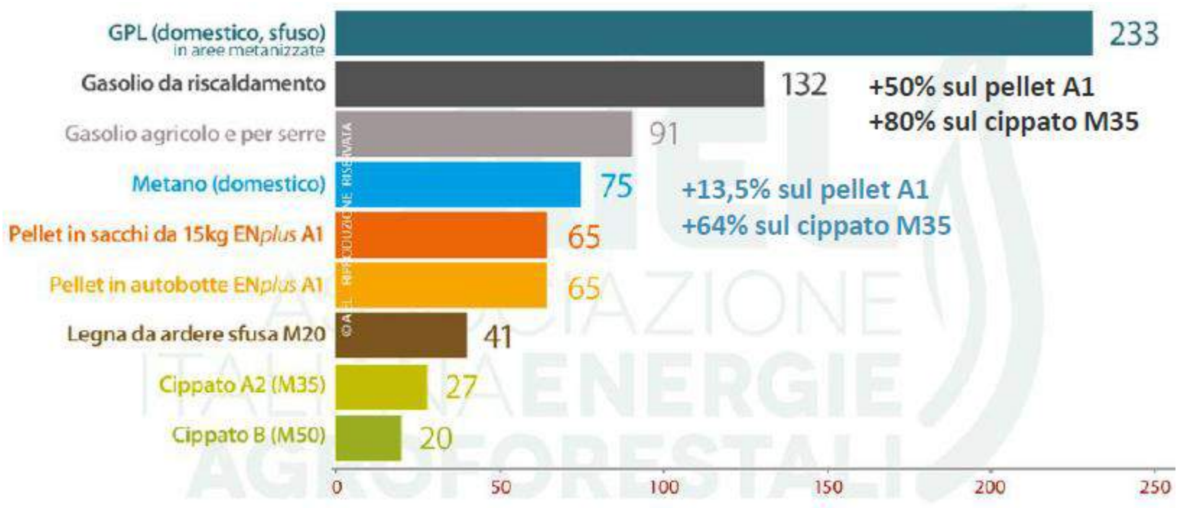

Figura 1. Costo dell'energia a carico del consumatore finale (includendo l'IVA e le accise, ed escludendo invece il costo del trasporto). Rilevazione eseguita per l'Italia nel Gennaio 2017. Unità di misura: Euro/MWh. (Fonte dei dati: Agriforenergy, Mercati e Prezzi, Marzo 2017 – a cura di AIEL)

Il cippato di legna, pertanto, ha un costo medio orientativo di circa 60 € a tonnellata. E' del tutto evidente che la qualità del cippato influenza significativamente questa valutazione, per esempio in rapporto al suo grado di umidità, il presumibile contenuto in ceneri (influenzato, per esempio, dalla presenza o meno di corteccia), dalle dimensioni medie della trinciatura e della regolarità dimensionale (la presenza di pezzi fuori misura può notevolmente influenzare la regolare utilizzazione del combustibile in alcuni impianti a biomassa). I gusci delle mandorle hanno un prezzo medio di circa 150 € a tonnellata, mentre il nocciolino ricavato dalla denocciolatura delle olive (prima della molitura) o delle sanse (dopo la molitura) ha un valore di mercato pari a circa 190 € a tonnellata e le sanse esauste (ovvero quelle disoleate) sono vendute a circa 100 € a tonnellata.
E' del tutto evidente che il modo più corretto di operare una comparazione di prezzo (ovvero del costo di acquisto) consiste nell'assumere a riferimento non tanto il peso unitario quanto, piuttosto, il valore energetico unitario, che costituisce il fine ultimo per cui quella biomassa combustibile è acquistata.
Avendo adottato questa coerente unità di riferimento comparativa, appare chiaro (dall'esame della Figura 1) che il cippato di legna rappresenta il combustibile largamente più economico, sia fra quelli che si originano dalla biomassa che rispetto ai combustibili di origine fossile. Il cippato B (M50), infatti, ha un costo di circa la metà del costo della legna da ardere e risulta tre volte inferiore rispetto al pellet categoria A1.

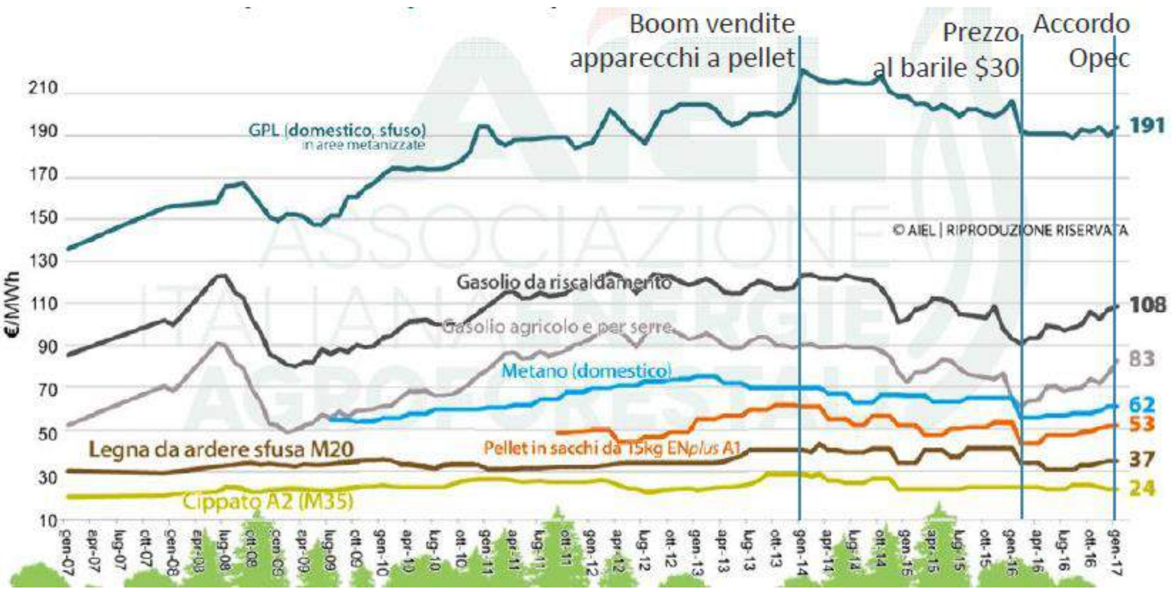

Figura 2. Dinamica temporale del costo finale dell'energia a carico del consumatore finale nel corso della decade 2007-2017 (IVA e costo del trasporto sono esclusi). Unità di misura: Euro/MWh. (Fonte dei dati: Agriforenergy, Mercati e Prezzi, Marzo 2017 – a cura di AIEL).

Il cippato A2 (M35) è quasi tre volte più economico del metano agricolo e quasi 5 volte più economico rispetto al gasolio da riscaldamento.
Questa condizione di spiccata convenienza economica risulta confermata nel corso dell'ultimo decennio, ed ancor prima, manifestando valori di prezzo particolarmente stabili nel tempo, a differenza di quanto osservato con riferimento ai combustibili di origine fossile che, invece, risentono tutti fortemente delle oscillazioni di prezzo a carico del petrolio, in particolare come riflesso di condizioni di crisi che, periodicamente, si vengono a determinare sullo scacchiere geo-politico internazionale.

G. Elementi di base per un'analisi SWOT

Punti di Forza ("*Strengths*")

S1. *L'agricoltura è settore economico trainante a scala regionale*. Il settore agricolo regionale è un settore rilevante dell'economia pugliese e da cui si origina una parte significativa della ricchezza regionale, nonostante alterni periodi di crisi e un certo grado di persistente e generale arretratezza. Non mancano, però, settori di eccellenza in cui è dato manifestare condizioni di primato a scala nazionale ed europea. Nei settori agricoli ed agro-industriali più efficienti, più innovativi, più sviluppati, l'ipotesi di far fronte ai consumi energetici aziendali mediante combustibili ottenuti da biomasse APPR potrebbe rappresentare una modalità d'investimento particolarmente attrattiva. La logica sottesa è quella di ridurre la dipendenza dell'agricoltura dall'impiego di risorse energetiche di origine "fossile" e di incrementare il livello di autonomia energetica così come l'efficienza d'uso dell'energia.

S2. *Ampia disponibilità di biomasse APPR ed elevati livelli di densità territoriale dei residui di potatura*. Come riferito nel paragrafo iniziale, la Puglia si caratterizza per essere una delle regioni italiane contraddistinte dalla massima concentrazione di oliveti e vigneti a cui si associano altre tipologie di fruttiferi (come ad esempio pescheti, albicoccheti e mandorleti). Ciò costituisce un fattore prioritario e propedeutico perché possano svilupparsi delle filiere agro-energetiche incentrate sull'impiego dei residui di potatura. In particolare, più che l'estesa superficie agraria investita a fruttiferi, è l'elevata densità spaziale delle potature a costituire un fattore oltremodo positivo per gli approvvigionamenti di biomassa, in quanto ciò riduce notevolmente il raggio territoriale di raccolta di frasche e sarmenti e, pertanto, consente di operare un risparmio significativo nella movimentazione dei residui legnosi, influendo sulla riduzione dei costi di trasporto, siano essi costi economici ma anche emissivi (GHG).

S3. *Sviluppo delle filiere olivicolo-olearie e viti-vinicole come "trampolino di lancio" delle filiere agro-energetiche*. Come corollario al punto precedente, fra i punti di forza occorre anche evidenziare il notevole sviluppo che hanno le filiere produttive a valle della produzione viticola ed olivicola, ovvero il settore delle produzione degli oli extra-vergini di oliva così come il settore della vinificazione. Si può considerare che questi siano settori agro-alimentari potenzialmente associabili alle agro-energie in quanto consentono il recupero di ulteriori materiali di scarto, o sottoprodotti, che integrano la disponibilità di potature a fini energetici. Il riferimento, ad esempio, è al "nocciolino" di olive, oppure alle sanse vergini od esauste che costituiscono tipologie di bio-combustibile ormai diffuse e richieste, che potrebbero considerarsi complementari alle potature. Analogamente, ma con riferimento al processo di vinificazione, sottoprodotti quali vinacce e fecce potrebbero avere anch'esse una destinazione energetica. Questa integrazione fra settori "contigui" e la possibilità di soddisfare le esigenze energetiche dei processi di trasformazione agro-alimentare potrebbe costituire elemento importante su cui far leva per il decollo di nuove filiere bioenergetiche.

S4. *Presenza di aziende "conto terzi" operanti nel territorio*. La presenza di "contoterzisti" offre la possibilità di affidare a queste tipologie di aziende agro-meccaniche lo svolgimento dei lavori di raccolta e di primo condizionamento delle potature. Ciò consente di affrancare l'agricoltore che, per la limitata estensione degli appezzamenti o per la mancanza di specifici macchinari dedicati alla raccolta, non abbia la possibilità di svolgere queste operazioni in modo economicamente conveniente o che, in ogni caso, non volesse dedicarsi a queste procedure. L'affidare le operazioni colturali al servizio offerto da aziende che operano "conto terzi" è pratica abbastanza diffusa in regione. Ciò consente alle aziende committenti di ridurre l''immobilizzazione di capitali per l'acquisto di macchine ed attrezzature; di contro, le aziende agro-meccaniche hanno, di frequente, un parco macchine altamente specializzato che potrebbe anche articolarsi nella disponibilità delle attrezzature le più opportune per la raccolta, la trinciatura o l'imballatura delle potature, secondo il modello di cantiere ritenuto logisticamente più confacente alle operazioni richieste nello specifico ambiente di coltivazione.

S5. *Possibilità d'implementare un'agricoltura di tipo "multifunzionale"*. Il modello agri-energetico è del tutto conforme al tipo di agricoltura "multifunzionale", oggi identificato come modello di riferimento a scala europea. La "multifunzionalità" ha come obiettivo la diversificazione delle attività agricole, la moltiplicazione delle opportunità di reddito (anche mediante attività non convenzionali ma connesse funzionalmente a quella agricola), l'approfondimento delle filiere produttive, avendo lo scopo di incorporare nei profitti aziendali quote di valore aggiunto ottenute dalla trasformazione delle materie prime in prodotti finiti. In quest'ottica, le aziende agricole, le cooperative, i consorzi, le associazioni di produttori, potrebbero porsi l'obiettivo di convertire le biomasse residuali in un vettore energetico (cippato di legna, oppure pellet, briquettes, etc.); in alternativa, sarebbe anche possibile gestire direttamente un servizio di fornitura dell'energia (sotto forma di calore od elettricità), per esempio attraverso esperienze di "*district heating*" a scala municipale.

S6. *Potenzialità di rafforzare il livello di occupazione*. Differentemente da altre tipologie di FER, l'impiego di biomasse a fini energetici implica la strutturazione di un'articolata filiera produttiva, con fitte connessioni territoriali, ciò che sollecita la partecipazione e l'integrazione di un'ampia gamma di figure professionali, agricole ed extra-agricole, in grado di garantire la mobilitazione, il condizionamento e la giusta conversione della biomassa in energia. Numerose, pertanto, sono le maestranze che possono partecipare alla filiera e che, direttamente od indirettamente, possono offrire il loro contributo professionale. Ciò è garanzia della valenza socio-economica degli investimenti nelle agro-energie e la possibilità che possano essere fattore di leva dello sviluppo rurale.

Punti di Debolezza ("*Weaknesses*")

W1. *Scarsa conoscenza delle possibilità offerte dai residui colturali degli impianti arborei*. Distinguendo rispetto ad alcuni casi d'eccezione, in termini generali, non si osserva una diffusa consapevolezza in merito alle potenzialità energetiche offerte dalle potature e. pertanto, non si presentano frequenti occasioni in cui imprenditori agricoli si pongano l'obiettivo di una valorizzazione dei propri residui.

W2. *Complessità inerente alla strutturazione di una filiera bioenergetica*. Alla mancata consapevolezza in merito alle potenzialità rappresentate dalle potature (W1) fa inoltre riscontro il timore diffuso che porre in essere una filiera produttiva sia compito particolarmente difficile sul piano organizzativo. In particolare, poiché qualunque progetto agro-energetico chiama in causa il coordinamento fra una pluralità di attori di filiera (ciascuno con il suo compito da assolvere), vien meno la centralità dell'imprenditore (almeno nei casi in cui siano gli agricoltori il motore primo dell'iniziativa) e la sua prerogativa di assumere decisioni nel campo degli investimenti aziendali. Questa esigenza, ossia quella di una gestione spesso collettiva e collegiale, difficilmente incarna la natura fieramente autonoma di numerosi imprenditori agricoli.

W3. *La meccanizzazione della raccolta delle potature è operazione costosa*. Nonostante i notevoli miglioramenti tecnologici registrati in questi ultimi anni nel settore della meccanizzazione della raccolta e del primo condizionamento delle potature, le operazioni logistiche connesse al cantiere di raccolta vengono ancora giudicate difficili, costose, organizzativamente esigenti e dispendiose (in termini di tempo da dedicarvi ed manodopera impegnata). Ciò, in particolare, è un problema che riguarda il piccolo agricoltore, ossia l'imprenditore che gestisce una superficie arborata relativamente modesta tale da non giustificare una dotazione meccanica specializzata in questo tipo di operazioni. Da qui anche la maggiore propensione ad affidare questo tipo di operazioni a ditte agro-meccaniche che lavorano in conto terzi.

W4. *Il valore unitario delle biomasse da potature è considerato assai modesto e, pertanto, economicamente poco profittevole*. La considerazione generale che origina scetticismo in merito alla possibilità di costituire filiere agro-energetiche incentrate sull'utilizzo delle potature è che il valore unitario di questa tipologia di biomassa risulti troppo modesto in raffronto, ad esempio, con altre tipologie quali le biomasse di origine forestale. Se questo è il dato di partenza, ogni ulteriore intervento a carico delle biomasse (raccolta, addensamento, trasporto, stoccaggio, ecc.) costituisce un costo aggiuntivo rispetto ad una materia prima di scarso valore e ad un prodotto energetico finale che, comunque, manifesta un limitato apprezzamento sul mercato. In altri termini, si considera che il processo di filiera debba essere particolarmente gravoso, in termini di lavoro, ed oneroso, in termini di costi, per giustificare la disponibilità sul mercato di un prodotto energetico dalla cui vendita, in tutta probabilità, non si riuscirebbe a recuperare quanto complessivamente speso.

W5. *Una gestione aziendale sostenibile dovrebbe richiedere che i residui colturali tornino al suolo e, pertanto, non venissero asportati*. In alcuni contesti agricoli, specie quelli tecnicamente più evoluti, si assume che la sistematica sottrazione dei residui colturali possa costituire un rischio per l'integrità delle caratteristiche di qualità del suolo agrario, con particolare riferimento alla sua dotazione in sostanza organica. Numerose sono ormai le aziende viticole (soprattutto) ed olivicole (un po' meno) che stanno orientando la gestione del frutteto verso un sistema complessivamente indicato come "agricoltura conservativa" il cui perno è rappresentato dalla drastica riduzione del numero d'interventi di lavorazione meccanica del suolo, fino alla introduzione della "non-lavorazione", accoppiata all'inerbimento della superficie del suolo, sia esso temporaneo o permanente, soprattutto in relazione alla disponibilità idrica e, quindi, alla possibile competizione per l'uso della risorsa. Di frequente, nei nostri ambienti, con l'approssimarsi della stagione arida estiva, il prato si dissecca naturalmente (lasciando però un utile ricoprimento a protezione del suolo) o viene falciato per contenerne gli effetti competitivi rispetto alle esigenze degli alberi. Tale regime di gestione è quindi poco propenso a ritenere le potature del materiale da indirizzare alla produzione di energia (anche nel caso di autoconsumo). L'esecuzione di un accurato bilancio della sostanza organica, specie allorché l'imprenditore adotti tecniche conservative, così come limitati ma preziosi apporti ammendanti (a parziale sostituzione dei concimi minerali) potrebbero garantire soluzioni "*win-win*", ovvero l'asportazione delle potature ed il contemporaneo ripristino della sostanza organica del suolo che si avvia a mineralizzazione.

W6*. Scarsa fiducia degli industriali nei riguardi degli impegni assunti dall'agricoltore, e viceversa*. Chi opera investimenti nel settore energetico realizzando impianti di media o grande taglia ha la necessità di stipulare contratti di fornitura con un ampio numero di piccoli agricoltori che possano garantire un approvvigionamento conforme (per quantità e qualità) a quanto necessario. Tale approvvigionamento deve essere assicurato nei tempi lunghi dell'esercizio dell'impianto, ossia per 15-20 anni almeno. L'agricoltore può essere ben incline a garantire la fornitura da un anno all'altro, diversamente, un contratto di lungo periodo è invece visto con scarso favore in quanto troppo vincolante ed incerto in merito alle possibili dinamiche di mercato (sia quelle del settore energetico ma anche quelle del settore agricolo). Da qui una tendenziale diffidenza ad impegnarsi così a lungo da parte dell'agricoltore, così come il timore da parte dell'industriale che i patti non vengano rispettati e che l'agricoltore "si chiami fuori" dall'impegno assunto. Questa condizione d'incertezza può essere risolta solo attraverso la stipula di contratti che prevedano differenti clausole di convenienza e di garanzia per entrambe le parti interagenti.

W7. *Incertezze rispetto agli investimenti. Percezione ancora alta del rischio imprenditoriale*. Mettendo a sistema le difficoltà di cui sopra, a cui si aggiungono ulteriori ostacoli in merito al costo ancora rilevante degli investimenti richiesti per l'acquisto dell'impianto, le incertezze di carattere amministrativo conseguenti alle procedure autorizzatorie, le complicazioni riguardo alla disponibilità ed alla collocazione del punto di connessione alla rete elettrica del gestore pubblico, le frequenti opposizioni da parte della popolazione residente alla realizzazione dell'impianto, le tecnologie di conversione alcune delle quali non ancora sufficientemente mature, tutto ciò definisce un quadro ancora altamente indeterminato e quindi rischioso, che poco favorisce gli investimenti e l'assunzione di impegni finanziari di lungo periodo. Ciò avviene nonostante i frequenti aiuti pubblici in conto capitale, le agevolazioni fiscali e gli incentivi tariffari, il che fornisce un'idea purtroppo chiara ed evidente delle notevoli contraddizioni del sistema.

W8. *Stagionalità dei prelievi e delle disponibilità delle biomasse residuali*. Una delle limitazioni più evidenti che possono interferire nella realizzazione di una filiera produttiva è quella rappresentata dall'accentuata stagionalità nell'esecuzione dei prelievi di biomassa. In particolare, le operazioni di potatura del vigneto e dell'oliveto hanno luogo a partire dal periodo successivo alla raccolta della produzione e possono protrarsi fino ad un periodo antecedente alla ripresa vegetativa degli alberi da frutto. Ciò significa che, di norma, il trimestre invernale è quello deputato all'esecuzione degli interventi cesori. Il tempo a disposizione, quindi, essendo assai ristretto, potrebbe costituire una limitazione oggettiva all'esecuzione della raccolta, specie quando le dimensioni del campo sono assai ampie o l'azienda che esegue il lavoro opera in conto terzi, con un fitto calendario di interventi. I residui di potatura possono essere lasciati sulla superficie del suolo, disposti in andane, per agevolare la successiva raccolta, oppure variamente accatastati. Il tempo di permanenza in campo e l'andamento meteorologico (preferibilmente secco ed in assenza di piogge)

possono consentire una disidratazione più o meno accentuata del legno, specie con riferimento alle potature più minute. Una tendenziale perdita delle foglie, conseguente al disseccamento dei residui in campo, potrebbe favorire un miglioramento della qualità combustibile delle potature, anche a fronte di una riduzione della biomassa complessivamente raccolta. Le tecniche di raccolta e l'organizzazione logistica del cantiere possono influenzare i tempi di raccolta; infatti, la trinciatura più che l'imballatura necessiterebbe di una disidratazione più spinta delle biomasse da raccogliere.
Al di là della difficoltà od operare la raccolta entro una finestra temporale abbastanza limitata, un'altra difficoltà che discende dalla stagionalità delle potature è rappresentata dalla necessità di disporre di un centro od una piattaforma di stoccaggio in modo da fungere da "sistema tampone" o "volano" fra i tempi concentrati della raccolta e, al contrario, i tempi più "diluiti" e regolari dell'approvvigionamento all'impianto. Di frequente, l'impianto destinatario degli approvvigionamenti non ha una disponibilità di spazio adeguata e sufficiente per garantire uno stoccaggio unico e concentrato di tutta la biomassa necessaria nel corso dell'anno solare; ciò implica, di conseguenza, la realizzazione di centri satellite di stoccaggio temporaneo, prima che la biomassa sia consegnata nel centro finale di utilizzazione. Questo servizio di stoccaggio potrebbe essere gestito dalle imprese agricole fornitrici (riunite in cooperativa o consorzio), dall'impresa industriale che si occupa della conversione energetica, ovvero da aziende intermediarie che possono o meno coincidere con l'azienda agri-meccanica che ha curato il servizio di raccolta in campo delle potature. Come si vede, i modelli di business possono essere molto variabili in rapporto alle condizioni socio-economiche di contesto.

W9. *I prodotti energetici ottenuti a partire dalle potature potrebbero non essere rispondenti a specifici parametri standard di qualità*. Nei contesti in cui il mercato dei prodotti bioenergetici è sufficientemente sviluppato, si vanno progressivamente affermando criteri condivisi e standardizzati di classificazione delle caratteristiche dei prodotti ottenuti a partire dalle biomasse. Ciò attiene, in particolare, ai caratteri merceologici dei prodotti medesimi; da un lato, infatti, occorre fornire garanzia al consumatore finale della rispondenza di quanto acquistato con le specifiche tecniche del prodotto ricercato; dall'altro, la conformità piena o parziale a tali criteri qualitativi non può che avere un'influenza rilevante sulla formulazione del prezzo di vendita del prodotto medesimo.
In ambito locale (ovvero considerando la regione Puglia), il mercato delle biomasse combustibili non è ancora sufficientemente sviluppato per poter dar seguito a criteri così evoluti di valutazione merceologica, per cui il prodotto energetico è spesso oggetto di scambio senza che siano opportunamente dichiarati fondamentali informazioni attinenti, ad esempio, al grado di umidità, contenuto in ceneri, potere calorifico, dimensionamento medio del cippato e sua variabilità campionaria, ecc. Questa condizione rende anche abbastanza incerta la reale valutazione commerciale del prodotto che, come risaputo, dovrebbe essere rapportata al contenuto energetico del prodotto e non semplicemente al suo peso.

Opportunità ("*Opportunities*")

O1. *Il sistema "agro-energetico" interpreta adeguatamente il modello "multifunzionale" oggi associato all'agricoltura*. Le strategie delle sviluppo rurale implementate nel quadro della Politica Agricola Comune (PAC) fanno perno, ormai da diversi anni, sul concetto di "multifunzionalità" dell'agricoltura, ovvero sulla possibilità che l'esercizio agricolo non interpreti esclusivamente finalità produttive ma che, al contrario, sappia intercettare esigenze molto ampie ed articolate in grado di promuovere lo sviluppo. Sempre più queste esigenze appartengono alla sfera di servizi ecologico-ambientali e socio-culturali. Così, ad esempio, aspetti qualificanti della multifunzionalità sono la conservazione e la salvaguardia ambientale (proteggere il territorio da fenomeni di dissesto idrologico; difendere la biodiversità; evitare inquinamenti e salvaguardare le risorse), così come la valorizzazione degli aspetti paesaggistici e la promozione delle opportunità turistico-ricreative del territorio; la dimensione sociale dell'agricoltura è quella che si occupa di

alcuni aspetti inerenti alla cura di alcune patologie, il reinserimento di persone che vivono condizioni di disagio, l'educazione e la formazione dei giovani, ecc. In questo quadro, come si può intendere estremamente variegato, si inserisce anche la possibilità che l'agricoltura, piuttosto che attività altamente energivora, si ponga l'obiettivo di alleviare il nostro deficit energetico e di promuovere le FER.
Questa strategia, inoltre, promuove la diversificazione produttiva e la multiattività, ciò che costituisce uno strumento poderoso per consentire agli imprenditori agricoli, specie quelli più prossimi a condizioni di marginalità, di rafforzare la loro capacità di permanere all'interno del sistema economico e di non esserne espulsi. La produzione di energia rinnovabile è, a tutti gli effetti, considerata attività agricola "connessa" allorché "non prevalente", ovvero rimanga entro una dimensione economica inferiore rispetto all'attività agricola propriamente detta.

O2. *Le bioenergie sono una forma di attività imprescindibile nel quadro degli interventi di mitigazione dei cambiamenti climatici*. In un quadro strategicamente assai ampio, che investe la scala planetaria, occorre assumere impegni vincolanti e decisamente più ambiziosi rispetto al passato ("Protocollo di Kyoto") per limitare il progressivo surriscaldamento terrestre. Tale strategia non può che trovare immediato e concreto riscontro anche alla scala regionale. E' infatti su questo tema, essenzialmente, che si incentra l'aggiornamento del PEAR della Puglia e la individuazione del "*burden sharing*" da adottare come obiettivo della strategia regionale di riduzione delle emissioni GHG. La gran parte degli analisti, sia governativi che non-governativi, assegna alle biomasse un ruolo imprescindibile nel progressivo sviluppo delle FER e nella capacità dei sistemi produttivi locali e nazionali di affrancarsi progressivamente dalla dipendenza "fossile". Questa condizione di assoluta necessità pone il settore FER, quello delle biomasse ed in particolare quello delle biomasse APPR, in una posizione assai favorevole (potremmo dire privilegiata) rispetto alle misure che dovranno essere poste in essere per incentivare la produzione di energia rinnovabile.
In particolare, le biomasse APPR sono unanimemente giudicate risorse "locali" (ovvero non sono biomasse trasferite da lontano), è ritenuto giusto ed opportuno valorizzarle, adottando tecnologie di conversione energetica le meno impattanti e le più rispettose dell'ambiente, stimolando così processi economici che promuovano lo sviluppo locale. E' dunque di prioritaria rilevanza trovare le modalità più opportune ed adeguate per modulare, a scala locale, un modello di progressiva espansione del settore bioenergetico che, però, non sia giudicato come modello "esogeno" (di semplice "colonizzazione") ma, al contrario, sappia interpretare bisogni ed esigenze delle comunità insediate nel territorio.

O3. *Riordino, in chiave sostenibile, delle operazioni colturali del frutteto*. Considerando i più probabili sviluppi della regolamentazione agricola e di quella ambientale (specie con riferimento alla necessità di ridurre drasticamente le emissioni di gas clima-alteranti) è altamente probabile che la pratica della bruciatura delle potature non venga più tollerata e, per contro, venga del tutto interdetta. Alla luce di questa possibile evoluzione, l'agricoltore che per consuetudine o semplificazione della pratica colturale sia ancora avvezzo a questa discutibile pratica dovrà radicalmente modificare il sistema di gestione del frutteto, orientandosi verso metodologie più innovative, quali le tecniche di tipo "conservativo", incentrate sulla minima lavorazione o la non-lavorazione, l'inerbimento, l'apporto di ammendanti organici, ecc. Questo nuovo regime, meglio rispettando le condizioni del suolo e la salvaguardia del suo contenuto in sostanza organica, potrebbe più agevolmente consentire una sistematica asportazione dei residui di potatura da destinarsi all'impiego energetico.

O4*. Le prospettive di mercato delle bioenergie sono favorevoli*. Sebbene il mercato delle biomasse combustibili sia ancora scarsamente sviluppato a scala regionale, le condizioni di scambio sono interessanti e riflettono abbastanza fedelmente le condizioni osservate a scala generale. In particolare, è dato rilevare il persistente vantaggio di prezzo che contraddistingue i combustibile da biomassa rispetto ai combustibili di origine fossile di cui sono succedanei. Oltre al vantaggio considerevole nel prezzo dell'unità energetica, ciò che consente un ammortamento più rapido dei costi d'investimento dovuti all'acquisto degli impianti a biomassa, un altro vantaggio è rintracciabile nella particolare stabilità che tale prezzo manifesta nel tempo, ovvero la relativa insensibilità del regime dei prezzi a quelle ripercussioni geo-politiche che di frequente determinano rapidi ed improvvisi innalzamenti di prezzo a carico del petrolio e dei suoi derivati (condizione definita di "volatilità" dei prezzi). Questa condizione di consolidata stabilità dei prezzi offre un buon livello di affidabilità nella definizione del "*business plan*" dei progetti bioenergetici e costituisce un fattore del tutto favorevole al decollo di nuove filiere.

O5. *Crescente miglioramento tecnologico degli impianti e perfezionamento dei sistemi di raccolta delle potature*. Il fatto interessante che è dato osservare in questi ultimi anni riguarda la progressiva attenzione che le ditte costruttrici degli impianti a biomassa hanno dedicato alla necessità di rendere "scalabili" alcune soluzioni impiantistiche attinenti a specifiche tecnologie termochimiche verso livelli più contenuti di potenza di generazione o di capacità oraria dell'impianto medesimo. E' questo un fattore tecnologico di grande rilevanza in quanto allarga significativamente il numero potenziale di imprenditori interessati all'investimento ed aumenta le possibilità d'intercettare, in modo più duttile e quindi più efficiente, le disponibilità territoriali di biomassa, riducendo l'estensione del bacino di approvvigionamento che un definito impianto dovrebbe controllare. Ne consegue, inoltre, che i costi d'investimento siano più contenuti. L'evoluzione del mercato e l'affermarsi di queste tecnologie a piccola o micro scala contribuisce ulteriormente ad abbassare i costi d'investimento, condizione che genera un circuito virtuoso che promuove l'affermarsi territoriale del settore. Le conseguenze indotte riguardano anche un aumento significativo delle specializzazioni tecnico-professionali in grado di fornire assistenza, operare le installazioni, controllare l'ordinario funzionamento dell'impianto e svolgere la necessaria manutenzione. Tutto ciò contribuisce ad incrementare il livello di affidabilità della tecnologie e, pertanto, sollecita ulteriori investimenti.

O6. *I meccanismi d'incentivazione e supporto agli investimenti nel settore delle bioenergie sono ancora rilevanti*. Sebbene gli ultimi anni si siano caratterizzati per una relativa contrazione dei vantaggi tariffari originariamente messi in atto per favorire una forte promozione delle FER, tali vantaggi ancora persistono e sostengono in particolare i piccoli impianti rispetto a quelli di taglia più elevata, così come le soluzioni tecnologiche ritenute più "*ecological friendly*". Ancora frequenti e numerose, inoltre, sono le opportunità di far ricorso al sostegno pubblico per fronteggiare i gravosi investimenti inerenti alla realizzazione di impianti a biomassa. In certi casi, è addirittura possibile operare (almeno in modo parziale) un certo cumulo dei finanziamenti erogati in conto capitale, purché non venga superata la soglia limite di agevolazione pari al 40%. Tali finanziamenti, nei modi e secondo meccanismi differenti, possono riguardare sia il settore dell'agricoltura così come quello dell'industria e possono far ricorso ad iniziative intraprese e coordinate a scala regionale, nazionale od europea. E' presumibile che il sostegno e l'incentivazione economico-finanziaria alla creazione di filiere bioenergetiche sia una strategia di "policy" perseguibile per tempi ancora medio-lunghi, in attesa di ottenere il risultato posto in agenda, ovvero le riduzioni di GHG ed i risparmi in risorse fossili così come da impegni assunti internazionalmente.

O7. *Opportunità di ridurre i costi connessi all'approvvigionamento dell'energia nelle attività produttive del settore agricolo, agro-alimentare ed industriale*. Le aziende che, in linea teorica, possono aderire al settore delle bioenergie a base APPR non sono unicamente quelle che intendono produrre energia per alimentare la rete elettrica nazionale. Ulteriori e ben più rilevanti opportunità sarebbero offerte a vantaggio di tutte quelle tipologie aziendali che debbono fronteggiare elevati costi energetici nel loro processo produttivo. Ciò implica, assai di frequente, il contestuale consumo di energia elettrica e di calore, pertanto il possibile ricorso ad un regime di "co-generazione" che consentirebbe di conseguire livelli di rendimento assai elevati, anche superiori all'80%. E' questo l'ambito applicativo di nuove filiere che meglio risponderebbe a soddisfare le esigenze del territorio, conseguendo significativi e reali risparmi di energia fossile, garantirebbe maggiore sicurezza negli approvvigionamenti energetici e livelli più elevati di autoconsumo. Si tratta, in altri termini, di procedere ad una sistematica e puntuale sostituzione di vecchi impianti convenzionali con nuovi impianti alimentati a biomasse, a servizio degli approvvigionamenti energetici connessi a processi produttivi che si svolgono presso aree industriali oppure agricole a forte concentrazione di industrie di trasformazione agraria.

O8. *Attivazione di progetti energetici a scala municipale e d'interesse pubblico*. Un altro fronte importante in cui si andrebbe ad incidere in modo rilevante nella contrazione dei consumi energetici fossili è quello del riscaldamento pubblico collettivo. In modo simile al punto precedente, si cerca d'intervenire non tanto nell'incrementare una generica offerta energetica (specificamente quella elettrica, soggetta a dispacciamento sulle lunghe distanze e, pertanto, esposta ad inefficienze, dispersioni, instabilità, blocchi, ecc.), quanto sul fronte della domanda, ovvero soddisfare direttamente le esigenze di consumo energetico per garantire lo svolgimento di processi manifatturieri, agro-alimentari o le esigenze di riscaldamento delle abitazioni, siano esse pubbliche o private. Con riferimento a quest'ultima esigenza, le amministrazioni municipali potrebbero promuovere iniziative miranti a garantire il riscaldamento di ambienti pubblici (le scuole pubbliche, il municipio, la palestra o la piscina comunale, ecc.) mediante l'installazione di caldaie a biomasse di nuovissima tecnologia in sostituzione di caldaie tradizionali, inefficienti e a manutenzione assai onerosa. Sarebbero, in particolare, quei comuni collocati geograficamente in fasce altitudinali piuttosto elevate (in collina od in montagna) ad intravvedere margini di convenienza sicuramente più spinti nel procedere alla sostituzione della vecchia caldaia con sistemi di teleriscaldamento. "Certificati bianchi" o "Conto termico 2.0" sono attualmente gli strumenti d'incentivazione messi a punto a livello nazionale per rendere più conveniente il passaggio o la "conversione" alle biomasse rispetto ai combustibili tradizionali ad elevato profilo d'emissioni (cherosene, gasolio, ecc.). Questo tipo di iniziative, inoltre, avrebbe il notevole vantaggio di far fronte ad un'esigenza a carattere collettivo, espressione della popolazione in termini larghi e generali, e non di una specifica e ben selezionata sua categoria, sociale, professionale, produttiva che fosse.

<u>Minacce ("*Threats*")</u>

T1. *Procedure autorizzatorie ancora poco chiare, diversamente interpretate, variamente applicate*. Grande è il disordine sotto il cielo! Particolarmente difficile è riuscire ad orientarsi nel "*mare magnum*" di decreti, leggi, regolamenti e linee guida, per giunta considerando la sovrapposizione e, di frequente, perfino il conflitto di competenze che sussiste fra la normativa statale e quella regionale. Ciò implica che non sia possibile attivare iniziative d'investimento senza fare appello ad una folta schiera di consulenti, ciascuno specializzato in particolari e specifici aspetti tecnico-normativi che disciplinano il settore. Ciononostante, le incertezze della procedura ed i tempi troppo spesso imprevedibili (sebbene in teoria contingentati "*ope legis*") rendono l'avvio dell'investimento un'impresa titanica, altamente incerta, oltremodo rischiosa, economicamente dispendiosa nella fase di avviamento. Nonostante la legge dia la massima priorità ad investimenti in questo settore in quanto ritenuti di rilevanza strategica, l'enorme mole di pratiche a cui assolvere, i numerosi vincoli, i pronunciamenti plurimi da parte dei numerosi uffici che preordinano il rilascio delle autorizzazioni, esercitano una serratissima selezione "*ab origine*" rispetto alle iniziative progettuali d'investimento. Nell'arco di pochi anni, inoltre, l'assetto normativo ha subito frequenti cambiamenti, rimaneggiamenti, improvvisi arresti e ripartenze, in alcuni casi perfino provvedimenti a carattere retroattivo.
Queste condizioni così complesse ostacolano e scoraggiano nuovi investimenti, creano un'artificiosa discriminazione fra gli imprenditori in base alla loro maggiore o minore confidenza riguardo alle procedure normative (è del tutto notorio che i piccoli agricoltori non hanno facile accesso a questo tipo di

informazioni), favoriscono investimenti meno radicati territorialmente ma guidati da imprenditori più spregiudicati rispetto a progetti di filiera costituiti dal raggruppamento di imprenditori locali.

T2. *Energica competizione esercitata da biomasse "esogene"*. Per biomasse "esogene" si intende materie prime combustibili che vengono acquisite da mercati diversi e solitamente distanti rispetto al mercato regionale. Anche da un punto di vista normativo, si assumono condizioni di "filiera corta" allorché il trasporto delle biomasse non superi una distanza di 70 km in linea d'aria dall'impianto servito. Superato questo valore limite (del tutto convenzionale sebbene specificamente normato), l'impianto a biomassa perde quelle prerogative di priorità e valenza che ne giustifichi il sostegno da parte del decisore pubblico. Si tratterebbe, in tal caso, di un investimento a carattere ordinario. Ciononostante, allorché l'approvvigionamento locale fosse soggetto ad oggettive limitazioni per una relativa carenza della risorsa combustibile o nel caso in cui i costi di approvvigionamento di biomasse "importate" fossero più convenienti rispetto ai costi attribuiti alla biomasse raccolte "in loco", si generebbero condizioni di competizione a scapito del prodotto interno, tale per cui non verrebbero a generarsi quei virtuosi rapporti di filiera e quell'auspicabile indotto di attività che è il fondamento primo di iniziative di tal genere. Le ragioni di questa efficace competizione possono essere diverse e, almeno inizialmente, allorché il mercato locale non sia sufficientemente consolidato, possono trarre origine in una migliore organizzazione logistica della filiera che ne riduce i costi di movimentazione, una migliore dotazione di macchine ed attrezzature per la raccolta delle potature ed una più efficiente organizzazione dei cantieri, una più consistente dotazione territoriale delle risorse ligno-cellulosiche oggetto di raccolta che rende più convenienti tutte le procedure, ecc.
Anche una notevole disponibilità di materie prime combustibili alternative e surrogabili può costituire fattore assai efficace di competizione, come ad esempio le sanse, il nocciolino, i gusci delle mandorle, ecc.

T3. *Opposizione sociale alla realizzazione di nuovi impianti a biomassa*. La cosiddetta "sindrome NIMBY" ("*Not In My Back Yard*") è pervenuta a livelli di diffusione assai preoccupanti, in particolare con riferimento alla regione Puglia, sebbene essa costituisca una fattore limitativo ormai su tutto il territorio nazuionale. Le esperienze di tumultuoso sviluppo regionale dell'eolico e del fotovoltaico hanno manifestato, in più di un'occasione, dei connotati di "aggressione" al territorio, considerata la rapidità crescente del loro insediamento ed il disordine "tumorale" che ne ha contraddistinto l'ascesa, senza che alcuna coerente pianificazione ne disciplinasse il fenomeno. Ciò ha rappresentato motivo di crescente risentimento da parte delle popolazioni locali che hanno subito tale offensiva senza che, per giunta, venissero a maturare particolari vantaggi in termini di sviluppo socio-economico territoriale (trattandosi d'investimenti a carattere prevalentemente "passivo" e a scarsa ricaduta interna). Questa condizione di progressiva ostilità verso le FER (sebbene originariamente l'atteggiamento più diffuso fosse esattamente l'opposto) ha finito per coinvolgere ed interessare anche gli impianti a biomasse. Una specifica recriminazione rivolta nei riguardi delle biomasse e dei processi termochimici implicati riguarda il fatto che la combustione genera delle emissioni atmosferiche che possono risultare nocive e pericolose. Particolare rilevanza è stata attribuita alle polveri sottile (PM10 e PM2,5) che sono individuati, unitamente ad altri inquinanti, come potenziale minaccia alla salute dei residenti. Poca giustificazione trova il fatto che numerosi altri insediamenti produttivi potrebbero manifestare questo tipo di problematiche o che dispositivi tecnici particolarmente sofisticati oggi consentono un abbattimento assai efficace di tali inquinanti dai fumi dispersi in atmosfera; rimane fortemente radicato un forte senso di minaccia e di timore, ulteriormente ingigantito dal sospetto che, oltre alle biomasse, possano essere "bruciati" materiali di diversa origine e, più nello specifico, non meglio definiti "rifiuti".

T4. *Scarsa conoscenza diffusa dei vantaggi ambientali offerti dall'impiego energetico delle biomasse*. Similmente alla minaccia descritta al punto precedente, anche questa ha principalmente a che vedere con lo scarso livello di consapevolezza in merito alle questioni in gioco da parte della cittadinanza e della società civile intesa in senso generale. Purtroppo, l'esistenza e la diffusione di alcune forme di sfruttamento energetico delle biomasse meramente speculative e la scarsa rilevanza attribuita in passato a rigorosi criteri di sostenibilità ecologica e compatibilità ambientale ha fatto sì che si diffondesse il sospetto che la gran parte delle iniziative progettuali nel settore delle bioenergie, lungi dal costituire una risposta efficace all'esigenza di mitigazione dei cambiamenti climatici, ne fosse addirittura fattore predisponente. Il gran dibattere a livello sia tecnico-scientifico che mediatico, il paventato conflitto fra produzione di cibo e produzione di energia, il timore di stravolgimenti nell'assetto del paesaggio agrario a seguito di cambiamenti d'uso del suolo, la preoccupazione che alcune coltivazioni tipiche regionali venissero soppiantate da colture energetiche dedicate è stato enormemente ingigantito e l'intero settore ne ha patito le conseguenze. Di contro, occorrerebbe essere molto chiari nel riaffermare i vantaggi che potrebbero discendere dalla realizzazione di iniziative progettuali che abbiano superato procedure rigorose di "screening" ambientale e che manifestino pienamente tutti quei requisiti tecnico-logistici oggi di agevole valutazione e verifica, per esempio adottando le procedure LCA "*Life Cycle Assessment*".

T5. *Divario intersettoriale. Ovvero, paventato squilibrio fra il potere esercitato dalla parte industriale rispetto alla parte agricola*. Allorché una filiera produttiva si strutturi in senso fortemente bipolare, evidenziando la posizione dominante di un acquirente unico e fortemente centralizzato (il polo industriale) a cui è conferita la materia prima da parte di una pluralità di piccoli fornitori (il polo agricolo), si generano condizioni contrattuali fortemente squilibrate. La formazione del prezzo della materia prima così come le condizioni per la sua vendita sarebbero, di fatto, determinate e vincolate dalla parte industriale senza che la pluralità dei contraenti possa esercitare una significativa influenza. Ciò è quanto oggi si osserva nel settore agro-alimentare che evidenzia la forte penalizzazione subita dall'imprenditore agricolo rispetto agli interessi della catena di trasformazione e di commercializzazione del prodotto lavorato. Si assiste, in altri termini, ad un chiaro effetto "*squeezing*" che comprime la remunerazione del produttore agricolo a vantaggio del valore aggiunto maturato sul prodotto da parte di chi opera trasformazione e commercializzazione. Occorre, pertanto, definire strumenti di contrattazione collettiva e modelli di accordo quadro a carattere generale che sappiano trasferire parte dei vantaggi conseguiti dalla porzione terminale delle filiera (quella a ridosso della produzione e vendita dell'energia) anche a monte, ovvero alla componente agricola della filiera.

Tabella 4. Fattori selezionati dell'Analisi SWOT

STRENGHTS	WEAKNESSES
S1. L'agricoltura è settore economico trainante a scala regionale. S2. Ampia disponibilità di biomasse APPR ed elevati livelli di densità territoriale dei residui di potatura. S3. Sviluppo delle filiere olivicolo-olearie e viti-vinicole come "trampolino di lancio" delle filiere agro-energetiche. S4. Presenza di aziende "conto terzi" operanti nel territorio. S5. Possibilità d'implementare un'agricoltura di tipo "multifunzionale". S6. Potenzialità di rafforzare il livello di occupazione.	W1. Scarsa conoscenza delle possibilità offerte dai residui colturali degli impianti arborei. W2. Complessità inerente alla strutturazione di una filiera bioenergetica. W3. La meccanizzazione della raccolta delle potature è operazione costosa. W4. Il valore unitario delle biomasse da potature è considerato assai modesto e, pertanto, economicamente poco profittevole. W5. Una gestione aziendale sostenibile dovrebbe richiedere che i residui colturali tornino al suolo e, pertanto, non venissero asportati. W6. Scarsa fiducia degli industriali nei riguardi degli impegni assunti dall'agricoltore, e viceversa. W7. Incertezze rispetto agli investimenti. Percezione ancora alta del rischio imprenditoriale. W8. Stagionalità dei prelievi e delle disponibilità delle biomasse residuali. W9. I prodotti energetici ottenuti a partire dalle potature potrebbero non essere rispondenti a specifici parametri standard di qualità.
OPPORTUNITIES	**THREATS**
O1. Il sistema "agro-energetico" interpreta adeguatamente il modello "multifunzionale" oggi associato all'agricoltura. O2. Le bioenergie sono una forma di attività imprescindibile nel quadro degli interventi di mitigazione dei cambiamenti climatici. O3. Riordino, in chiave sostenibile, delle operazioni colturali del frutteto. O4. Le prospettive di mercato delle bioenergie sono favorevoli. O5. Crescente miglioramento tecnologico degli impianti e perfezionamento dei sistemi di raccolta delle potature. O6. I meccanismi d'incentivazione e supporto agli investimenti nel settore delle bioenergie sono ancora rilevanti. O7. Opportunità di ridurre i costi connessi all'approvvigionamento dell'energia nelle attività produttive del settore agricolo, agro-alimentare ed industriale. 08. Attivazione di progetti energetici a scala municipale e d'interesse pubblico.	T1. Procedure autorizzatorie ancora poco chiare, diversamente interpretate, variamente applicate. T2. Energica competizione esercitata da biomasse "esogene". T3. Opposizione sociale alle realizzazione di nuovi impianti a biomassa. T4. Scarsa conoscenza diffusa dei vantaggi ambientali offerti dall'impiego energetico delle biomasse. T5. Divario intersettoriale. Ovvero, paventato squilibrio fra il potere esercitato dalla parte industriale rispetto a quello della parte agricola

2. PIANO D'AZIONE

Tabella 5. Tabella riassuntiva del Piano di Azione elaborato considerando le Quattro strategie identificate tramite l'analisi SWOT

SO	STRENGHTS	STRENGHTS	ST
OPPORTUNITIES	**ATTACK STRATEGY** 1. AIMING AT AN EFFICIENT AND INTEGRATED REGIONAL APPR ENERGY SYSTEM 2. SUSTAINABLE APPR ENERGY GENERATION AS A PATH TO RURAL DEVELOPMENT 3. A MARKET ORIENTED APPR ENERGY SECTOR TO INTERCEPT AND SATISFY SOCIETY NEEDS	**DEFENCE STRATEGY** 8. PROVING THE FEASIBILITY OF THE APPR VALUE CHAINS AND ITS VALUE IN MICROGENERATION PROJECTS 9. REACTING TO AN IMPROPER AND DELIBERATELY MISLEADING INFORMATION BY PROMOTING FULL AWARENESS AND SOCIAL ACCEPTANCE	THREATS
OPPORTUNITIES	**REORIENTATION STRATEGY** 4. SUPPORTING AN INNOVATION TREND IN BIOENERGY TECHNOLOGY AND A SHIFT TO MORE EFFICIENT ENERGY USE FROM APPR BIOMASS 5. TRIGGERING SOCIAL AND POLICY INNOVATION IN THE APPR SECTOR 6. CONSOLIDATING THE ECONOMIC AFFORDABILITY OF BIOMASS USE AND THE ECONOMIC RETURN ALONG THE APPR VALUE CHAIN 7. BOOSTING APPR BIOMASS SOURCES AND SETTING UP CONDITIONS TO STRENGTHEN THE APPR SUPPLY CHAIN	**SURVIVING STRATEGY** 10. MITIGATING THE ENVIRONMENTAL BURDENS ALONG THE BIOENERGY VALUE CHAIN, FROM FARMING OPERATIONS TO ENERGY CONVERSIONS 11. WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE 12. RESISTING THE COMPLEXITY OF THE REGULATION SYSTEM ON BIOENERGY AND THE LACKING OF A FARSIGHTED VISION ABOUT THE SECTOR	THREATS
WO	WEAKNESSES	WEAKNESSES	WT

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 regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues. S3. Development of olive-to-oil and grape-to-wine value chains as a "springboard" for agro-energy supply chains.	O1. The "agro-energy" system adequately interprets the "multifunctional" model associated with agriculture today. O2. Bioenergy is a form of activity that is essential in the context of climate change mitigation measures. O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations.

Target ②	SUSTAINABLE APPR ENERGY GENERATION AS A PATH TO RURAL DEVELOPMENT. **Strategy:** Strengths + Opportunities → **SO "Attack"**
S5. Possibility to implement the "multifunctional" model of agriculture.	O1. The "agro-energy" system adequately interprets the "multifunctional" model associated with agriculture today.

Target ③	A MARKET ORIENTED APPR ENERGY SECTOR TO INTERCEPT AND SATISFY SOCIETY NEEDS. **Strategy:** Strengths + Opportunities → **SO "Attack"**
S1. Agriculture is a regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues.	O4. The bioenergy market outlook are favorable. O6. Investment incentives and supporting measures for bioenergy are still significant. O7. Opportunities to reduce the costs associated with energy supply in the agricultural, agro-food and industrial sectors.

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. Poor knowledge about the possibilities offered by fruit tree residues. W2. Complexity in structuring of a bioenergy value chain. W3. Mechanization of pruning management is a costly operation.	O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations. O5. Increasing technological improvement of biomass plants and refinement of pruning harvesting systems.

Target ⑤	TRIGGERING SOCIAL AND POLICY INNOVATION IN THE APPR SECTOR. **Strategy:** Weaknesses + Opportunities → **WO "Reorientation"**
W1. Poor knowledge about the possibilities offered by fruit tree residues. W2. Complexity in structuring of a bioenergy value chain. W6. Poor trust of industrialists in the commitments made by the farmer, and vice versa.	O2. Bioenergy is a form of activity that is essential in the context of climate change mitigation measures. O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations. O8. Activation of energy projects on a municipal scale and in the public interest.

Target ⑥	CONSOLIDATING THE ECONOMIC AFFORDABILITY OF BIOMASS USE AND THE ECONOMIC RETURN ALONG THE VALUE CHAIN. **Strategy:** Weaknesses + Opportunities → **WO "Reorientation"**
W4. The unit value of pruning biomass is considered to be very modest and, therefore, economically unprofitable. W7. Uncertainty about investments. Still high perception of entrepreneurial risk.	O4. The bioenergy market outlook are favorable. O6. Investment incentives and supporting measures for bioenergy are still significant. O7. Opportunities to reduce the costs associated with energy supply in the agricultural, agro-food and industrial sectors.

Target ⑦ BOOSTING APPR BIOMASS SOURCES AND SETTING UP CONDITIONS TO STRENGTHEN THE APPR SUPPLY CHAIN. **Strategy:** Weaknesses + Opportunities → **WO "Reorientation"**	
W2. Complexity in structuring of a bioenergy value chain. W3. Mechanization of pruning management is a costly operation. W4. The unit value of pruning biomass is considered to be very modest and, therefore, economically unprofitable. W8. Seasonality of collection and availability of residual biomass.	O1. The "agro-energy" system adequately interprets the "multifunctional" model associated with agriculture today. O3. Reorganize, according to sustainable criteria, the fruit-tree cultivation operations. O5. Increasing technological improvement of biomass plants and refinement of pruning harvesting systems. O8. Activation of energy projects on a municipal scale and in the public interest.

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 regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues. S3. Development of olive-to-oil and grape-to-wine value chains as a "springboard" for agro-energy supply chains. S4. Presence of mechanical "contracting" companies operating in the territory.	T2. Strong competition from exogenous biomass. T4. Limited knowledge of the environmental benefits of energy from biomass.

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 regional economic driving force. S2. Wide availability of APPR biomass and high territorial density of pruning residues. S6. Potential to strengthen the level of employment.	T3. Social opposition to the setting up of new biomass plants. T4. Limited knowledge of the environmental benefits of energy from biomass.

Target ⑩	MITIGATING THE ENVIRONMENTAL BURDENS ALONG THE BIOENERGY VALUE CHAIN, FROM FARMING OPERATIONS TO ENERGY CONVERSION.	
Strategy:	Weaknesses + Threats → **WT "Surviving"**	
W5. A sustainable management should require crop residues to return to the soil and therefore not be removed.		T4. Limited knowledge of the environmental benefits of energy from biomass.

Target ⑪	WITHSTANDING THE RISK OF A LOCAL APPR MARKET FAILURE.	
Strategy:	Weaknesses + Threats → **WT "Surviving"**	
W1. Poor knowledge about the possibilities offered by fruit tree residues. W6. Poor trust of industrialists in the commitments made by the farmer, and vice versa. W7. Uncertainty about investments. Still high perception of entrepreneurial risk. W9. Energy products obtained from pruning may not meet certain standard quality parameters.		T2. Strong competition from exogenous biomass. T5. Intersectoral divide. Imbalance between the powers of the industry with respect to the agricultural sector.

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"**	
W2. Complexity in structuring of a bioenergy value chain.		T1. Authorization procedures still unclear differently interpreted and applied.

RINGRAZIAMENTI

Di seguito sono indicati i nominativi di alcuni degli "stakeholder" contattati ed intervistate nel corso della elaborazione dell'analisi di settore e del piano d'azione. Siamo loro molto grati per la collaborazione e hanno accettato di essere citati.

Nome	Società o Dipartimento	Ruolo
Luigi Tarricone	Centro di Ricerca CREA	Ricercatore
Ivo Montedoro	AssoBio Capitanata	Società di Servizi in AGricoltura
Luigi Trotta Anna Maria Cilardi	Assessorato Agricoltura, Regione Puglia	Dirigenti della Regione Puglia, Settore agricoltura
Barbara Valenzano, Francesco Corvace	Assessorato Ecologia, Regione Puglia	Pianificazione energetica territoriale
Antonio Baselice	Agritoppi Srls	Agricoltore e

		produttore di pellet
Andrea Iantoschi	CIA – Confederazione Italiana Agricltori	Funzionario
Pietro Spagnoletti	Coldiretti – Associazione della categoria degli agricoltori	Funzionario
Vincenzo Patruno, Miriam Girone, Mario de Angelis	Confcooperative –FedAgri Puglia	Funzionario
Maria Teresa Chiarella	GAL - Terre del Primitivo	Funzionario
Giuseppe Bratta Riccardo Amirante	Distretto "La Nuova Energia"	Presidente e vice-presidente
Al di là delle suddette parti precedentemente elencate, UFG e DARe ringraziano le tante altre persone che hanno contribuito a questo lavoro con idee e suggerimenti. Una menzione speciale va ai partecipanti a tutti i workshop realizzati nella regione pugliese. Fino ad allora non avevamo idea dell'entusiastico coinvolgimento che tutte queste persone sarebbero state in grado di dimostrare.		

ANNEX E1

"Memorandum of Understanding" (to be) approved in the Returning Workshop

Contents of the document

THE FORUM OUTCOME AND FOLLOW OUT

The *Forum,* held in the framework of the European project "*uP_running*", showed the active participation of a wide representative of the productive sectors involved in the energy valorisation of fruit tree residues from pruning and uprooting operations.

This important and successful achievement is the outcome of the supporting activities put in place by the "*uP_running*" initiatives in the region, and the result of the networking capabilities gradually developed, in pace with the project dissemination.

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 joined the *Forum*.

A comprehensive range of stakeholders expressed interest and commitment, together with a strong intention in building up the best operating conditions for the taking-off of new and innovative value chains centred on wood residues from fruit tree plantations as a feedstock.

Economic, social and environmental issues, to be complied under specific regional conditions, are in favour of this *mission*. 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 ("decarbonisation"). By contributing to energy self-consumption and relieving the energy dependency of some agro-food and industrial activities, the risks and costs of energy supply to the productive processes would be also reduced. Through diversifying and expanding the productive activities, a solid and stable business would also be encouraged.

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

To leave no scope to vague intentions or too easy auspices, some starting requisites are needed: a unified vision, the share of common interests, convergence of ideas and proposals, joint capacities to act considering specific goals. For this purpose, a "*Sector Analysis*" was performed and an "*Action Plan*" was consequently developed, with the contribution of all the stakeholders. While the first clearly defines the current conditions, the second launches new perspectives through the deployment of operational measures able to achieve the goals.

Local authorities, public officers, policy makers, and all the institutional persons of regional relevance, together with representatives of associations involved in issues of public interest are called to endorse the present statement.

Having participated in the initiatives implemented by the "*uP_running*" project, culminating in the final WP2 *Forum*, or having received all the related information, the signatories of this document testify their agreement with the reported considerations and declare their commitment to achieve the objectives highlighted therein.

A PARTICIPATORY TOOL

Through establishing a "*Stakeholders' Network*", the *Forum* protagonists intend to boost the public debate on biomass energy sources from crop residues, favour the development of bioenergy supply chains, facilitate the unravelling of crucial issues related to this energy sector, critically considering obstacles, limitations, weaknesses, together with opportunities and strengths. On this respect, non-technical constraints may be as limiting as the technical ones, sometimes even more. Being associated with cultural influences, conventional mind-sets, mortifying bureaucratic procedures, inextricable legal routines, etc. the rapid elimination or at least the modification of all these types of non-technical constraints is not at all an easy task.

The "*Stakeholders' Network*" promotes a participatory approach aiming at developing a common vision among participants, proposing analysis and synthesis useful for technical provisions, encouraging the launch of new productive activities coherent to its vision, addressing the needs to conveniently design new projects, intercepting public contributions and funding, trying to achieve full public acceptance and support.

The elective playfield of the "*Stakeholders' Network*" is at regional level mostly, but it could also takes on the task of interacting at different scale, from local to national and European level, moreover operating among different authorities and association representatives. It should be considered a common "place" (or a "platform") to exchange free services (not performed by any formal recognized body and in no way eager of substituting roles, rights, duties and responsibilities of the institutional entities in charge, as well as administrative bodies or representative structures).

Some basic principles have been formulated hereafter to set consensus on a unified vision. A precise agenda, both in the objectives, intervention measures and time of implementation, identifying concrete goals to be achieved over the project period and immediately after, is arranged according to the *Action Plan*.

LOCAL RESIDUAL BIOMASS NEED TO BE VALORISED

The use and valorisation of residual biomass is part of a new ecological "vision" to be built, for the full achievement of a conversion to a "bio-based" society. Our world is currently experiencing a climate change because of GHGs emissions into the atmosphere of from fossil energy combustion. For this reason, we must adopt stringent and effective solutions. Bioenergy supply chains, when properly designed at regional scale and implemented according to small or micro-generation models (low capacity energy facilities), may demonstrate the full respect of environmental standards and positive ecological performance. If these conditions are fully accomplished, the public community may recognize their utility and social value.
Every local resource needs to be properly valorised, that is why the conventional open field burning of crop residues should be categorically avoided. Notwithstanding the frequently applied regional derogations and exemptions to national and European regulations, burning crop residues in the open field should be considered a harmful and wasteful operation. It reduces farmer's work only apparently; conversely, it decreases soil quality and its productivity in the long run, pollutes the air by uncontrollably emitting smoke, particulate matters and GHGs, moreover, it prevents the use of biomass as a valuable feedstock for further applications (the conversion into energy first of all).

AGRICULTURE IS THE STARTING POINT

A closer and virtuous connection between farming and industrial activity should be properly considered and favoured. Not only food processing is the link; a strong agro-industrial integration could positively been achieved also considering the energy sector and the large potential energy utilization of agricultural biomass. This connection strictly links biomass availability to the land and the rural territory, according to its specific resources and vocations. This productive model calls for a more balanced relationship between agriculture and industry, today mostly shifted to the benefit of the latter than the former.

SUPPLY CHAINS INTEGRATION

Bioenergy supply chains (particularly considering those based on fruit tree residues) are developed harmonically within the territorial framework and can offer new and unusual opportunities to the energy sector. Their performance is complementary with respect to the existing productive processes (both farming and extra-farming activities) and may represent an interesting further opportunity to set up new productive business and incorporate additional income. In this way, "non-food" agriculture (the “shaded side” of food-agriculture) promotes a further integration with the industrial sector. This tight integration allows achieving very high transformative efficiencies.

AN OPEN AND MULTIFUNCTIONAL APPROACH

The local dimension of the bioenergy value chains and the residual nature of feedstock ensure that the development of the new productive sector does not exceed its environmental boundaries. At the same time, its growth and success does not cause any drawbacks to other agricultural sectors (i.e. those related to food or feed production), for example by subtracting arable land, water resources or investments.
These local bioenergy projects are not invasive, but still in harmony with existing agricultural and industrial activities; they respect the territorial constraints but are also responsive to the new opportunities offered: recovering energy from residues, sustain farming, diversifying the production systems, increase employment and create new chances for business. In one word: triggering processes of rural development according to a multifunctional model of agriculture. Bioenergy should be recognized as an important part of this multifaceted agro-industrial sector; conversely, it cannot become an absolute, one-dimensional and all-encompassing business objective, losing its links with the land and the people living there.

A NEW SOCIAL STANDARD OF ENERGY QUALITY

Although the increasing availability of renewable energy, alternatives to fossil fuels, is considered very useful, nay extremely necessary, this cannot be performed arbitrarily. Therefore, the value of bioenergy cannot be expressed, simplistically, with the amount of produced renewable energy or with the net and effective amount of fossil fuel displaced. A more comprehensive set of indicators need to be considered, also taking into account the actual improvement in the quality of life, made of the three-dimensional combination of environment, economy and society. In other terms, more relevant should be the way renewable energy from agricultural residues is obtained, than the total amount of this new form of energy that becomes available. This observation calls for a new, integrated concept of energy quality, not only affected by its renewable origin, but also mindful of the structural organization of its value chain, the social equity it can generate, the local level of autonomy that is promoting, the cascading economic benefit that is spreading, and so on.

Self-Sustainable Local Development

This productive strategy, embedded at the territorial scale, calls for the vision of a self-sustainable local development, based on the concept of "carrying capacity", i.e. the balanced supply of biomass with respect to the actual land availability and ecological potential resources. This is the first, essential condition for developing well-structured bioenergy supply chains, in compliance with sustainability criteria, the regeneration of natural resources and the reduction of environmental burdens. Some other relevant goals to accomplish local development should involve social and economic features, such as the fair distribution and efficient use of public and natural resources; an equal access to quality public services; employment generation and equal job opportunities; honest and responsive government. These goals can only be achieved when local government, community, and private sector make joint efforts. Relations among them should be governed by the principles of long-term vision, transparent decision-making, inclusion and empowerment.

"Get Inspired and Take Action"

The "*Stakeholders' Network*", relying on a choral collaboration of people, might exert a useful function on many different issues; by way of example, some of them have been listed below:

- Spreading knowledge and awareness about the structure of bioenergy supply chains, their technologies and territorial organization, as well as their resulting socio-economic impact.
- Promoting a progressive convergence on criteria of environmental assessment and technical optimization of bioenergy, taking into serious consideration the criticisms raised by a part of the public opinion and working according to a transparent and inclusive approach, which aims to encourage dialogue and participation.
- Dealing with criteria of regional energy planning, to define energy basins having a specific bioenergy vocation (based on the nature, density, suitability for conversion of locally supplied biomass) and, correspondingly, to identify bioenergy districts with proper infrastructures assisting energy production.
- Helping to overcome "non-technical" constraints that hinder investments in the sector. Very often, these constraints can be related to cumbersome administrative procedures for issuing authorizations to construct and operate the energy plants. Frequently, it happens in small towns and considering the application made by small companies, cooperatives or associations, interested in the construction of small size energy facilities.
- Favouring technological innovation, identifying new and more reliable processes of energy conversion and biomass valorisation for the benefit of the industry.

- Jointly assess the positions that the *network* should take with regard to regulations and norms, standards and best practices, showing ability to dialogue with all stakeholders internally, but especially with the institutions upon which the government of the sector depends.

Relevant Issues of the Action Plan

To be defined specifically for each Demo Region. By way of example:

- Accelerate and streamline the process for adopting new and innovative biomass value chains centred on wood residues from fruit tree plantations as a feedstock.
- Develop methods for integrating program applications for setting up bioenergy value chains across the considered region.
- Connect the common capabilities within the "network" to implement several financial tools at regional or national scale in order to better direct prospective applicants to the correct program authorities.
- Improve financial feasibility studies.
- Coordinate periodical multi-stakeholder meetings that will bring together the entire value chain to identify and create opportunities to reduce environmental impacts while creating business and social value.
- xxxx
- xxxx

General Terms

This MoU is not a financial or funding document. It does not impose any financial commitments on either Party. Each Party will direct, manage and finance its own participation under the terms of this MoU.

Nothing in this MoU shall obligate the signatory Parties to transfer any funds. Specific work or projects that involve the transfer of funds, services, or property among the Parties will require execution of separate agreements and be contingent upon the availability of appropriated funds. Appropriate statutory authority must independently authorize such activities.

This MoU is effective starting on the date affixed to the signature of the Parties.

Signature of the Adhering Parties

Institution (Private/Public, Governative/ non Governative, …)	**Signed by …** (name of the institutional representative)	**Date**
…	…	…

ANNEX E2

DECLARATION OF PRINCIPLES FOR AN ENHANCED PROMOTION OF APPR BIOMASS

FRAMEWORK OF THE PRESENT DECLARATION

The present declaration has been prepared by uP_running partners based on a wide consult to stakeholders of the region of Aragón. CIRCE and ASAJA Aragón have celebrated a total of 4 workshops in Fraga, Valjunquera and Barbastro, as well as multiple bilateral conversations with potential entrepreneurs, producers of the APPR residue (farmers, cooperatives), agro-service companies, ESCOs, councils, associations or bodies promoting rural development, public servants of the agro and energy sectors, and policy makers.

The stakeholders consulted have expressed their vision on the current status of the use of APPR biomass for energy, and have revealed the current existing barriers and the actions needed to drive a change in the current situation: practically no use of APPR biomass for energy.

The declaration is supported by a deep sectorial analysis and action plan developed by CIRCE and ASAJA, which configures a 30 pages document. The present declaration bases on it, and does include a brief annex explaining the text.

DECLARATION OF PRINCIPLES FOR AN ENHANCED PROMOTION OF APPR BIOMASS

General terms

The present Memorandum is a declaration of interest and support to the statements below. The signature does not involve any legal or financial commitment for the signatory. The list will be utilised by uP_running as one of the results of the Workshop, to visualise the support and interest that multiple interested parties have, to promote the use of APPR (Agricultural Pruning and Plantation Removal) woody biomass.

Declaration

Herewith the signatory express its adherence to the vision expressed below, on the relevance that the use of the woody residues from vineyards, olive and fruit plantations (from now on APPR biomass), when properly done, becomes sustainable, and may demonstrate a full respect of environmental standards and positive ecological, social and economic performance. If these conditions are fully accomplished, the public community may recognize their utility and social value. So, the value for the society derived from APPR biomass use is not a single issue of fossil fuel displaced, or renewable energy growth, but also of improvement in the quality of life.

For this reason the signatory considers that it is precise building up the best operating conditions for the taking-off of new and innovative value chains centred on wood residues from vineyards, olive and fruit plantations as a feedstock.

The vision is in line with next 12 statements:

1. The use of APPR biomass can allow significant savings in fossil energy, and so contribute to the objectives of reduction in atmospheric emissions (“decarbonisation”).
2. The alternative use of PAPR residues as biomass can contribute to improve its current

management; furthermore its residual nature avoids any drawbacks to other agricultural sectors for example by subtracting arable land, water resources or investments.

3. The use of APPR biomass, as endogenous resource can contribute to relieving the energy dependency of some farm, agro-food and rural industrial activities in respect fossil fuels
4. Through diversifying biomass resources, the pressure on forestry resources is lowered, and a new path can be open to use other agro-biomass resources, currently underutilised.
5. A sustainable use of APPR biomass resources may foster the regional economic development, especially in rural areas.
6. Promoting new APPR biomass uses can contribute to the diversification of the activities for farmers, but specially can contribute to cause savings in the expenses needed to manage their plantations
7. burning crop residues in the open field should be considered a harmful and wasteful operation, which pollutes the air by uncontrollably emitting smoke, particulate matters and GHGs
8. APPR biomass is not an issue only of the agricultural sector producing olive, grape and fruit, and so a closer and virtuous connection between farming and industrial activity is necessary to favour APPR use.
9. The cooperation between agricultural, industry and environmental departments in public bodies, councils and the government can be a key for unifying the vision and promoting the necessary conditions to unblock the current limited use of APPR biomass
10. The future development of policy and support instruments for promoting the APPR biomass would ideally require the vision of the multiple stakeholders involved: agricultural sector, energy sector and public sector. Joints efforts and cooperation of government, community and private sector is to be promoted.
11. In this line, the promotion of new pioneering initiatives for establishing the use of APPR biomass may unblock the current situation, by creating referential experiences to be replicated. Rural development, energy efficiency and renewable energies, industrial innovation and agricultural policy instruments considering APPR biomass as activities of singular impact may foster its development in our territory.
12. The sector analysis and action plan developed by uP_running includes a wide view of the current barriers and multiple actions that can promote the use of APPR biomass, which could be utilised for setting the path for an expanded use of APPR biomass residues.
    - Here each partner could choose if including some of the most relevant summary of driving forces or action plan in form of bullets, or leaving it simple, with the text expressed in bullet 12 alone

SIGNATURE OF THE ADHERING PARTIES

Institution (Private/Public, Governative/ non Governative, …)	**Signed by …** (name of the institutional representative)	**Date**

ANNEX E3

Proposal not of law
and
“Declaration of principles” for an enhanced promotion of APPR biomass
Spain

CORTES DE ARAGÓN Parlamento

C's Ciudadanos Aragón

CORTES DE ARAGON
IX LEGISLATURA
15 FEB. 2017
HORA 11:38
ENTRADA N.º 1265

A LA MESA DE LAS CORTES DE ARAGÓN:

D. Jesús Sansó Olmos, Portavoz Adjunto del Grupo Parlamentario Ciudadanos – Partido de la Ciudadanía (C's), de conformidad con lo establecido en el artículo 200 y siguientes del Reglamento de las Cortes de Aragón, presenta la siguiente Proposición no de Ley relativa a la promoción de la biomasa procedente de podas agrícolas y de la renovación de plantaciones para su debate y votación en la Comisión de Desarrollo Rural y Sostenibilidad.

EXPOSICIÓN DE MOTIVOS

En la actualidad, los residuos leñosos procedentes de las podas agrícolas y renovación de plantaciones (de ahora en adelante, PARP) son triturados *in situ* o, en la inmensa mayoría de las ocasiones, quemados. En la práctica, su utilización con fines energéticos es inexistente en Aragón.

Sin embargo, el aprovechamiento de estos residuos de forma sostenible y respetuosa con el medio ambiente es posible y puede conllevar impactos económicos y sociales muy positivos, beneficiando a la comunidad en su conjunto y, muy especialmente, a las zonas rurales.

No se trata, tan solo, de conseguir una reducción del consumo de combustibles fósiles o de aumentar la cuota de uso de las energías renovables sino que esta cuestión debe ser contemplada también como una solución a la gestión de dichos residuos.

Por todo lo expuesto, este Grupo Parlamentario presenta la siguiente

Grupo Parlamentario Ciudadanos - Partido de la Ciudadanía

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CORTES DE ARAGÓN
Parlamento

C's Ciudadanos Aragón

PROPOSICIÓN NO DE LEY

Las Cortes de Aragón instan al Gobierno de Aragón a la elaboración de planes de fomento de uso de los residuos leñosos procedentes de las podas agrícolas y de la renovación de plantaciones en el entorno rural así como a la elaboración de un Manual de Buenas Prácticas para la gestión de dichos residuos agrícolas.

Zaragoza, 15 de febrero de 2017

El Portavoz Adjunto
D. Jesús Sansó Olmos

Palacio de la Aljafería
50004 Zaragoza
Teléfono (+34) 976 289 500
ciudadanos@cortesaragon.es

Carta de apoyo para el Proyecto de uP_running

Para quien pueda interesarle, en Zaragoza, a 27 de febrero de 2017.

Como representante de la Alianza Agroalimentaria Aragonesa, escribo en apoyo a la propuesta del proyecto de **uP_running** que se presenta al Horizon 2020.

La **Alianza Agroalimentaria Aragonesa** es una iniciativa de cooperación que tiene por objeto el desarrollo de una estrategia conjunta de comunicación destinada a la opinión pública con el propósito de trasladarle la importancia de la agroalimentación y del medio rural.

Las entidades que conforman la Alianza son las siguientes:

Asociación Agraria de Jóvenes Agricultores (ASAJA).
Asociación de Industrias de la Alimentación de Aragón (AIAA).
Colegio Oficial de Ingenerieros Agrónomos de Aragón, Navarra y País Vasco.
Colegio Oficial de Ingenieros Técnicos y Peritos Agrícolas de Aragón.
Colegio Oficial de Veterinarios (Huesca, Teruel y Zaragoza)
Cooperativas Agro-alimentarias de Aragón.
Unión de Agricultores y Ganaderos de Aragón (UAGA).
Unión de Pequeños Agricultores y Ganaderos de Aragón (UPA).

En mi papel como representante de la Alianza, quiero expresar nuestro interés en el proyecto de uP_running, como adhesión a la visión que se expone a continuación sobre la relevancia que el aprovechamiento de los residuos leñosos de los viñedos, olivares y frutales (de ahora en adelante biomasa APPR), realizada de manera sostenible, pueda tener para demostrar que puede ser utilizada respetando el medioambiente y conllevando impactos económicos y sociales. Bajo esta premisa, la comunidad en su conjunto y especialmente en zonas rurales, puede beneficiarse y con ello es preciso ensalzar que el uso de la biomasa PARP, no es tan sólo una cuestión de conseguir reducir el consumo de combustibles fósiles o de aumentar la cuota de uso de las energías renovables, sino que puede resolver un problema de gestión de residuos y promover la mejora en la calidad de vida de la sociedad.

Tte. Coronel Valenzuela, 5, 4ª
50004 Zaragoza
Telef. 976.23.03.88 – 976.23.03.89 Fax: 976.21.60.75
agronomos@coiaanpv.org

Por esta razón, el firmante considera que es preciso crear unas condiciones adecuadas para favorecer un cambio en la gestión de los residuos de PARP y con ello una mayor expansión de nuevas cadenas de valor, centradas en los residuos de madera de los viñedos, olivares y frutales.

Atentamente,

Firma
Nombre: Ángel Jiménez Jiménez
En representación de la Alianza Agroalimentaria Aragonesa

Tte. Coronel Valenzuela, 5, 4ª
50004 Zaragoza
Telef. 976.23.03.88 – 976.23.03.89 Fax: 976.21.60.75
agronomos@coiaanpv.org

ANNEX E4

Memorandum of Undestanding

Ukraine

Український клуб аграрного бізнесу

АУСП | USPA
АСОЦІАЦІЯ «УКРСАДПРОМ» | UKRSADPROM ASSOCIATION

МЕМОРАНДУМ ПРО СПІВРОБІТНИЦТВО

м. Вінниця «31» січня 2017 року

Асоціація «Український клуб аграрного бізнесу», іменована надалі «УКАБ», в особі Генерального директора Тараса Висоцького, що діє на підставі Статуту, з одного боку, та

Асоціація «Укрсадпром», іменована надалі «Асоціація», в особі Голови Асоціації Дмитра Крошки, що діє на підставі Статуту, з іншого боку,

(в подальшому разом іменуються - «Сторони», а кожна окремо – «Сторона»), враховуючи сучасні пріоритети розвитку аграрної політики держави, з метою створення стимулів для збільшення виробництва, переробки, експорту, імпорту та обігу сільськогосподарських культур, зокрема, плодово-ягідної продукції, садивного та насіннєвого матеріалу, забезпечення стабільності ситуації на внутрішньому аграрному ринку, дбаючи про створення умов для стабільного прогнозованого розвитку аграрного сектору, усвідомлюючи необхідність забезпечення продовольчої безпеки держави, уклали цей Меморандум про співробітництво (надалі іменується – «Меморандум») про наступне:

1. МЕТА ТА НАПРЯМИ СПІВРОБІТНИЦТВА

1.1. Сторони розвиватимуть співпрацю у сфері надання суб'єктам господарювання в аграрній сфері вичерпної і оперативної інформації, що необхідна для реалізації державної політики в агропромисловому комплексі відповідно до чинного законодавства України.

1.2. До основних напрямків співробітництва Сторони відносять наступну діяльність:

1.2.1. Спільна участь в розробці проектів нормативно-правових актів, спрямованих на регулювання відносин в агропромисловій сфері, а також внесенні змін і доповнень до нормативно-правових актів;

1.2.2. Залучення представників УКАБ та Асоціації до підготовки рішень та здійснення відповідних заходів, які впливатимуть на розвиток аграрного ринку;

1.2.3. Інформування стосовно поточної ситуації на аграрному ринку, впливу органів виконавчої влади на формування та розвиток ринкових відносин;

1.2.4. Сприяння підвищенню інвестиційної привабливості учасників аграрного ринку;

1.2.5. Врегулювання проблемних питань щодо діяльності агроформувань, здійснення імпорту та експорту сільськогосподарської продукції та ресурсів аграрного виробництва;

1.2.6. Координація співпраці із органами державної влади.

2. ФОРМИ СПІВРОБІТНИЦТВА

2.1. З метою встановлення і вдосконалення форм співробітництва Сторони:

2.1.1. Узгоджують та координують співпрацю із органами державної влади та управління;

2.1.2. Створюють спільні робочі групи, зокрема юридичну експертно-аналітичну групу, робочу групу із цінового моніторингу та інші;

2.1.3. Інформують одна одну про проведення заходів аграрної тематики;

2.1.4. Організовують і проводять круглі столи, семінари, симпозіуми, конференції, зустрічі ділових кіл, а також інші аналогічні заходи.

2.2. Співпраця не обмежується заходами, зазначеними в Статті 2 , та може бути розширена за взаємною домовленістю сторін.

2.3. Сторони будуть прагнути створенню сприятливих умов і наданню один одному допомоги в підвищенні професійного рівня шляхом вивчення міжнародного досвіду функціонування аграрного ринку та сприянню адаптації українського законодавства до європейських норм, що стосуються аграрної сфери.

2.4. Сторони сприятимуть проведенню заходів, направлених на повне і всебічне виконання положень даного Меморандуму в формах, які Сторони вважатимуть прийнятними.

3. ОБОВ'ЯЗКИ СТОРІН

3.1. Сторони зобов'язуються прикладати всіх зусиль для розвитку напрямів та форм співробітництва, перерахованих у пп. 1.2.1 – 1.2.6, 2.1 – 2.4.

4. ПЛАТА І ПОРЯДОК РОЗРАХУНКІВ

4.1. Цей Меморандум не передбачає фінансових зобов'язань між Сторонами. У випадку необхідності фінансування спільних проектів, між Сторонами укладаються відповідні договори, угоди тощо.

5. ВІДПОВІДАЛЬНІСТЬ СТОРІН ЗА ПОРУШЕННЯ ДОГОВОРУ

5.1. У випадку порушення однією зі Сторін зобов'язань, що виникають з цього Меморандуму (надалі іменується «порушення Меморандуму»), інша Сторона вправі ініціювати розірвання цього Меморандуму.

5.1.1. Порушенням Меморандуму є його невиконання або неналежне виконання, тобто виконання з порушенням умов, визначених змістом цього Меморандуму.

5.1.2. Сторони не несуть відповідальності за порушення Меморандуму, якщо воно сталося не з їх вини (умислу чи необережності).

5.1.3. Сторони не несуть відповідальності за порушення Меморандуму, якщо вони доведуть, що вжили всіх залежних від них заходів щодо належного виконання цього Меморандуму.

6. ВИРІШЕННЯ СПОРІВ

6.1. Усі спори, що виникають з цього Меморандуму або пов'язані із ним, вирішуються шляхом переговорів між Сторонами.

6.2. Якщо відповідний спір неможливо вирішити шляхом переговорів, він вирішується в судовому порядку за встановленою підвідомчістю та підсудністю такого спору відповідно до чинного законодавства України.

7. ДІЯ МЕМОРАНДУМУ

7.1. Цей Меморандум вважається укладеним і набирає чинності з моменту його підписання Сторонами та його скріплення печатками Сторін і діє до моменту письмового повідомлення однією із Сторін про бажання розірвати даний Меморандум.

7.2. Якщо інше прямо не передбачено цим Меморандумом або чинним в Україні законодавством, зміни у цей Меморандум можуть бути внесені тільки за домовленістю Сторін, яка оформлюється додатковою угодою до цього Меморандуму.

7.3. Зміни у цьому Меморандумі набирають чинності з моменту належного оформлення Сторонами відповідної додаткової угоди до цього Меморандуму, якщо інше не встановлено у самій додатковій угоді, цьому Меморандумі або в чинному законодавстві України.

7.4. Цей Меморандум вважається розірваним з моменту належного оформлення Сторонами відповідної додаткової угоди до цього Меморандуму, якщо інше не встановлено у самій додатковій угоді, цьому Меморандумі або в чинному законодавстві України.

8. ПРИКІНЦЕВІ ПОЛОЖЕННЯ

8.1. Даний Меморандум складений українською мовою в 2 (двох) оригінальних примірниках, які мають однакову юридичну силу - по одному для кожної із Сторін.

8.2. Будь-які зміни та доповнення до даного Меморандуму мають силу тільки в тому випадку, коли вони оформлені письмово, підписані уповноваженими представниками Сторін та скріплені їх печатками.

8.3. Передача Сторонами окремих прав та обов'язків за цим Меморандумом можлива лише за попередньою письмовою згодою Сторін.

8.4. Сторони зобов’язуються у випадку зміни місцезнаходження, а також інших реквізитів, повідомити іншу Сторону про такі зміни протягом 10 (десяти) календарних днів з дня настання таких змін.

8.5. Сторони визнають офіційним листуванням між собою будь-яке листування у електронній формі, здійснене із використанням адрес електронної пошти, визначених у реквізитах Сторін цього Меморандуму.

МІСЦЕЗНАХОДЖЕННЯ І РЕКВІЗИТИ СТОРІН:

УКАБ	Асоціація
«Асоціація «Український клуб аграрного бізнесу» 01032, м. Київ, вул. Жилянська, буд. 146 Тел.: +380 44 236 20 97 Факс: +380 44 236 20 79 info@ucab.ua www.ucab.ua	**Асоціація «Укрсадпром»** 04050, м. Київ, вул. Січових стрільців, 77, оф. 701 т. +38(044)232-22-68 info@ukrsadprom.org www.ukrsadprom.org
Підпис ______________ Генеральний директор Висоцький Т. м. п.	Підпис ______________ Голова Асоціації Крошка Д. м. п.

АСОЦІАЦІЯ «УКРАЇНСЬКИЙ КЛУБ АГРАРНОГО БІЗНЕСУ» код 37995932 Україна м.Київ

АСОЦІАЦІЯ «УКРСАДПРОМ» м. Київ ідентифікаційний код 40375245 АУСП I USPA

ANNEX E5

"Declaration of principles"

for an enhanced promotion of APPR biomass

Greece

uP_running

Διακηρυξη Αρχων για την Προωθηση της Χρησης Βιομαζας Απο Μονιμες Καλλιεργειες (Αγροτικα Κλαδεματα και Εκριζωσεις)

Πλαισιο Της Παρουσας Διακηρυξης

Η παρούσα διακήρυξη έχει προετοιμαστεί από τους εταίρους του Ευρωπαϊκού έργου uP_running στην Ελλάδα, το Εθνικό Κέντρο Έρευνας και Τεχνολογικής Ανάπτυξης (ΕΚΕΤΑ), την ΠΑΣΕΓΕΣ και το ΙΝΑΣΟ-ΠΑΣΕΓΕΣ μετά από διαβούλευση με φορείς της Περιφέρειας Πελοποννήσου. Στο πλαίσιο του έργου το ΕΚΕΤΑ, η ΠΑΣΕΓΕΣ και το ΙΝΑΣΟ-ΠΑΣΕΓΕΣ, έχουν διοργανώσει δυο ημερίδες στη Νεμέα (30/5/2016) και στην Παλαιοπαναγιά Λακωνίας (25/7/2016) καθώς και πολλές διμερείς συναντήσεις και συζητήσεις με εκπροσώπους του πρωτογενούς τομέα (αγρότες, συνεταιρισμούς), εταιρείες που δραστηριοποιούνται στον αγροτικό, αγροτοβιομηχανικό και βιομηχανικό τομέα, εκπροσώπους της δημόσιας διοίκησης και άλλους φορείς.

Οι παραπάνω φορείς εξέφρασαν την άποψή τους σχετικά με την τρέχουσα διαχείριση των αγροτικών κλαδεμάτων και εκριζώσεων, τα εμπόδια που σχετίζονται με την ενεργειακή τους αξιοποίηση και τις δράσεις που απαιτούνται για την αλλαγή της τρέχουσας κατάστασης, στην οποία πρακτικά δεν υπάρχει καμία ενεργειακή αξιοποίηση αυτών των ειδών βιομάζας.

Η διακήρυξη αυτή υποστηρίζεται από μια αναλυτική μελέτη που εκπονήθηκε από το ΕΚΕΤΑ, την ΠΑΣΕΓΕΣ και το ΙΝΑΣΟ-ΠΑΣΕΓΕΣ, η οποία και επισυνάπτεται σε αυτή τη διακήρυξη.

Διακηρυξη Αρχων για την Προωθηση της Χρησης Βιομαζας απο Μονιμες Καλλιεργειες (Αγροτικα Κλαδεματα και Εκριζωσεις)

Γενικές αρχές

Το παρόν έγγραφο αποτελεί μια Διακήρυξη ενδιαφέροντος και υποστήριξης για την Προώθηση της Χρήσης Βιομάζας από Μόνιμες Καλλιέργειες (Αγροτικά Κλαδέματα και Εκριζώσεις). Η υπογραφή της Διακήρυξης δε συνεπάγεται οποιοδήποτε νομική ή οικονομική δέσμευση για τους υπογράφοντες. Η λίστα των υπογραφόντων θα χρησιμοποιηθεί στα πλαίσια του έργου uP_running προκειμένου να καταδειχθεί η ευρεία υποστήριξη και το ενδιαφέρον από τους υπογράφοντες φορείς για την ενεργειακή αξιοποίηση της βιομάζας από μόνιμες καλλιέργειες.

Διακήρυξη

Με το παρόν, οι υπογράφοντες εκφράζουν την υποστήριξή τους στο στρατηγικό όραμα που αφορά στην ενεργειακή αξιοποίηση των ξυλωδών υπολειμμάτων από ελαιώνες, αμπελώνες και οπωρώνες και το οποίο αναφέρεται αναλυτικά στις κάτωθι παραγράφους. Η αξιοποίηση αυτή, εφόσον πραγματοποιείται με ορθές πρακτικές, είναι αειφόρα, εναρμονίζεται πλήρως με τις περιβαλλοντικές απαιτήσεις και έχει θετικό οικολογικό, κοινωνικό και οικονομικό πρόσημο. Με την εκπλήρωση των παραπάνω συνθηκών, το ευρύτερο κοινό μπορεί να αναγνωρίσει τη χρησιμότητα και την κοινωνική τους αξία. Κατά τον τρόπο αυτό, η αξία που παράγει η ενεργειακή χρήση της βιομάζας από τις μόνιμες καλλιέργειες δεν αφορά μόνο την υποκατάσταση ορυκτών καυσίμων ή την παραγωγή ανανεώσιμης ενέργειας, αλλά στη βελτίωση της ποιότητας ζωής συνολικά.

Για το λόγο αυτό, οι υπογράφοντες θεωρούν ότι η παρούσα Διακήρυξη αποτελεί ένα πρώτο βήμα στην προσπάθεια δημιουργίας νέων και καινοτόμων εφοδιαστικών αλυσίδων που βασίζονται στα ξυλώδη υπολείμματα από τα αγροτικά κλαδέματα και τις εκριζώσεις.

Το Στρατηγικό Όραμα συνοψίζεται στα ακόλουθα 12 σημεία:

1. Η χρήση βιομάζας από μόνιμες καλλιέργειες μπορεί να πετύχει σημαντική εξοικονόμηση ορυκτών καυσίμων και επομένως να συνεισφέρει στη μείωση των εκπομπών αερίων του θερμοκηπίου που εκλύονται στην ατμόσφαιρα.
2. Η εναλλακτική χρήση των αγροτικών κλαδεμάτων και υπολειμμάτων ως καύσιμη βιομάζα συνιστά βελτίωση έναντι της τρέχουσας διαχείρισης. Επιπλέον, το γεγονός ότι αφορά αξιοποίηση υπολειμμάτων δεν επιφέρει περιβαλλοντική επιβάρυνση εξαιτίας πρόσθετης χρήσης υδάτινων πόρων, απαιτήσεων χρήσης γης ή άλλων επενδύσεων.
3. Η βιομάζα από τις μόνιμες καλλιέργειες είναι ένας εγχώριος ενεργειακός πόρος, η χρήση του οποίου μπορεί να μειώσει την ενεργειακή εξάρτηση των αγροτικών, αγρο-βιομηχανικών και βιομηχανικών δραστηριοτήτων από τα ορυκτά καύσιμα.
4. Μέσω της αξιοποίησης αυτών των ειδών βιομάζας, μπορεί να επιτευχθεί μείωση της ανάγκης για εκμετάλλευση των δασών και να περιοριστούν φαινόμενα όπως οι παράνομες υλοτομίες.
5. Η αειφόρος χρήση της βιομάζας από τις μόνιμες καλλιέργειες μπορεί να προωθήσει την οικονομική ανάπτυξη της Ελληνικής περιφέρειας, ιδίως στις αγροτικές περιοχές.
6. Η προώθηση της ενεργειακής χρήσης των κλαδεμάτων και των εκριζώσεων μπορεί να συνεισφέρει στη διαφοροποίηση των εργασιών των αγροτών αλλά κυρίως και στη μείωση του κόστους διαχείρισης των καλλιεργειών τους.
7. Η ανεξέλεγκτη καύση αγροτικών υπολειμμάτων στο χωράφι είναι μια επιβλαβής πρακτική, η οποία ρυπαίνει τον αέρα μέσω της εκπομπής σωματιδίων, καπνού και άλλων αέριων ρύπων.
8. Η βιομάζα από τα αγροτικά κλαδέματα και τις εκριζώσεις μπορεί να αποτελέσει αφορμή για την καλύτερη και αρμονικότερη σύνδεση του πρωτογενούς τομέα και των βιομηχανικών δραστηριοτήτων στην Περιφέρεια.
9. Η συνεργασία μεταξύ των φορέων του Δημοσίου (Περιφέρεια, Δήμοι, κεντρική κυβέρνηση κτλ.) είναι απαραίτητη για να αλλάξει η παρούσα κατάσταση και να προωθηθεί η ενεργειακή αξιοποίηση αυτών των ειδών βιομάζας.
10. Η προώθηση της χρήσης βιομάζας από μόνιμες καλλιέργειες προϋποθέτει την ανάπτυξη κατάλληλων υποστηρικτών εργαλείων και μηχανισμών, τα οποία θα διαμορφώνονται λαμβάνοντας υπόψη τις προτεραιότητες φορέων από τον αγροτικό, τον ενεργειακό / βιομηχανικό και το δημόσιο τομέα. Προς το σκοπό αυτό, απαιτούνται κοινές προσπάθειες και συνεργασία των τοπικών φορέων, του αγροτικού / συνεταιριστικού χώρου, αλλά, και του ιδιωτικού τομέα με τη συνδρομή και την υποστήριξη ερευνητικών φορέων.
11. Τα υποστηρικτά εργαλεία και οι μηχανισμοί προώθησης της ενεργειακής αξιοποίησης βιομάζας από μόνιμες καλλιέργειες θα πρέπει να μπορούν να άρουν τους παράγοντες που εμποδίζουν την ανάπτυξη νέων πρωτοβουλιών μέσω της δημιουργίας τοπικών παραδειγμάτων αναφοράς και της προώθησης των καλών πρακτικών. Τα αναπτυξιακά εργαλεία υποστήριξης του αγροτικού τομέα, της εξοικονόμησης ενέργειας και των ανανεώσιμων πηγών ενέργειας και της βιομηχανικής καινοτομίας θα πρέπει να λαμβάνουν υπόψη τους τις δυνατότητες αυτών των ειδών βιομάζας στη συνολική

κατεύθυνση της προώθησης της Περιφερειακής ανάπτυξης.

12. Η μελέτη και το σχέδιο δράσης που εκπονήθηκε από τους εταίρους του έργου uP_running, εξετάζει αναλυτικά τα τρέχοντα εμπόδια στην ενεργειακή αξιοποίηση της βιομάζας από αγροτικά κλαδέματα και εκριζώσεις και προτείνει μια σειρά από μέτρα που μπορούν να εφαρμοστούν για την προώθηση της χρήσης της.

ΛΙΣΤΑ ΥΠΟΓΡΑΦΟΝΤΩΝ

Φορέας, Οργανισμός, Εταιρία	Υπογράφων	Ημερομηνία
Πρόεδρος Περιφερειακού Συμβουλίου Περιφ. Πελοποννήσου	Στρατηγάκος	
Περιφερειακή Ενότητα Λακωνίας		7-7-2017
Πρ. ΑΣ Βορδονίας		
Πρ. ΕΑΣ Λακωνίας		07/7/2017
Α.Σ Ανωγείων		
ΕΑΣ Λακωνία Παπαρακός Σπύρος		
Σπυριδάκος Γιάννης ΕΥΔΕΠ Πελοποννήσου		7.7.17

Φορέας, Οργανισμός, Εταιρία	Υπογράφων	Ημερομηνία
Συνεταιρισμός Γεωργικός Γρηγορίου, Καντζας		
Αγρ/κος Συνε/σμός Παλαιοπαναγιάς	Λογαντζής Γεώργ.	
Α.Σ. ΑΝΘΕΩΝ ΒΕΝΕ ΤΣΑΝΟΣ		
Α.Σ. Ζηραχάκινια Παπαγιαννακη	Ανω Πε	
Συν. ΕΑΣ Σύμβουλος ΝΙΚΙΑΣ ΠΑΝΑΓΙΩΤΗΣ		
Δήμος Μονεμβασίας	ΜΑΝΤΑΒΡΑΚΟΣ ΧΡΙΣΤΟΦΟΡΟΣ	
ΕΚΕΥΑ	Καραμπίνης Μανώλης	7/7/2017
Α.Σ. Γοράνων Πρόεδρος	Μπολωτάκος Ιωάννης	7/7/17
ΔΗΜΟΣ ΣΠΑΡΤΗΣ	ΑΝΤΙΔΗΜΑΡΧΟΣ ΣΚΡΟΥΜΠΕΛΟΣ ΒΑΣ	
ΕΑΣ Λακωνίας	Δημητρόπουλος Χρήστος	
ΔΗΜΟΣ ΣΠΑΡΤΗΣ	ΜΑΡΓΥΖΟΠΟΥΛΟΥ ΧΡΙΣΤΙΝΑ	

Φορέας, Οργανισμός, Εταιρία	Υπογράφων	Ημερομηνία
Γρηγοράτος Ιωάννης		7/7/17
Χατζηνικολάου Παναγιώτης		7/7/2017
Παλαιοδημητρίου Γιάννης		7/7/2017
ΜΠΑΤΣΑΚΗΣ ΠΑΝΑΓΙΩΤΗΣ		7/7/2017
Στρατάκος Γιώργος ΕΑΣ ΛΑΚΩΝΙΑΣ		7/7/2017
Γραμμέλης Παντελής ΕΚΕΤΑ		7/7/2017