AgroBioHeat

Promoting the penetration of agrobiomass in European rural areas

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D5.1: National and European framework conditions

Part 8: National framework conditions - Spain

Lead Beneficiary: AVEBIOM, CIRCE

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Abbreviations

Abbreviation	Explanation
CAP	Common Agricultural Policy
CHP	Combined Heat and Power
EAFRD	European Agricultural Fund for Rural Development
EECCEL	Spanish Strategy for Climate Change and Clean Energy
EFA	Ecological Focus Area
IDAE	Institute for the Diversification and Saving of Energy (IDAE); body assigned to the Ministry for the Ecological Transition
MAPA	Spanish Ministry of Agriculture, Fisheries and Food
NAPCP	National Air Pollution Control Plan
NECP	National Enegy and Climate Plan
NGOs	Non-Governmental Organizations
PM	Particle Matter
RDP	Rural Development Programme
RTD	Research and Technological Developmenty
UNE	Spanish Association for Standardization
VAT	Value Added Tax

Project consortium

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Country: Spain

Spain is divided in 17 administrative regions corresponding to the NUTs2 classification into the Nomenclature of Territorial Units for Statistics (NUTS) of the European Union. These administrative units are the so-called "Autonomous Communities", usually also called Spanish "regions".

Spain is a country where agriculture is a relevant economic activity, and agricultural land is therefore very extended. Some principal facts about agriculture and about heating demands is presented next:

1. Agricultural is a key economic activity, amounting to 2.8 % of Spanish GDP. Among the European Union countries, Spain is the second in land area devoted to agricultural purposes, only behind France.
2. Spain has a huge potential for agrobiomass as it is world leader of production of some crops. A list of the predominant crops and their principal agricultural and agro-industrial biomass residues is as next:
    a. Olive trees → 1st world producer of olive oil → Olive Cake, Olive Stones, Olive tree prunings
    b. Vineyards → 3rd producer of wine in the world → Vineyard prunings, Grape Cake, Grape pit
    c. Cereal → 6th producer of cereal in the EU → straw, husks, corn stover, corn cub
    d. Nut trees → 3rd or the world in almonds, leader in pine nuts → shells
    e. Citric trees → 6th producer of citrics in the world → prunings
3. Large areas of Spain need heating in a similar way to central areas of Europe due to continental climate, the central plateau (Castilla la Mancha, Castilla León, Madrid), other communities (principally in Northern Spain) as well as mountain areas in all Autonomous Communities (Spain is 2nd European country with mountainous areas). 15 % of households in Spain do not have any heating system[1].
4. A 70 % of the energy consumption in Spain is dedicated to heat and hot water
5. Biomass for heating is growing quite steadily every year in Spain. Most used biomass is firewood (6 Mtons although decreasing in the last years), though during last years wood pellets use is growing very fast (600,000 tons in 2019).
6. Some agrobiomasses have been traditionally used locally where the crops are grown: olive stones, almond shells, pine nuts, etc. and lately their use is being modernized with the use of up-to-date boilers and stoves and the upcoming of standards for these fuels

[1] www.idae.es/uploads/documentos/documentos_11406_Guia_Practica_Energia_3ed_A2010_509f8287.pdf

1. Agrobiomass availability

1.1 Areas and distribution

Spain has a huge potential for agrobiomass due to its great surfaces dedicated to agriculture and its consequent production of many crops and its residues and by-products derived. In consequence, Spain is one of the most important countries in the world in this aspect. Spain is 1st world producer of olive oil, 3rd world producer of wine, has a great cereal potential, is leader in citric trees and is a very important producer in nut trees. In addition, some of the crops that are grown in Spain have residues or by-products very interesting for energy uses (from olive oil industry olive cake and olive stones, from vineyards and olive trees the prunings, etc.).

Table 1: Main crops grown in Spain (Source: Eurostat & MAPA).

Type of Crop	*Surface (ha)*	*Data source*	*Production (t/y)*	*Data source*
Olive trees	2,594,150	Eurostat 2019	9,264,540 (oil) 555,030 (table)	Eurostat 2018
Vineyards	941,154	Eurostat 2015		
Fruit trees	2,941,143	Eurostat 2017		
Almond trees	633,600	MAPA 2017	244,000	MAPA 2017
Cereals for production of grain	6,027,610	Eurostat 2018	25,358,140	Eurostat 2018

Probably the largest agrobiomass potential in Spain are the multiple by-products derived from olive tree growth and olive oil extraction in industrial facilities: olive tree prunings, olive stones and olive cake (wet residue after mechanical extraction of olive oil) or exhausted olive cake (dry residue of chemical extraction from olive cake). The distribution is basically the south of Spain and main regions where olive trees can be found are Jaén and Córdoba (area surrounded in red). Being Spain the country with more surface dedicated it's logical that is also the world largest producer of olive oil and its derivates. Below, the olive trees are marked in yellow on the map.

Figure 1: Olive trees distribution (Source: BIORAISE).

Vineyards are very present in Spain and almost in every region. The biggest concentration is in Castilla La Mancha (area surrounded in red) and probably one of the world largest area of continuous cultivation of vineyard with circa 500,000 ha. This region counts on with as much surface as other well-known wine producing areas like Duero Ribera (area surrounded in yellow) and Rioja (area surrounded in green) PDOs, or other concentrated wine producing areas in DOPs sited in Extremadura (area surrounded in blue), Aragón (area surrounded in pink) or Cataluña (area surrounded in white).

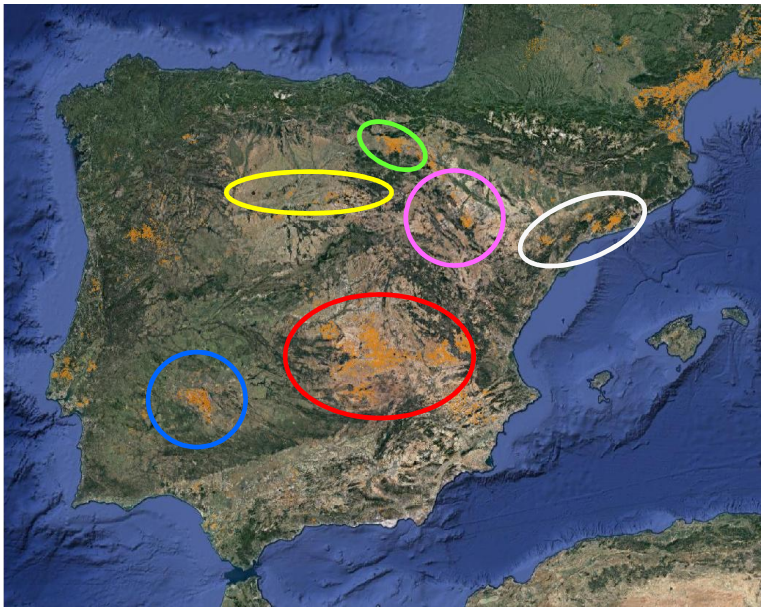

Figure 2: Vineyards distribution (Source: BIORAISE).

The area dedicated to cereal in Spain is impressive, around 6 million hectares; due to the irregularity of the rains in Spain the production is very variable and it may change widely from one year to year. These inter-annual variations cause that cereals and straw are abundant in good years. Those years there is sufficient straw to cover animal feeding and energy demands. However, in years where the droughts cause low productivities in rainfed areas there is lack of straw even for animal feeding and it is necessary to import from France. Main areas of distribution are both large regions in the central Spain called Castilla (Autonomous Communities of Castilla y Leon in the North (area surrounded in red) and Castilla La Mancha in the south (area surrounded in yellow)).

Figure 3: Rainfed annual crops (Source: BIORAISE).

Another source of agrobiomass with high potential are the fruit trees. Special relevance has the concentration of citric in the east coast (Castellón, Valencia, Alicante, and Murcia - area surrounded in red) from which the pruning is abundant (due to very intensive cropping systems and good conditions for the vegetative growth of the crops) and from tree wood when the plantations are removed to change varieties (replacement periods are short in comparison to vineyards or olive tree plantations). Spain is one of the countries with largest production of citric fruits.

Figure 4: Fruit trees crops (Source: BIORAISE).

Other fruit tree plantations like pome and stone fruits are also grown in intensive environments and most of land is irrigated to assure no water stress. Production of fruit is usually concentrated in areas historically dedicated to this activity and usually near river basins. Productivity of pruning and frequent rotation of crop variety cause these areas to be relevant locally or regionally as a source of residues available for energy use. Dry fruit trees are as well extensive planted in Spain, though only partially irrigated. This causes some areas to present low productivity. However, due to the continued crisis in the fruit sector (2016 onwards) fruit products are switching from pome or stone fruit trees to almond plantations. New plantations entering in production are much more productive in terms of tons per hectare as they are managed more intensively than traditional dry fruit plantations.

1.2 Agricultural residues – potentials and market

In the following table it is presented the estimations for agrobiomass potentials made with the on-line GIS tool BIORAISE segregated in the main categories. After applying some different restrictions limiting the gathering of residues (slope, etc.) and the competence with already established uses (firewood principally) the "available" column shows the agrobiomass technical potential. As it is shown in the table below, the largest potentials are for rainfed crops (mainly cereal) and irrigated crops. Out of the cereal crop, straw can be used for energy purposes in appropriated devices, on the other hand, irrigated crops are more complicated to use due to several reasons (moisture content in case of rice straw and orchard resides, contaminations of greenhouses (plastics, …)). Additionally, the table includes the potential of prunings coming from different kinds of woody crops (olive trees, fruit plantations and vineyards).

Table 2: Agricultural biomass potential in Spain (Ceder-Ciemat / BIORAISE, Biomasud Plus project).

Type of Crop	*Potential (t DM/y)*	*Available (t DM/y)*
Rainfed crops	16,944,193	5,420,661
Irrigated crops	4,682,592	3,746,230
Rice crops	394,983	316,204
Olive plantations	1,819,981	1,455,168
Fruit plantations	1,411,563	1,129,094
Vineyards	843,949	675,000
Crop mixtures	123,225	99,416
Total Agriculture	**26,220,486**	**12,841,774**

Nowadays there are several agrobiomass that are being used already mainly in the industrial market for electric generation or big industrial boilers. Most agrobiomass used are the prunings and agriculture tree replacements (olive tree prunings / replacement, fruit trees prunings / replacements, etc.), especially in Southern Spain. Exhausted olive cake is the second largest solid biofuel (behind firewood) in terms of traded amount with 800,000 tons in a normal year (olive trees do not produce every year exactly the same quantity, they have a cycle with, normally 1 good year, 1 bad year and 2 normal years). Also there are some biomasses very interesting for domestic boilers and stoves like olive stones that if they are valorized (dried and sieved to increase their "value") they have very good quality, more constant and homogeneous, getting a granulated fuel similar in terms of its good properties to wood pellets. Moreover, almond shells and other shells can be used for domestic heating. These kind of agrobiomasses have a Spanish quality Standard (UNE 164003 for olive stones and UNE 164004 for dry nut shells) and they have been included inside the BIOmasud Certification scheme.

Table 3: Use of agrobiomass in Spain (Source: AVEBIOM & CEDER – CIEMAT, Biomasud Plus project).

Solid Biofuel	*Domestic Quality (t DM/y)*	*Industrial Quality (t DM/y)*	*Total (t DM/y)*
Prunings and agriculture trees replacements	323,021*	1,000,000	1,323,021
Vineyard pruning pellets		4,673	4,673
Exhausted olive cake		800,000	800,000
Olive Stones	130,000	300,000	430,000
Almond shells	10,000	140,000	150,000
Chopped pine cone		38,250	38,250
Pine nut shells		6,588	6,588
* Larger pruning pieces used for firewood			

It is complicated to obtain prices for some biomass since there is not a real market and some of them are just theoretical or estimations (corn stover pellet) or they have a very small market (straw pellet, vineyard pruning pellets). Other like olive cake and stones have a more developed market. As a matter of fact, these fuels were object of a high demand and export some years ago (before 2013) to feed some biopower plants or for being mixed with coal in cofiring plants of other EU countries. However, there was a change in their national policies leading to a switch in the demand. These plants recently stopped the imports of exhausted olive cake to rely on local resources, or the imports base on wood pellets in dedicated biomass plants (no cofiring). As the demand sunk, so it did the price reaching very low prices that made them interesting again.

Table 4: Agrobiomass characteristics and prices in Spain (Source: AVEBIOM & CIRCE 2019),

Agrobiomass	*LHV (kJ/kg)*	*Moisture (%)*	*Price (€/t)*	*Price (c€/kWh)*
Straw	14,750	11.8	50	1.22
Straw pellet	15,939	6.3	140	2.94
Corn stover pellet	15,939	5.5	125	2.60
Replacement fruit trees chipped	14,398	27.9	45-70	1.13-1.75
Olive tree prunings (firewood)	12,581	27	45-70	1.29-2
Vineyard prunings	14,009	20	50-70	1.29-1.8
Exhausted olive cake	15,010	15	20	0.48
Olive stones (industrial)	15,282 – 13,607	17-25	55-70	1.65-1.85

For olive stones, AVEBIOM publishes continuously an index price since 2014 that can be accessed HERE[2]. A price index is also published there for wood chips and wood pellets. The index price is only for domestic olive stones (class A1 or A2 of the Spanish standard UNE 164003). Nowadays the prices are between 3.16 c€/kWh for bulk pellets and 4.14 c€/kWh in individual bags.

[2] www.avebiom.org/proyectos/indice-precios-biomasa-al-consumidor

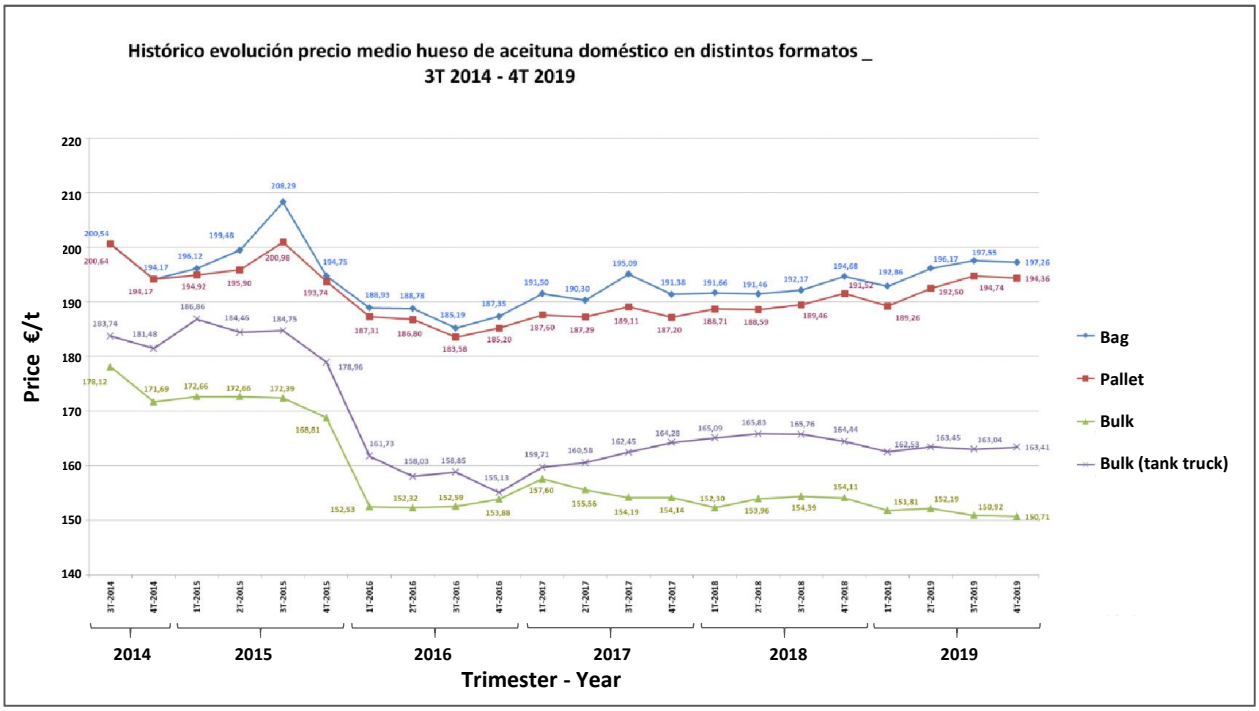

Figure 5: Evolution of the average price of olive stone for domestic heating in various formats. Info by trimester (Source: AVEBIOM).

1.3 Energy crops

In Spain there are no data regarding Energy Crops except for some surfaces where experimental Energy Crops are being grown. As per CEDER-CIEMAT data, there are only 38 ha in Spain (2018). There are other experimental areas of few hectares associated to other research centers. However, the fact is the absence of data, and the absence of large areas cultivated with energy crops. There is currently no production of lignocellulosic energy crops for energy purposes. Several hundred hectares were in demonstration status few years ago, promoted by companies operating biomass power plants or intending to install few of them. These plantations have been at the moment stopped or just abandoned.

2. Rural Development

Rural Development	
How is Rural Development managed?	Rural Development in Spain is managed on a decentralised basis by the main administrative regions of the country. According to the Rural Development policies 2014-2020 of the EU, 18 Rural Development Programmes (RDPs) coexist: 1 National Program of Rural Development and 17 Regional Programmes. Each Spanish region (so-called in Spanish as Autonomous Community) has drawn up a Rural Development Programme which, in addition to the horizontal measures and common elements set out in the National Rural Development Framework, include specific measures to respond to different regional situations. On the basis of the RDPs, the Autonomous Communities and the Ministry of Agriculture, Fisheries and Food publish calls for aid so that potential beneficiaries (persons or entities linked to the rural environment) can apply for, obtain and implement it in order to comply with the measures established in the plan. These RDPs are funded under the European Agricultural Fund for Rural Development (EAFRD) and national contributions. The RDPs set out priority approaches and actions to meet the needs of the specific geographical area they cover. Rural development funding through the EAFRD is part of a broader framework of European Structural and Investment Funds (ESI Funds), including also Regional Development, Social, Cohesion, and Fisheries Funds. With regard to the new National Strategic Plan, the new instrument proposed by the Commission to implement the CAP in each country, Spain is committed to a plan in which the Autonomous Communities play a key role, both in the measures of the first pillar (direct aid) and in those of the second pillar (rural development). In this way, the governance model will incorporate the authorities of the Autonomous Communities responsible for management, while ensuring the necessary coordination at national level.
Are agrobiomass feedstocks suitable for bioheat included in the Ecological Focus Area? (for example, Short Rotation Coppice, Miscanthus, Silphium perfoliatum)	In Spain, since 2018 the following agrobiomass feedstocks are included in the EFA (in addition to nitrogen-fixing crops): • Miscanthus • Silphium perfoliatum

Rural Development	
Are there any restrictions on the cultivation of dedicated energy crops (woody or grassy varieties)?	In respect agricultural land there is no restriction limiting the plantation of energy crops. Currently in Spain there is a very limited use of agricultural land for such purpose, and therefore no restrictions have been posed. In respect utilization of forestry species in agricultural land, the current framework considers the new land is forestry in terms of the new management. Forestry stands, or silvicultural operations which purpose is obtaining feedstock exclusively for energy production, can also be considered as energy crop, and thus susceptible of incentives. However, in terms of the planning and access to the resource, the conditions are established by the forestry management plan of every Autonomous Community, and subsequently by the management plan for each forest area.
Are there any restrictions or mandated practices covering agricultural residues collection?	At the moment no restrictions to gather straw, corn stover, or prunings. As well no mandate to collect them. Some areas in which the integration of residues in the soil a potential risk for pest or diseases establishment and propagation are, there are strong advices to avoid it, though not a mandate. The solution is then not the collection, but the withdrawal and disposal in open fires, and a facilitation of permits given the need of the disposal.

Rural Development	
Is there any support for the valorization of agricultural residues at national level? Or at local level?	Not currently. The current Common Agricultural Policy (CAP) covering the period 2014-2020 transposed in Spain foresees as cross-compliance measures for direct payments (Royal Decree 1075/2014) mulching, but not the use of agricultural residues for energy or other uses. There was however from 2012 to 2014 aids for pruning collection 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 utilized either as biomass, or as cover for the soil. Some measures could be implemented in future using part of the new CAP funds. The current draft of the Spanish NECP foresee measures to support the use of prunings for energy, concretely. The NECP indicates that the Ministry of Agriculture will be responsible. Measure 1.11: which foresees the promotion of biomass use, promotion of biomass logistic centers, and establishment of strategic plans for pruning utilization, to be performed by each Autonomous Community (NUTs2). Measure 1.25: includes the use of pruning for CHP, pelleting or energy uses. As well for composting. Support measures are foreseen to be implemented by National Government in coordination with Autonomous Communities. At local or regional level no instrument has been detected supporting directly the valorization of agricultural residues.

Is there a ban on burning stubbles, prunings or other agricultural residues?	There is not a strict national banning. In terms of the agricultural regulations, the Royal Decree 486/2009 establish a series of good practices, and declares as obligatory the "non-burning" of stubble from annual crops, and strongly recommends "non-burning" of prunings (as considering there are alternatives like mulching or energy). However, exceptionally it establishes that burning could be allowed in case of phytosanitary reasons. In Spain each Autonomous Community decides the specific regulations to allow and perform the practice of the open field burning. In general the applied measures follow next logical sequence: By default open field burning of agricultural residues not desired and not allowed In case of a declared need to burn the stubbles/prunings, the Autonomous regions publish yearly the procedures to perform such disposal methods. They usually include: Local authorities (environmental departments of city councils) expede temporary authorization to farmers (with a deadline) The Autonomous publish daily the zones where open burning of residues could be allowed (according to rains, droughts, wind…) There is a minimum set of practices: fire cannot be abandoned (person to be controlling it), need to have minimum means for stopping fire in case of propagation, distance to forest, etc. Accessing to these permits is dependent on region and local authority. Some regions/local authorities try to decrease open burning of stubbles or prunings, whereas other facilitate it more. The situation is inhomogeneous along Spain, and also inside every Autonomous Community. Even when referring to air quality there is no explicit reference to the fumes and pollutants from open air burning of stubbles and prunings. Neither does it the Directive 2008/50 / EC on ambient air, and thus the current order in force neither does it (Royal Decree 102/2011). As result, the existing framework foresees the open burning, which is quite extended practice, though slowly abandoned due to more exigent conditions. A total restriction is applied only due to seasonality: from late Spring to late September is a period where open field burning is forbidden. The period depends upon the Government of each Autonomous Community (NUTs2).

Rural Development	
	It may be foreseen an increase of measures orientated to reduce the burning of agricultural stubble and prunings. The CAP may include measures. And currently the NECP includes a reference of more restrictive regulation for burning stubbles in its Measure M1.21.

3. Logistics and other market considerations

Logistics	
Are harvesters/balers for agricultural residues readily available in the market?	In general bases, there is available machinery in the market for harvesting by-products of agricultural activity. A significant number of Spanish manufacturers already have specific equipment for agrobiomass and pruning harvesting, such as Serrat, López Garrido, Picursa or Promagri, among others. In this regard, H2020 project uP_running addressed how to collect and mobilize agrobiomass from plantation removals. Concretely in Spain, crops such as olives, fruit trees, vineyards, hazelnuts or almonds were identified. In this sense, all of them need to be renovated with a certain frequency. From a global point of view, according to uP_running inputs, the methods to collect and mobilize agrobiomass from plantations removal may be classified into three different approaches: 1. Whole tree uprooting, shredding and further processing, performed with **bulldozers or excavators**. 2. Felling the trees to be processed by crushing, shredding or chipping. Trees can be felled manually by farmers or workers with **chainsaws**, or mechanically, with **cutting discs or shears mounted on a hydraulic arm**. 3. Integrated felling with shredding / chipping. The process requires a **tractor of high power with a large shredder installed in front**. As the tractor advances in the line of trees, these are bended and/or cut and as they fall the shredder/chipper reaches the stem and start processing.
Is there an investment support available to cover the cost of these machines?	The Spanish Ministry of Agriculture, Fisheries and Food (MAPA) offers a specific call for the direct award of state subsidies for the **renewal of agricultural machinery (Plan RENOVE)**. This aid is regulated by the Royal Decree 704/2017, the following machinery for harvesting/baling being eligible for aid: • Agricultural tractors • Automotive machines: harvesting equipment, among them • Machines towed and suspended to a tractor vehicle (such as direct sowing machines)

Are there any specialized service companies for agricultural residues harvesting and logistics?	Agricultural services companies are common in Spain. They offer integral solutions providing consultancy services, products, machinery or tools. Although they are not specifically addressed just for agricultural residues harvesting and logistics, their activities include also providing the tools and facilities to perform this residue management.
How does the biomass market usually operate?	Biomass market operation can be explained according to the respective biomass: <u>Straw</u> Given the fact that several straw based plants operate in Spain, and the issue that there is a traditional use as fodder and bedding for cattle, and for industry purposes, here is a well-established national market. Providers can be found all along the geography. Price for energy is usually fixed by these large companies. Given the interannual variations in straw production (an important area is planted in rainfed conditions, and thus, susceptible of drought stress) these companies usually count on with structure to reserve straw interannually, and thus their supply cost is more stable. In dry years price of straw grows above the limits desirable for power plants, and then part of straw is imported from France. Straw for heating is unusual in small to medium heating units. Given the framework these facilities consume straw under self-consumption scheme usually. Alternatively, they are subjected to market prices variation. In some industries for heat, they switch fuel depending the price (e.g. farms or dehydration units). <u>Olive cake</u> Principally in Andalusia and Southern Spain. In Andalusia there a market (and export) of exhausted olive cake has been in operation for more than 20 years for industrial uses such us power generation, cement plants, brick factories, etc. Exports sunk from 2013 onwards as regulations in other EU MS limited the feed-in tariff for cofiring for imported fuels like olive cake and the consequent change to dedicated biomass power plants using wood pellets. The price sunk and year 2018 large plants sited in Andalusia and Extremadura have started a shift from woody biomass to agrobiomass (olive cake, pruning, up-rooted plantations) and therefore new value chains have been established. Olive cake can be supplied to any point in Spain, principally from Southern regions. <u>Olive Stones</u> Only olive stones coming from olive mills are used. Olive stones coming from edible olives cannot being used due to the salt content that causes a high chlorine content and corrosion and emissions if used. Approximately a 70 percent is used directly from the olive mill without any valorisation (drying process followed by a screening of peelings and

	olive flesh). Users are small industries, and the supply mainly local although its great density similar to pellets makes possible some quantities be shipped to distant consumers. About 30% of the olive stone is valorised, leading to an olive stone of higher quality and homogeneity. A number of new companies have started this novel activity in last years. They buy raw material to oil mills and they dry and sieve the olive stones to obtain a good quality fuel almost with the same characteristics as wood pellets have. This good quality olive stones goes to domestic installations (even stoves that can easily adapted) and small industries. Normally Olive Stones' market in Andalusia, Castilla La Mancha, Madrid and some parts of Navarra and Cataluña. Nowadays the main producers of olive stones (4 in total) are certified with BIOmasud® certification system. The production is not regular and due to the olive trees cycles mentioned some years there is enough in Spain to export (mainly Italy), whereas other years there is a lack and some imports can be made (mainly from Tunisia) <u>Almond shells</u> There is a possibility to order truck delivery to any point in Spain, though usually the supply remains regional. Costs are not even along Spanish geography and vary along the seasons. Principal consumers are households, farms and some industries. There are some almond producers that are valorizing the shells by removing the fines fraction and crushing them for obtaining a more homogenous particle size and they sell to domestic uses. Normally a local or regional supplier takes care of the supply in a certain region. There were some exportations in the past but they are not very common due to the low density that penalize the costs of logistics. <u>Firewood from fruit and olive plantations</u> Normally local or regional suppliers. Not a national market. Small suppliers, though some have expanded their volumes and reach and provide firewood and supply trucks in large distances. <u>Prunings and wood from cleared plantations</u> There are two models: (A) The areas where a large power plant consumes pruning, and (B) the areas where singular consumption exists. (A) Areas near large power plants Traditionally in Andalusia, where some of the biomass power plants based on olive cake started to use prunings from late 90s and his consumption has grown till today. In such areas farmer can supply directly biomass, though the largest volume correspond to intermediate service companies that gather the pruning biomass and supply it to these power plants.

	A change in the situation has happened as a large company started 2018 a new supply strategy based in their Corporate Social Responsibility compromises and vision to avoid the use of roundwood for energy. Large power plants in Andalusia, Extremadura and now in Castilla La Mancha have started a shift towards agrobiomass. New value chains for pruning and up-roted plantations have surged in just 2 years, based on existing service companies and forestry companies already operating in the area. For domestic biomass, some (only few) suppliers are starting a diversification of the material to supply heat consumers (selecting then the batches with better quality). (B) Areas where only small consumption exist Singular facilities are using pruning wood for energy. Usually there is no market, but a self-consumption. However in some cases a bilateral relation is established between the consumer and supplier. Normally the supplier is a company already operating in the area that diversifies partially its activity to get an additional income.

Are there companies producing agro-pellets?	Nowadays in Spain there are several companies making agro-pellets but still quantities are minority compared to woody biomass pellets. The following companies has been located: PELETS, COMBUSTIBLE DE LA MANCHA S.L. → Vineyard prunings. Production: 6,000 t/y (2018). Production capacity : 32,000 t/y. Premium Pellets Spain → Straw pellets. New facility that will start in 2020 and will produce around 2,000 t/y. Energy use but also for animal feeding / bedding. Agropal → Straw pellets. Small quantities with its own raw material for its own facilities. Moligrasa → Straw pellets. Energy use but also for animal feeding / bedding. Pellets Solución: provides turnkey facilities and produces multiple pellet types. Among them agropellets for high added value purposes. Agropellets Aragón: this company started operation 10 years ago; produces batches under request, though its principal activity is fodder production.
Are there any resistance in the market for this kind of product?	Multiple fodder / feed granulating industries or wood pellet plants: it is usual to find feed industries that have tested the production of straw pellets or mixed pellets (straw, stalks, prunings, forestry wood). As well some wood pelletizers have tried. However currently no market. Therefore, even not producing, some actors are ready in case a growth in the demand. The AGROinLOG H2020 project[3] investigates the coNECPt of turning a fodder agro-industry (Agroindustrial Pascual Sanz) into an Integrated Biomass Logistics Centre producing also pellets for the energy market. The main barriers for these kind of pellet are the lack in the market of devices to use them and the lack of information and trust of general public in these solid biofuels.

[3] http://agroinlog-h2020.eu/en/home/

4. Air quality

Air quality	
Has the state submitted a NAPCP? (National Air Pollution Control Programme)	Yes, in September 2019. Link: http://cdr.eionet.europa.eu/es/eu/nec_revised/programmes/
Competence over air quality related issues is at National or at Local level?	Competence is set by the 34/2007 Law on air quality and is shared between national government and Autonomous Communities (NUTs2). Spanish Government competences (with participation of Autonomous Communities: • Update pollutants levels and set air quality objectives • Elaborate national programs and plans to comply with EU compromises and international treats • Update national inventory of pollutants Regional Government has the faculty to: • Evaluate air quality • Set more restrictive values tan those established by national laws • Adopt plans for pursuing the objectives in their region • Inspection and control to ensure individual accomplishment of the law • Impose sanctions Local authorities have competences in local road traffic, fires, urbanism, sanitary systems, management of local infrastructure and protection of local environment. Competences assigned by the 7/1985 Law. The competences assigned in terms of air quality are: • Preparation of local policies • Execution, control, monitoring and coordination of policies in place To assure a good communication in issues related to environment three principal mechanisms are being utilized: 1. Environment sectorial Conference: participated by highest responsible persons in environmental issues from national and regional governments (to assure cooperation and coherence) 2. Commission of cooperation in Environmental issues: working groups between national and regional governments 3. National environment board, to assure coordination of public-private sectors

Air quality	
Are performance standards and/or emission limits a possible barrier to deployment of agrobiomass heating systems up to 500 kW?	In Spain, the current regulation (EU) 2015/1189 on Ecodesign requirements for solid fuel heating appliances is in force, that affects (1) solid fuel boilers of less than 500 kW and starts to apply to new equipment from 01/01/2020 and (2) solid fuel stoves of less than 50 kW, and starts to apply to new equipment from 01/01/2022. The first additional provision that establishes specific considerations for the use of solid biofuels in non-industrial boilers is the Spanish Royal Decree 818/2018 on measures to reduce national emissions of certain atmospheric pollutants. In this Royal Decree 818/2018 is detailed that solid biofuels that are sold for use as fuel in non-industrial boilers must identify their quality class and specifications, as established in the UNE-EN-ISO 17225 standards, based on the typology of the solid biofuel and in the case of olive stones and nut peels, they must comply with the specifications established in the standards UNE-164003 and UNE-164004, specifically.
Are performance standards and/or emission limits a possible barrier to deployment of agrobiomass heating systems from 500 kW to 1 MW?	No specific standards or emission limits are established for agrobiomass heating facilities between 500 kW – 1 MW.

5. Tax breaks

Tax breaks	
What is the VAT applicable to agrobiomass feedstock?	Agricultural products or raw materials are taxed with a 10 % VAT (example wood logs sold by a forest owner). When they are transformed (wood chip; olive stones or nut shells, pellets) a 21 % VAT is imposed.
For comparison, what is the standard VAT rate and the one applicable to fuels used for heating (e.g. heating oil, LPG, natural gas, firewood, pellets, etc.)?	SPAIN standard VAT: 21 % Natural Gas: 21 % Fire wood: 10 % LPG: 21 % Heating Oil: 21 % Pellets: 21 %
Are there any tax detraction on refurbishment of buildings/replacement of heating system that can be potentially applied to agrobiomass heating?	*See below*

There are tax deductions, but not throughout the whole Spanish territory. In the following map, the Autonomous Communities that apply this type of exemptions for biomass have been located.

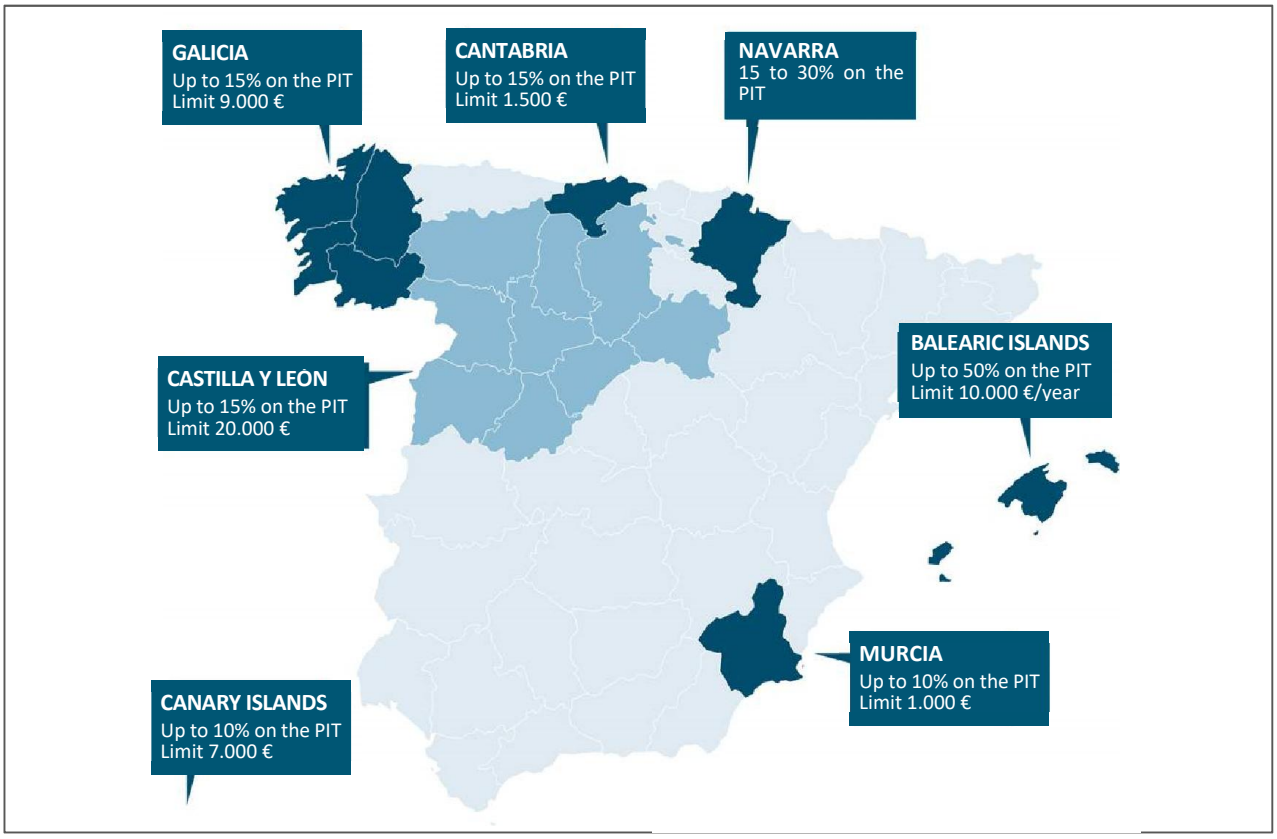

Figure 6: Tax deductions for domestic renewable energy investments in Spain (Source: AVEBIOM).

Table 5: Tax deductions for domestic renewable energy investments in Spain (Source: AVEBIOM).

Autonomous Community	*Tax deduction (% on the Personal Income Tax – PIT)*	*Limitation*
Canary Islands	Up to 10% on the PIT	7,000 €
Cantabria	Up to 15% on the PIT	1,500 €
Castilla y León	Up to 15% on the PIT	20,000 €
Galicia	Up to 15% on the PIT	9,000 €
Balearic Islands	Up to 50% on the PIT	10,000 € per year
Murcia	Up to 10% on the PIT	1,000 €
Navarra	Up to 15 - 30% on the PIT	

6. Other support measures targeting heating

Other support measures targeting heating	
Are there any rural development measure in place to support the production of bio-heat on-farm?	The Spanish Strategy for Climate Change and Clean Energy. Horizon 2007-2012-2020 (EECCEL) is the main instrument for fighting climate change in Spain. The EECCEL integrates different measures that contribute to sustainable development in the field of climate change and clean Energy. Under the heading of rural development, various measures have been included to complement the EECCEL during the, financed under the European Agricultural Fund for Rural Development (EAFRD). Thus, the EAFRD measures related to each 17 regional PDRs in Spain are currently one of the key political programmes for climate action in Spain. Among other specific objectives, the PDRs programmes envisage the promotion of renewable energy, so as the reduction of greenhouse gases and energy recovery from waste derived from agriculture, livestock, forestry and industry agri-foodstuffs. There are specific measures dedicated to support the different actors in the supply chain for the sustainable supply of biomass for energy production.
Are there national or local incentives to substitute old fossil fuel boilers (investment support)? *Are they applicable to agrobiomass heating solutions?*	There are no national schemes or incentives nowadays. There were some years ago some programs managed by IDAE but these programs are over (Biomasa, PAREER, GIT, etc.). In the last months (end 2020) it was in principle expected (based on personal communications) that a new support scheme for heat could be published and managed again by IDAE. However, due to the difficulties in forming the government (formed in the beginning of 2020) they are apparently in delay. Nevertheless, indeed there are incentives or supports regionally for practically all the Autonomous Communities. Each Autonomous Community adapts them to their own needs and expectations, with the majority of these grants being for investments in energy savings, energy diversification and energy efficiency measures. The use of indigenous and renewable resources and the transition to a low-economy carbon is being promoted in all productive sectors. Most of the support is co-financed with European ERDF funds. Some of this support has been addressed exclusively at biomass because it is a strategic renewable energy source in these region's energy mix, expressly indicating the range of eligible biomass resources. They promote the use of agricultural and livestock by-products / residues, the exploitation of forest resources to minimize the incidence of forest fires, etc., in general orientated to domestic heating and industry process heat. There are, in addition, subsidies for renewable energy projects and energy saving and efficiency in the companies of primary agricultural

Other support measures targeting heating	
	production in Galicia and in some provincial government such as Córdoba (Andalusia). At the national level, a support scheme has been published for the energy rehabilitation of households and also for cooperation for the sustainable supply of biomass within the framework of the National Rural Development Program.
Are there any specific measures in support of energy communities / renewable energy cooperatives that could be applicable to agrobiomass heating?	Not currently, at least in large scale. The NECP (still under public consultation for amendments) acknowledges the need of measures to support energy communities. It acknowledges two types: RE communities (cooperatives included there) and citizens communities (which may promote multiple actions in RE, transport, among others). Several measures foreseen, especially relevant M1.13. Listed below: M.1.4: in promotion of self-consumption, energy communities will be able to benefit from low-rate loans and other benefits M1.6: in promotion of heat, energy communities may be fundamental to establish heating and cooling networks: capacity building for city council technicians, and specific national monitoring of its evolution M1.13: specific on promotion of energy communities including: creation of regulation to facilitate the registration, info point, permanent support office, capacity building and demo projects. Following M1.13, IDAE (national Institute for Energy Saving and Diversification, as public body depending of the Ministry of Ecologic Transition), is mentioned to have a role of information and promotion of new local RE communities. In this sense, IDAE has already started communication actions with Spanish Energy Cooperatives and other key actors, has included a section for energy communities in its web site, and has provided guides to promote new RE projects based on community through an already existing mechanism, the IDAE Participation in Innovative Investment Projects, facilitating technical assistance and financing (no subsidies). M1.14: promotion of active participation of citizens, foresee facilitation to create community financed instruments M1.18: to simplify the administrative burdens to register community projects

Other support measures targeting heating	
	Other measures for block building community of owners for energy efficiency, and to facilitate access to community projects to load their power generation into the electric network. It must be noted that these measures do not explicitly refer to biomass (though increasing community heating and cooling will require new biomass based initiatives). Notwithstanding tis generic driving force for the community based RE generation, the social groups actively supporting this change in the current paradigm are mainly: citizens movements, consumers organizations, and environmental NGOs. The latter are however not well aligned with biomass as energy resource, and in general find as priority other RE sources like solar (heating, cooling, power, efficient buildings) or wind energy (power).

7. Buildings Efficiency

Buildings Efficiency	
Are there any incentives to renovate buildings integrating renewable heat? *Are agrobiomass systems eligible for support under such schemes?*	There were some national schemes for support the renovation of buildings and improve their efficiency (PAREER, PAREER II and PAREER CRECE programs). Nowadays at national level there is only one scheme managed by IDAE supporting the switch in the Estate's administration owned buildings: FEDER-POPE program that has extended its deadline until 31 December 2020. As mentioned in the point 6, in many regional schemes for supporting the update of the heating system to a modern biomass device, often the supports are also promoting the buildings efficiency improvements and they are usually eligible to local agrobiomasses too.

8. Policy Coherence

Policy Coherence Are policy instruments impacting agrobiomass designed in a coherent way?	
1. Soil considerations vs. Valorisation of residues	*1.* ***Soil considerations vs. Valorisation of residues*** Currently no specific regulations promoting soil integration or valorization as energy. Some regional support system have been established for farmers to acquire mulchers to dispose pruning. In some regions no-tillage sowing has been promoted, as well as straw integration, but not at moment a compulsory scheme. More relevant is the coming framework, where this dichotomy of agricultural residues to soil or for energy will occur. Attaining all biomass types (including agrobiomass): The NECP does not consider the RE potentials and relies in the quantification performed in previous plans (where exhaustive assessments were performed). Projections are not explicitly compared with potentials. It is advised in measure 5.12 the specific improvements in biomass assessments through RTD actions. This is derived from a risk detected on a potential supply break if due to climate change productivity and access to biomass sinks. Specific support for creation of new value chains, as part of Measure 1.11 (increase of biomass utilization) Specific on agricultural residues: Mobilization of biomass pruning to energy specifically quoted in M1.11 Promotion of agricultural residues (specially pruning, though may be extended to other feedstock) to be utilized for energy as part of waste recycling or valorization for GHG reduction in M1.22 However, measures promoting use for bioenergy are in conflict with carbon sink orientated measures like M1.25 where biomass residues integration into agricultural soils is a strategic item to increase the soil organic carbon. Conservation Agriculture is described there as the best practice in annual crops. Mulching of pruning wood as soil cover considered for woody crops. As summary M1.25 confronted to M1.11 and M1.22 Relative to Energy Crops: They are not explicitly mentioned. No specific measures foreseen.

Policy Coherence Are policy instruments impacting agrobiomass designed in a coherent way?	
	It is denoted in Measure M1.24, on forestry carbon sinks, the need to promote recovery of natural vegetation in riversides as a mean to reduce effect of floods, increase biodiversity and behave as green filter and carbon sink. It is also stated that non-productive agricultural land could be utilized for poplar plantations (long term, formerly orientated to timber). This gives a chance for supporting expansion of poplar plantations, which could in some cases be orientated to energy, thus becoming energy crop.
2. Definition of waste vs. co-products/agri residues	***2. Definition of waste vs. co-products/agri residues*** *<u>Is there a clear definition of residue- by -products?</u>* There is not a clear definition in the Spanish legislation of which agro-residues or even woody biomasses are considered solid biofuels. Nomenclature and laws use three different words: waste, residues and by-products. To increase the misunderstanding, in Spanish, the word "residuo" means "waste" and in the other hand, the word, "residues" would be better translated as "resto" (leftovers). Even in the standards (ISO 17225) there is confusion and in the origin sources is written "residuo" instead of "resto" and this issue was addressed by AVEBIOM to the National solid biofuels standardization committee and after being discussed, the committee took the decision of letting in the standards "Residuos/restos)" instead of changing it to "restos" only because in some laws (i.e. RD 815/2013 Regulation on industrial emissions) it was written "restos" and it could bring some problems. *<u>Are there any agricultural residues / agro-industrial residue defined as waste?</u>* As previously mentioned there are not clear definitions and it may differ also from one region to another. Basically, usually agrobiomass can be used without problems and it's considered a residue or a by-product about all when is produced locally. For example, in Andalusia where most of olive trees are and most of the olive stones production there are no problems for storing or using them, but in other regions, i.e. Madrid, some civil servants interprete these by-products fall in the classification of "waste" ("residuo" in Spanish) and place impediments to be utilized. AVEBIOM and other entities prepared a report that delivered to the Industry Ministry explaining that olive stone is a solid biofuel (with even a Spanish standard) and not a waste. This

Policy Coherence Are policy instruments impacting agrobiomass designed in a coherent way?	
	procedure has been initiated, but modifying the current definition of waste shall take years. Also in some regions, Navarra, Olive pomace is considered waste. *<u>If this is the case, how does this situation impact on their use/collection?</u>* This situation is complicating the use of agrobiomass in some regions because if they are considered as waste, all the companies storing, using agrobiomass should be declared as waste managers, this might not be a big issue for multiple companies; however, the declaration as waste imply that final users that would have to be registered as waste manager. Hopefully these cases are minority and usually there are no problems to use agrobiomass. AVEBIOM as national biomass association is trying to solve these issues and to lobby for a clear legal definition of agrobiomasses as solid biofuels.
3. Is the Common Agricultural Policy Strategic plan being developed in harmony with the National Energy and Climate Plan?	***3. Is the Common Agricultural Policy Strategic plan being developed in harmony with the National Energy and Climate Plan?*** There is at the moment no draft of the National Strategic Plan on the CAP. However, there are documents summarizing the advance of the working groups. There it is evidenced a good interconnection of the Strategic Plan with the NEPC. The current analysis of the working group of Objective 4 (Climate Change Action) reveals a total alignment with NECP, including the utilization of the energy and emissions scenarios considered in NECP as reference starting point. The drafts elaborated by the Working Group of Objective 8 (Vibrant Rural Areas) includes constant references to NECP and to the measures to promote biomass as a driver of rural development, following the opportunity of creating a strong biobased industry activities and the strength of the huge biomass potentials (forestry and agricultural residues). Draft analysis of the Working Group on Objective 5 (Environmental care) also reveals connections with NECP.

Policy Coherence

Are policy instruments impacting agrobiomass designed in a coherent way?

4. NECPs: 5 dimensions are developed in harmony?

4. NECPs: 5 dimensions are developed in harmony?

Dimension	Development
Security, solidarity and trust	Internal solidarity is described. Fuel security aimed and tackled through use of autochthonous resources and higher efficiency, according the objective scenario.
Fully integrated internal energy market	Measures to ensure grid connection with EU M.S.s . No legal / protection barriers detected.
Energy Efficiency	Multiple measures of energy efficiency included. Aligned with EU directives (also efficiency in buildings).
Climate, decarbonizing the economy	NEPC totally aligned with EU roadmaps and vision towards 2030 and 2050.
Research, innovation and competitiveness	Innovation actions included as necessary instruments in several measures. EU innovation also included in a measure.

5. Is there a national bioeconomy strategy? Are there any measures targeting agrobiomass for energy? Are those measures coherent with rural development and energy and climate related policies?

5. National Bioeconomy Strategy

There is a National Bioeconomy Strategy released in 2015, with 2 action plans in documents published in 2016 and 2018. The Strategy acknowledges the role of biomass for multiple functions and uses, including the production of bioenergy. As well it emphasizes the high potential in agricultural and agroindustrial residual biomass, and the need to be exploited for growing new bio-based activities (including energy). However, energy crops are not mentioned.

Action plans include horizontal measures to be developed, and therefore no explicit mention to energy. The scope of this strategy is well aligned with the PNEC and principal objectives of the CAP. However, it was released in 2015. Therefore, no crossed references.

Recently the DG on Agriculture and Food hosted an event on the "Circular Bioeconomy for Rural Development through the use of biomass" (LINK). Authorities from various Ministries and Public Bodies exposed the alignment of biomass for energy and for bioeconomy, and multiple success cases and on-going initiatives were presented. To this end the bioeconomy strategy counts at the present with agrobiomass for energy as a strategic line.