Policy Guidelines

uP_running

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

Grant agreement: 691748
From April 2016 to June 2019

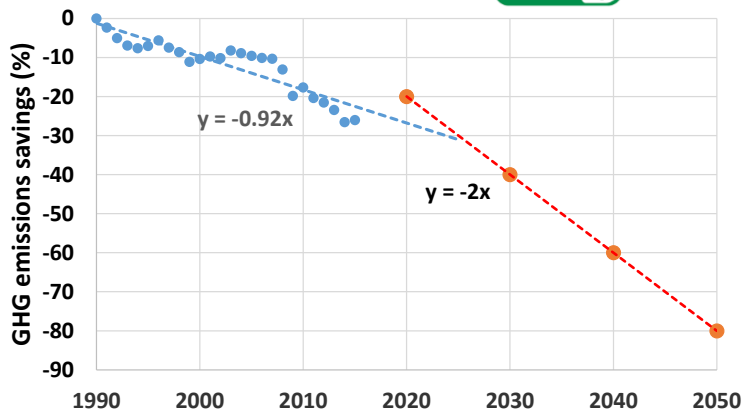
project funding from the EU's Horizon 2020 R&I programme under GA n°691748

KEY MESSAGES

1st Message:
Climate change is the absolute planetary priority to be tackled

Potential drivers	Connected to Mission 1	Possible risks or barriers
Transition to a low carbon, climate resilient, sustainable development is an imperative target to manage effectively the risks associated with climate change	Biomass plays a relevant part in the set of renewable energy sources	Climate change poses a severe threat to future sustainable development unless anthropogenic effects driving GHG emissions are fully reconciled

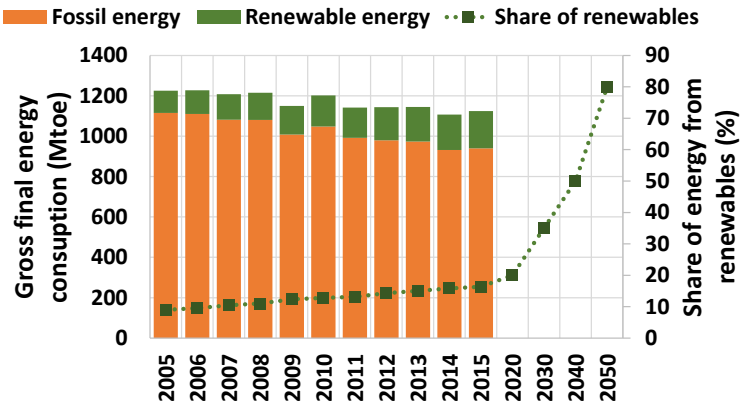
Facts & Figures



GHG reduction over time

- ✓ The European Union is currently on track to achieve its GHG emission reduction target of a 20 % decrease by 2020.
- ✓ Faster decreasing rates of GHG emission are necessary to achieve 80%, or even 95%, decrease by 2050.

Data source: Eurostat.
Calculation: "uP_running"



Share of renewables over time

- ✓ The European Union is currently on track to meet its renewable energy target, i.e. that 20% of its energy should come from renewable sources by 2020.
- ✓ In view of the EU's longer-term target for 2050, the RES deployment rate should increase significantly.

EU Parliament and Council provisionally agreed on a share of energy from renewables of at least 32% of the Union's gross final consumption in 2030, with an upwards revision clause by 2023.

Actions to be taken:

- ➢ The Paris agreement on GHGs reduction (COP 21) is very demanding and needs to be implemented as soon as possible, carefully planned and also monitored ongoing.

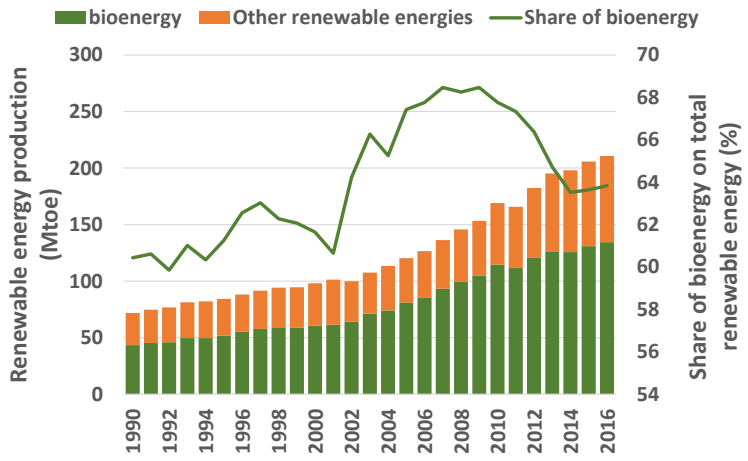
- Renewable energy must continue to play a fundamental role in the transition towards a more competitive, secure and sustainable energy system. This transition will not be possible without significantly increase the share of renewable energy.
- An exceptional effort needs to be deployed in order to boost transition towards renewable energies, on both supply and demand side. This requires a strong and rapid strengthening of the renewable energy installed capacity, specifically considering the role of biomass as sustainable energy source.
- In parallel, considerable efforts are requested in improving the energy conversion efficiency as well as the energy end-use efficiency in order to save energy and increase the energy intensity of the economy in Europe. RED II is leading the way in this direction. Similarly, "eco-design" standardization is also offering further improvements in energy efficiency and emission savings. Industry should take a prominent role in these issues.
- Potential great synergies can be established between the circular economy and various biomass uses for a range of products with higher added-value than just energy. In this regard, APPR are biomass source ready at hand to be included in circular economy and bioeconomy vision.

2nd Message:

Bioenergy and solid biomass are playing a very crucial role in contributing in the EU energy mix

Potential drivers	Connected to Mission 1	Possible risks or barriers
Bioenergy (also including advanced biofuels) represents the largest proportion of the EU renewable energy mix, and it will continue to be important also in the future	Biomass plays a relevant part in the set of renewable energy sources	Although other forms of renewable energy sources are remarkably increasing their contribution, there is a high risk of failing to achieve long-term climate goals without considering bioenergy provision

Facts & Figures



EU-28 gross inland energy consumption of solid biomass

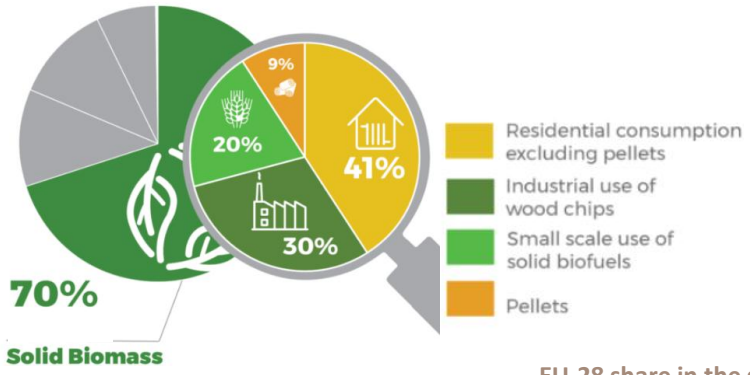
Data source: Eurostat: AEBIOM calculation

The great relevance of bioenergy

Bioenergy is by far the most significant renewable energy source in the EU. It accounts for 64 % of all renewable energy production in 2016

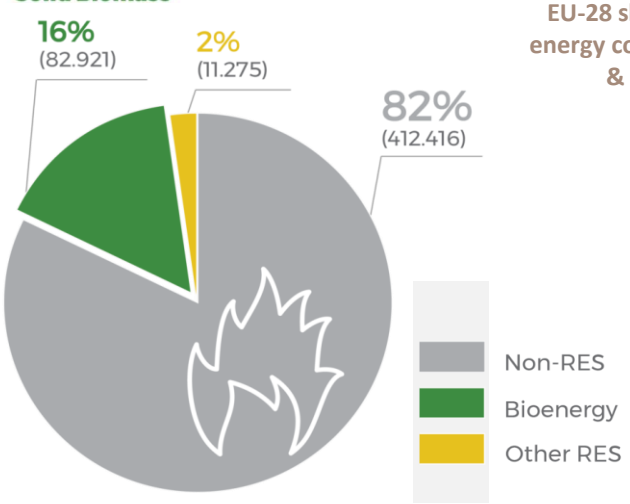
Solid biomass is the most important energy carrier

More than two thirds (70 %) of biomass consumed in Europe consists of **solid biomass** being mostly forestry residues but also agro-residues such as APPR biomass



Heating and cooling represents around 50% of total EU energy consumption, of which 82% is powered by fossil fuels Bioenergy is currently the leading renewable in heating and cooling (88%) representing 16% of European gross final consumption of energy in this sector

EU-28 share in the gross final energy consumption for heating & cooling biomass



Renewables in heating and cooling are becoming a key priority for EU policy, specifically in buildings, a sector which is essential to address in order to reach EU decarbonisation objectives

Data source: Eurostat; AEBIOM calculation

Actions to be taken:

- The contribution of bioenergy to a low-carbon scenario is of crucial importance. Energy from solid biomass is a strategic asset in EU. Therefore, EU and MS national policy should consider with great care and attention the biomass / bioenergy sector and the large influence it has on the energy system and in the economy at large.
- Sustainable bioenergy is an essential component in the portfolio of measures for a low-carbon energy system. This relevant condition should be confirmed also in the years to come.
- Considering that the electricity obtained from biomass (biopower) is programmable (i.e. continuously produced in a stable form), it can effectively contribute to integrating non-programmable renewable sources (such as photovoltaic systems and wind turbines) without altering the electrical grid. In the meanwhile that “smart grids” are implemented routinely, biomass contribution in feeding the grid should remain substantial.
- Biomass addressed to heating and cooling are the best candidate in contributing significantly in decarbonisation; both the building and industrial sectors could be rapidly decarbonized, if solid biomass systems are implemented.
- A faster turnover of outmoded biomass plants together with the scrapping and substitution of old bioenergy systems (stoves, boilers, thermal appliances, etc.) can promote new high-efficiency technologies and a better monitoring of atmospheric emissions (with particular reference to PM10 and PM2.5). These conditions would also promote a larger use of biomass for energy purposes.
- A large amount of energy (heat or cold) is lost by leakage from buildings of low constructing quality.

Two-third of the EU's buildings were built when energy efficiency requirements were non-existent. A large and pervasive requalification plan of old buildings should be implemented.

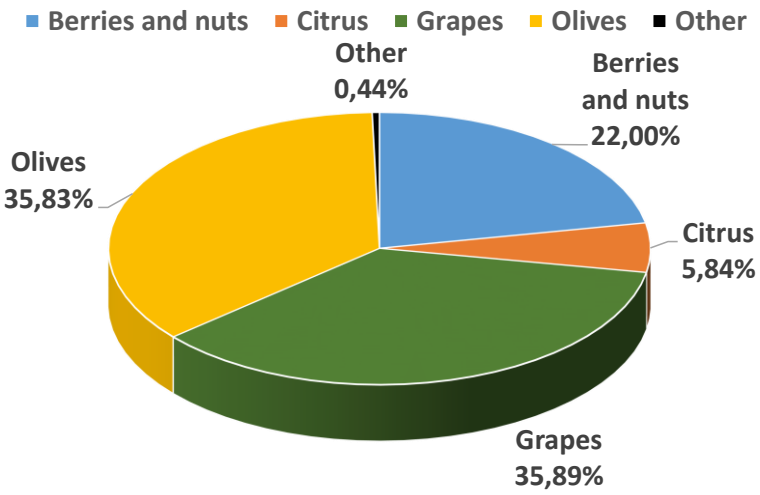
- As can be observed, biomass energy sources can make heating and cooling an efficient and sustainable priority for Energy Union. Unfortunately, the heating and cooling sector remains underestimated, showing great room for improvement.
- Conversely, subsidies to fossil fuels should be removed, in both their direct and indirect forms of support, as well as a "carbon tax" to sectors outside ETS should be applied, considering appropriate accounting procedures (see "policy recommendation").

3rd Message:

Impressive, unexpected and largely distributed is the amount of renewable energy potentially obtainable from APPR biomass in Europe

Potential drivers	Connected to Mission 1, 8	Possible risks or barriers
A wide range of biomass feedstock can be supplied, a wide range of final energy products can be obtained, and a wide range of energy services can be offered	**Biomass plays a relevant part in the set of renewable energy sources** **APPR energy use lessen the energy dependence of the agricultural sector**	A slower-than-expected growth in APPR bioenergy is still observed, but biomass extraction rate should be in tune with soil conditions and its carbon content. Moreover, dispersed sources of APPR poses a feasibility challenge due to logistics

Facts & Figures



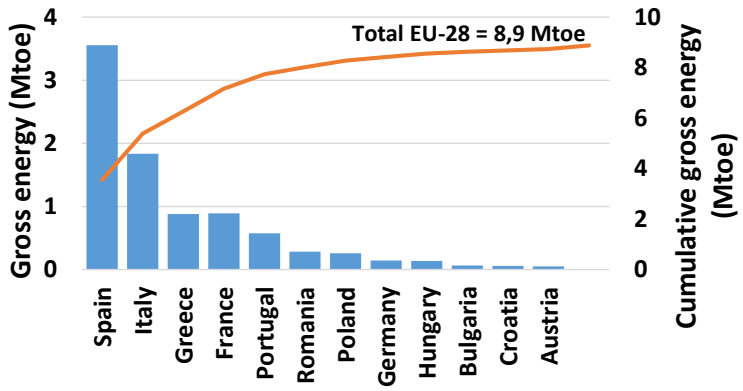
Breakdown (%) of fruit tree surfaces in EU-28

Data source: Eurostat. Calculation: "uP_running"

Some meaningful estimates

- ✓ Fruit tree cultivation surfaces ~ 11.33 Mha
- ✓ Theoretical potential pruning availability ~ 25 Mt/y (dry matter). No possible alternative uses are considered.
- ✓ Potential gross energy content ~ 8.9 Mtoe/y
- ✓ More than 80% of the potential gross energy can be obtained from the first 4 countries in the rank

Read *Note 1* for explanations about estimates



Contribution by country to the potential availability of gross energy from pruning in EU-28

Data source: Eurostat. Calculation: "uP_running"

- ✓ Potential power generation (considering all the available biomass):
  ~ 23.9 TWh/y
  ~ 3 GW electrical installing capacity;
  ~ 4.9 Billion Euro of value;
  ~ 15 Million people served.
- ✓ Potential heat generation (considering all the available biomass):
  ~ 57.9 TWh/y
  ~ 7 GW installing capacity
  ~ 3.6 Billion Euro of value.

Read *Note 1* for explanations about estimates

Actions to be taken:

- Agro-residues (and particularly APPR) are a relevant renewable energy source, but still not used or largely under-used. Further efforts should be made in promoting bioenergy value chains, disseminate the knowledge about the best available technologies, contribute to increase the level of information on biomass valorisation opportunities.
- Farmers generally regard pruning as a waste, not a resource; this considered, their main concern is simply to get rid of them as quickly and as cheaply as possible. A stronger awareness about the value of APPR biomass should start, first, from the farmer category, and then be spread at every level in society.
- The renewable energy obtained by mobilizing APPR biomass in EU is potentially remarkable and should be sustainably tapped. The first commercial outlet for APPR would be heat production at local scale (drying facilities, household heating, food processing at farm or cooperative level, etc.). Standardized fuel production (like chips and pellets) to be supplied to local markets is another option. The second commercial outlet could be the supply of CHP systems (combined heat and power). In this latter case, logistics of supply would play a crucial role and only a well organised agro-business could be effective and competitive.
- APPR are considered to be of low quality and uncompetitive if compared with wood obtained from forestry. Chips and pellets from APPR should be matched with solid biofuels of similar quality, such as olive pomace, olive stones, different kind of nuts and husks, marc, lees, etc. According with the type of energy plants (stoves, boilers, larger thermal appliances, etc.), different kind of solid biofuels can be supplied and a wide range of possible uses can be supposed.
- End-users can be informed and encouraged in diverting from their conventional fuel in favour of APPR biomass if they find the right convenience and the proper quality, perfectly matching the standard they need.
- The labour intensity of APPR collection, together with logistic costs, are the major problems in biomass mobilisation, while production per hectare is often low and still somehow uncertain. The costs associated with pruning harvesting, transport and storage may be considered too high to allow a profitable business. Innovative business models that share the costs amongst several collection sites together with the creation of logistically improved biomass platform should be implemented in those areas were APPR availability is quite large (*Note 2*).

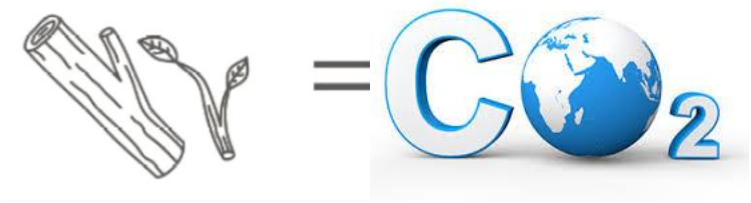
4th Message:

Renewable energy value chains based on solid biomass are climate friendly energy solutions and can effectively save large GHG emissions

Potential drivers	Connected to Mission 6	Possible risks or barriers
Maximising the efficient use of APPR biomass in order to deliver robust and verifiable GHG emission savings, effectively replacing fossils	**Energy from APPR contributes significantly to the "decarbonisation" of the energy system**	Ensuring long-term climate benefits will require the application of well-defined sustainability criteria on biomass supply (such as the ones reported in the RED II) avoiding any kind of possible environmental pressure on natural resources

Facts & Figures

How much GHG emissions are potentially saved?



- ✓ Energy value chains based on pruning reach a 90 % at least of GHG savings as compared with fossils (through *Life Cycle Assessment*)
- ✓ 23.9 TWh of electricity are theoretically able to substitute approximately 8.4 Mt of CO_2 equivalent

How much CO2 is theoretically sequestered?

This overall amount of CO_2 emission saved approximately corresponds to the annual growth in wood of 560 kha of a new-forested area.

Read *Note 2* for explanations about estimates

Actions to be taken:

- ➢ The carbon footprint of agro-pruning energy value chains is very low as compared to other renewable energy sources and GHG savings are very high as compared to fossils; for this reason energy projects based on APPR biomass should be prioritized and promoted through an intelligent and flexible financial support (see “policy recommendation”).
- ➢ Clear evidence of the environmental benefits should be given considering each single bioenergy projects. Specific and well-based estimates about the fates of carbon equivalent emissions and savings should be presented along the project permitting procedure; alternatively, baseline or default values agreed upon at EU and national level should be assumed as reference. The LCA approach and calculation procedures should be definitely applied (according to the EU RED II).

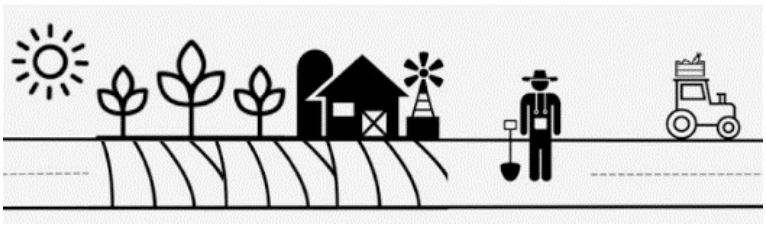
5th Message:

APPR kind of biomass represents a side-stream feedstock and a supplementary energy source to be used sustainably, but also plentifully and successfully

Potential drivers	Connected to Mission 7, 8, 10	Possible risks or barriers
APPR biomass should be considered an "advanced" energy carrier (according to the RED II definition) because it reaches very high GHG emission savings and, therefore, it performs according to very good levels of sustainability	**APPR biomass can be conveniently used as a renewable energy carrier without claiming additional resources** **Energy from APPR lessens the energy dependence of the agricultural sector** **APPR supply enhances the farm productive diversification, also favouring income integration**	Pruning utilization for energy purposes should imply a comprehensive rearrangement in the management of the fruit plantation and a enhancement in the technical and logistic farm organization. This could represent a strong challenge.

Rethinking the conventional agricultural practices

APPR energy valorisation is a reliable and profitable alternative to the conventional management of pruning residues.
Free pruning burning in open-air conditions, directly on the field should be banned definitely or, at least, drastically limited.



- ✓ Drive a change towards more sustainable agricultural practices: soil amendment with manuring and compost, green soil cover and cover cropping, no- or minimum-soil tillage.
- ✓ Reduce farmers' costs avoiding traditional operations.
- ✓ Reduce the risks of pest and diseases propagation.

Actions to be taken:

- ➢ According to the RED II and specifically considering its residual character, the APPR biomass should be considered the proper feedstock to obtain "advanced" biofuels. Therefore, zero life-cycle greenhouse gas emissions is assigned to APPR up to the process of collection. This point fully justifies the priority to address pruning to energy conversion (as compared to other possible and alternative uses) and the consequent policy actions focused on promoting and sustaining the bioenergy value chains based on APPR (see "policy recommendation").
- ➢ Farmers should be gradually introduced in applying "conservation agriculture" as an innovative farming system, not only to save energy and money, but most of all to protect the soil carbon content (organic matter) and properly allowed the pruning removal from the field, avoiding a decline in soil fertility, thus safely addressing APPR to energy conversion.
- ➢ Pruning shredding followed by mulching or subsoiling shall be considered a good agronomic practice, but unfortunately it offer some risks of pest and disease propagation and, unless certainly healthy, pruning should be better removed from the field. Information should be given to farmers about these

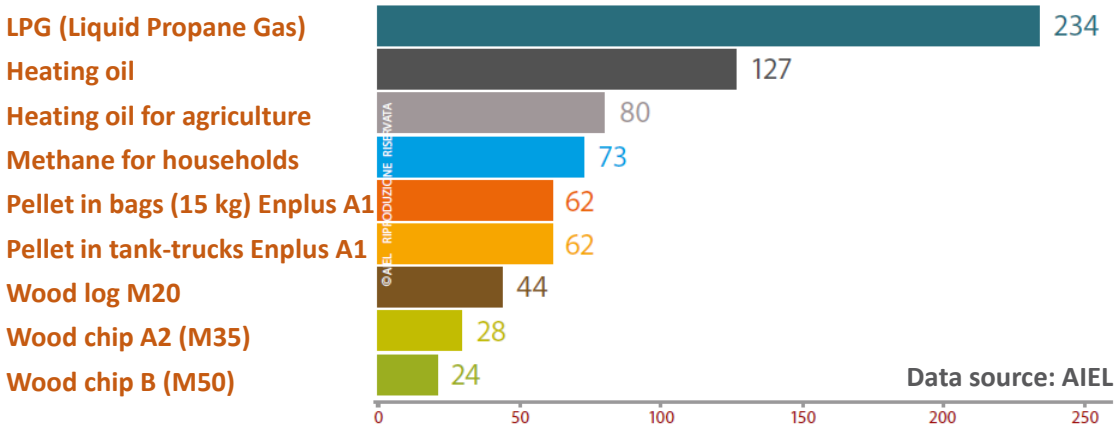
possible risks and how they can be detected and managed.

- The free burning of pruning in open-air conditions, directly on the field or at the field margin, is, unfortunately, still usual and frequently applied by farmers. This improper operation should be avoided, finally forbidden, possibly without exceptions or derogations at national or regional level. It is currently well known that this is a very hazardous operation, it generates polluting emissions, reduces soil carbon, also worsening soil quality. Farmers should be informed and be aware about the alternatives to be applied. Pruning removal for energy conversion is one of them. Probably the best option.

6th Message:
Solid biomass from APPR is an affordable renewable energy carrier

Potential drivers	Connected to Mission 8, 10	Possible risks or barriers
APPR biomass is a low value feedstock but offers potential cost saving to farmers and an alternative management of crop residues producing additional income	Energy from APPR lessens the energy dependence of the agricultural sector APPR supply enhances the farm productive diversification, also favouring income integration	The profit margins foreseen for all the players along the supply chain can be small considering the limited unit value of the feedstock. This requires an excellent logistic organization and, possibly, a larger economy of scale

Facts & Figures



Comparison of primary energy costs (Euro/MWh) produced by fossil fuels and solid biomass energy carriers in Italy in 2017

Actions to be taken:

- Considering that wood biomass is one of the most affordable energy carrier to be applied in heating appliances, household boilers, district heating systems, etc. its general use should be promoted,

smoothed, expedite, increased and sustained through a well-tuned market policy.

- At the same time, the former policies should be accompanied by a regulation about biomass/APPR quality standards, traceability rules, strict criteria of biomass sustainable extraction and mobilisation.
- Reducing logistic costs, enlarging the mobilized biomass, organizing treatments and storage platforms, collecting different types of residues in order to avoid strong seasonality of supply; these are some of the measures that, altogether, can produce a reduction in logistic costs.
- Agro-residues, considered as renewable energy carriers, generally have lower quality than solid biomass from forestry, but they can be cost competitive and adaptable to energy plants or appliances after simple technical adjustments.
- The purchase of new, updated and technological advanced energy plants or boilers (properly designed considering APPR feedstock) should be assisted and promoted, while the turnover of old and inadequate boilers (still emitting large pollutants in the air) should be accelerated through subsides to substitution.
- Criteria of "circular economy" and "bioeconomy" should be applied to biomass use. This will ensure that the maximum value is extracted from the biomass resource, and that environmental costs are not externalised. This will support not only the sustainable use of existing biomass resources, but also encourage the use of lower-value and lower-quality biomass, such as pruning for energy (*Note 2*).

7th Message:

Renewable energy value chains based on APPR value chains define a virtuous social-economic model that can be properly applied in promoting rural development at local scale

Potential drivers	Connected to Mission 9, 2, 3, 4, 5	Possible risks or barriers
Bioenergy from APPR can effectively sustain rural development through new forms of agro-industrial integration, in parallel (and not in competition) to food processing industries. 	APPR valorisation represents a "flywheel" for rural development Bioenergy is triggering new forms of agro-industrial integration Bioenergy is a bioregional, land-tailored process Bioenergy primes a self-sustained local development Bioenergy value chains participate in an open and multifunctional model	Each actor operating within the bioenergy value chain should find a benefit in implementing the investment project. Usually, there is the risk that farmer's benefit is not considered as a priority, while large part of the added value associated to energy sale is shifted to the energy company. 

Linking APPR bioenergy with rural development

Bioenergy value chains are connected and included within the territorial milieu, offering new opportunities and services, in a complementary relationship with pre-existing agricultural activities.

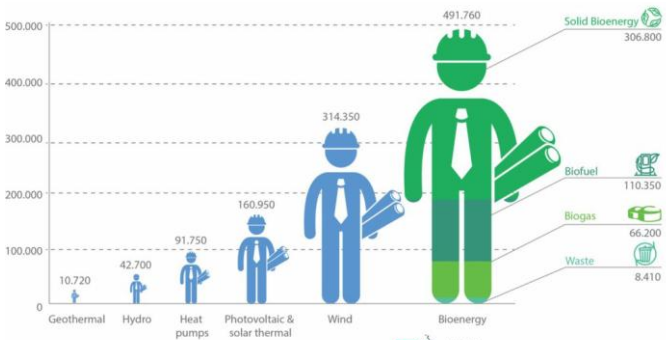
(Source: read *Note 3* for reference)

- ✓ A large variety of bioenergy value chains and business models are available, each according to specific territorial characteristics and socio-economic traits.
- ✓ APPR are generally not suitable for long-distance transportation, unless conveniently pre-treated and densified. Therefore, most APPR value chains are local and biomass is sourced over short or medium distances (5 to 30 km). These conditions are favoring local development, small-scale business, and local markets, particularly connected to rural districts.
- ✓ The concept of "distributed" energy model should be coupled to the concept of "distributed" margins of income all along the bioenergy value chain. It means that a fraction of the higher payment price the energy producer receives from subsidized energy sale (a higher cost payed by the collectivity) should be transferred to the APPR providers (i.e. farmers) all along the value-chain in the upstream direction. More generally, every operator in the value chain should find its proper economic advantage to contribute in the biomass supply and conversion.
- ✓ APPR are widely dispersed across multiple collection sites, therefore logistics and transportation play a relevant role in defining the biomass supply costs and the overall profitability of the business. Some forms of increased scale economy could be required and farmers' association to get a significant higher amount of biomass to be delivered is probably needed.
- ✓ The energy valorization of APPR produces positive social and economic impacts. Bioenergy creates jobs in the region, more than coal, methane, and also other renewables, for which the largest share of value remains in the hand of the final producer company.

Manual pruning and preparation of branches	Integrated collection with shredding	Download on truck at field side	Storage in a roofed facility	Transport to final users	On-site storage and energy conversion

Facts & Figures

EU-28 employment unit distribution in the renewable by sector in 2014. Direct and indirect jobs were considered



Source: Eurobserv'ER. Elaboration: AEBIOM (Statistical report, 2016)

Actions to be taken:

- Promote new forms of agro-industrial integration and lessens the energy dependence of the agricultural sector.
- According to a multifunctional strategy, bioenergy enhances the farm productive diversification and favours income integration. This can be considered a relevant objective of the CAP to be kept as a fundamental target.
- Farmers' associations, farmers' co-operative should be promoted as the most suitable organizations for overcoming scale and investment barriers. CAP Rural Development funding should assist co-ownership of harvesting machineries, storage and logistics platforms.
- Where a region does not have suitable end-users, collective end-use of prunings should be encouraged through community facilities (such as district heating), operating at medium- to large-scale applications (*Note 2*).
- Agro-residues promote rural development. Bioenergy initiatives and projects, based on APPR, are inevitably rooted at local scale, are community oriented, self-reliant, self-sustaining models of development. This development strategy should be fostered by the CAP Rural Development and by other funding schemes.

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