

S2Biom Project Grant Agreement n°608622

D6.3

**Policy options to mobilize sustainable non-food
biomass resources for the biobased economy**

Version 2

December 2016



About the S2Biom project

The S2Biom project - Delivery of sustainable supply of non-food biomass to support a “resource-efficient” bioeconomy in Europe - supports the sustainable delivery of non-food biomass feedstock at local, regional and pan European level through developing strategies, and roadmaps that will be informed by a “computerized and easy to use” toolset (and respective databases) with updated harmonized datasets at local, regional, national and pan European level for EU28, Western Balkans, Moldova, Turkey and Ukraine. Further information about the project and the partners involved are available under www.s2biom.eu.

This project has received funding from the European Union’s Seventh Programme for research, technological development and demonstration (FP7).

Project coordinator



Scientific coordinator



Project partners



About this document

This report corresponds to deliverable 6.3 ‘*Report on policy options, with a discussion of pros, cons, points of attention and guidelines*’ of S2Biom. It has been prepared by VITO:

Due date of deliverable:	D28
Actual submission date:	D39
Start date of project:	2013-01-09
Duration:	39 months

Work package	WP6 – Regulatory and financial framework to mobilize non-food biomass to biobased products and bioenergy markets
Task	Task 6.3 – Policy guidelines and good practices
Lead contractor for this deliverable	VITO
Editor	
Authors	L. Pelkmans, M. Van Dael (VITO), C. Panoutsou (Imperial College), E. Alakangas (VTT)
Quality reviewer	

Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services):	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Version	Date	Author(s)	Reason for modification	Status
0.1	26/10/2016	L. Pelkmans	First draft for input core partners in the task (Imperial, VTT)	Draft
1.0	25/11/2016	L. Pelkmans et al.	Version distributed for feedback from the other partners	Draft
2.0	23/12/2016	L. Pelkmans et al.	Integration of feedback	Final

This project has received funding from the European Union’s Seventh Programme for research, technological development and demonstration under grant agreement No 608622.

The sole responsibility of this publication lies with the authors. The European Union is not responsible for any use that may be made of the information contained therein.

Table of contents

1. Introduction	4
2. Supply chains and policy landscapes	4
2.1 Supply chain.....	4
2.2 Policy landscapes	5
2.3 Examples and categorization of measures and instruments	7
3. Long term strategies	10
3.1 Consistent policy framework & long term vision	10
3.2 Sustainable biomass production systems	10
3.3 Support sustainable mobilisation of biomass	11
3.4 Biomass quality and commodities	11
3.5 Value chain assessment & resource efficiency	11
3.6 Consistent focus to reduce the consumption of fossil fuels	12
3.7 Inform the public debate	12
3.8 Project financing & investment models.....	13
4. Policy options	14
4.1 Biomass supply and logistics	14
4.1.1 Primary forest biomass.....	14
4.1.2 Agricultural biomass.....	18
4.1.3 Industry by-products and residues.....	21
4.1.4 Post-consumer waste.....	22
4.1.5 Logistics.....	24
4.2 Conversion and distribution.....	25
4.2.1 Electricity and heat.....	25
4.2.2 Biofuels for transport	30
4.2.3 Biobased products	32
4.3 End use markets	34
4.3.1 Biomass heat	34
4.3.2 Biofuels	35
4.3.3 Biobased products	36
5. Conclusions and main recommendations	38
References	39

1. Introduction

This report is the result of Task 6.3 ‘Policy guidelines and good practices’ of the S2Biom project. Objective of this task is to develop policy guidelines and exemplary policy options that will allow policy makers from the respective levels to quickly appreciate potential support frameworks that exist and efficient ways to apply them to mobilize sustainable biomass resources for different market sectors of the biobased economy.

In order to achieve a competitive bioeconomy, complementary approaches, such as providing sustainable biomass at a competitive price, creating and maintaining markets for environmentally sustainable products, funding basic and applied research, and investing in multi-purpose infrastructure and education will be necessary. In addition, these will need to be combined with shorter term policies such as fostering public dialogue and increasing support for the adoption and use of internationally accepted standards for sustainability and life cycle analysis together with a range of other incentives designed to reward environmentally sustainable technologies.

2. Supply chains and policy landscapes

2.1 Supply chain

There are different stages in the biomass value chains.

For biomass sourcing (**supply**) we will make distinction between biomass production/growth (and harvesting) and waste/residues. On the one hand, biomass production/growth includes harvested biomass, relying on growth levels, related to agriculture, forestry, and possibly also biomass from nature/landscape management. On the other hand there are waste and residue streams, either from harvesting practices (e.g. agriculture, forestry, landscape), conversion processes (e.g. industry), or from end use (e.g. material end-of-life).

The **logistics** stage contains the process to store the biomass and transport/ship the biomass to the conversion site, including intermediate products (after pretreatment).

The **conversion** step contains the conversion of the biomass input to products and/or energy carriers (electricity, heat, fuels) or intermediates (pellets, torrefied or steam exploded biomass, pyrolysis oil ...) which can be further transported to the final conversion. Specific for biomass is that in this stage by-products can be produced (soil improvers such as digestate, compost, bio-fertilisers), which feed back into the biomass production level and therefore close the nutrient cycle.

Distribution is the transport of the product or energy carrier to the end user. This can be through various grids (e.g. electricity, gas, and district heating), specific logistics (e.g. harbour infrastructure, storage facilities, truck/train transport and pipelines), and fuel stations.

The **end use** (i.e. final market) stage contains the use of fuels in the transport system, the consumption of electricity and heat, and the use of materials (wood/paper products, chemicals, plastics, fertilizers ...). The latter one also includes end-of-life of these materials (e.g. recycling, waste).

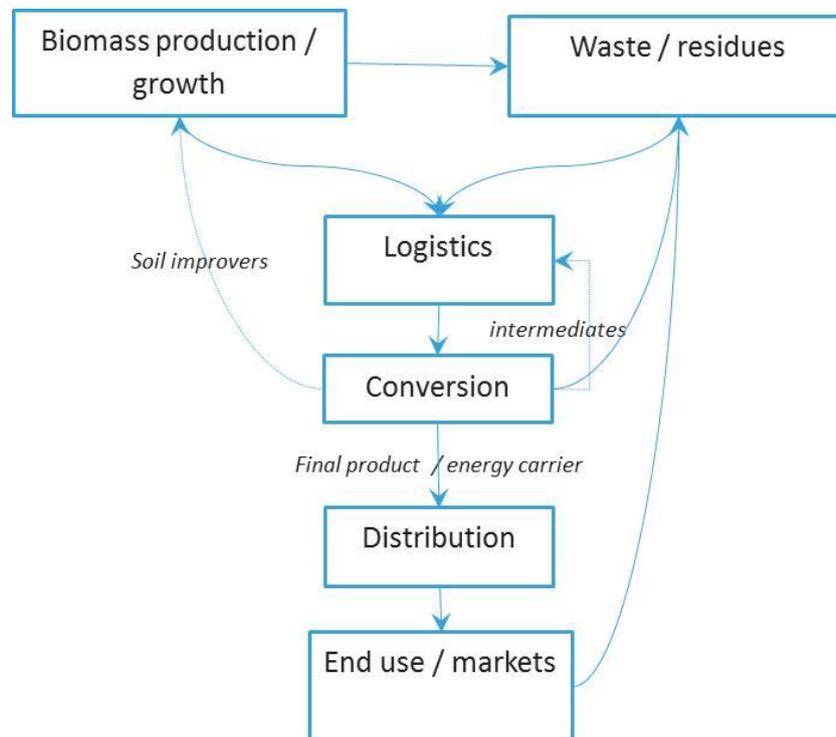


Figure 1: Schematic overview of biomass value chains (Pelkmans, Van Dael, 2014).

2.2 Policy landscapes

Policy measures and instruments can be related to the steps of the value chain which they impact. Figure 2 shows a structured overview of (mostly European) examples of policy instruments and how they relate to different parts of the value chain.

For every country, a similar country-specific policy landscape can be developed, and they can also be specified for specific biomass types. Examples can be found on the Biomass Policies website¹.

¹ http://www.biomasspolicies.eu/?page_id=414 – Workpackage 3 – National Policy Landscapes

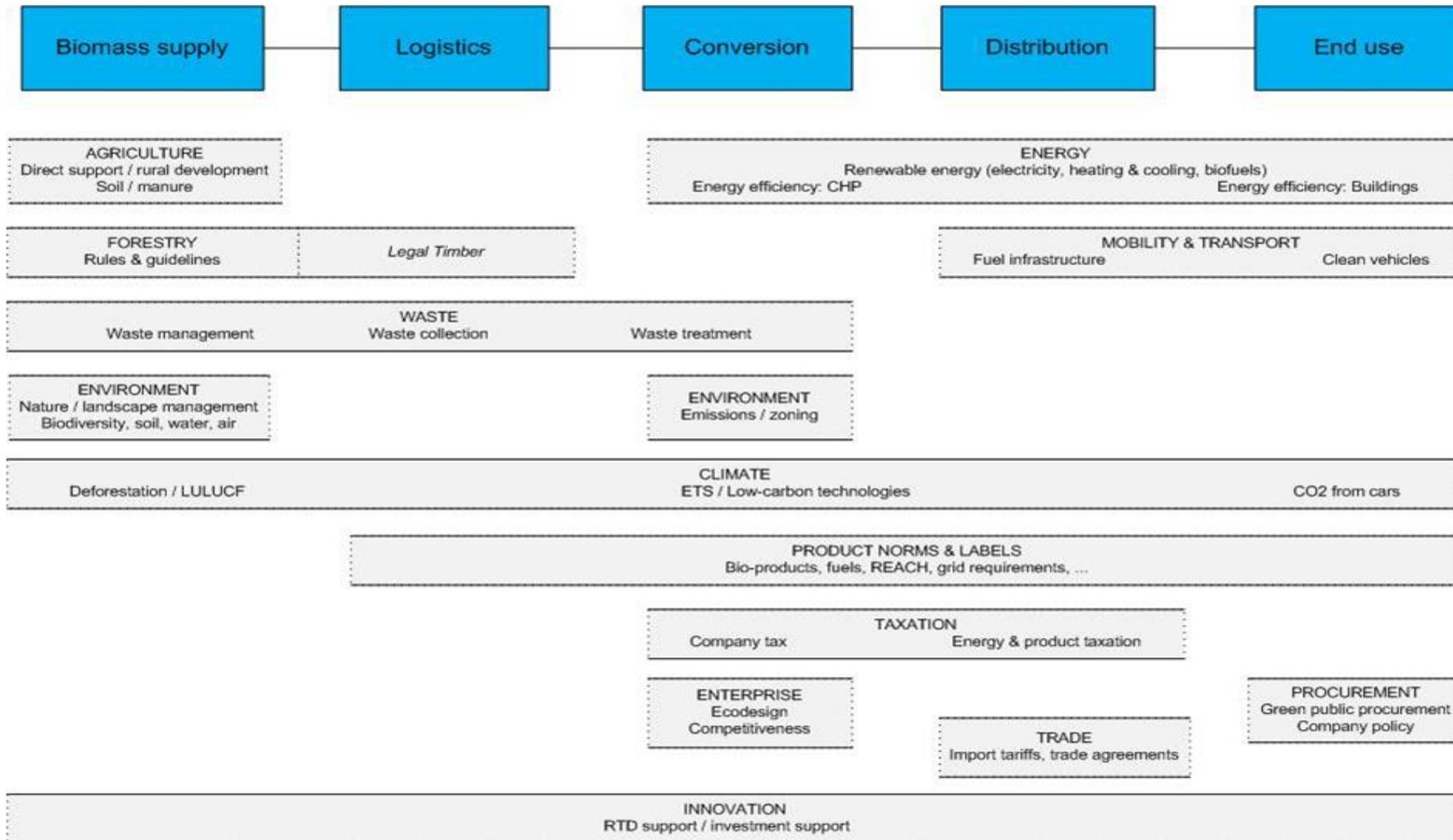


Figure 2: Examples of (European) policy fields and instruments (derived from Biomass Policies)

2.3 Examples and categorization of measures and instruments

Three types of policy measures can be distinguished: regulatory, financial and soft measures. These categories are also used in the S2Biom policy database (<https://s2biom.vito.be/>). Some further categorization can be seen in the following table.

Table 1: classification of policy measures

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Quotas / mandates	Investment grants / subsidies	Guidelines / Best practices / Lessons learnt
Product standards	Loans / loan guarantees	Voluntary standards / labelling
Targets & qualifying criteria for incentives	Tradable certificates	Promotion
Green procurement rules	Feed in tariffs/ Feed in premium	Capacity building / education / platforms
Permitting / zoning	Tax incentives	Awareness raising
	User charges	Action plans / strategies
	Research funds	

Source: Panoutsou, 2016

The following table provides (non-comprehensive) examples of types of policy measures and instruments over the different parts of the supply chains.

Table 2: examples of policy measures/instruments in different parts of the supply chains

Biomass supply – forestry

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Forest regulation: sustainable forestry rules	Support of sustainable forestry management	Forest harvesting guidelines
Ecological zoning & restrictions (in relation to EU Natura2000 & Habitat Directive)	Support of smallholders grouping	Voluntary standards (FSC, PEFC)

Biomass supply – agriculture

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Requirements of good agricultural practice (in relation to EU-CAP) as precondition for financial support	Direct payments (EU-CAP)	Product labels at farm level (e.g. organic farming)
Ecological focus areas & zoning: possibilities / restrictions to grow crops (in relation to EU Natura2000 &	Rural development support, e.g. for on-farm bioenergy, or energy crop premium (in	Capacity building on good agricultural practices and specific farming techniques

Habitat Directive) Restrictions of soil improvers on agricultural land (fertilizers, manure, compost, digestate, sludge (in relation to EU Nitrates Directive) Obligation to treat excess manure	relation to EU-CAP); R&D support for crop development	
--	--	--

Biomass supply – landscape biomass

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Ecological zoning & restrictions (in relation to EU Natura2000 & Habitat Directive) Rules for management of road sides and nature areas (e.g. by local communities)	Support for establishment of forest roads	

Biomass supply – waste & residues

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Waste regulations in terms of waste management, waste separation, classification, landfill restrictions, recycling rules, end-of-waste criteria, waste hierarchy.	Waste fees, return fees e.g. bottles	Guidelines for avoiding waste, waste recycling, reuse (e.g. plastic bottles)

Logistics

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Phytosanitary requirements	Support of infrastructure development especially forest roads	Setting up collection systems (separated streams)

Conversion (distinction between electricity, heat only, CHP, green gas, transport biofuels and bio-materials)

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Renewable energy mandates CHP mandates Emission legislation Requirement of Best Available Technologies (BAT) Zoning rules (industry park, ...)	Subsidies / loans for conversion installations Producer tax incentives Taxes for fossil fuels in energy production Tradable certificates for biofuel/bioenergy producers	
Product norms & fuel standards	Emission Trading Scheme	Guidelines how to use standards
Requirements/restrictions for the use of co-products & residues (e.g. for compost/digestate)	R&D support for process development, demo and scale-up installations	

Distribution

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Substitution mandates (quota) for fuel & energy distributors	Feed-in tariffs / feed-in premiums	Labelling / certificates of origin
Grid connection requirements (electricity, natural gas grid, district heating)	Support for grid development (e.g. district heating)	
Obligations to develop alternative fuel infrastructure	Subsidies to develop alternative fuel infrastructure Trade import tariffs	

End use / markets

<i>Regulations (imposed by Law)</i>	<i>Financial support</i>	<i>Soft measures</i>
Obligations for renewable energy in buildings (relation to EU EPBD)	Promotion of clean and energy efficient vehicles	Green procurement (private)
Green public procurement	Taxation - tax differential for energy products according to renewable and/or CO2 advantage User incentives (tax incentives biofuel vehicles, free parking, exemption of congestion charge / road tax, ...)	

3. Long term strategies

In the project BioTrade2020+² various stakeholder consultations have been organized to discuss long term strategies in relation to European bioenergy markets (with a focus on trade). Some of the recommendations are also relevant for further developing the biobased economy in Europe. The following presents an overview.

3.1 Consistent policy framework & long term vision

A positive investment climate is crucial for further developments and growth of the biobased economy. This implies long term perspectives and a consistent policy framework. Uncertainties and stop & go policies are detrimental for investments. This does not mean that nothing can be changed. **Policy needs to be consistent, but also dynamic to be effective** (e.g. in case of price fluctuations). It is very important to have a **long term policy vision**.

Timeframe for a vision should be 20 years and more (e.g. 2050); a policy framework needs to be clear for the next 10 to 20 years, as this is also the timeframe for investments.

Biomass and developments in the biobased economy link to different policy fields (agriculture, forestry, environment, climate, energy, trade, economy ...). It is important that there is **consistency between these policy fields**.

3.2 Sustainable biomass production systems

One of the basic principles for the mobilization of biomass is that biomass production and harvests (in forests, agriculture or in nature management) should fit in the frame of long-term sustainability. **A sustainability frame is to be applied to the management of forest or agriculture overall, independent of the end use of its products**. The sustainability frame includes environmental, social and economic aspects (see GBEP sustainability indicators for bioenergy and UN Sustainable Development Goals).

Sustainability performance should be demonstrated; **transparency and controllability** of the value chain are key. Sustainability requirements are important and necessary to get acceptance from society ('social license to operate'), but it should also be kept in mind that such requirements need to be workable in practice. If overly strict measures are taken, this creates additional barriers. People should realize there is also a '*cost of doing nothing*'.

² http://www.biotrade2020plus.eu/images/publications/BioTrade2020plus_Deliverable_5.4.pdf

3.3 Support sustainable mobilisation of biomass

Mobilisation of biomass is the key for further deployment of the biobased economy. Various assessments have shown that there is ample biomass potential in different fields (forestry, agriculture, waste), but the mobilization of these potentials is not straightforward. Biomass is typically a disperse resource (opposed to fossil fuels), sometimes at remote and difficult to reach locations. Most biomass potential is in low-quality material; for higher quality material there is more demand, often also in other markets, which creates a risk for competition. Logistic systems for these low-quality materials have not been optimized. Dedicated support, training and assistance in sustainable mobilization of biomass will be crucial.

3.4 Biomass quality and commodities

Variability of biomass quality is an issue, particularly for residues or herbaceous material. Most biomass potential is in low-quality material.

A major step to mobilize lignocellulosic materials is to turn them into real commodities. **Technical standards** would be needed and preferably agreed at international level (ISO), including trade codes (CN codes) to monitor trade. For wood based materials such standards already exist, although they can still not be considered as real commodities. Low quality material would need to be converted to an intermediate product, e.g. pyrolysis oil or pellets (potentially torrefied or steam explosion treated material). **Commodities** are fully tradable and compatible with storage facilities, shipping and conversion processes. This facilitates contracting, opens markets and provides easier access to finance. Governments can stimulate this process.

3.5 Value chain assessment & resource efficiency

When assessing the performance of biomass value chains, the full chain (from production of biomass, over logistics, conversion, up to the end use) needs to be taken into account.

In terms of **greenhouse gas emissions**, a minimum GHG saving performance compared to fossil fuels is included in the sustainability criteria for biofuels, and this will probably be extended to the application of solid and gaseous biomass for electricity and heat.

Overall **energy efficiency** over the full value chain is another parameter which fits in the concept of resource efficiency. Improved energy efficiency means that more can be done with the same amount of biomass. Energy use over the value chain can be a basis for calculating greenhouse gas emissions; however, currently the combustion of biomass over the value chain is not included as it is considered carbon neutral. So a dedicated monitoring of energy use over the full value chain is needed.

Of course the energy discussion also fits in the principle of the ‘trias energetica’, which defines the following priorities of energy policies:

- (1) reduce energy demand,
- (2) improve efficiencies,
- (3) replace the remaining energy demand by renewable resources.

It should not be the aim to substitute fossil energy with bioenergy one on one; the first step is always to increase efficiency and reduce demand. Energy policy per se goes beyond the scope of this study.

In the discussion about resource efficiency, also cascading use of biomass is often mentioned. Cascading defines a certain priority of use (materials, energy) of biomass, depending on its quality. In a biorefinery approach synergies between energy and (new) material markets can be explored. The question is how and if policy should interfere and impose a priority list in terms of cascading use, or that this should be left to markets. A more thorough analysis of resource efficiency was done in the sister project Biomass Policies (Pelkmans et al., 2014; Panoutsou et al., 2016).

3.6 Consistent focus to reduce the consumption of fossil fuels

A serious and urgent reduction of fossil fuels is needed in the frame of climate change mitigation. Current markets and systems are designed for fossil fuels, these are still the standard. So the alternative of acting is always ‘*to do nothing and continue to use fossil fuels*’. The use of biomass has different sides and conditions to it (carbon storage, land use, biodiversity, water, emissions ...), and this complexity is frequently used as an excuse for not acting.

Fossil fuels are by definition unsustainable and currently they don’t have to demonstrate their sustainability performance, e.g. in terms of GHG emissions, land use ... This creates an unlevel playing field with the alternatives on biomass which have to put efforts in chain of custody reporting and certification.

There may be ways to deal with the phasing out of fossil fuels, e.g. through the introduction of a carbon tax, potentially in combination with ETS/carbon pricing, specific phasing out policies for fossil fuels, or potential sustainability requirements for fossil fuels. This issue requires dedicated analysis and study work, which goes beyond the scope of this study.

3.7 Inform the public debate

Overall the public image of biofuels and bioenergy has worsened in the past years, which also extends to other applications of biomass. The fact that the public, media and policy makers are not very well informed about possibilities and opportunities of

biomass, bioenergy and the biobased economy are considered some of the most important barriers of further deployment.

Independent answers should be given to some of the concerns to provide clarity for policy makers and the public and also demonstrate opportunities. Assessments should preferably be based on monitoring; one should be careful with model results, or anecdotal information.

A typical debate at the moment is about carbon accounting principles. There are diverging opinions, slogans and methodologies and clarity also needs to be provided in this debate. The comparison with fossil value chains and other counterfactuals always needs to be highlighted. It is also important to relate biomass and land use for energy to other applications, e.g. food, feed and materials.

Carbon accounting may not be the first concern of the public, which may focus more on local effects, e.g. number of trucks passing by, emission impacts, deforestation, land ownership ...

3.8 Project financing & investment models

Risk perception is high in the biobased economy and **access to finance** is an issue. Governments can use tools to reduce financing risks, e.g. through providing guarantees, low-interest loans.

Government support can also be about developing knowledge (through research projects) and spreading knowledge through the support of demonstrators and cooperation platforms. This also helps reduce risk perception, which improves the investment climate.

4. Policy options

This chapter will identify a number of relevant policy options to mobilize biomass resources for the biobased economy. Options will be split up according to the part of the supply chain that is addressed.

4.1 Biomass supply and logistics



4.1.1 Primary forest biomass

Background

In the European Union the formulation of forest policies is the competence of the Member States, with a long history of national and regional laws and regulations based on long term planning. The European Commission has published EU Forestry Strategy documents in 1998 and 2013 to provide guidance to Member States. Several EU policies do concern forests (environmental, agricultural, energy policies, climate policies, etc.) but decisions regarding sustainable forest management practices belong to Member States. Co-financing of forestry measures under the Rural Development Regulation has been and will remain an important means of EU-level funding.



The new EU Forest Strategy (2013) mentions the following guiding principles:

- Sustainable forest management and the multifunctional role of forests, delivering multiple goods and services in a balanced way and ensuring forest protection;
- Resource efficiency, optimizing the contribution of forests and the forest sector to rural development, growth and job creation;
- Global forest responsibility, promoting sustainable production and consumption of forest products.

The main objectives formulated in the EU Forest Strategy are to ensure and demonstrate that all forests in the EU are managed according to sustainable forest management principles and that the EU's contribution to promoting sustainable forest management and reducing deforestation at global level is strengthened, thus

contributing to balancing various forest functions, meeting demands, and delivering vital ecosystem services; and providing a basis for forestry and the whole forest-based value chain to be competitive and viable contributors to the bio-based economy.

Mobilizing wood supply from forests

In order to increase wood supply on short and long term from European forests the following measures can be implemented (based on Khawaja, Janssen, 2014):

- Increase the harvesting of logging and forest residues (integrated to the current harvesting of stemwood for the wood processing or pulp & paper industry);
- Increase the productivity of standing forest area which will increase the harvest level of the forest that is productively used. This can be done by taking silvicultural measures such as site preparation, fertilisation, weed control, protection measures, species and provenance selection, spacing, thinning intensity and better managing production time.
- Increase the harvest area by starting to harvest (part of) the annual increment from unexploited forests. This may imply motivating forest owners to start (sustainably) managing parts of their forest that were previously unused.

However, all these measures might have constraints with respect to the sustainability of future forest biomass supply. Constraints can be technical (e.g. losses from harvesting and logging techniques, road infrastructure and logistics), social (e.g. forest owners' low willingness or interest to manage forests), economic (e.g. increase of wood price) and environmental (e.g. biodiversity, nutrient losses). Sustainable forest management is key in this respect.

Policy options

Key in the mobilization of biomass from forests is to consider the **multi-functionality** in forests and stimulate further deployment of **sustainable forest management** (rules, guidelines, certification), also extending it to currently unmanaged forests. The following focus points can be mentioned:

1. Increase the share of forests managed through SFM (sustainable forest management) principles
2. Afforestation/reforestation
3. Improve access to forests through infrastructure deployment
4. Restrictions can be placed on the types of forest biomass which are entitled for renewable energy support

Apart from the specific Forest Acts which are implemented in most countries, the following specific items can be supported (in some countries these are implemented through provisions in their Forest Act):

Regulatory measures:

- Adopt measures to prevent forest damage, forest fires or diseases (FI, FR, HU, PT)
- Restrictions can be placed on the types of forest biomass which are entitled for renewable energy support, to reduce the risk of competition with wood processing industries (BE, FI).

Financial measures:

- Stimulate harvesting of non-commercial thinnings in the frame of sustainable forest management and to obtain healthy and well-growing forests (FI);
- Afforestation/reforestation (BE, FR, UA, also through Rural Development Funds);
- Building roads, tracks and other infrastructure to improve access to forests and assist the extraction of timber from woodland (UK)

Soft measures:

- Establish grouping of (small) forest owners to facilitate joint management plans (BE, FI);
- Facilitate the preparation of forest management plans (BE);
- Provide guidelines and training for sustainable forest management; increased information provision measures towards private forest owners by means of capacity building and awareness campaigns at national and regional level (FI);

Discussion**1. Increased uptake of sustainable forest management principles**

Some measures focus on increasing the share of forests managed through SFM (sustainable forest management) principles. Forests which are sustainably managed are healthier and more productive compared to unmanaged forests. So there will be more carbon uptake and more biomass production (see experience in Scandinavia). It also reduces the risks for fires or diseases and provides safeguards for biodiversity, soil quality and carbon stock. Mind that SFM principles are region dependent; this is acknowledged in FSC or PEFC certification. Considering the climate, in South Europe there will be much more focus on forest fire prevention. Some regions also focus on reducing or removing invasive tree species and decrease insect and disease outbreaks. Reducing forest fires or diseases has a large impact on forest carbon storage (LULUCF).

For small players it is expensive (per ha) to receive a SFM certificate, and also difficult to get access to markets (as major market players require sufficient volumes). Grouping these players to obtain a sufficiently large area and substantial volumes provides access to markets and decreases the amount of unmanaged forests. This grouping can happen on voluntary basis, but support from government side to establish such cooperation and to prepare specific forest management plans can really make a difference.

2. Afforestation/reforestation

Regrow/replanting after harvest is a principle of sustainable forest management. In addition, a country can apply measures to specifically promote afforestation of unused/degraded lands or reforestation. This increases the amount of forest and carbon storage capacity. This option can be applied within rural development support programmes.

3. Infrastructure to improve access to forests

Providing access to forests (through infrastructure) is also an instrument to reduce transportation costs and create opportunities to mobilize forest resources, both for materials and energy.

Overall, when increasing the feedstock base this leaves open further processing options further on in the supply chain (for materials or energy), keeping a level playing field between these different applications.

4. Restrictions on biomass types

The last option deals with cascading principles (prioritization of material applications). This is applied in Belgium (Flanders), basically to protect the wood processing industry and pulp and paper industry from competition with the (subsidized) energy sector. As such, the guiding principle is valid, but the practical implementation is challenging. In fact these industries are also some of the biggest bioenergy producers, mostly based on their processing residues. Some lessons from the application of this system in Flanders:

- The paper and wood processing industry could decide which biomass was entitled to receive renewable energy support, so they were judge and party at the same time. This sometimes created a conflict of interest. Large bioenergy players were driven to international imports instead of using domestic resources (as it was difficult for them to negotiate which resources were OK). If applied, the decision power on such prioritization should remain in independent hands.
- Industry players are acting in international markets. Considering that Flanders is a very small region, resources could easily be exported to neighbour regions where these rules do not apply. So this creates market distortions. Some alignment between (neighbour) countries would be needed.
- The stress on woody resources is mostly valid in countries that have a high industrial use of these resources in relation to the domestic potential.

Finland has also adopted a similar measure in their production subsidies for renewable electricity³. For forest chips produced from wood suitable for forest industry (pulp or sawmills) and which originate from forest stands consisting of wood classified as 'large sized merchantable wood', the support level when used for bio-

³ <https://s2biom.vito.be/node/1099>

electricity is reduced by 40%. This regulation was adopted to ensure that wood suitable for forest industry will not be used as energy.

While there has been a lot of focus on how energy demand may affect current supply for materials, on the other hand, increasing biomass mobilization may also reduce potential problems in terms of competition.

Performance indicators (see Deliverable 6.2):

- Share of forests certified by a sustainable forest management scheme (FSC, PEFC);
- Biomass harvested from forests, in relation to the annual forest increment, split up in fuelwood removal and industrial wood removal.

4.1.2 Agricultural biomass

Background

EU Member States' agricultural policies are largely driven by the framework provided by the European Common Agricultural Policy (CAP).

For direct payments (Pillar 1 of the CAP), firstly there are the cross-compliance rules, representing the compulsory basic layer of environmental requirements and obligations to be met in order to receive full CAP funding. On top of this, from 2015 onwards, the CAP introduces a new policy instrument in Pillar 1, the "Green Direct Payment", accounting for 30% of the national direct payment envelope. It includes three obligatory agricultural practices: (1) maintenance of permanent grasslands, (2) ecological focus areas and (3) crop diversification.



Pillar 2 of the CAP (Rural Development) funds €100 billion from 2014 to 2020, with each EU country receiving a financial allocation. The framework provides instruments to Member States to put priorities in their rural development programmes (RDP). These RDPs set out the actions to be undertaken and the corresponding allocation of funding for these measures. Member States will have to build their RDPs based upon at least four of the six common EU priorities (each with a number of focus areas):

- (1) knowledge transfer and innovation in agriculture, forestry, and rural areas,
- (2) enhancing farm viability and competitiveness of all types of agriculture in all regions and promoting innovative farm technologies and sustainable management of forests,

- (3) promoting food chain organization, including processing and marketing of agricultural products, animal welfare and risk management in agriculture,
- (4) restoring, preserving and enhancing ecosystems related to agriculture and forestry,
- (5) promoting resource efficiency and supporting the shift towards a low carbon and climate resilient economy in agriculture, food and forestry sectors,
- (6) promoting social inclusion, poverty reduction and economic development in rural areas.

At least 30% of funding for each RDP must be dedicated to measures relevant for the environment and climate change.

Especially priorities 4 and 5 are highly relevant for MS actions towards the biobased economy. Analysis of the RDPs of EU Member States shows that 44% of the funding is allocated to priority 4 (ecosystems) and 8% to priority 5 (resource efficiency).

The focus areas for priority 4 (ecosystems) are:

1. Restoring and preserving biodiversity (including in NATURA 2000 areas and areas of High Nature Value farming) and the state of European landscapes.
2. Improving water management.
3. Improving soil management.

Focus areas for priority 5 (resource efficiency) are:

1. Increasing efficiency in water use by agriculture.
2. Increasing efficiency in energy use in agriculture and food processing.
3. Facilitating the supply and use of renewable sources of energy, by-products, wastes, residues and other non-food raw materials for the bio-economy.
4. Reducing nitrous oxide and methane emissions from agriculture.
5. Fostering carbon sequestration in agriculture and forestry.

Mobilizing biomass supply from agriculture

The main actions to further mobilize biomass supply from agriculture are to:

- Utilize **agricultural residues**, i.e. field residues (like straw) and on-farm residues (like manure). In terms of field residues, attention should be given to soil carbon and ecosystem services;
- Further support **agricultural productivity**, also with attention for soil carbon & ecosystem services; with increased productivity, less land will be needed to supply food and feed demand.
- Mobilise **unutilised potentials**, including marginal/abandoned lands. Some could be dedicated to non-food crops.

As mentioned before, for the EU Member States, policies related to agriculture should fit in the framework of the Common Agricultural Policy which provides several instruments, but also conditions for good agricultural practice. The obligation of keeping land in good agricultural and environmental condition refers to a range of standards related to soil protection, maintenance of soil organic matter and structure, avoiding the deterioration of habitats, and water management.

Policy options

The primary tool to mobilize biomass resources in agriculture for EU member states is in Priority 5, focus area 3 of the CAP, i.e. ‘facilitating the supply and use of renewable sources of energy, by-products, wastes, residues and other non-food raw materials for the bio-economy’. Member States can state specific activities that are entitled for financial support within this framework.

The key policy suggestions⁴ for the agricultural biomass sector are presented below:

- Design expenditure mechanisms which will support the **integration of food production with energy** both at field (field residues) and within agro-industries (processing residues). These mechanisms can be combined with respective regulations that foster sustainable farming and renewable energy in agro-industries.
- Expenditure measures should favour the development and/ or upgrade of **biomass logistics/ trade centres**, etc. in order to facilitate the development of local capacities with high quality standards which will further trade currently un-mobilised indigenous biomass sources.
- Research grants should target the development of **high yielding varieties** with tolerance in the regional climate and ecology (e.g. high temperature and low rainfall for the southern EU countries, etc.)
- Introduce modules for agricultural biomass in regular **training activities** and/ or awareness campaigns for farmers, farmer cooperatives, etc.

The following policy mechanisms are recommended to reinforce agricultural biomass mobilisation at local and regional level:

Regulations:

- Ensure CAP cross-compliance rules of good agricultural practices as a requirement for Pillar I and Pillar II payments are followed.

⁴ Policy suggestions are drawn from the Biomass Policies project work in the 11 participating Member States and from available literature for the non-participating ones.

Financial measures:

- CAP P1 Direct Payments: Ensure that budget from ‘Green Direct Payments’ includes appropriate crop diversification activities matched to local ecosystems and practices which can lead to optimised biomass mobilisation, including sustainable harvesting of residues.
- CAP, pillar 2 – Rural development: Introduce (where they are not existing) targeted national and/or regional rural development programmes focusing on the shift to a low-carbon economy (including on-farm renewable energy production).
- Specific stimulation measures can be included for non-food perennial crops.
- Provide support in the form of grant or tax exemptions for improving existing wood trade centres and including other biomass forms, such as straw bales, prunings, etc.
- Introduce new varieties with higher yields and good adaptation to local ecosystems and reinforce research programmes on selection and adaptation of varieties suitable to local ecosystems.

Soft measures:

- Capacity building to existing wood trade centres on handling agricultural residues as well.
- Capacity building for improved quality handling and storage of straw and other field agricultural residues (e.g. prunings, etc.)
- Learn from Good Practices (e.g. Danish programme on straw for energy)

Performance indicators (see Deliverable 6.2):

- Use of agricultural residues (‘other vegetal materials and residues’) for energy
- Share of agricultural land dedicated to non-food crops (including perennial crops)
- Yields per hectare

4.1.3 Industry by-products and residues

Industry residues, sometimes called ‘secondary residues’, have the advantage that they are already available at a central location, i.e. at the industry site. Most of these residues are already valorised in some way. The issue for policy is more to direct these residues to resource efficient applications (see further).

Performance indicators (see Deliverable 6.2):

- Use of wood by-products or residues (part of ‘fuelwood, wood residues and by-products’) for energy (e.g. bark)
- Use of agricultural by-products (‘other vegetal materials and residues’) for energy

4.1.4 Post-consumer waste

Background

Even though the EU has set a framework for waste management⁵ with the Waste Framework Directive (2008/98/EC), the Landfill Directive (1999/31/EC) and the Industrial Emissions Directive (2010/75/EU) there has been room for different national and local adaptations of those frameworks. EU Member States are in different stages in waste management development, as was discussed in the S2Biom Benchmarking report (D6.2). The figure below presents the share of municipal waste that is landfilled in 2013, which is indicative for the waste management development stage in the different countries.

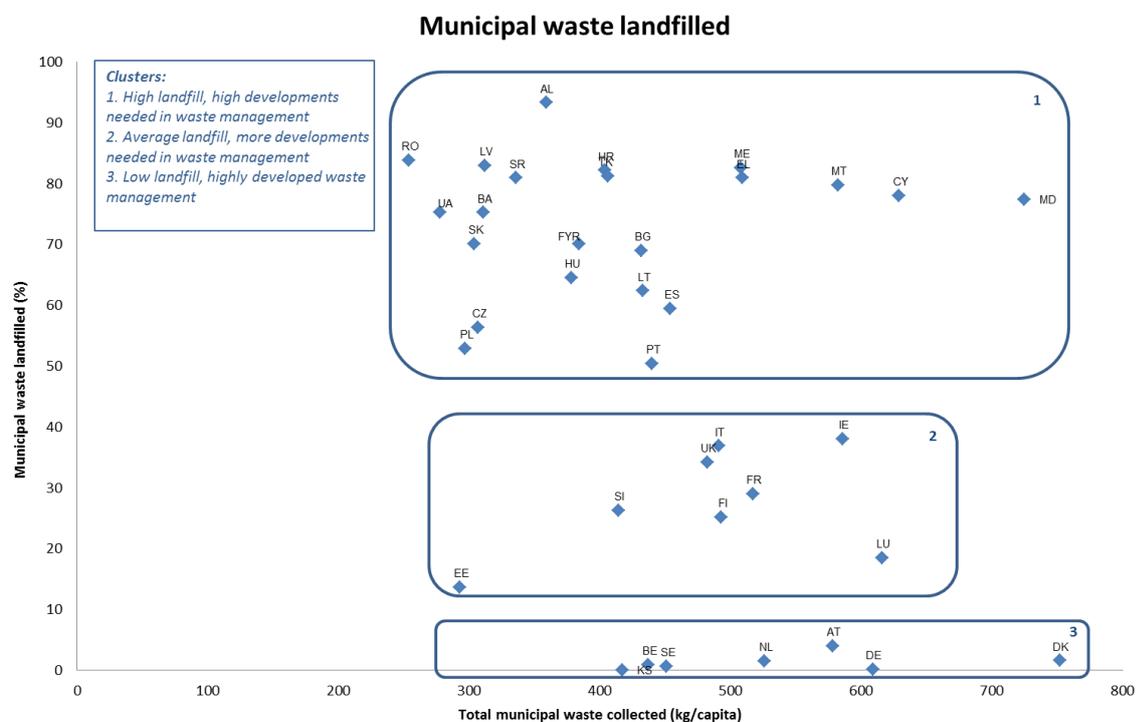


Figure 3: Country clusters – Total municipal waste and landfill (Van Dael et al, 2016)

⁵ <http://ec.europa.eu/environment/waste/legislation/index.htm>

According to the Waste Framework Directive, the following priority order (waste management hierarchy) should be applied in waste prevention and management legislation and policy:

- a. Prevention
- b. Preparing for re-use
- c. Recycling
- d. Other recovery, e.g. energy recovery
- e. Disposal

The EU Circular Economy strategy, which was adopted in December 2015, includes clear targets for reduction of waste and established a long-term path for waste management and recycling. Key elements included⁶:

- A common EU target for recycling 65% of municipal waste by 2030;
- A common EU target for recycling 75% of packaging waste by 2030;
- A binding landfill target to reduce landfill to maximum of 10% of municipal waste by 2030;
- A ban on landfilling of separately collected waste;
- Promotion of economic instruments to discourage landfilling;
- Simplified and improved definitions and harmonised calculation methods for recycling rates throughout the EU;
- Concrete measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material;
- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes (e.g. for packaging, batteries, electric and electronic equipment, vehicles).

Policy options

Given the different stages in waste management in the different countries, the priorities can also be different. Countries with high landfill shares will in first instance focus on shifting from landfill to mixed waste treatment (taking out recyclable components and combusting the remaining fraction with energy valorisation), and also capture of landfill gas. Other countries with more developed waste management systems, will focus more on separate collection of waste stream types, and further processing these into products (e.g. as input for biobased products).

The key policy suggestions for the waste sector are presented below:

Regulations

- Refine terms and conditions in the EU Waste Framework Directive and respective legislation in Member States and account for all potential uses of organic wastes;
- Set up waste treatment systems as alternative for landfill;
- Set up separate collection systems of waste streams to increase the availability of organic waste fractions (source separation);
- Introduce regulations for recycling of waste wood by the wood industry

⁶ http://ec.europa.eu/environment/circular-economy/index_en.htm

Soft measures

- Capacity building and guidelines on best practices for waste treatment;
- Measures to promote re-use and stimulate industrial symbiosis;
- Provide clear definitions of ‘end-of-waste’ criteria (i.e. when certain waste ceases to be waste and obtains a status of a product or a secondary raw material).

Performance indicators (see Deliverable 6.2):

- Municipal waste collection and treatment (share of landfill, incineration, recycling and composting/digestion)

4.1.5 Logistics

Background

Logistics play an important role in the mobilization of biomass resources. Biomass is typically a disperse resource (opposed to fossil fuels), sometimes at remote and difficult to reach locations.

Variability of biomass quality is an issue, particularly for residues or herbaceous material. Most biomass potential is in low-quality material. A major step to mobilize lignocellulosic materials is pretreatment to turn them into tradable commodities. This is particularly the case when larger scale operations are envisaged (such as biorefineries, advanced biofuels, large CHP, etc.). Technical standards would be needed and preferably agreed at international level (ISO), including trade codes to monitor trade. For wood based materials such standards already exist, although they can still not be considered as real commodities. Low quality material would need to be converted to an intermediate product, e.g. pyrolysis oil or pellets (potentially torrefied or steam explosion treated material). Commodities are fully tradable and compatible with storage facilities, shipping and conversion processes. This facilitates contracting, opens markets and provides easier access to finance.

Policy options

Regulations:

- Refine terms and conditions in the EU Waste Framework Directive and respective legislation in Member States to set up collection systems of waste streams
- Obligations for local authorities to manage and collect roadside cuttings
- Quality assurance and quality control of marketable commodities

Financial measures:

- Building roads, tracks and other infrastructure to improve access to forests (UK)
- Support for regional hubs & biomass trade and logistic centres or terminals

- Support demonstration of pretreatment technologies to commoditize low-quality material
- Support and organize decentral pretreatment to open up markets

Soft measures:

- Bring stakeholders together to stimulate industrial symbiosis (connect local supply and demand)
- Facilitate setting up quality standards for pretreated biomass, preferably at EU or international (ISO) level

4.2 Conversion and distribution



4.2.1 Electricity and heat

Background:

The European Renewable Energy Directive (2009/28/EC, RED) provides the framework for electricity and heat from biomass, with specific renewable energy targets per country. Most European countries that are not members of the EU have also adopted similar targets.

Support systems for bio-electricity and -heat are predominantly demand side measures (feed-in tariffs/premiums, mandates and green power certificates) and/or support for project financing. Mind that most support systems focus on renewable electricity. There is a lack of focus on renewable heat in the renewable energy debate, while heat represents a major share of total energy demand and the role of biomass therein is substantial.

In terms of renewable heat, the following priorities can be identified:

- Developing monitoring systems for renewable heat;
- Financing of renewable heat projects, e.g. repayment bonus, soft loans with low interest rates;
- Promote district heating with centralized heat production (through biomass);
- Promote biomass heat in (agro-)industries;
- Valorise residual heat in industrial collaborations.

In support systems for renewable electricity, more attention should be paid to CHP opportunities so residual heat can also be valorised. This can be through CHP bonus

payment or premiums above certain conversion efficiencies. There is also a lack of awareness, so capacity building is needed on CHP in industry and waste management sectors.

Specifically for the role of bio-electricity, the (future) role of bioenergy in **grid balancing** should be considered, creating synergies with intermittent renewable electricity sources.

Concerning solid and gaseous biomass for electricity and heat production, no binding **sustainability criteria** have been imposed (yet) at EU level. A few member states with high share of biomass import (UK, NL, BE) have developed their own systems. In 2016, the EC has reviewed its bioenergy sustainability policy in the frame of the renewable energy package for the post-2020 period. On 30 November 2016, the Commission published a proposal for a revised Renewable Energy Directive⁷. The Directive would strengthen the existing EU criteria for bioenergy sustainability and extend them to cover also biomass and biogas for heat and power. It would specifically include the following new requirements for the post-2020 period⁸:

- A new sustainability criterion on forest biomass used in energy, in order to mitigate the risk of overharvesting and ensure LULUCF accounting;
- A 80% GHG saving requirement for heat and power produced from biomass and biogas (applying to large scale installations with a fuel capacity equal or above 20 MW);
- A requirement that electricity from biomass is produced using highly efficient combined heat and power technology (including inter alia a grandfathering of existing installations).

Policy incentives given to high efficiency CHP plants and the use of heat through district heating systems proved to be the key success factors in countries like Finland, Sweden and Austria, so they are highly recommended to other Member States as well.

The right policy mix depends on the country-specific conditions (climate conditions) and the heat and also industrial sector (i.e. existence of infrastructures, biobased industry has often surplus of heat, which could be used in municipalities). However, combinations of investment subsidy and tax incentives are well-proven approaches, especially for countries where the markets are at their early development stages and the district heating systems are not existing or not well developed.

Strengthening knowledge transfer towards the industrial sector is important when it comes to bio-electricity (via CHP). Measures that encourage industrial sites to switch from fossil to renewable energy sourcing should be promoted and also provide their extra or waste heat to municipalities. One of the reasons why this switch is not

⁷ https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v7_1.pdf

⁸ http://europa.eu/rapid/press-release_MEMO-16-3987_en.htm

currently taking place at a large scale today is the lack of information and awareness of industrial sites, as well as the fact that carbon is not properly priced today. Therefore, targeted capacity building actions are recommended with high emphasis on CHP in agro-industry and waste management sectors.

Policy options

Regulations:

- Renewable energy mandates for heat and power distribution sectors
- Biomass sustainability criteria as a condition to receive support
- CHP mandates, with a more specific role of bio-CHP
- Emission and efficiency requirements for medium and large scale combustion installations (see Medium-scale combustion plants directive)
- Requirement of Best Available Technologies (BAT)
- Grid connection requirements
- Accounting for the provisions of State Aid regulations⁹ and ensure appropriate conditions are developed to use these biomass fractions in Member States.

Financial measures:

- Project level support & requirements:
 - Green heat support, often in the form of project financing
 - Financing support: providing guarantees, soft loans with low interest rates
- Demand side measures:
 - Feed-in tariffs/premiums
 - Renewable energy mandates in connection with green power certificates
 - CHP support systems
 - Fossil fuel taxation e.g. CO₂ taxes in heat production
- Infrastructure support:
 - Support for grid development (e.g. district heating);
 - Grid connection support (electricity, natural gas grid, district heating);

Most options can include certain restrictions or sustainability criteria.

Project support is often applied in bidding/tendering systems to limit public expenses.

Soft measures

- Labelling / certificates of origin enabling the use of grids.

⁹ COMMUNICATION FROM THE COMMISSION Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01). [http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628\(01\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628(01)&from=EN)

- Efforts to improve knowledge, especially at remote regions and local markets, need to be continued and reinforced in order to promote uptake of indigenous sources and ensure combined measures with energy efficiency, especially in industries.

Discussion

It is crucial that any renewable electricity/heat policy would also consider the energy efficiency policies and design the policy framework accordingly.

Loans, credit lines and investment subsidies are very effective for the development of new market capacity. In countries with low market development of resource (appropriate seasoning of forest biomass, etc.) and energy efficient (modern boilers, stoves) biomass heat, they function better if they are combined with information provision activities such as capacity building, awareness campaigns, etc.

Taxation in the form of tax credits for biomass or tax for the fossil fuel counterpart (e.g. heating oil, etc.) is an effective mechanism once the market is established but requires careful monitoring and periodic adjustments.

Premiums are effective only in mature markets with high awareness and provide a means for policy makers to refine both the market sub segments (e.g. residential boilers, specific scales of CHP with certain feedstocks, etc.) and the scales to be promoted.

While least cost options such as biomass co-firing can be supported in the short-term, they should be considered as transition technologies that can enhance feedstock supply and at the same time ensure target achievement. The design of such support mechanisms should take into account the sustainability concerns and at the same time give priority to indigenous feedstocks, mainly primary forest residues, straw, landscape care wood, perennial crops etc.

Feed-in premiums, with its advantage of creating a relatively stable investment climate, combined with investment support and further tax incentives, are expected to be effective in promoting bioelectricity. The MS that are lagging far behind also apply similar policy mixes. This indicates that the level of support provided in these countries is not sufficient enough to overcome the existing barriers. Policy frameworks for these countries should be tailored to the existing country-specific barriers.

Dedicated policy support to certain feedstocks, be it a feedstock bonus or a dedicated subsidy for harvesting for energy purposes, can be successful with the pre-condition that other barriers in the value chain are also sufficiently addressed (i.e. enough financial support is provided for instance for the conversion technologies, the

high efficiency in CHP is promoted etc.). This, however, needs to happen hand in hand with other policy domains to establish strong sustainable forest and agricultural management practices that are key to the success of bioenergy policy support.

Most policies concerning renewable electricity and heat target renewable energy in general and not bioenergy specifically. By introducing these broader energy policies, policymakers avoid picking winning and losing technologies, but favour more established technologies and the status quo as it is easier to crowd out new competition. If the policymakers would have the goal to promote bioenergy as a specific energy source, it would be more preferred to design more specific policies.

Having an increased number of policies also negatively affects the development of a sector as it becomes increasingly complex. Incentives expire in most cases and need to be reauthorized which makes long-term investment planning challenging. (Ebers, 2016)

Performance indicators (see Deliverable 6.2):

- Overall renewable energy consumption in electricity and heating and cooling
- Role of bioenergy in renewable energy: solid biofuels, biogas, renewable share of MSW, liquid biofuels
- Gross electricity generation through CHP
- Amount of district heating (km/capita)
- Solid biofuels:
 - o Gross inland consumption
 - o Transformation input and final energy consumption in industry, residual and other applications
 - o Transformation input solid biofuels in electricity only, CHP, heat only
 - o Role of imports and exports of solid biofuels
- Biogas:
 - o Gross inland consumption
 - o Transformation input and final energy consumption in industry, transport and services
 - o Transformation input biogas in electricity only, CHP, heat only

4.2.2 Biofuels for transport

Background:

The European Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD) provide the framework for transport biofuels for European Member States, as being part of the 10% target for renewable energy in transport and 6% reduction in GHG intensity of transport fuels. This already included sustainability criteria (in terms of GHG reduction, land use and agricultural feedstocks) for biofuels (for transport) and bioliquids (for electricity and heat). These Directives were amended by the iLUC¹⁰ Directive in September 2015. The amendments include a limit of 7% of the share of biofuels from crops grown on agricultural land that can be counted towards the 2020 renewable energy targets, an indicative 0.5% target for advanced biofuels as a reference for national targets, a requirement that biofuels produced in new installations achieve a minimum GHG saving of 60% compared to fossil fuels, and stronger incentives for the use of renewable electricity in transport. The recently proposed revised Renewable Energy Directive would increase the GHG savings requirement (after 2020) to 70%.

This project (S2Biom) focuses on lignocellulosic resources. Biofuels from lignocellulose belong to the category of **advanced biofuels** which have specific promotion mechanisms. For instance, already in the original RED, biofuels from waste, residues and lignocellulose can be counted double towards the 10% target. The iLUC directive included a specific indicative 0.5% target for advanced biofuels (excluding commercial biofuels like used cooking oil biodiesel). This directive also lists which feedstocks qualify for the status of advanced biofuels.

The aim in terms of advanced biofuels is to broaden the feedstock portfolio, make sure that potential iLUC impacts are contained, and avoid potential competition with food production.

Future policy on advanced biofuels should be in line with the long term decarbonisation plans (2050) that foresee a shift of biofuel use from light duty vehicles to heavy duty vehicles, aviation and shipping. A dedicated target should be set for advanced biofuels - this can be successful where future supply and target levels are balanced.

Policy options

In terms of biofuels, principally two policy options have been applied by countries:

(1) fuel tax exemptions/reductions and

¹⁰ indirect Land Use Change

(2) substitution mandates/distribution obligations for fuel providers (possibly with tradable certificates).

Other complementary policies and measures are¹¹:

- Support to the cultivation of agricultural feedstock production (energy crops)
- Capital investment support for biofuel production facilities
- Support or mandate of biofuel infrastructure (fuel stations for high blends)
- User incentives (e.g. for flex-fuel vehicles)
- Biofuel standards; fuel specifications

Specifically for advanced biofuels, the following options can be considered:

- Specific mandates for advanced biofuels
- Capital investment support
- Dedicated tax reductions for advanced biofuels
- Premiums for specific feedstocks
- Capacity building and recognition of practices for low-iLUC biofuels

The market seems to move away from high biofuel blend options (e.g. flex-fuel vehicles) in favour of ‘drop-in’ biofuels, which reduces the need for specific biofuel standards, dedicated fuel stations, or adapted vehicles. Electric mobility also receives a lot of attention, but the vast majority of new vehicle sales are still powered by combustion engines; so in the coming decades the majority of the vehicle fleet will still need hydrocarbon fuels.

New markets like aviation biofuels are also gaining attention. As these operate in international markets, the traditional instruments of tax reduction or mandates are more difficult to apply, so more dedicated support systems and engagements of the involved industries would be needed.

Discussion

Tax reductions have been very effective to launch biofuel uptake in transport fuel markets. A feature of tax exemptions is their ability to steer the market by applying different reduction rates to various types of biofuels. The drawback of such a system is that it becomes very expensive once consumption volumes go up; moreover market prices need to be tracked to make sure that overcompensation is avoided. Tax reductions can also be revised depending on the States’ income needs.

Substitution/distribution mandates (or quota obligations) became more popular when biofuel volumes increased, as the cost is carried by the fuel distributors/oil companies, although it is reasonable to assume that additional costs for the fuel are

¹¹ T. Wiesenthal et al, 2009

passed on to the final consumers. One of the major advantages of the obligation to fuel suppliers is the predictability of the market volumes that will be reached in a certain year. An obligation system thus sets a long-term, predictable framework to the biofuel producers, which consequently have a higher investment security. On the other hand, if the annual targets are set too low, the obligation may not exploit the full potential of biofuels. One of the major risks is related to the incentive for fuel suppliers to opt for the lowest cost biofuels. While this ensures achieving a certain share of biofuels at minimum cost, it risks having drawbacks on fulfilling the key objectives behind the biofuel support unless additional instruments are employed to steer the market. Double counting of advanced biofuels has been one of the means to steer markets more into advanced biofuels. In practice, markets have also here searched for minimal cost solutions, resulting in a focus on the rather low cost biodiesel from used cooking oil or animal fats which also qualified as advanced biofuel (and is now imported to a few countries that have a favourable double counting mechanism). As a consequence there was hardly any uptake of technologically challenging advanced biofuels.

A quota obligation alone is not sufficient to promote advanced biofuels based on innovative technologies. Additional policy mechanisms that would reduce investment risk and ramp up the production of advanced biofuels are required.

Performance indicators:

- Production capacity of liquid biofuels
- Primary production of liquid biofuels
- Gross inland consumption of liquid biofuels
- Share of 'advanced' biofuels in liquid biofuels consumption (distinction between counting towards the renewable energy target (including multiplication factors) versus physical share of in biofuels)
- Role of imports and exports

4.2.3 Biobased products

Background:

So far biobased products have not received the same (policy) attention as bioenergy or biofuels. This has brought up voices from wood processing industries and chemical industries (considering producing biobased chemicals) about an unlevel playing field with bioenergy.

Of course non-energy materials markets work in a completely different way, but replacing fossil resources in these production processes can also lead to considerable GHG savings. Next to support for industries themselves, the focus for

biobased products is much more towards pull from end use markets (providing information to the public and public procurement policies), see chapter 4.3.

Policy options for production of biobased products:

Financial measures:

- R&D support towards new biobased products and production processes.
- Project support for demonstrators:
 - Project financing
 - Financing support: providing guarantees, soft loans with low interest rates

Soft measures:

- Fostering knowledge exchange through interdisciplinary and multi-sector cooperation;
- Development of product norms;
- Certification / labelling of value chain impacts (e.g. carbon footprint)
- Specific sector targets for the biobased economy.

Performance indicators:

- Share of biobased feedstocks in production of specific products (e.g. chemicals)

4.3 End use markets



Demand side measures are often directed towards production and distribution (obligations or cost reduction), particularly for bioenergy and biofuels. Measures to stimulate end users towards certain products are less common than support measures in the rest of the value chain.

At European level some initiatives are clearly directed towards the (purchase) behaviour of the final customer. Examples are requirements and support systems for renewable heat in buildings (within the EPB Directive), or Green Public Procurement (GPP) for public authorities, which is of course much broader than biobased energy or materials.

The discussion will focus on biomass heat, biofuels (high blends) and biobased products. Bio-electricity is not discussed here as this is mostly a matter of production and distribution as part of the grid.

4.3.1 Biomass heat

Although biomass heat is widely known across countries, there is still a lot of market improvement required towards the end user to ensure that biomass is used with the appropriate moisture content, is well stored and that existing stock of small-scale boilers & stoves is substituted with high efficient, low polluting ones where required. The cost of this investment is still high compared to fossil fuels and therefore, there is a need to encourage such investment to take place.

The new RES directive could extend and strengthen the requirement to include RES in 'Nearly Zero Energy Buildings' (NZEB) applying to new buildings and renovated ones. Article 13.4 of the RES directive could be reinforced to complement EPBD and ensure RES deployment in buildings.

As far as existing buildings stock is concerned, national long-term refurbishment planning of existing building renovation, based on primary energy use requirement, could be envisaged. Such a provision would mean a need for mechanisms triggering renovation cycles by 2050 that promote only the most efficient technologies using renewable energy (for example, for individual appliances, linking support schemes with eco-labelling requirements). Long term renovation planning, including the replacement of heating systems is more effective than a quick-fix-approach which can lock-in technologies not compatible with long-term decarbonisation objectives.

Policy options:

The following examples of end use policy measures can be identified for biomass heat (at end user level):

Regulations:

- Obligation of renewable heating in new buildings (in the frame of the European Energy Performance of Buildings Directive)
- Ecodesign: efficiency and emission requirements for new boilers and stoves

Financial measures:

- Subsidies, tax credits or cheap loans for the purchase of renewable energy installations (including wood or pellet burners)
- Taxation on fossil fuels (carbon tax) – exemption for non-fossil fuels

Soft measures:

- Awareness campaigns on biomass fuel quality and efficient stoves/boilers and other biomass heating

Performance indicators:

- Share of renewable electricity in overall electricity production and the role of bioenergy
- Share of renewable heating & cooling in overall energy consumption for heating & cooling consumption and the role of bioenergy

4.3.2 Biofuels

The market seems to shift towards ‘drop-in’ biofuels. IEA Bioenergy Task 39¹² defines drop-in biofuels as ‘*liquid hydrocarbons that are functionally equivalent and as oxygen-free as petroleum-derived transportation fuels*’. Examples are hydrotreated vegetable oils (HVO) or Fischer Tropsch liquids (FT). Unlike conventional biofuels like ethanol or biodiesel (FAME), drop-in biofuels should be indistinguishable from petroleum fuels for end uses. These are fully compatible with current fuel infrastructure and vehicles.

Nevertheless, some advanced biofuels like DME, high ethanol blends (e.g. E85), or biomethane need dedicated fuelling infrastructure and vehicle technology.

¹² <http://task39.org/>

Governments can foresee dedicated support for these fuels and vehicles towards end users.

Policy options:

The following examples of end use policy measures for biofuels can be identified:

Financial measures:

- User incentives for clean vehicles, including vehicles capable of driving on high biofuel blends (cfr. flex-fuel vehicles)
 - Tax credits, free parking, exemption of congestion charge / road tax

Soft measures:

- Information campaigns on the impact of specific biofuels (blends) on vehicles;
- Awareness campaigns;
- Information on environmental impact of these biofuels;
- Long-term targets for biofuels/renewable energy in transport.

Performance indicators:

- Share of renewable energy in transport and the role of biofuels

4.3.3 Biobased products

Specifically for biobased products, acceptance by the public is crucial and can only be achieved by means of (i) communication campaigns with full and transparent information to the public and the consumer about the benefits, costs and risks of novel and traditional products and technologies; (ii) incentivising the uptake and development of bio-based products through public procurement policies.¹³

In the United States, USDA manages the BioPreferred Program¹⁴. The goal of BioPreferred is to increase the development, purchase and use of biobased products through two initiatives: (1) mandatory purchasing requirements for federal agencies and their contractors; and, (2) a voluntary labelling initiative for biobased products.

¹³ <https://ec.europa.eu/research/consultations/bioeconomy/bio-based-economy-for-europe-part2.pdf>

¹⁴ <https://www.biopreferred.gov/BioPreferred/faces/pages/AboutBioPreferred.xhtml>

Policy options:

The following examples of end use policy measures can be identified:

Regulations:

- Restrictions in terms of packaging materials (e.g. bans on non-biodegradable plastics bags, ...)
- Public procurement rules (e.g. SFM wood, biobased products)

Financial measures:

- Additional taxation (e.g. carbon tax) of fossil products – exemption for non-fossil alternatives

Soft measures:

- Awareness campaigns to stimulate demand for biobased products
- Certification and labelling for consumers

Performance indicators:

- Share of biobased products in sales of certain product types

5. Conclusions and main recommendations

Support within the full supply chain needs to be considered in a holistic view, in viewpoint of the bioeconomy, i.e. considering biomass supply, logistics, conversion, distribution and end use. The effective use of biomass for energy purposes depends not only on market developments but also on the successful integration of energy, environment, agricultural, forestry, waste, industry, rural development and trade policies. It would be best that different policy options are coupled that provide incentives at different steps in the value chain. Solutions depend on the local situation and the specific (interacting) goals for that region (e.g. biomass supply, energy demand). Many good examples exist where mutually reinforcing linkages among different policy options are applied.

The focus should be on developing synergies between sectors to make maximum use of the biomass and integrating policies towards both bioenergy and biobased products, thereby creating a level playing field so as to reach maximum resource efficiency.

Distinction should be made between measures to support early markets, mature markets, or to sustain markets. R&D grants and investment subsidies are clearly linked to early markets; tax exemptions, tendering schemes and obligations are more directed towards mature markets.

Improving the availability of sustainable raw materials in sufficient quantities and quality and at competitive prices is one of the key focus points. To achieve a sustainable bio-economy, there is a strong consensus on the need for further efforts and support in basic and applied research, technological development, demonstration projects, translational research infrastructure creation and training activities, involving all actors (including farmers, foresters, fishermen, advisory services, industry (all involved in the supply chain), consumers and society at large), at local, regional, national, European and global level, aiming to achieve cooperative knowledge transfer¹⁵.

Long term visions are needed and national bio-economy platforms should be set up to coordinate between the political, scientific and business communities and agree on measures that need to be taken.

¹⁵ <https://ec.europa.eu/research/consultations/bioeconomy/bio-based-economy-for-europe-part2.pdf>

References

- Becker et al. (2009) Financial considerations of policy options to enhance biomass utilization for reducing wildfire hazards.
- Ebers et al. (2016) Inventory and classification of United States federal and state forest biomass electricity and heat policies.
- EC (2009). Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Renewable Energy Directive). <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=EN>
- EC (2009). Directive 2009/30/EC of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC (Fuel Quality Directive). <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0030&from=EN>
- EC (2010). Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings (EPBD). <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>
- EC (2011). Bio-based economy in Europe: state of play and future potential. <https://ec.europa.eu/research/consultations/bioeconomy/bio-based-economy-for-europe-part2.pdf>
- EC (2013). A new EU Forest Strategy: for forests and the forest-based sector. COM(2013) 659 final. September 2013. http://ec.europa.eu/agriculture/forest/strategy/communication_en.pdf
- EC (2014). A policy framework for climate and energy in the period from 2020 to 2030. COM(2014)15 final. January 2014. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015&from=EN>
- EC (2014). Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC. http://ec.europa.eu/environment/gpp/eu_public_directives_en.htm
- EC (2014). The EU's common agricultural policy (CAP): for our food, for our countryside, for our environment. https://ec.europa.eu/agriculture/cap-overview/2014_en.pdf; https://ec.europa.eu/agriculture/cap-overview/index_en.htm
- EC (2014). Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01). [http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628\(01\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628(01)&from=EN)

- EC (2015). Directive (EU) 2015/1513 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources (iLUC directive). September 2015. <https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/land-use-change>
- EC (2015). Closing the loop - An EU action plan for the Circular Economy. COM(2015) 614. December 2015. <http://ec.europa.eu/environment/circular-economy/>
- EC (2016). Proposal for a directive on the promotion of the use of energy from renewable sources. COM(2016) 767. November 2016. https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v7_1.pdf
- GBEP (2011). The Global Bioenergy Partnership Sustainability Indicators for Bioenergy. December 2011. http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/Indicators/The_GBEP_Sustainability_Indicators_for_Bioenergy_FINAL.pdf
- Kautto (2005). Analysis of policy options and implementation measures promoting electricity from renewable biomass in the European Union (JRC report)
- C. Khawaja and R. Janssen (2014). Sustainable Supply of Non-Food Biomass for a Resource Efficient Bioeconomy - a Review Paper on the State-of-the-Art. http://www.s2biom.eu/images/Publications/S2biom_review_state-of_the_art_Final.pdf
- C. Panoutsou et al. (2016). Lessons and recommendations for EU and national policy frameworks. Deliverable 4.4 of the Biomass Policies project. March 2016.
- L. Pelkmans, M. Van Dael (2014). Template for monitoring biomass policy landscapes. Deliverable 3.2 of the Biomass Policies project. June 2014.
- L. Pelkmans et al. (2014). Guidelines and indicators for the evaluation of sustainable resource efficient biomass value chains. Deliverable 2.6 of the Biomass Policies project. August 2014.
- L. Pelkmans et al. (2016). Advisory document on long-term strategies to include sustainable biomass imports in European bioenergy markets. Deliverable 5.4 of the BioTrade2020plus project. August 2016. http://www.biotrade2020plus.eu/images/publications/BioTrade2020plus_Deliverable_5.4.pdf
- S2Biom policy database: <https://s2biom.vito.be>
- UN (2015). Sustainable Development Goals – 17 goals to transform our world. <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

UNFCCC (2015). Paris agreement. December 2015.

<http://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf>

USDA (2014). The BioPreferred® Program.

<https://www.biopreferred.gov/BioPreferred/faces/pages/AboutBioPreferred.xhtml>

M. Van Dael et al. (2016). Report on benchmarking of country policy approaches. Deliverable 6.2 of the S2Biom project. November 2016.

T. Wiesenthal et al. (2009). Biofuel support policies in Europe: Lessons learnt for the long way ahead.

<http://www.sciencedirect.com/science/article/pii/S1364032108000166>