

S2Biom Project Grant Agreement n°608622

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**Policy Brief: Vision for 1 billion tonnes of dry
lignocellulosic biomass for the biobased economy in
2030**

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About 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, Turkey and Ukraine. Further information about the project and the partners involved are available under www.s2biom.eu.

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About this document

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Vision for 1 billion dry tonnes¹ lignocellulosic biomass for biobased economy by 2030 in Europe

Bioeconomy in Europe is not new; it already accounts for more than 2 trillion € annual turnover and almost 20 million jobs. These numbers include food production and agriculture. The current market share for biobased products in EU28 is already significant and it is growing fast. Consumer awareness and product availability is increasing in European markets, and innovations will be brought faster to market via initiatives such as the “Biobased Industries Initiative Joint Undertaking²”, a new public-private partnership between the EU and the industry. The biobased products market demand in the EU is expected to double by 2030³.

One of the challenges to attract future investments in biobased economy in Europe is mobilising indigenous biomass feedstocks in a sustainable and resource efficient manner⁴ and preparing for the transition to advanced technologies using lignocellulosic feedstocks.

S2Biom (www.s2biom.eu) is a European funded project aiming to improve evidence on the availability, cost supply, technologies and framework conditions (sustainability, policy, financing) for lignocellulosic non-food biomass in Europe⁵ by 2030. Within the project framework, a Vision statement for an expanded role of sustainable non-food biomass supply and delivery in the European biobased economy, is prepared.

The work planned includes also a series of dedicated policy briefs to ensure effective dissemination of the project results to policy and decision makers at European, national and regional level. These are regarded as important, since the project intends to provide support for the development and implementation of future policies on sustainable supply of non-food biomass.

The information presented in this policy brief is based on a meta-analysis of an inventory of 350 studies covering a period of the last ten years (2005- 2015) and internal consultations with the project partners. The presented “Vision aggregate numbers” have been narrowed (for consistency and harmonised approach reasons) to Biomass Energy Europe (BEE)⁶, Biomass Futures⁷, Biomass Policies⁸, Wasted⁹, EUBIONET¹⁰ I, II, III, Bioboost¹¹, BIOTIC¹² and recent work in the Energy Community¹³.

¹ Total technical potential of lignocellulosic biomass for all biobased economy sectors

² <http://bbi-europe.eu/>

³ Bio-Tic project: Market roadmap (2015) - <http://www.industrialbiotech-europe.eu/new/wp-content/uploads/2015/10/Market-Roadmap-Final-1-OCT-2015.pdf>

⁴ According to the EU 2020 Flagship Initiative Resource efficiency is a way to deliver more with less (natural resources). It increases aggregate economic value through more productive use of resources over their life cycle. It requires using those resources in a sustainable way, within the planet’s long-term boundaries. This includes minimizing impacts of one resource’s use on other natural resources.

⁵ EU28, Western Balkans, Moldova, Ukraine, Turkey

⁶ <http://www.eu-bee.eu/>

⁷ www.biomassfutures.eu

⁸ www.biomasspolicies.eu

⁹ <http://www.theicct.org/wasted-europes-untapped-resource-report>

¹⁰ <http://www.eubionet.net/>

¹¹ <http://www.bioboost.eu/home.php>

Why a Vision for lignocellulosic biomass in 2030?

- Biomass is important for energy, fuels, biobased products and materials.
- Investors seek stability and consistency in policy formation BUT this implies also a clear picture for a resource efficient and sustainable biomass supply.
- The future market uptake relies strongly on developing common understanding for the whole system and applying common metrics across sectors.

Current lignocellulosic biomass use across biobased sectors in Europe

- Current consumption¹⁴ of wood from European forests is estimated to be 530 million tonnes (out of which 485 million tonnes in EU28 and the rest in W. Balkans, Moldova and Ukraine) per year. An estimated 261 million tonnes (245 million tonnes in EU28) of wood used as a "classical" bio-based material primarily used in the woodworking and pulp and paper industry. 269 million tonnes (with 240 million tonnes in EU28) of wood are used for production of energy (mainly heat and power).
- The annual consumption of agriculture based lignocellulosic biomass is estimated at 5-10 million tonnes (dry) but information relies on individual studies without recent harmonisation across EU.
- Estimates of annual wastes (municipal waste, mix of lignocellulosic and non-lignocellulosic material) use for energy reach up to 73 million tonnes¹⁵.

Sustainable lignocellulosic non-food biomass potential to 2030

Analysis of recent published studies of biomass assessments in the period 2020-2030 shows that there is significant potential in Europe. These studies identify four sources that could provide additional biomass and support growth of bio-based industries, namely:

- field agricultural residues
- forest biomass
- wastes
- non-food crops

A range of estimates for EU and Energy Community (Western Balkans, Ukraine, Moldova) is available for **four major sources of biomass** that could support further growth of the biobased industries as compared to the current status i.e. field agricultural residues, forest biomass, wastes and land available for non-food crops.

A first source of biomass relates to different **types of agricultural residues** that are currently underutilized. Estimates range from 186 Million tonnes to 252 Million tonnes in the

¹² <http://www.industrialbiotech-europe.eu/>

¹³ https://www.energy-community.org/portal/page/portal/ENC_HOME

¹⁴ Sources: EuropaBio, Nova Institut, DG ENER, Energy Community

¹⁵ <http://www.cewep.eu/>

2030 time frame. The lower estimates put strong restrictions on collection of agricultural residues, e.g. for reasons related to protection of soil fertility, etc.

A second source of biomass relates to **additional biomass from sustainable forestry**. Estimates range from 615 Million tonnes to 728 Million tonnes in the 2030 timeframe. Compared to an estimated current use of 530 Mio tonnes, it is estimated that EU forests could sustainably supply between 85 and 198 Mio tonnes of additional woody biomass by 2030.

A third source of biomass relates to **wastes** (the lignocellulosic fraction after recovery and recycling; including paper waste, wood fraction of Municipal Solid Waste, cellulosic material in the form of unused food and garden waste, etc.), mainly deriving from households and businesses with previous estimates in the range of 110-150 million tonnes per year in EU for 2030.

A fourth major source of biomass relates to **dedicated production of industrial crops on released agricultural land**. Europe has unused land: some of this land is in this condition because of its inherent characteristics (difficult access, location, soil composition, climate), while other parts have once been profitable as farm land and are now abandoned as a result of overexploitation, pollution, climate change and/or exodus from rural areas. Working towards defining the potential of cropped biomass in such types of land is a key issue for short to medium term research.

Estimates for the EU in 2030 are in the range of 84 to 180 million tonnes of biomass while the respective figures for Western Balkans, Moldova and Ukraine add another 54-62 Million tonnes. So, in total the estimates for the production of industrial crops in EU28 & Energy Community are totalling a range of 138-242 million tonnes.

The overall figures for all four categories are in the range of 1,049 - 1,372 million tonnes of biomass which can be technically available within Europe by 2030 under sustainable practices. A consolidated picture then emerges, indicating that in addition to current uses of biomass there are two potential ranges:

- Low range: some 176 Million tonnes of agricultural residues + 85 Million tonnes of forest material + 37 Million tonnes of wastes+ 144 Million tonnes of biomass from industrial crops could serve as sustainable feedstock for new bio-based industries. **This represents a total "additional biomass potential" of 436 Million tonnes.**
- High range: some 242 Million tonnes of agricultural residues + 198 Million tonnes of forest material + 77 Million tonnes of wastes+ 242 Million tonnes of biomass from industrial crops could serve as sustainable feedstock for new bio-based industries. **This represents a total "additional biomass potential" of 759 Million tonnes.**

Cost of sourcing lignocellulosic biomass

In Europe, recent analysis of four biomass feedstock types and supply chains identified feedstock costs of between 67.2 and 107.2 €/ tonne for European sourced woodchips¹⁶. Local agricultural residues were estimated to cost 58.5 to 73.5 €/ tonne. Imported pellets from North America are competitive with European wood chips if they must be transported from Scandinavia to continental Europe¹⁷.

These are only average representative examples, and one should bear in mind that there will be significant variation in actual feedstock costs, depending on the actual feedstock origin and project details¹⁸.

Expected projections for market growth of biobased products

The current market share for bio-based products in EU28 is already significant and it is growing fast. Consumer awareness and product availability is increasing, and brand owners show growing interest. . Industry has expressed expectations for substantially higher market share from 2020 and beyond.

	Current state	2020	2030
Bioplastics	<ul style="list-style-type: none"> European Bioplastics: 280 kT (2013) BioTic: around 1 B€ 	<ul style="list-style-type: none"> European Bioplastics: 512 kT (2018) BioTic: around 2 B€ 	<ul style="list-style-type: none"> - BioTic: around 5,2 B€
Biolubricants	<ul style="list-style-type: none"> ERRMA: 137 kT (2008) BioChem: 150 kT (2008) 	<ul style="list-style-type: none"> ERRMA: 420 kT (2020) BioChem: 230 kT (2020) 	<ul style="list-style-type: none"> -
Biocomposites	<ul style="list-style-type: none"> ERRMA: 362 kT (2010) Nova institute: 315 kT (2010) 	<ul style="list-style-type: none"> ERRMA: 920 kT (2020) Nova institute: 830 kT (2020) 	<ul style="list-style-type: none"> - -
Biochemicals	<ul style="list-style-type: none"> Chemical industry is estimated to use 8-10% renewable raw materials BioTic: around 1 B€ (Chemical building blocs - 2013) 	<ul style="list-style-type: none"> The share of biobased chemicals is expected to be 20% BioTic: around 1,5 B€ (Chemical building.g blocks) 	<ul style="list-style-type: none"> The share of biobased chemicals is expected to be 30% (BIC Vision) BioTic: around 3 B€ (Chemical building blocks)
Bioenergy & biofuels	<ul style="list-style-type: none"> BioTic: bioethanol around 4 B€ Nova institute: biofuels (all) around 6 B€ (2011) DG Agri: bioethanol 3,3 Mtoe (2013) 	<ul style="list-style-type: none"> BioTic: bioethanol around 11 B€ and 0,5 B€ aviation fuels DG Agri: bioethanol 6,1 Mtoe (2023) 	<ul style="list-style-type: none"> BioTic: bioethanol around 14,2 B€ and 1 B€ aviation fuels

Current state and expected market shares by 2020 and 2030 for biobased markets in Europe

¹⁶ European Climate Foundation et al., 2010

¹⁷ According to the report, at present forest residues and agricultural residues are only utilised to a significant extent in Scandinavia and Denmark respectively and there are only two pellet mills in the world with a production capacity of 500 000 tons per year or more.

¹⁸ For pellets the heat value considered was 16 900 kJ/kg and moisture content of 10%.



The respective market in the Energy Community Contracting Parties is highly focused on bioenergy (mainly heat and a few CHP/ DH plants) while the development of biobased markets is still quite slow.

In 2013 in EU28, almost 10% (8 out of 79 million tonnes)¹⁹ of the raw materials base for the **European chemical industries** was based on renewables, with sugar and starch having the higher share (1.56 million tonnes), followed by plant oils (1.26 million tonnes), bioethanol ETBE (1 million tonnes), natural rubber (1.06 million tonnes), pure bioethanol (0.46 million tonnes), animal fats (0.43 million tonnes), glycerine (0.41 million tonnes) and several other smaller categories.

Western Balkans

According to the FAO statistics²⁰, the value of agricultural production in the region of Western Balkans reached 11.8 billion USD in 2012, and production of roundwood - the most important forestry product in the region - increased to 21 million m³.

Overall volume of the bio-based economy markets in the region of Western Balkans is not easy to estimate, mostly due to the absence of national bioeconomy strategies, comprehensive studies or sufficient statistical data.

Activities related to advanced bio-plastics, bio-lubricants, bio-composites, and bio-chemicals are rare, occurring mainly in the area of EU financed research and scientific programmes. Traditional biobased materials - wood products - play an important role in the use of biomass resources. Annual consumption of biomass for wood products was 0.99 million m³ in 2013.

Bioenergy is important in the region which covered 7.7% in Croatia, 12.2% in Serbia and 24.1% in Montenegro of total final energy consumption in 2013, using biomass²¹. Expressed in figures, total consumption of woody biomass on the Western Balkans was 32.1 million m³ in 2013, out of which 23.2 million m³ or 72.4% was used for energy purposes and 8.8 million m³ was used for industrial purposes.

The main characteristic of woody biomass consumption in the form of firewood in all the countries in the region is the high inefficiency of firewood utilization which is manifested in large amounts of wood consumed for heating purposes compared to the size of the heated area.

¹⁹ Sources: Cefic, VDI

²⁰ FAO Stat 2014 - data for Montenegro and Kosovo* not included/available

²¹ Based on Montenegro Energy Balance - MONSTAT, Energy balance of the Republic of Croatia, Energy balance of the Republic of Serbia