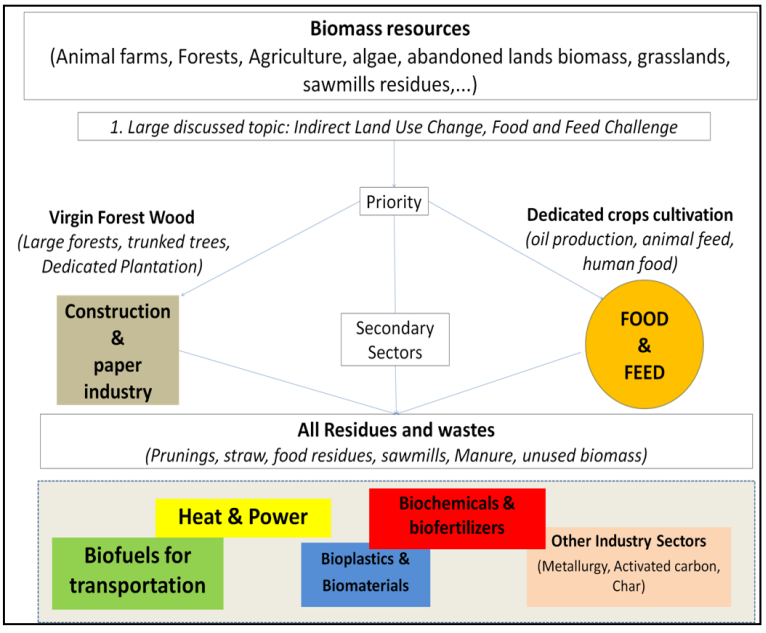
European Biomass Residues - 269 MTOE of green Energy for a sustainable Biobased Economy

There is a general consensus in Europe that a biobased sector development is strongly related to the sustainability challenge. The environmental sustainability of biomass feedstock has a huge impact on the whole value chain from land to bio-products; at the same time, European and global biomass resources represent the raw material for a wide range of industry sectors, all of them expecting an impressing market growth with a related increase of biomass demand within 2050. Biomass is the only existing renewable carbon source able to replace fossil fuels in the production of 73,000 market products, however, most of biomass consumed worldwide is related to three main sectors: paper, construction and food. These sectors have the priority in the consumption of high quality biomass, while other industry sectors, in competition with fossil fuels for the production of fuels, energy and materials, represent the emerging promising markets looking for the road for the take off.

1. Primary Sectors: Paper, construction, food
2. Emerging Sectors: Heat, power, plastic, chemicals and biofuels industries

Due their strong position as global traditional markets, Primary Sectors have the priority in the exploitation of resources and use of land. The emerging sectors are still under development and aim to grow rapidly in the next decades. Their development and success depends on the efficient and sustainable exploitation of remaining biomass feedstock. On the basis of this consideration, European Commission, together with Member states support, is driving the change to move for an actual sustainable development of emerging biobased industry sectors.



One of the most relevant sustainability criteria affecting emerging biobased sectors development is the efficient exploitation of resources. iLUC (Indirect Land Use Change) concern has triggered a general re-evaluation of the sustainability of the biobased sectors. Rapid growth of EU biofuels sector has recently slowed due to the sustainability concerns. The transportation biofuels industries moved from 1st generation to 2nd generation biofuels, facing all the issues related to more expensive processes needed to extract sugars from solid low quality biomass. The same direction has been taken by Sustainable Biomass Partnership, an industry-led initiative formed in 2013 by major European utilities that use biomass in large thermal power plants. The general trend for emerging biobased sectors seems to be orienting towards the utilization of low quality feedstocks, wastes, organic by-products from agricultural activities, with a small contribution of Short Rotation Plantations and microalgae - seaweed.

In summary, the current EU trend for new biobased sector can be summarised as: ***Avoid primary land use, focus on the valorisation of residues and abandoned lands***
Given the huge amount of residues available, as well a large amount of non-used land, there is now a strong need for a valuable exploitation strategy able to set a sustainable path for large scale development of emerging bio-based sectors mentioned above. **European Countries are estimated to produce 143 Mtoe of biomass residues available only from agriculture.**

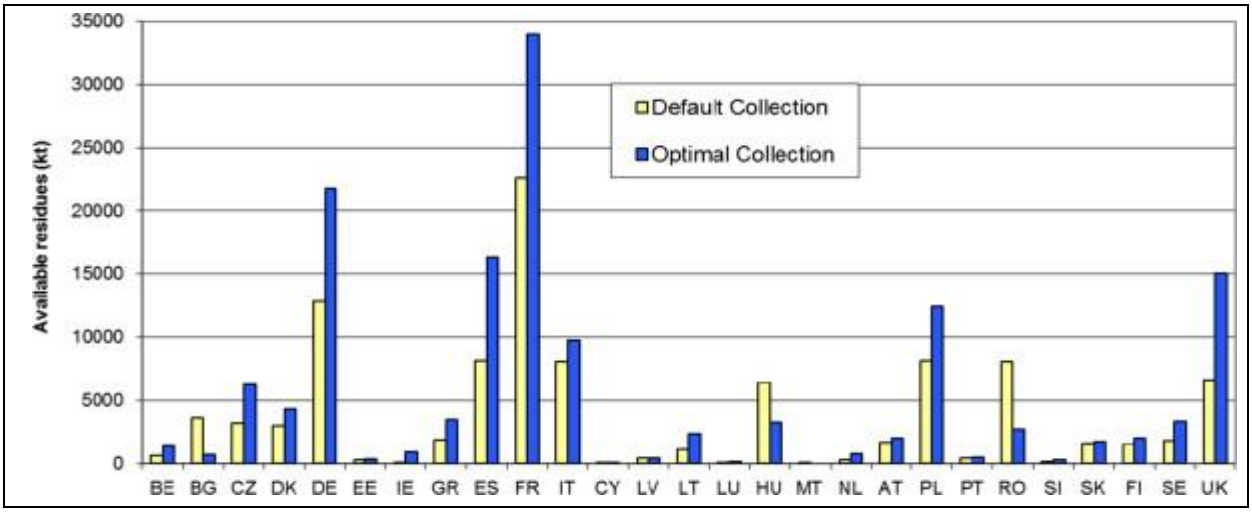


Figure. 1 Amount of agricultural residues available for energy production in EU-27 countries. ktonnes of dry matter. (Optimal energy use of agricultural crop residues preserving soil organic carbon stocks in Europe F. Monforti, 2015)

A valuable amount of these residues may be cost effectively recovered from land an utilised as a raw material in the emerging bio-refining technologies. However, only 20% of residues from agricultural activities are efficiently managed in EU, and there is no region going over 50%.
Similar potential is represented by Food residues: Over 100 million tonnes of food (25-28 MTOE)are wasted annually in the EU (2014 estimate). Recycling food waste would in an efficient way would bring a huge benefit to the EU economy reducing expenses and increasing the amount of valuable biomass to be used for different purposes.
Forests represent another important source of residues: about 200 MTons (85MTOE) of forestry residues available, 45-50 Mtons/year are not yet used in Europe.

A very rough estimation brings to the average value of 11,3 EJ of residues are available in Europe, equal to about 269 Million TOE. The challenge is now how to valorise European and global biomass residues to meet the expected growing demand reported by recent market studies and related to each of the emerging sectors. The development trend of Emerging biobased sectors can be reported as follows:

Bioelectricity

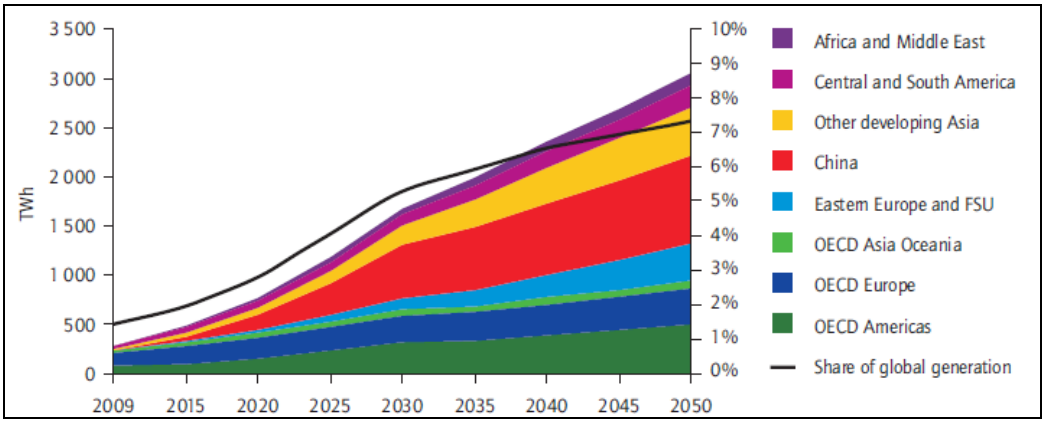


Figure. 2 Bio-electricity generation expected growth in different world regions (IEA 2013)

The share of renewable electricity will increase from 19% in 2009 to 50-60% in 2050. Bioenergy share in total electricity will raise from 1,5% to 7,5% in 2050. In particular, the total expected electricity capacity in 2050 is estimated around 575GW by the International Energy Agency, Investments in different forms will be needed to achieve this value. About 650 TWh electricity are expected to be generated in EU in 2050, equal to about 58 MTOE.

Biofuels

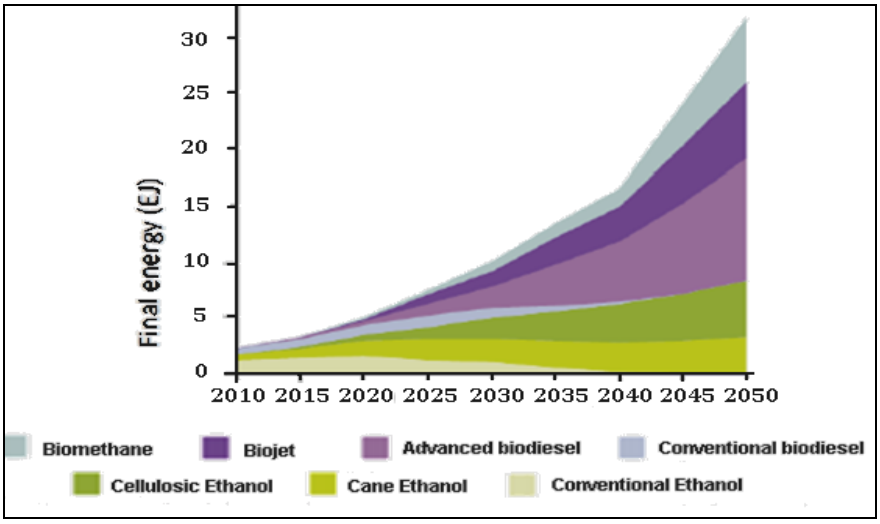


Figure. 3 Expected growth of biofuels global market: 2010 to 2050 (IEA 2013)

The two dominant liquid biofuels are bioethanol and biodiesel. 80% and 20% of the market, respectively. Together they meet about 3% of the global transport fuel demand and are produced using 2-3% of the global arable land (2012).

IEA estimates that the use of liquid biofuels could grow reaching a level of 9% (11.7 EJ) of the total transport fuel (126 EJ) by 2030 and about 27% by 2050. The general expected growth for will bring liquid and gaseous transportation biofuels from a 2.5 EJ today to a 32 EJ in 2050, about 27% of the total transportation fuels consumption will be represented by Biofuels in 2050. **Expected consumption in Europe is about 226 MTOE in 2050**

Biochemicals and Bio-plastics

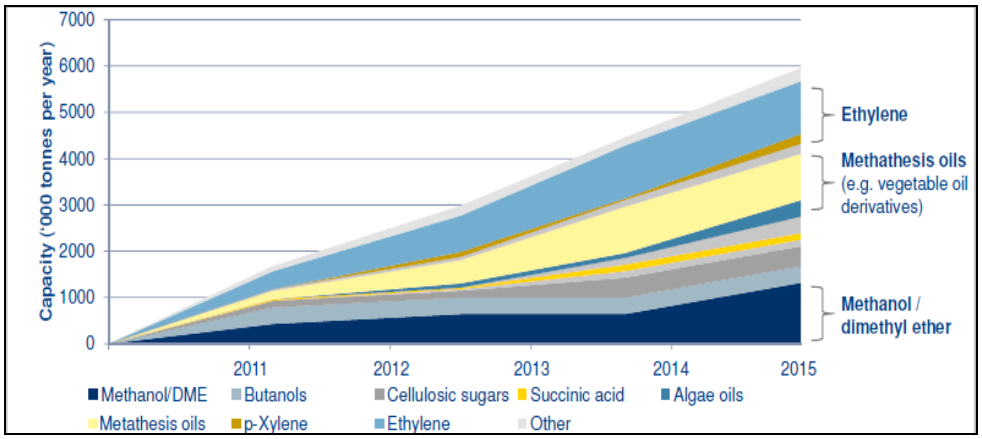


Figure. 4 Global Cumulative novel bio-based chemicals capacity 2011-201. (Phil Webster et al. A market overview on bio-based fuels and chemicals, 2012)

Biobased chemicals and materials industry capacity is expected to double in market potential to $ 19.7 billion in 2016 as global manufacturing capacity increases by 140 percent. SBI Energy expects the bio-

based chemicals market to grow to $12.2 billion by 2021, accounting for 25.4 billion pounds of bio-based chemical production at the end of the decade.

Bio-plastics

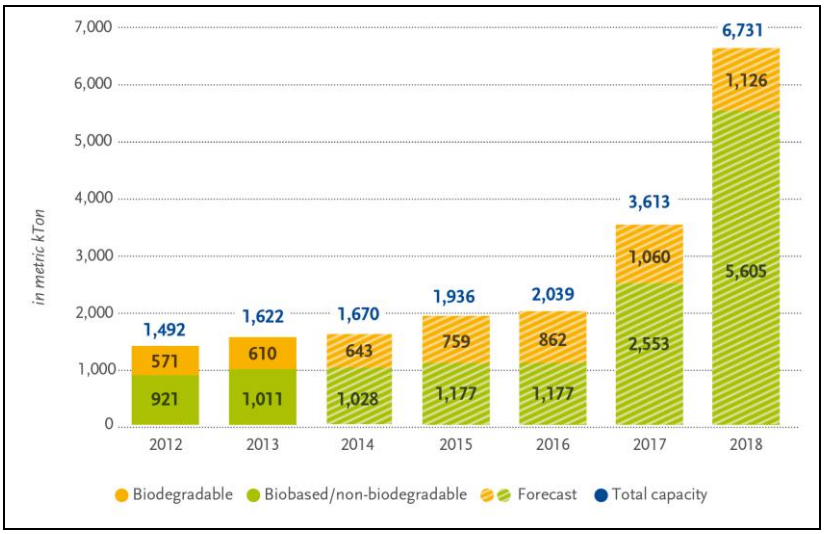


Figure. 5. Global Production Capacities of Bioplastics. (European Bioplastics, 2014)

The bioplastics market is growing more than 20 percent per year. The worldwide capacity of biobased plastics rapidly incresed from 0.36 Million tons in 2007 to 2.3 MT in 2013, Institute for Bioplastics and Biocomposites and the nova-Institute shows that between 2013 and 2018, production capacities worldwide are expected to multiply to 6.7 million tonnes.

EUBIA, the European Biomass Industry Association, is orienting more and more on residues valorization strategies and technologies able to support a competitive development of the European Bioeconomy. To this end, EUBIA is working on several international and private projects focused on the valorization of:

- Food Wastes,
- Sludges and sewage water
- Manure and animal dejections
- Solid agricultural residues

The main activity of the association is to develop, promote and support project strategies for an efficient exploitation of iLUC free resources, able to secure a sustainable development of the Biobased Industry sector. EUBIA strongly believes in the need to improve the effectiveness of valuable existing and emerging technologies through their integration in small and medium scale biorefinery concepts.