EUROPEAN BIOMASS INDUSTRY ASSOCIATION

Promising Future of Biobased European Markets

Overview on most promising biobased sectors on the basis of the latest targets for GHG emission reduction and renewable energy consumption in 2030

Andrea Salimbeni

November 2014

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BIOMASS PROMISING PERSPECTIVES IN EU.

Overview on most promising biobased sectors on the basis of the latest targets for GHG emission reduction and renewable energy consumption in 2030

1 European Council - The expected Climate and Energy Policy Framework for 2030

The 2030 goal has been one the hottest topic of the year 2014. With 6 years missing to the well known 2020, investors, companies and national governments needed to set the pathway for the next 15 years. The European Council collected information, experiences and controversies emerged by the 28 Members States and, late on 23rd Thursday night, agreed on the 2030 climate and energy policy framework. GHG emissions reduction, energy efficiency, renewable energy, interconnections and ETS: these the most relevant topics discussed in Paris. An agreement seemed uncertain until the very last moment due to objections by Poland and other Eastern European countries on emissions reduction. The UK and France also had to be convinced on energy efficiency targets.

The minimum targets agreed:

- 40% emissions reduction from 1990 levels by 2030 (nationally binding)
- 27% energy efficiency increase by 2030 (binding on EU level)
- 27% renewable energy share by 2030 (binding on EU level)
- 15% increased energy interconnections between Member States by 2030 (binding on EU level)

The above target resulted from the European Council meeting of the 23/10 are still general proposals to be discussed further along the next year. In particular, the calendar expected for 2015 is the following:

- 1-12 December 2014: COP20 Lima, meeting of the Parties of the Kyoto protocol.
- Q1 2015: The Commission will be tasked to bring forward legislation in order to achieve the targets indicated by the European Council. There is not at the moment a clear timeline; however the European Council gave some precise indications on particular issues.
- 19-20 March 2015: European Council meeting: the Commission will present a Communication on progress towards enhanced interconnectors and PCIs.
- Spring 2015: An agreement on the Market Stability Reserve' (MSR) under the EU Emissions Trading System (ETS) is expected.
- 30 November- 11 December 2015: COP21 Paris

The Member States secured to come forward with ambitious targets and policies to be presented at the UNFCCC COP21 conference in Paris in 2015.

The EU could provide an important signal to world leaders if its heads of state would agree on a 40% greenhouse gas (GHG) reduction target at the European Council meeting in Brussels this week. However, it will be China and United States that will decide whether a binding agreement on GHG emissions is agreed at the following UN summit in December. The Conference of Parties 15th summit, to be held in Paris, has been labelled as the most important negotiation ever. It will decide how the remaining "carbon space" that can be emitted globally while staying below a 2 °C warming level will be divided among the countries of the world.

2 Specifications and application method agreed according to 2030 targets

2.1 40% binding target on GHG emissions reduction

The Council agreed a binding EU target of at least 40% domestic reduction in greenhouse gas emissions, compared to 1990s level, endorsing the proposal made by the Commission. The reduction will be achieved through reductions in both the ETS sector (43%) and non-ETS sector (30%) compared to 2005..

2.2 Renewable energy

- The Council confirmed the Commission's proposal on renewable energy, agreeing to set a target of at least 27% - binding on EU level;
- Member States will be free to set more ambitious targets.

2.3 Energy efficiency

- The Commission's original proposal for a 30% target was brought down to 27%. The indicative target will be reviewed by 2020 having in mind an EU level of 30%;
- The Commission will propose priority sectors in which significant energy-efficiency gains can be made, however the targets will not be translated into national binding targets and the freedom of Member States to determine their energy mix will be ensured.

2.4 Internal energy market: a matter of urgency to overcome energy islands

- Urgent measures to ensure a minimum 10% target of existing electricity interconnectors will be developed. The Council indicated the objective of arriving up to 15% by 2030.
- Projects in Portugal, Spain and Baltic States, which have not yet achieved a minimum level of integration, will be prioritised.
- The implementation of projects of common interest is seen as one of the main ways to boost interconnections. The Commission is invited to present a Communication ahead of the March 2015 European Council to effectively achieve this ambitious target.

It is general consensus that these figures do not represent a real ambitious target and that no relevant changes will be connected to this 2030 target. This report will focus on Renewable energy and GHG reduction targets established by the European Council, with a special focus on the potential role and opportunities of biomass sector within the coming Policy Framework.

3 Analysis of the 40% GHG reduction target

Before introducing the role of Biomass in this new context (to be approved in several further steps), it is crucial to identify the potential consequences of new EU policy:

Public authorities, industry, SMEs and households are becoming more and more aware of the energy-saving possibilities. CO2 performance requirements in transport will reduce fleet average emissions of new passenger cars by 40% by 2021 compared to 2007. The Commission now estimates that the EU will achieve energy savings of around 18-19% in 2020. It should be noted that about one third of the progress towards the 2020 target will be due to the lower growth during the financial crisis. On this basis, the Commission has proposed binding targets to reduce greenhouse gas emissions by 40% in 2030 (relative to emissions in 1990) and to raise the energy consumed from renewable sources up to minimum 27% in 2030.

The EU emission reduction is acceptable (40% GHG reduction from 1990), which would mean to double the target set for 2020. This approach could lead to a huge number of activities to be promoted in order to strongly reduce the emissions. The most important aspect of this 40% reduction target, which seems to be the column of the 2030 action plan, is to be binding for all Members States.

Practically, each of the 28 Member States will be asked to respect this target and to modify the legal framework in order to make the step forward.

There has been a great deal of controversy over the above target, in particular in the eastern part of Europe. For instance the Polish Government, which is currently moving towards a more efficient exploitation of its large coal reserve, presented several remarks regarding the possibility to reach the 40% reduction target.

Some EU countries – led by Germany, UK and France – will try to reach an agreement on a 40% CO2 reduction target compared to 1990 levels by 2030. This preliminary agreement is necessary to have a firm negotiating position ahead of the global UN summit which will take place in Paris next year. However, some financial aid may be offered to lower income countries – including Poland – to modernise their energy systems. According to EU diplomatic sources, this action would be undertaken in order to involve these countries in the 40% agreement. "We have foreseen a new reserve in which some member states receive some funding to modernise their energy systems," said one senior EU diplomat. Funds for carbon capture technologies and investments could be provided by the European Union to Poland and to the other countries which will prove evident difficulties in reaching the emission reduction target.

The achievement of the 40% reduction will be achieved by reforming and monitoring the EU ETS (Emission Trading System) and non ETS-sectors. In particular the ETS sector must cut the emission by 43% from 2005, which represent a crucial improvement for the industrial sector. Nevertheless the non ETS sector will also decrease its GHG emissions by 30% compared to 2005 as well. Below a focus on both ETS and Non ETS sectors expected contribution

3.1 EU ETS sector: focussing on low income Member States, competitiveness & low carbon innovation

The need of a reform for the emission trading system has been considered a crucial aspect to create a more stable energy market. The Council agreed on the following targets:

- Increasing the annual linear reduction factor from 1,74% to 2,2% from 2021 onwards;
- Free allowances even beyond 2020, in order to prevent the risk of carbon leakage and preserve competitiveness of the European industries against international competitors. The Council stressed the need to take into consideration both direct and indirect carbon costs and to ensure affordable energy prices;
- Special consideration to low income Member States (with a GDP per capita below 60% of the EU average) which can opt to keep on giving free allowances to the energy sector up to 2030. The maximum amount handed out for free after 2020 should not exceed 40%;
- Renewing the existing NER300 by increasing its scope and endowment (NER400). Not only renewable and CCS, but also low carbon innovation in the industrial sector, including small-scale projects;

- An additional new reserve of 2% of the EU ETS allowances will be set aside to address particularly high investment needs in low income Member States, aiming to improve energy efficiency and modernise the energy systems.

3.2 Non-ETS sector: flexibility, distributed effort and a close eye on the transport sector.

At present, a relevant share of the industrial sector is not part of the EU ETS. Transport, light industry, buildings and agriculture, all fall outside the ETS thus contributing significantly to GHG emissions. In fact, these non-ETS sectors account for 58% of EU greenhouse gas emissions and are covered by another EU law that is rarely mentioned: the EU Effort Sharing Decision (ESD), which gives legal effect to the non-ETS part of the greenhouse gas target for 2020. The new measure set by the council aims to include this sector in a single regulation, in particular:

- Contributions will be established on the basis of the GDP per capita, in view of an overall EU reduction in 2030 of 40% compared to 2005 levels;
- More flexibility for Member States with national reduction targets above the EU average will be introduced through a one-off reduction of their ETS allowances. This will be set before 2020;
- The Commission is requested to further examine instruments and measures to promote in particular emission reduction and energy efficiency in transport, electric transport and renewable energy sources after 2020. The need to rapidly adopt the calculation methods and reporting requirement pursuant to Directive 98/70/E on fuel quality was also recalled;
- Member States are invited to look at the possibilities to include the transport sector within the framework of ETS;

The transport sector was the biggest missing among the most relevant sectors considered for the 2030 action plan. According to this first meeting, European Council decided to include the sector in the Non-ETS target, however, the importance of this sector and its role in emission reduction is crucial for all European Countries. The transport sector includes a broader range of sectors which affect the whole emissions of light and heavy vehicles. In particular: Energy Efficiency improvement and Renewable sources application represent the future of transportation in EU.

Biomass, as unique existing renewable carbon-based source, plays a crucial role not only in the renewable energy sector (see the following paragraph) but also in Carbon capture, GHG emission reduction and increased sustainability for the transport sector. The paragraph below shows some figures concerning the present state of development and the potential future impact of biomass sector in the EU market.

4 Biomass role in EU GHG emission reduction.

4.1 Emission of agricultural wastes

The agriculture sector produced 461 567 kilo tonnes of CO2 equivalent greenhouse gases in 2010, around 10% of the total EU emissions (excluding Land Use, Land Use Change and Forestry (LULUCF) net removals) for that year. Emissions from the agricultural sector have declined by 22 % since 1990. This optimum trend is due to two main factors:

- Reduced nitrous oxide emissions from agricultural soils, (now 49% of total agricultural emissions in EU) that decreased by 23 % mainly due to a decline in the use of nitrogenous fertilisers, now no more applicable.

- Reduced methane enteric fermentation emissions (now 32% of total agricultural emissions) that decreased by 22 %, due to an overall reduction in livestock numbers i.e. cattle and sheep.

It is general consensus that, at this stage, biomass application plays a crucial role and should be strongly supported in the next years. In fact, efficient agricultural residues valorisation could lead to a further reduction of both the factors reported above.

The application of synthetic fertilizers has an high impact in terms of CO2 emission. In 2012 the fertilizer production industry generated about 300 million tons of CO2 on world scale.

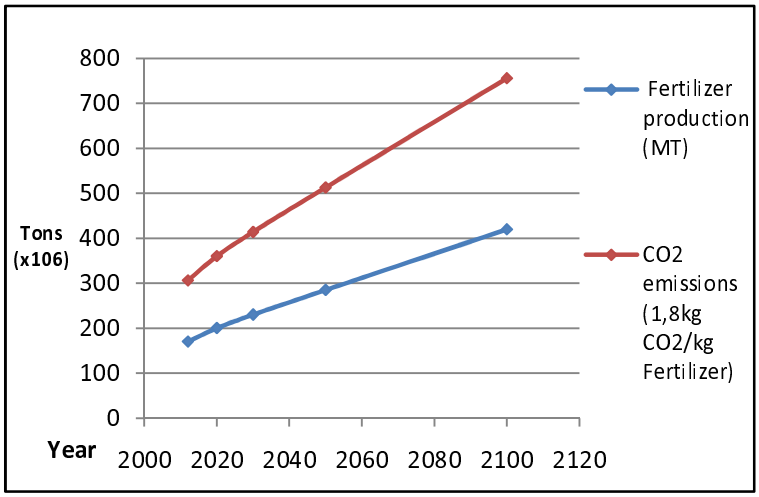

Figure. 1. Expected increase of CO_2 emission due to fertilizer production growth 2012-2050

Biofertilizers industry can become a new promising sector where biobased feedstock will be able to replace the fossil based Nitrogen sources and reduce the emissions related to their utilization. Many technologies have been identified and studied during the last years.

Anaerobic digestion is a well known technology which counts more than 12000 plants in EU. After a large development in the last years, where biogas production was mainly related to animal manure, sludges and other wet organic residues valorization.

However, anaerobic digestion of lignocellulosic residues like straw and panicles is now getting one of the most interesting research application. In fact, the digestion and co-digestion of manure, together with straw, agricultural residues, sludges is proved to increase both the biogas production and the methane content in raw biogas. Finally, the large application of AD is concerning the re-utilization of digested substrate (digestate) as valuable organic fertilizer. It is important to point out that biofertilizer acts differently than synthetic ones. Azotobacterias for example increases soil Nitrogen content up till 30 kgN/ha and help plantation to better fix nitrogen. At contrary, synthetic fertilizers give directly nutrition to the crops. Other potential biofertilizer could be the digestate matter, which is rich of Nitrogen (40kgN/ton of digestate) but its N is slowly converted to NH4 in the soil, thus it has not an immediate impact on plantation (weeks-months). This emerging sector would contribute to the reduction of agricultural emissions both by reducing the nitrogen emission of the soil (mainly due to the utilization of synthetic fertilizer), and by improving the manure storage, management and treatment processes, thus limiting the emission of CH4, NOx and CO2.

In addition to AD technology, several other processes are under investigation and already presented valuable results (Struvite production, Composting and heat reutilization, funghi inoculation, microalgae treatment). Furthermore, Urea, which is currently the most used sinthetic fertilizer in the world, is produced with fossil natural gas and Hydrogen. This process could be easily replaced by biomass-

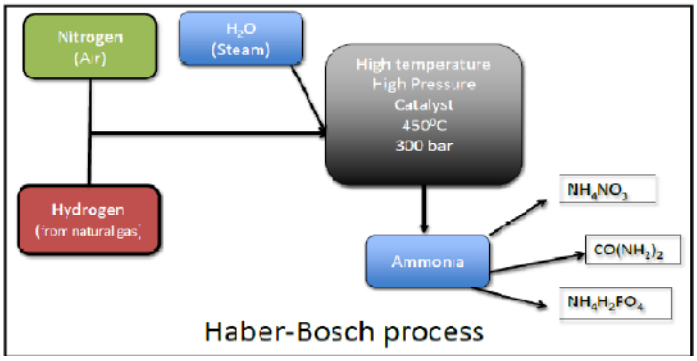

Figure. 2 Synthetic fertilizer production process

based syngas or biogas. Syngas produced by thermochemical conversion of lignocellulosic residues, as well as biogas generation by anaerobic digestion represents suitable gaseous feedstocks which could replace natural gas in Urea production processes. This solution would contribute to largely decrease both global and EU emission due to the fertilizer industry.

4.2 Biomass application for CO_2 Capture and Storage

Biomass Carbon Capture Storage (Bio-CCS) combines sustainable biomass conversion with CO2 Capture and Storage (CCS) – e.g. in biofuels and bioenergy production – and is already being deployed at industrial scale in the U.S. (Bio-CCS may be defined as processes in which CO2 originating from biomass is captured and stored. These can be energy production processes or any other industrial processes with CO2-rich process streams originating from biomass feedstocks. The CO2 is separated from these processes with technologies generally associated with CCS for fossil fuels) Use of biofuels and bioenergy is steadily increasing in the European Union (EU) due to targets for renewable energy sources and certain biofuels production routes could provide "low-hanging fruits" for early, low-cost CCS deployment. A recent study indicated that, globally, Bio-CCS could remove 10 billion tonnes of CO2 from the atmosphere every year by 2050, and up till almost 20% of global emission cuts required by 2050. using available sustainable biomass – equivalent to a third of all current global energy-related emissions.

In Europe, Bio-CCS could remove 800 million tonnes of CO2 from the atmosphere every year by 2050 using available sustainable biomass – equivalent to over 50% of current emissions from the EU power sector. This is in addition to any emissions reductions achieved by replacing fossil fuels with that biomass.

A real development of Bio-CCS technology at large scale level could bring a valuable share of industry sectors to a net emissions below zero, which could then offset emissions in other sectors where reductions are more difficult to attain.

4.2.1 Carbon Capture in power generation industry:

- Post-combustion: CO2 is removed from the exhaust gas through absorption by selective solvents.
- Pre-combustion: The fuel is pre-treated and converted into a mix of CO2 and hydrogen, from which the CO2 is separated. The hydrogen is then used as fuel, or burnt to produce electricity.

4.2.2 Oxy-fuel combustion:

The fuel is burned with oxygen instead of air, producing a flue stream of CO2 and water vapour without nitrogen; the CO2 is relatively easily removed from this stream. The technology is based on a fundamentally new principle for oxidizing fuels, Chemical-Looping Combustion (CLC), and using it with biomass. It uses well-known circulating fluidized bed technology in combination with an oxygen carrier that transfers oxygen from air to fuel. CLC ideally avoids all costs and energy penalties of gas separation as CO2 capture is inherent in the process. CLC has a unique potential for low cost and energy penalty for CO2 capture.Chemical Looping Combustion is getting more and more interesting as it represents one of the most promising technologies able to be scaled up to more than 10 MWe. Chemical looping Combustion technology presents a wide range of applications, from power production to steam production and CO2 capture in industrial processes to reduce the GHG impact.

4.2.3 Microalgae cultivation and application as CO2 capture solution.

One of the most interesting algae properties is to be able to grow with few nutrients, water and CO2. In particular, the impressive value is given by the CO2 absorption rate which can be achieved with Microalgae cultivation. In fact. well known microalgae species like Chlorella Vulgaris, or Nanocloropsis, can fix about

1,7 tons of CO2 per ton of dry biomass produced. In addition, the demonstrated capacity of some algae species (chlorella for example) to fix CO2 contained in internal combustion engines exausted gases represents an additional aspect to consider. Many research activities and industrial initiatives are working to test the benefit of introducing microalgae photobioreactors in large scale biorefineries. The application of innovative microalgae closed cultivation systems next to heat and power generation facilities is under evaluation and many projects are running on this topic. Last but not least, microalgae biomass is considered a high quality biomass, also for the production of second generation biofuels, farmaceuticals, bioproducts. The development of microalgae, macroalgae and biomass in general as feedstock in these crucial industry sectors would largely contribute to the achievement of the so far 40% GHG emission reduction target defined by the European Council.

4.3 The role of biomass in plastic industry GHG emission reduction

The total polymer consumption of Western Europe is about 50 million tonnes per year. According to the University of Utrecht, bioplastics could technically substitute approximately 42 million tonnes of this consumption. Technically, biobased plastics could potentially be a substitute for around 85 percent of polymers1. Nevertheless, there simply is not yet enough volume produced to make this a short or medium term possibility. The production of bioplastics is projected to increase from around 1.5 million tonnes (2012) currently to over 6 million tonnes in 2017. However, growing volumes of biobased, non-biodegradable plastics, so called drop-in solutions (e.g. PE, PET or soon PVC and PP), as well as new polymers that are biodegradable (e.g. starch-based materials) already provide ample opportunities for converters, brandowners, retail and consumers. Bioplastics are rightly regarded as a family of materials that offers multiple perspectives to both industry and society. Early in 2013 the nova-Institute predicted that by 2020 bioplastics production could rise to 12 million tonnes, principally due to drop-in polymers, particularly bio-PET. With an expected total polymer production of about 400 million tonnes in 2020, the bio-based share should increase from 1.5% in 2011 to 3% in 2020 without the help of any support measure, In order to make a valuable comparison and to push EC to engage more with the development of this sector, it worth to mention that, in Japan was enacted a law providing for a 20% replacing of fossil polymers by 2020.This has led to the development of hybrid polymers and polymers with a partial content of natural resources. The same could be considered as feasible solution for EU members states which should start working hard to meet the hot target of 40% reduction. Below a table showing the emission reduction of GHG related to different bio-based products compared to the fossil based ones.

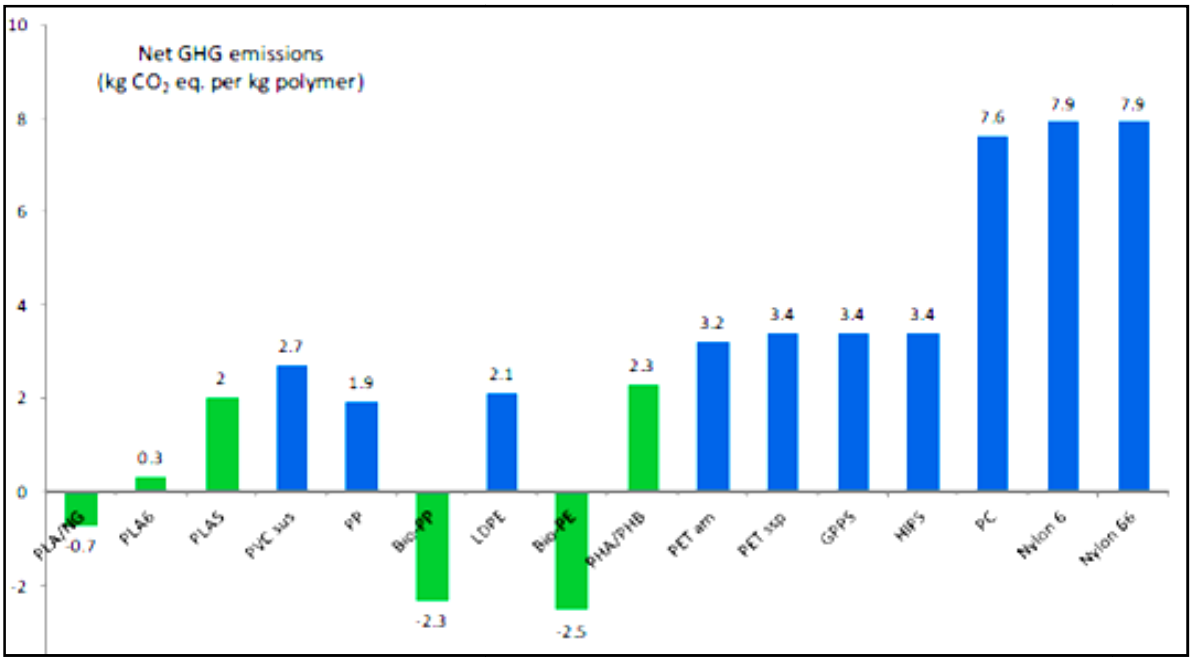

Figure. 3 Greenhouse gas emissions (as CO2) for various petro and biopolymers

Starting from the above consideration, the importance of bioplastics and biopolymers on the global GHG emission reduction it is easy to understand. However, the impact on GHG emission reduction, and the

economic benefits brought by a biochemicals / bioplastics biorefinery are strongly related to the national market conditions. It is little known that most of the plastics produced in Europe are made from fossil fuels and that biomass utilization decreases the global value chain GHG emissions. In order to facilitate the concept explanation, an example of bioplastics market supporting measure is considered below:

A detailed support scheme based on the real biomass potential would be provided in order to take in account the efforts required to MS for reaching the target. In addition, on the basis of these data, different support incentives would be provided.

- Lack of land – supporting efficient valorization of agricultural residues, providing incentives for straw, prunings and forestry residues recovery for biofuels and biobased chemicals production.
- High amount of low quality soil available – supporting specific biomasses cultivation practices, financing initiatives on the valorization of desert soils for green products market

- These conditions would be used also to develop sort of "biomass potential coefficients" per sector, in order to calculate specific target depending on national characteristics. Below two possible coefficient calculation:

$$K = \frac{Agro-forestry\ residues\ annually\ available\ (MT)}{Biobased\ product\ annual\ demand\ (MT)}$$

$$W = \frac{Non\ food\ arable\ land\ available\ (ha)}{Biobased\ product\ annual\ demand\ (MT)}$$

A crucial role is played by the quantity of material imported (% of total consumed) as well as the final product imported country by country. In summary: the more material is imported, the higher the impact. The more final product is imported, the higher the need to focus the supporting scheme on the production of that product with biomass feedstock. EU plastic production (2011): 59 MT – plastics demand is 47 MT, thus, EU-27 exports about 1 MT/month. In particular, the most relevant types of plastics produced are: Polyethylene (39%), polypropylene(19%), Polyviny(11%). It is important to consider that, of the total 47 MT/y consumed, 25.1MT ended as waste stream in 2012!

- Plastic imported (% of total consumed)
- Gas made plastics (% of produced)
- Oil made plastics (% of produced)
- Gas importation rate
- Oil importation rate

The above mentioned parameters, can be combined with two coefficients, concerning the country biomass potential availability (K & W) reported above. Below a very rough example including all coefficients for the determination of a minimum bioplastics consumption national target :

4.3.1 Bioplastics consumption target

The concept equation can be reported as a sum of the contribution of all parameters mentioned above:

$$[\boldsymbol{X} + (\mathbf{1} * \boldsymbol{G} * \boldsymbol{Ig} + \mathbf{1} * \boldsymbol{O} * \boldsymbol{Io} + \mathbf{1} * \boldsymbol{F}) + \boldsymbol{K} + \mathbf{1} * \boldsymbol{W}]*$$

*Where:

X*= minimum percentage to be reached by all countries (in relation with EU second generation biofuels target)*
G*= Gas based production (% production)*
O*= Oil based production (% production)*

***Ig** = Imported Gas (% G)*
***Io** =Imported Oil (% O)*
***F** = Imported final product: (% total)*
***K** = Solid biomass wastes availability (residues available/demand) - goes from 0,2 to 1,5*
***W** = Non food arable Land for biobased products production (hectares/demand) – goes from 0,08 to 0,30 (% 1*K)*

Es: minimum percentage: 10% of total consumption for bioplastics*

G= 100% of total used for production, Ig = 100% (all imported)
O= 0% of total used for production, Io =0%
F=20%
K = 0,2
W = 30%
Total biobased product consumption target is 11,7%

*The coefficients, the example as well as the equation calculated above are all estimations provided by EUBIA.

This paragraph wants to present a draft of what is the strategy evaluated assumed and defined by EUBIA for the promotion of a threshold for biomaterials consumption per country to be achieved within 2030.

The example reported above has been provided in order to underline the importance of non-energy products industry sector and the potential impact of biomass utilization as feedstock. Large scale biorefineries have been deeply studied in the last years thanks to a valuable support of Europea Commission Seventh Framework Programme. These efforts led to very promising results and demonstrated that biobased industry could be competitive with an efficient exploitation of the resources. However, specific targets should be defined and have been clearly asked by the investors to the European Community in order to set the investment plan for 2030. There is a strong need of a detailed support policy measures on biochemicals, bioplastics as well as all other non-energy industry sectors where biomass could play a crucial role and have a strong impact on EU GHG emission reduction target defined above.

4.4 Biofuels: Second generation, Carbon Saving and expected future for 2030.

Among the most interesting emerging bio-based markets, liquid biofuels sector is probably the hottest topic discussed in the last year in the context of European Commission debates. Due to their huge market, biofuels for light and heavy vehicles are attractive both for public and private sector. Unfortunately, at present, the most convenient biomass species cultivated for biodiesel and bioethanol production in Europe are mostly food crops: sunflower, soybean, sugar beet, sugar cane, etc..these called “first generation” biofuels encountered problems in terms of cultivation sustainability, resources availability and food competition. In order to reduce the environmental impact of liquid biofuels, ILUC proposal and next possible future directive has the intent to reduce progressively the first generation biofuels market development up to 6% of global fuels consumption (almost already achieved), supporting the development of second generation transportation biofuels to get the target of 10% on global EU consumption, thus reducing the future perspectives of food-crops-made biofuels. The liquid biofuels market in EU is now focusing on the valorization of lignocellulosic biomass. However, high quality woody biomass does not completely suit the sustainability requirements for biofuels market due to the long time growth required by forests (50 years -1 century in Sweden, Finland), and to the even more large market of biomass combustion for heat and power generation.

A relevant bottleneck of biofuels for transportation production from low quality biomass is represented by the production costs, which automatically increase when the feedstock quality decreases. Also for this reason, the first generation biodiesel production value chain was based on “high quality food” crops, despite their high fluctuating market price. Infact, the utilization of oil or starch crops reduce the liquid biofuels

production costs and permitted them to be fairly competitive with the low cost fossil ones. It can't be the same with the new lignocellulosic residues-based biofuels.

Fractionation of solid biomass, hydrolysis and fermentation steps influence the final price of these products, keeping them far from competing also with the present high cost of conventional petrol oil based fuels. In any case, thanks to the European support and to the national directives establishing a minimum amount of biofuels to be blended with fossils, some large 2 generation biofuels production industries grew in the last years and are now extending their market all over the world.

Currently the feedstocks for industrial sugar based chemicals are potatoes, cereal grains, sugar based crops, etc..However, EU recognizes the negative impact of using food crops for industrial production and, to avoid this, there is currently a drive to develop processes which can utilize both non food oleaginose crops (Castor, Crambe, safflower, etc..) and lignocellulosic residues. The land use affected by biomass industry is associated to two main sustainability issues:

- Biodiversity loss and additional green house gas emission if it involves deforestation
- Increased demands for agricultural crops on the level of volatility of food prices.

It is well known that biodiesel can be produced from non food-crops like jatropha, castor, safflower, etc..However, this strategy does not avoid an environmental impact due to the first of the points reported above: risk of "biodiversity loss and additional green house gas emission if it involves deforestation".

A study performed by the European Academies Science Advisory Council (2012) introduces the EU policies relevant to the development of biofuel use, and explores the impacts of biofuel production on GHG emissions and other environmental dimensions such as biodiversity, water resources availability and soil quality. Another recent summary study done by Chatham House (Bailey, 2013) with a UK focus summarises the consequences of expanding biofuel use in relation to environmental, social and economic sustainability.

In the past years, mandates in EU concentrated on supporting and defining a development pathway addressed to biofuels market, focusing on the preservation of biofuels industry sustainability and pushing towards the second generation biofuels, discouraging the scale of investment needed to incentivize another crucial biomass market: the biorefinery sector.

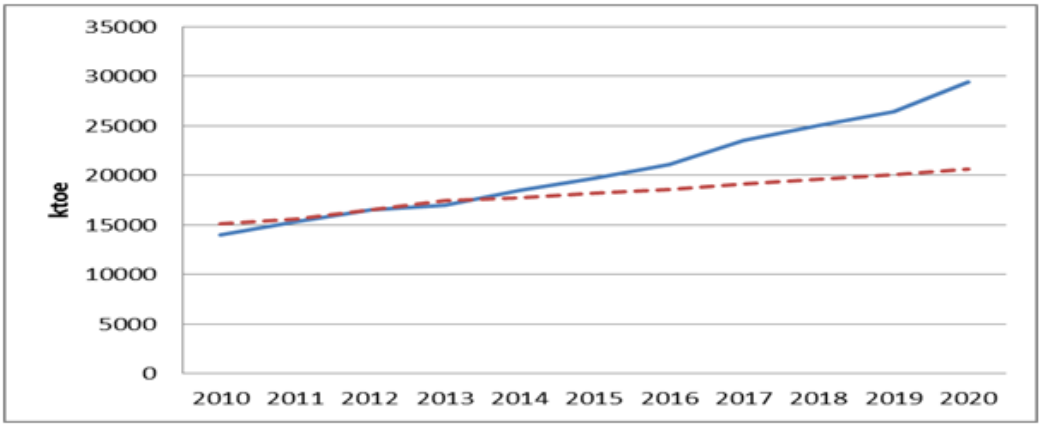

Figure. 4 Planned (blue) versus estimated (red/dotted) trend in EU biofuels

The prognosis of biofuels development trend in EU present a slight surplus over the planned trajectory with a decrease in relation with the targets defined for the 2020.

It must be considered that, due to amendment included in ILUC proposal regarding the 10% target for renewable energy in the transport sector, requiring greater use of non-food feedstock to contribute towards the target, greater reliance on advanced feedstock (which produces higher greenhouse gas savings than food-related feedstock) clearly requires additional measures for the target to be reached. In order to carry on this

trend where second generation biofuels will be supported, a big effort should be done both by investors and governments. In fact, the competitiveness of these new generation biofuels is not yet comparable with the well known first generation biofuels produced from oil crops like the mentioned above. The only solutions are represented by integrated multy-processes biorefinery, which could be representing the future in this sector. Otherwise, unless there are policy or economic benefits associated with a particular feedstock, processors will choose to use the simplest sugars (i.e. sugars from food crops), due to their ease of use, low cost and existing infrastructure.

Member States can make up for the absence of advanced biofuels targets at the EU level by establishing their own goals. Italy has recently approbed a decree which obliges fuel suppliers to have at least a 0,6% advanced biofuels in petrol and diesel from 1 January 2018, 0,8% in 2020 and 1% in 2022. This move should bring more certainty and a new boost for the production and research on advanced biofuels and should be followed by other Member States, even if a European mandate is approbed within the framework of the ILUC directive.

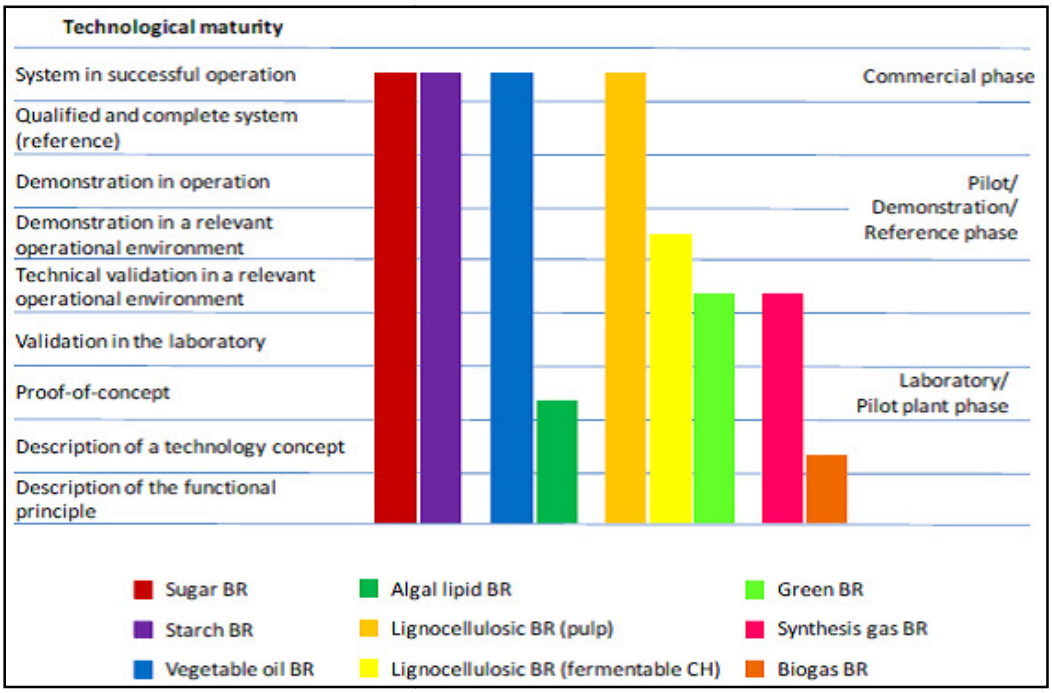

Figure. 5 Technological maturity of most used biorefinery processes. Source: OECD based on Federal Government of Germany, 2012

Due to the relevant role of transportation sector, both in terms of GHG emissions and economic impact on EU landscape, a more specific target on biofuel blending and minimum consumption target within 2030 would be recommended. In fact, According to the EC, the transport goals regarding decarbonisation have been established in the White Paper on Transport, but those are clearly insuficient and too vague: 40% use of sustainable low carbon fuels in aviation; at least 40% cut in shipping emissions; 60% cut in transport emissions by the middle of the century.

At present, the industrial development of transportation biofuels' production plants is still far to be competitive with the large oil companies dominating the market, but the impact biofuels can grow intensively in the next years and the marklet share could be enlarged in order to move away from the present political and economiuncertainty, mainly due to:

1. The increasing global oil market price coming from the current main EU suppliers, and the clear environmental impact of new shale gas/shale oil production processes

2013	Suncor	Imperial Oil	COS
Lifting costs	45.23	32.84	59.59
Non-income related taxes	5.64	8.86	4.57
Total cost of sales	**50.87**	**41.7**	**64.15**
Depreciation	16	5.34	12.55
SG&A, R&D	1.28	1.78	1.08
Financial costs	0.89	0.08	1.15
Total costs	**69.04**	**48.9**	**78.93**
Production [kbpd]	392.5	236	98.1
Realized price per barrel	**85.88**	**72.85**	**93.58**

Figure. 6. Sand Oil price per barrel and costs items

Two main aspects are influencing the oil importation in EU. First of all, the conventional oil price, coming from eastern countries, Russian area and north africa is estimated not to decrease below the 100 $/barrel as average annual value. This trend of the conventional oil price represents a valuable opportunities for renewable energy sources in EU.

The incoming revolution in fossil oil market is represented by the Shale oil, and sand oil. However, the impact of this new heavy oil is not so much related to its price, which is not so low if compared to the middle east countries. Considering the Figure 5., Canadian sands oil price per barrel is close to 100 $, this means that, in order to have valuable income, the global market price won't be easily lower. In fact, as reported in the figure 6. below, the oil reserves in North America and Canada will compete with the old oil producers in terms of potential oil extraction per day, but not for the production costs. Middle east and north africa oil production costs remains much lower than every other site. This relevant figure can be considered as a demonstration that the present Oil market price won't reduce drastically in the next years.

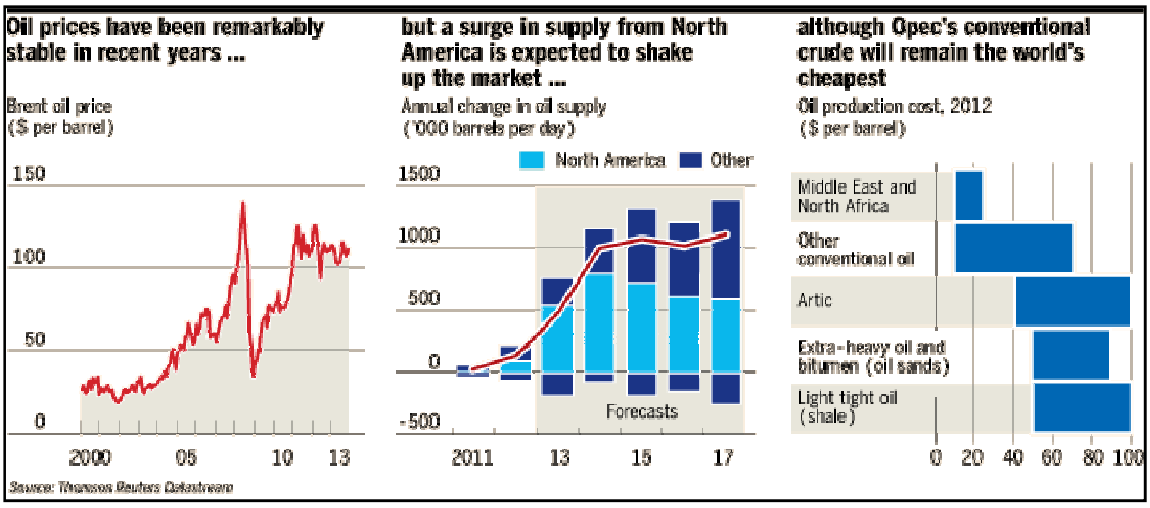

Figure. 7. Heavy oil overview on production costs

In addition, two additional factors could really influence the future of EU fuel importation:

2. The crisis of middle east countries and the instability of the Energy supply international agreements

The below cake explains well how the EU is related to two instable regions, whch are middle east and Russian Area. The uncertainty of future market partnership represents a stressing aspect of EU policy. EU member states are directly influenced by the external international events for their impact on energy sector economics. Unfortunately oil supply is often used as high value commodity able to influence governments' political stand and international relationships.

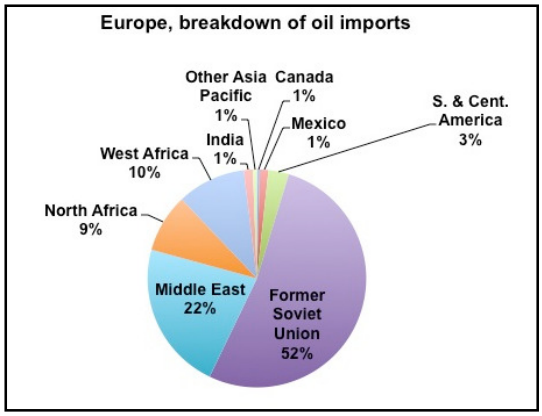

Figure. 8. European fossi oil import, 2011

3. The lack of diversified feedstock providers and the dependence on few large companies dominating the market.

All the above aspects contribute to increase the interest in this sector and the potential competitiveness of liquid biofuels for transportation. In addition, the production processes are getting more and more environmentally and economically sustainable:

- The improvement of liquid biofuels thermochemical production technology
- Advanced process catalysts, enzimes for biomass biochemical treatment
- New concept multi-process biorefineries
- The potential of new raising technologies and strategies
- The biomass cost reduction potentials

Unfortunately, the technological development is not enough to secure a linear development of this sector. The power of influence of large companies, as well as the always exhisting diffusion problems related to new markets and the present need of a further support towards large scale development, are all factors which underline the need of a latest support initiative by both European and National authorities,. Transportation biofuels sector demonstrated to be ready for the industrial scale, a further step is needed and this is the time to push forward the development of this sector.

5 Renewable energy - The decision to increase the target up to 27%, the parallel step backward to consider this limit as non binding as national level.

Below the most relevant figures resulted from the meeting in paris of thursday 23rd of October 2014 concerning renewable energy share within 2030:

- The Council confirmed the Commission's proposal on renewable energy, agreeing to set a target of at least a 27% - binding at EU level;
- Member States will be free to set more ambitious targets.

The target of 27% can be surely considered not so ambitious, even more if considering the fossil fuel cost increase, the energy market instability and the strong need of reducing importation in EU. A legally binding renewables target at national level – as was the case for the 2020 package – nevertheless seems unlikely. The commission has proposed an EU-wide targetof a 27% share for renewables in energy consumption, but no national targets. As ultimate result, the non-binding 27% would create an uncertain development rate for some countries which, after the achievement of the 2020 goal, they won't be clearly asked to provide exact figures regarding a further improvement in renewables. Major European Member States already established

new very promising targets towards the 2030. Germany, for example, stated a share of renewable energy of 45% within 2030. These very different approaches in terms of future energy policy identified among EU countries, in addition to a 2030 common target, with new non binding measures at national levels, would increase the spread between major and minor countries, creating an unstable and non uniform development of green economy in Europe.

Firthermore, another important aspect must be considered. The Ukraine crisis has proved once again the enormous dependency of the EU on energy imports, specifically Russian hydrocarbons. Despite the increasing share of renewables in the energy mix, last year, more than half of the Union energy came from third countries, many of them emplaced in volatile regions. For example, based on the latest figures, imports of Russian natural gas represented a 39% of EU gas imports in 2013, and EU Member States such as Finland, Bulgaria, Slovakia, Latvia, Lithuania Hungary and Estonia are enterely or highly dependent on Russian natural gas. In the case of oil, Russia is the biggest supplier representing a third of all imports. This excessive reliance on unstable energy suppliers can limit the EU capacity to act in the global sphere and may harm its competitivity. As a matter of fact, the EU spends more than a billion euros per day in energy imports harming its capacity to compete with other major economies.

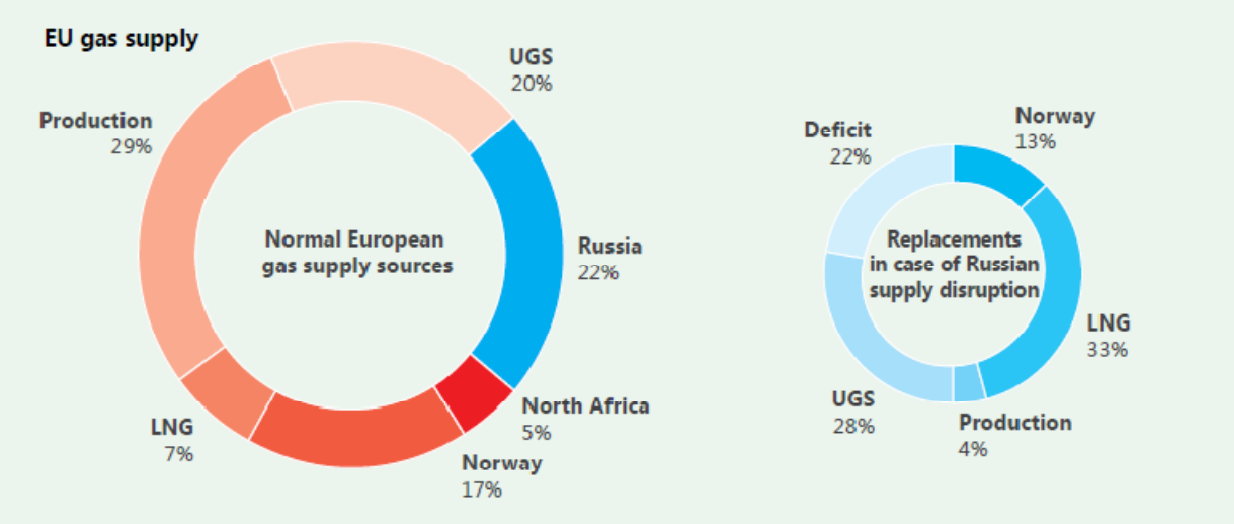

Figure. 9 Natural Gas Supply in Europe.

In this context, renewable energy should be at the center of any European energy security strategy. The EU has the natural resources and the technical and scientific expertise to untap the potential of Europe's bioenergy. Nowadays, biomass represents a competitive option for heating, reaching more than a 25% share in several EU member states and saving the Union billions in natural gas imports. In the same way, promoting the production and consumption of biofuels would reduce the impact of any energy crisis while boosting quality jobs all along the supply chain. Rural areas specially, would largely benefit of an healthier bioenergy market generating extra revenues for farmers. As a matter of fact the Biomass sector already generates more than 480.000 jobs in the EU. The recently published EU Energy Security Strategy recognized the essential role of renewables in the heating sector but still kept on focusing on the construction of infrastructures for the transport of fossil fuels.

The EU institutions should therefore, keep in mind that a strong renewables sector would not only preserve the Union position at the vanguard of the fight against climate change or at the forefront in terms of technology and economic sustainability. A firm position on renewable energies resources would also guarantee a higher degree of autonomy, avoiding any possible blackmailing and strengthening the Union's voice in international affairs. Thus, a more ambitious renewable energy goal for 2030 and mandatory national objectives could foster many more jobs and cut extra gas imports. Member States are still in time to approve a more ambitious target. The current situation in the Ukraine must be a wake-up call to react and opt for endogenous and inexhaustible resources. Europe’s economy and its global influence would greatly benefit from a stronger commitment.

Biomass should play a key role in the energy transition and the decarbonization of the EU's economy. Its characteristics make it a more flexible and versatile type of energy than any other renewable source, for it can be generated when and where it is needed and in different forms, such as biomass for energy in combustion, for syngas production, biogas for production electricity or biomethane for gas grid injection or even biofuels for the transport sector.

The role of natural gas in EU is strongly related to the heat generation. The increase of feedstock cost has a direct impact on citizens expenses and could represent a real problem in an economi recession period. More than for electricity pourposes, where wind energy, hydroelectricity, PV and ocean energy could play a relevant role, Biomass becomes the most important renewable energy source for heat generation. Several technologies are raising in order to increase the efficiency of bio-heat production in EU Member States. The next step, crucial for a large scale natural gas replacement, will be the valorization of agricultural and forestry residues. As already mentioned in the EC communicaiton on Sustainability (see EUBIA report published in September 2014) low quality biomass valorization would increase the global supply chain sustainability and drastically reduce the energy cost. Many activities have been already carried out at EU level to improve the supply chain efficiency and develop new suitable technology able to burn low quality feestock, however, a further support must be provided for the final take off of this new trend in bioenergy sector. Biomass can make a significant contribution to reduce the EU's dependence on hydrocarbon imports and a hurdle to any possible energy supply crisis.

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