

Bioenergy Markets and Policies

Learning Diary

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1. Background

The discussions and incentives to promote Bioenergy in Europe and worldwide are constantly present in Environment and Forest Forums, as well as the search for new technologies to improve this process. Concerns about energy derived from fossil fuels has some part to play in the interest shown to develop bioenergy solutions, also the oil prices and its crisis along the decades are some of the reasons that drove the interests in bioenergy. The European industry exists mainly because of policy incentives. The two explicit policy drivers are (i) a concern about energy security, and (ii) an effort to reduce carbon emissions to combat global warming, which has tended to dominate the European initiatives.

To guarantee a sustainable development for Bioenergy, that could contribute to climate change mitigation and minimize the risks of negative environmental impacts some instruments have being proposed by FAO, and they can be grouped in 4 main categories:

- Mandates with Sustainability Requirements
 - Types of Chain of Custody Systems
 - Sustainability of Biofuel Production
 - Social Sustainability Issues
- National Standards for Certification
- Financial Incentives
 - Subsidies
 - Tax Credits

- Grants
- Capacity Building
- Information sharing and dissemination, education and research, trainings

Bioenergy could be obtained from many different sources. The most frequent source is attributed to forest biomass, however agricultural residues, as well as specific energy crops are important sources. Infinite pathways are possible to generate bioenergy from different sources (FIGURE 1).

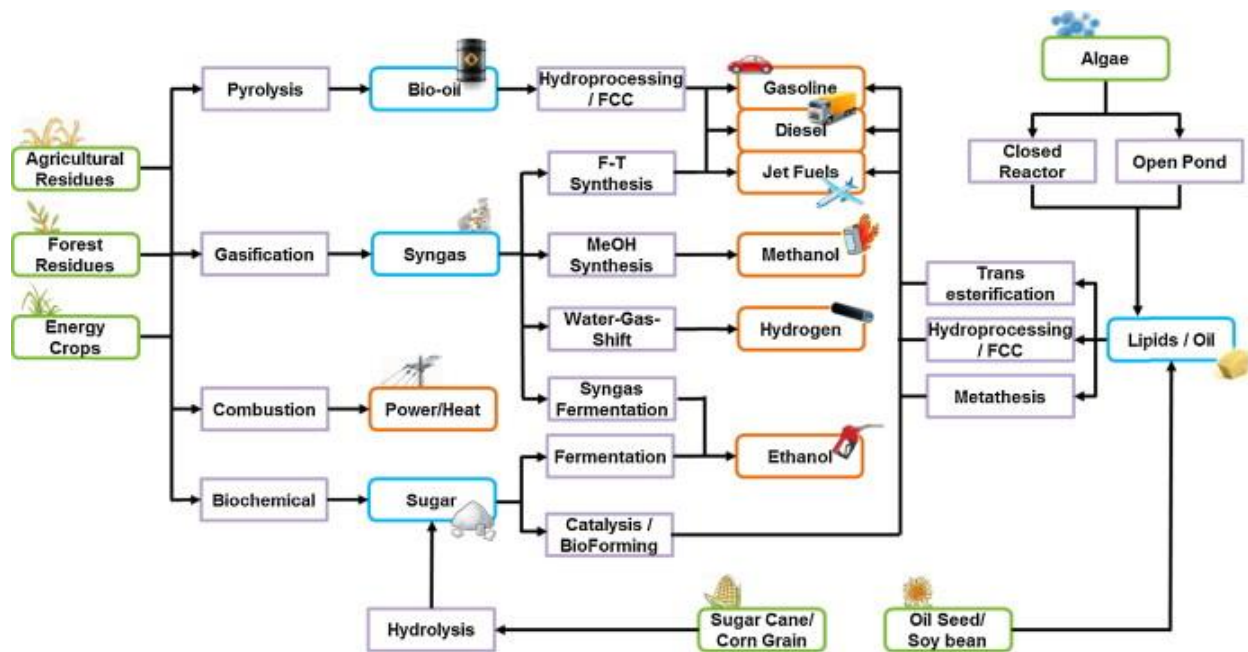


FIGURE 1: Selected conversion pathways from terrestrial and aquatic biomass to intermediates and to final biofuel products (Yue, 2014).

During the Bioenergy Markets and Policy course the main important aspects regarding bioenergy development were presented, to present the available technologies and better ways to manage environmental resources, with a focus on forest sector.

2. The role of policy

Supporting Bioenergy through the development of policies that regulate its production and development are the tools utilized by governments to support this activity. But what is the role of policies in this context? Environment and Climate Change conferences and initiatives, as the Paris Agreement and many others, play an important role in the development of these policies. To follow the agreement demands, many countries recognize the necessity of developing new policies to support the Bioenergy sector. Also, many companies are starting to understand the necessity of having more sustainable sources of energy, increasing the investments in this sector.

The reduction of oil and fossil fuels dependence is an important point that have been considered and is one of the reasons for the creation of new policies that encourage new alternatives of energy. When considering the development of new policies, some externalities may occur. Externalities are positive or negative consequences of an economic activity experienced by unrelated third parties. In Bioeconomy, the externalities are related with the policies (Environmental, Agricultural, Energy) created or edited to support this activity. For example, Bioenergy can affect:

- Changes on Climate Conditions in the nearby areas
- Changes on general climatic conditions
- Affect CO₂ Market and market prices
- Provoke soil losses and increase potential risks
- Affect Soil Conservation and Water Quality
- Landscape and Biodiversity

It is important to understand that many policies work to correct externalities as much as possible, by creating a propitious environment for new policies development.

3. Economic instruments

Many are the options for governments to support the Bioenergy expansion. The success of using economic instruments requires understanding feedstock markets, government policies, and consumer demand for fuel. Many countries authorities have set an objective of more than double the use of bioenergy by 2020, and are therefore providing financial support to the bioenergy sector, as investment grants to individuals and enterprises that shift to bioenergy from electricity or petroleum.

The economic instruments have the main task of either increase the use of bioenergy and reduce the GHG emissions. However, achieving these two goals are a difficult task. Povellato et al. (2007) give a review of cost-efficiency of policy measures in agriculture and forest sector in Europe; in most of these studies where the costs are estimated, it is done via calculating the relative change in income or welfare, or costs per another unit. In Sweden and Finland, several studies have analyzed the energy and emissions policy, as well as effectiveness and cost-efficiency of policy measures, but also there, we have not come across studies which, in a realistic economic framework, simultaneously analyze the effects of energy policies affecting bioenergy and GHG emissions, together with the costs of these policies.

Investment grants to bioenergy installations cannot ensure lowered GHG emissions, so this policy is only reflected in increased bioenergy consumption. On the other hand, increased taxes on competing fuels may increase bioenergy consumption, even if this measure is not directly designed to do so, but to decrease fossil fuel consumption. (Sjølie, 2010).

4. Adoption dynamics in bioenergy

Besides the use of logging residues from harvesting operations, the development of bioenergy is attached to the development and use of new sources of raw material. One of the alternatives for this issue is the use of fast-growing

crops. Among the different crops proposed for energy uses, willow (*Salix*) is one of the few alternatives that has been planted commercially to a significant extent in the EU. In Sweden, for example, more than 16 000 ha of short rotation willow plantations were established, making the country one of the most important ones in willow commercial plantations.

However, the conversion of traditional land uses to this emerging renewable energy sector has brought some disagreement among the farmers. There is a certain resistance from them to accept this new model of business, considering the different treatments needed for this crop compared with the common ones. In Sweden, the measures implemented to promote energy crops started with:

- Government ration gasoline and heating oil
- Research grants and investments on Bioenergy development (Plantations)
- Commercial plantations
- Plan for the deregulation of Swedish agricultural sector
- Incentives for plantations
- Implementation of CAP (Common Agricultural Policy), for annual crops

As a manner to stimulate the conversion to this new model the government proposed to pay 1200 euros/ha for the farmers that change the plantation of cereals for any other activity. And, another subsidy of 1300 euros/ha if the farmer changes the plantation of cereals to Willow production. In addition, taxes on Sulphur and CO₂ for fossil fuels in heat production increased significantly after 1992, making wood-fuels more competitive.

In general, the subsidies for willow have been revealed as a necessary tool to promote the plantations, however after the reduction of the subsidies in 1996, the expansion ceased.

5. Market behavior

Bioenergy based in wood material requires a structural organization to allow the sustainable use of the wood material and its supply. A range of factors affect the wood markets and its structure: the price of the product, the availability of wood, the transport logistic, the distance from industry etc. With the tendency of more bioenergy adherence among the energy alternatives the dynamic of supply and demand should the market should drive the prices up, and consequently increase the market turnover (FIGURE 2).

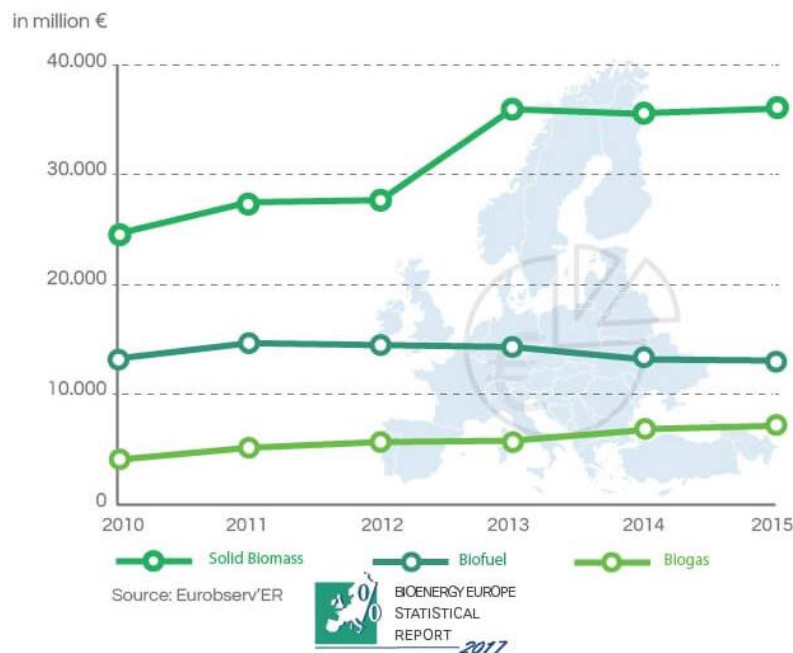


FIGURE 2: EU-28 evolution of the turnover within the bioenergy sector.

Poland case

When Poland entered the EU, it led to significant change, including energy production from renewable energy sources. As a tool for support, Poland implemented a system of Tradable Green Certificates. This tool became the most important element of renewable energy market in Poland. The impact of this

solution was the creation of competitive pressure on Renewable Energy Source producers and forcing of economic efficiency improvement.

6. Governance

Environmental Non-Governmental Organizations - ENGO's are organizations concerned with environmental issues and are formed by public members, no government connections. Their main roles are: Monitor and review environmental legislation, increase environment awareness and education for the population that are not so concerned about it, promote effective dialogues, solve and understand conflicts, offer technical services.

Regarding bioenergy issues, the role of ENGO's are very related to conflict situations. Conflicts, regarding natural resource management, occur when there are disagreements and disputes regarding access and management of natural resources, (FAO, 2000). In bioenergy and forest sector in general, are common conflicts involving different stakeholders as indigenous communities, private companies, farmers, illegal loggers and conflicts regarding opposite sectors as agriculture x forests x cattle raising. Usually these conflicts are very harmful, being categorized as violent conflicts.

A tool to understand and minimize the conflicts could be the Ethical analysis, that is classified as a research and conflict management tool to understand complex conflicts and map differing principles, interests, and values of stakeholders. This methodology can be resumed in 6 steps:

1. Identification of problems
2. Identification of the stakeholders
3. Identification of their interests, values and principles
4. Explore the stakeholders' differences 'perception
5. Identification of bridges (common interests, values and principles)

6. Make stakeholders aware of the ethical assessments and give a possibility to comment

7. International bioenergy trade

The pellet production, market and trade has been increasing in many European countries. Germany, Sweden, Italy, Austria and Finland are the biggest producers. Most of these countries has incentives such subsidies, tax reduction, Green certificate system to support and develop the activity. On the other hand, the main barriers to strength the pellet market and trade are difficult of raw material supply, lack of financial policy support and logistic.

Policy support measures to produce renewable electricity in various European countries and rising heating oil prices have enabled wood pellets to successfully compete with fossil fuels. Wood pellets are one of the most successful bioenergy-based commodities traded internationally (FIGURE 3)



Figure 3: World pellet map and trade flow in 2017 (million tonnes). Source: Bioenergy Europe, 2018.

In Finland, the policy initiatives in pro of Pellets started in the 90's with carbon tax introduced, investment subsidies for CHP plants and energy tax increased. As a projection of a future development for pellets we can say that it will develop fast in Finland considering:

- High demand in international markets that guarantees a large-scale production of pellets;
- Accessibility of raw materials – about 700,000 – 800,000 solid m³ of dry material from sawmills (Alakangas, 2002);
- National support for end-users;
- Potential market of small-scale users – about 300,000 oil fired one-family houses built in 1960-1970s with heating boilers soon to be replaced (Alakangas, 2002);
- Availability of technology and equipment as there are several stoves and boilers built for the national market;
- Rising awareness about pros and problems of pellet heating.

8. Bioenergy market supply

Government initiatives play an important role in sustaining the bioenergy market, especially during economic crisis. The government incentives to assist the market supply could include international treaties, legislation on commercial activities (trading, transport, storage) incentives for investments and guidelines for production. By designing and operating biomass chains that secure stable and competitively-priced feedstock supply for bio-energy plants it is also possible to support and develop the bioenergy activity (FIGURE 4).

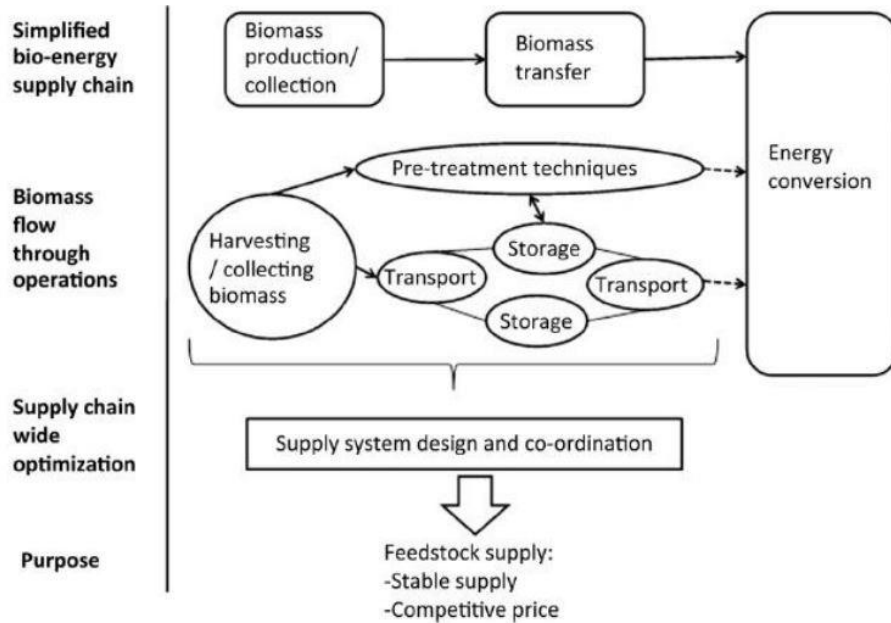


Figure 4: Biomass flow along the bioenergy chain.

One example of product that could assist the supply of bioenergy in the market is the biodiesel. Biodiesel is gradually gaining acceptance in the market as an environmentally friendly alternative diesel fuel. However, for biodiesel to establish and continue to mature in the market, various aspects must be examined and overcome. Some of the key issues such as improving efficiency of the production process, using low cost feedstock, developing cost effective catalyst, and managing agricultural land, have been reviewed. As with any new technology or products, biodiesel will require continuous improvement especially in producing cleaner emissions and having less impact on the environment. Further development on the use of the by-product will enhance the economic viability of the overall biodiesel production process. Finally, the incentives posed by the government resulting in promotion of the biodiesel production and usage will assist in establishing the biodiesel as a sustainable fuel.

9. International policies

The Bioeconomy development, that also englobes the bioenergy sector, has been one of the most discussed topics worldwide. Many projects and target goals are being discussed and planned for the next years. Europe has an important role in these discussions and is contributing with many proposals. One of them is related to climate and energy framework for 2030, that aims to achieve a more competitive, secure and sustainable energy system to meet its long-term 2050 GHG reductions target. Also, Europe has presented its 2030s target as:

- At least a 40% reduction in GHG emissions by 2030, compared to 1990
- At least 27% of renewable energy in the EU
- Energy efficiency increase to 30% by 2030
- The completion of the internal energy market by reaching an electricity interconnection target of 15% between EU countries by 2030.

Considering international policies, until 2030 the European union intend to have new indicators for the competitiveness and security of the energy system (ex. price differences with major trading partners, diversification of supply and interconnection capacity between EU countries); a new governance system (based on national plans) for competitive, secure and sustainable energy.

10. Future trends

The future of Bioenergy relies on an international cooperation in pro of its sustainable development. It requires some key actions that includes (I) Stability: by creating a long-term policy framework; (II) Innovation and Deployment: Provide sustained funding for advanced biofuels RD&D and commercial deployment, Support research efforts on land availability mapping and biomass potential analysis; (III) Sustainability: Internationally aligned sustainability certification for biofuels, Link economic incentives to sustainability performance of bioenergy, Incentivize use of wastes and residues; (IV) International Collaboration: Engage in

international collaboration on capacity building and technology transfer, Promote the alignment of bioenergy and other related policies (agriculture, forestry, rural development).

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