

Bioenergy markets & policies

Learning portfolio

Name: Barat Robin

Student number: 295579

1. Background

What is biomass?

In the field of energy, biomass is the organic matter of plant, animal, bacterial or fungal (fungi) origin, usable as a source of energy. Energy can be extracted by direct combustion (eg wood energy), or by combustion after a process of transformation of the raw material (methanization, biogas).

History & development of bioenergy

Because of the Yom Kipur War between Israel (supported by the United States) and Egypt / Syria / Jordan (supported by Soviet Union), the oil prices suffered a drastic increase in price resulting in a global energy crisis that developed along the following years. This war will cause the rise of oil price by 70%. As a result, many countries established new energy policies oriented towards the diversification of energy sources. Sweden and Finland are leaders in bioenergy development and implementation because of their forest resources.

The graph below represents the main sources of energy. How are they transformed? and the sale of biomass on the market.

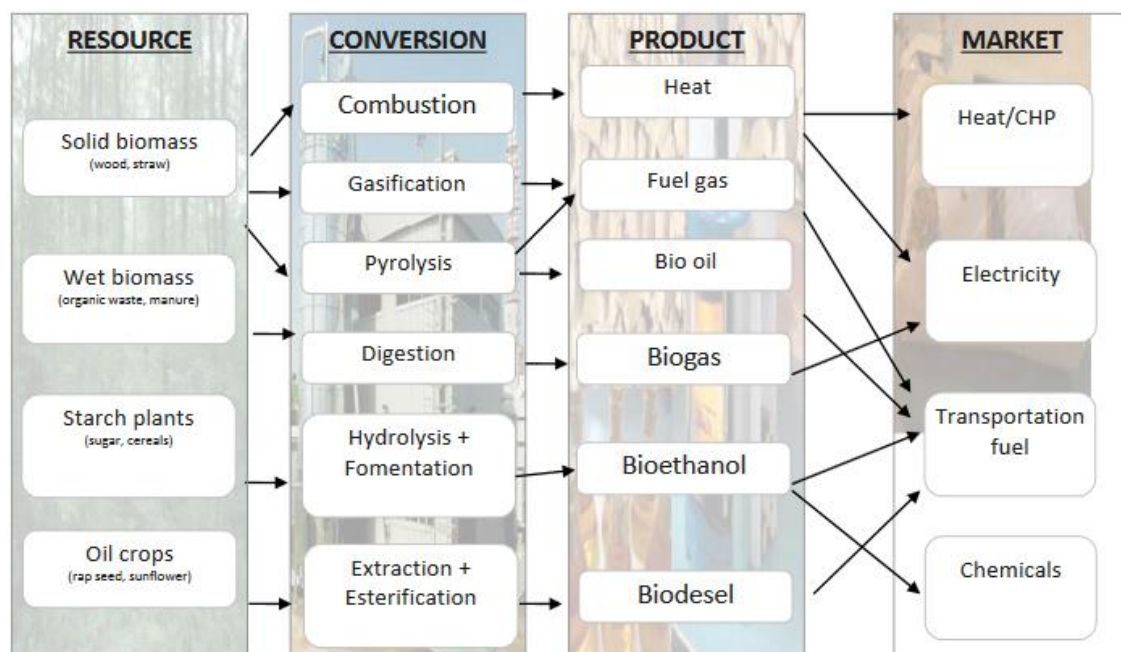


Figure 1 : Bioenergy resources and its transformation

2. The role of policy

The role of policy is fundamental when studying the development of bioenergy in Europe. There are different benefits produced by the use of wood biomass for energy, which have been encouraged through different policies.

The concept of externalities play an important role in forestry and have an impact on the bioenergy market prices. An externality is a consequence of an economic activity experienced by unrelated third parties; it can be either positive or negative. Pollution emitted by a factory that spoils the surrounding environment and affects the health of nearby residents is an example of a negative externality.

For the production of biomass there are different positive and negative externalities, here are some examples:

Reason to support bioenergy production

Environmental reasons:

- carbon neutral
- available resources (Finland, Sweden,...)
- reduce environment hazard

Social and economic reasons:

- good for local economy
- existing technology
- energy serenity
- diversify

Reason to not support bioenergy production

- expansive costs (investments, energy density)
- deforestation (sustainability)
- food security
- soil depletion

Bioenergy policies must anticipate these externalities so that the biomass production is a minimum of impact on the population and the environment. There is different type of policy for the bioenergy market [figure 2]. The different policy objectives are implemented and become a “demand” factor stimulating the development of bioenergy market.

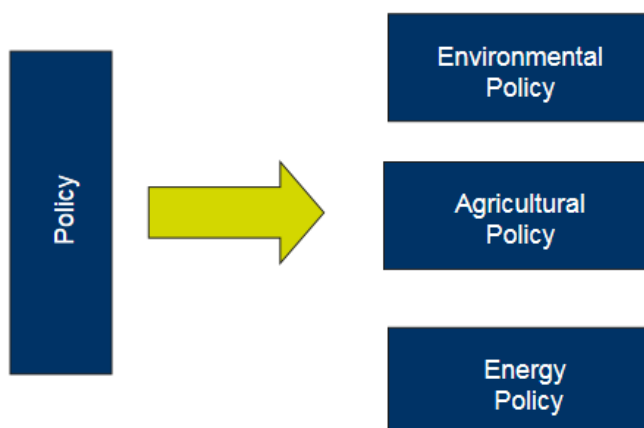


Figure 2 : Bioenergy policies

These policies have different objectives. Therefore, there is often no discussion between them and this, raise a real problem for the development of bioenergy in some countries.

3. Economic instruments

The market is shaped by the demand and supply of commodity. The demand and supply curve set the market price. Generally, low supply and high demand increase price. In contrast, the greater the supply and the lower the demand, the price tends to fall. The equilibrium price is the price at which the producer can sell all the units he wants to produce and the buyer can buy all the units he wants.

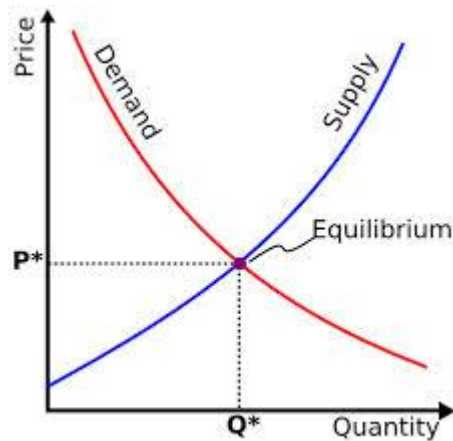
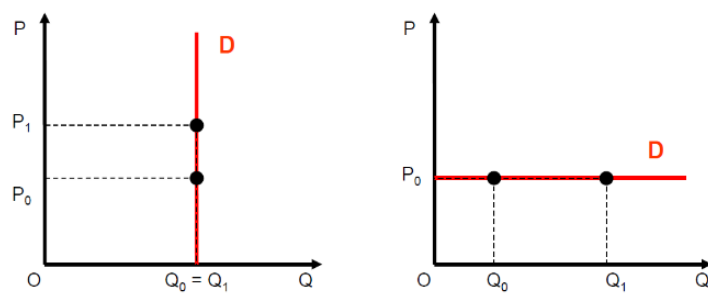


Figure 3 : Supply and demand curve

The effect of a changing price on the demand or supply is called elasticity. The demand or supply curve can be either elastic or inelastic. For example, the graphs below represent the demand curve for different markets.



Inelastic
(Oil, energy, food)

Elastic
(highly competitive market)

Figure 4 : Demand curve for different market

The main policy tools used are **taxes** and **subsidies** but there are other such as quotas and restrictions, green labeling or even research grants.

Effects of the taxes in the markets as a tool to promote bioenergy

A tax may be applied to the manufacturer or the consumer.

When the tax is applied to the producer: the price increased by the amount of the tax (supply decreases -> sliding of the supply curve to the left) = prices increases on the market - > consumer pay more but less than the amount of the tax.

When the tax applied to the consumer: the tax has the effect of increasing the unit cost of the merchandise (demand decreases -> sliding of the demand curve to the left)-> a tax reduces the amount of merchandise that applicants are willing to acquire.

The tax had the effect of lowering the price balance on the market.

Effects of the subsidies in the markets as a tool to promote bioenergy

A subsidy is the opposite of a tax. A subsidy is a form of financial aid or support extended to an economic sector generally with the aim of promoting economic and social policy. Although commonly extended from government, the term subsidy can relate to any type of support – for example from NGOs or as implicit subsidies

To promote bioenergy, subsidies are a big help for biomass producers. But these subsidies can have an impact on a parallel market. It has been found that subsidies given for biodiesel production tend to increase the forest biomass price which, in turn, may decrease the production of wood-based heat and power in the region.

4. Adoption dynamic in bioenergy

Plantation owners do not have the same way of thinking that the policy makers. For the policy makers energy crops is a small part of the energy mix.

There are different policy tools to encourage cultivations for energy utilization. For example, in Sweden subsidies were given to farmers who grew willow (1330€/ha + 530ECU/ha for fencing) and taxes have been applied to heat producers that emit CO₂ and sulfur.

The effect of these policy tools are efficient because the number of the agricultural crop cultivation are increased significantly.

There are 5 stages of adoption dynamics. The first stage consists out of innovators and is penetrating the smallest part of the market. Then early adopters, early majority, late majority and then the so-called laggards.

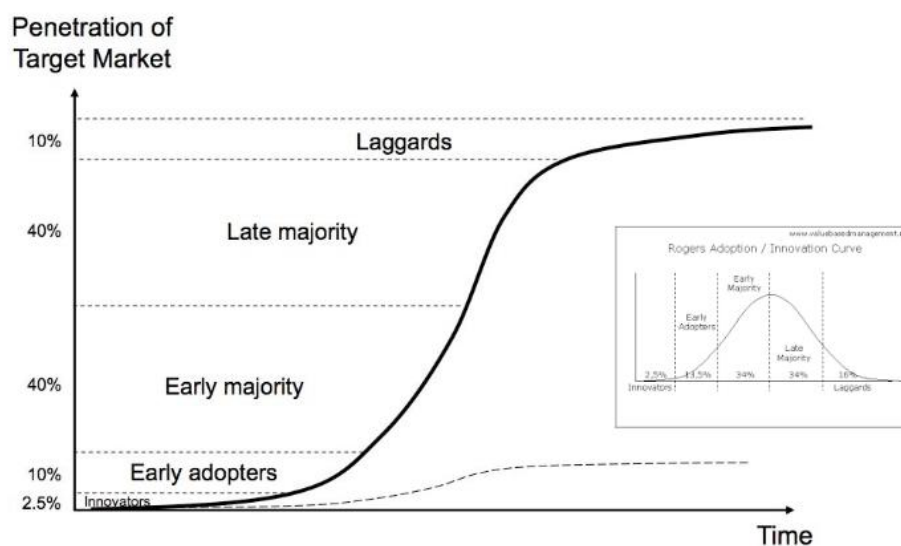


Figure 5 : Stages of adoption dynamics in bioenergy market

5. Governance

Bioenergy can play an important role in managing the transition towards a low-carbon energy system. However, in many countries its rapid expansion increases pressures on agricultural land use and natural ecosystems, resulting in conflicts with conservation aims and food security.

Definition: Establishment of policies, and continuous monitoring of their proper implementation, by the members of the governing body of an organization. It includes the mechanisms required to balance the powers of the members (with the associated accountability), and their primary duty of enhancing the prosperity and viability of the organization.

Establishing an **effective governance framework** for bioenergy, to safeguard against sustainability risks and promote the efficient use of scarce biomass resources, but is complicated by the existence of multiple objectives, multiple market failures and the variety of possible value chains

Public acceptance is identified as a key factor influencing the broad implementation of renewable energy technologies and the accomplishment of energy policy objectives. Significantly expanding bioenergy will not be feasible without social acceptance, which is primarily established through public trust and support, and this requires a policy framework for efficient and interactive communication between stakeholders

Several factors influencing social acceptance of bioenergy in European countries are:

- Lack of information
- Political uncertainties
- Sustainability of bioenergy
- Diversity in supply chain
- Competition for new industries

ENGO's & their role (Environmental Non-Governmental Organization) -> Examples of ENGOs include the WWF, Greenpeace, Conservation International, The Nature Conservancy, Friends of the Earth and the Environmental Investigation Agency.

The goals of environmental ENGOs include but are not limited to:

- creating relationships with the government and other organizations,
- offering training and assistance in agricultural conservation to maximize the use of local resources,
- establishing environmental solutions
- managing projects implemented to address issues affecting a particular area

6. International biomass trade

Wood pellets are a renewable energy carrier which is produced from sawdust or other ground woody materials. Over the past 10 years, the production of wood pellets increased steadily, driven by a corresponding constantly rising demand. For 2006, the production was estimated between 6 and 7 Mt expanding globally to 14.3 Mt in 2010 and surpassed 26 Mt in 2015. There are different pellets from different sources and qualities available today, such as wood pellets, agropellets, torrefied pellets etc. So far, wood pellets of dedicated qualities are dominating and are delivered and consumed in two different markets:

- In the electricity generation sector, they are co-fired in coal-based power plants and mono-fired in converted coal power plants to reduce greenhouse gas emission of electricity generation.
- In the residential heating sector, they are widely used as a convenient solid biofuel application in automatic stoves and boilers.

The largest pellet producer in Europe are: Sweden, Germany, and Finland, Austria as well as US and Canada.

7. Bioenergy regions

Bioenergy is seen as an important option for the reduction of carbon emissions in the energy sector and increasing the security of energy supply, while simultaneously offering chances for rural income generation and development. Consequently, many governments have adopted ambitious expansion plans and implement renewable policies in order to reduce the emissions. Some certification systems and standards have been developed especially for the use of biomass in power plants. Green certification system is one of the encouraging approach which will be given to organizations who produces electricity from renewable sources.

8. Policies and Modeling of Energy Systems for Reaching European Bioenergy Targets

A carbon tax is a fee imposed on the burning of carbon-based fuels (coal, oil, gas). More to the point: a carbon tax is the core policy for reducing and eventually eliminating the use of fossil fuels whose combustion is destabilizing and destroying our climate.

A carbon tax is a way to make users of carbon fuels pay for the climate damage caused by releasing carbon dioxide into the atmosphere. If set high enough, it becomes a powerful monetary disincentive that motivates switches to clean energy across the economy, simply by making it more economically rewarding to move to non-carbon fuels and energy efficiency.

A case study was done whether to invest in CHP or biofuel production plants based on two different policy tools such as carbon tax and biofuel support and the conclusion is:

- CHP: high carbon cost and low biofuel support
- Biofuel: high biofuel support and irrespective of the carbon cost

A conflict of interest raises between the increase biofuel production and the decrease of CO2 emissions.

9. Bioenergy policies for EU & Nordic Region

The table below show the different types of policy tools to promote bioenergy in Europe:

Policies		Instruments	Examples
Explicit	Fiscal policies	Taxes (Incentive or penalty) or Subsidy	Investment tax credit, excise tax credit for renewable energy, Carbon tax, emission taxes, Subsidies for flex fuel vehicles, Price supports and deficiency payments, Tariffs or subsidies on imports/exports
	Market mechanism	Enforcement of property rights and trading	Cap and trade, Clean Development Mechanism
	Regulatory policies & Voluntary agreement	Direct control	Fuel standards, Mandatory blending, Emission control standards, Efficiency standards, Quotas
	Policy process	Educational and informational Programs, Improving governance Compensation Schemes	Labeling, Certification programs Payment for environmental services
Implicit	Regulatory policies & Voluntary agreement	Agriculture and Trade policies, Vehicle policies	CAP
Best solutions	R& D policies		
	Mix Policies		

A carbon tax is the price that determines the level of emission. It is opposite of ETS. The EU ETS (European Union Emissions Trading System) is the world’s Oldest and largest multi-sector GHG trading program. A cap on the total emissions allowed within the scheme is set, and allowances adding up to the cap are provided to the companies regulated by the scheme. The companies are required to measure and report their carbon emissions and to hand in one allowance for each tonne they release. Companies can trade their allowances, providing an incentive for them to reduce their emissions.

2020 renewable energy target

The EU's Renewable energy directive sets a binding target of 20% final energy consumption from renewable sources by 2020. To achieve this, EU countries have committed to reaching their own national renewables targets (49% in Sweden). They are also each required to have at least 10% of their transport fuels come from renewable sources by 2020.

A new target for 2030

Renewables will continue to play a key role in helping the EU meet its energy needs beyond 2020. EU countries have already agreed on a new renewable energy target of at least 27% of final energy consumption in the EU as a whole by 2030 as part of the EU's energy and climate goals for 2030.

On 30 November 2016, the Commission published a proposal for a revised Renewable Energy Directive to make the EU a global leader in renewable energy and ensure that the 2030 target is met.

11. Future trends in bioenergy

The annual global primary production of biomass is equivalent to the 4,500 EJ of solar energy captured each year. About 5% of this energy would have covered almost 50% of the world's total primary energy demand in 2006, as shown in Figure 6. These 225 EJ are in line with other estimates based on models which assume an annual sustainable bioenergy market of 270 EJ.

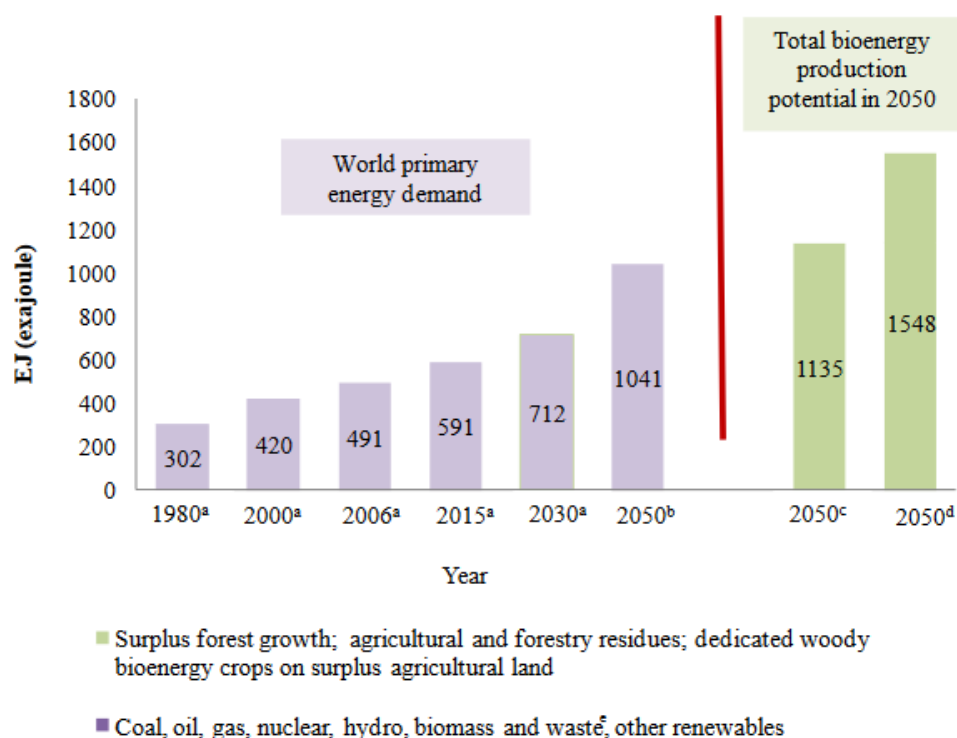


Figure 6 : World primary energy demand for years 1980, 2000, 2006 and forecasts for years 2015, 2030 and 2050 and estimates for total global bioenergy production potentials in 2050

The future potential for energy from biomass depends to a great extent on land availability.

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