

# Bioenergy markets & policies

## Portfolio

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### 1. Background

Bioenergy is a renewable source of energy and is considered as environmentally friendly because produce energy through biological sources (agricultural wastes, food, forest and other **biomass sources**). Related to energy biomass is the organic matter of plant, animal, bacterial or fungal (fungi) origin, usable as a source of energy.

Bioenergy can be produced either by solid or liquid sources. The most common sources of biomass production can be divided into solid, wet (liquid), starch plant and oil crops, having different conversion technologies in bioenergy production such as ethanol and fuels.

In obtaining energy from biomass there are several methods depending on the need, combustion methods produce the heat energy while extraction is used for biodiesel production. Here are some examples of conversion techniques and its application:

- Solid biomass (e.g. wood) combustion, gasification, pyrolysis, biogas, fuel.
- Wet biomass (e.g. organic waste) digestion Biogas, used as fuel (e.g. ethanol and biodiesel).
- Oil crops and starch plants fermentation/extraction Biodiesel/bioethanol etc.

The leading countries for bioenergy are Finland and Sweden and their major feedstock sources are forest-based sources due to high availability.

The usage of municipal waste into energy production is also a common way of producing energy in many countries. However, special precaution needs to be done

because of the possibility of toxic chemicals involvement. The common fast-growing plantations/ short rotation trees are for instance willow, eucalyptus, poplar... they are fulfilling the energy demand in many countries due to their fast-growing nature. Moreover, they can also work as a feedstock source for combustion in district heating power plants in countries like Finland.

The major concern with wood handling is to avoid moisture absorption which can be done by many techniques such as wrapping of wood properly, by using advance technologies as well as better logistics.

## 2. Role of policy

The role of policy is to promote environmental friendly energies and trying to get rid of oil. One important concept is externality which means that when the cost or benefit affects a party who did not choose to incur that cost or benefit. 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.

When we are talking about the production of biomass there are advantages and disadvantages:

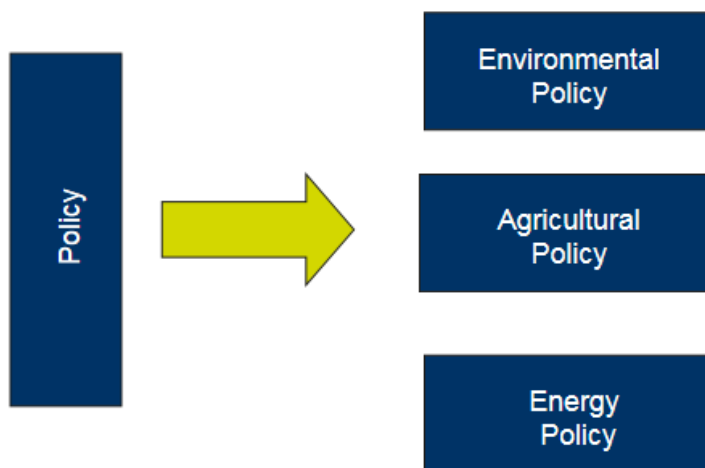
Reasons to **support** bioenergy production:

- Available resource (depending on the country).
- Less environmental hazards.
- Carbon neutral.
- Diversity of sources.
- Sovereign energy strategy.
- Improve local economy.
- Existing technology.

Reasons to **not support** bioenergy production:

- Costs (investments).
- Food security.
- Soil depletion.
- Deforestation (sustainability).

Main policies affected by bioenergy:



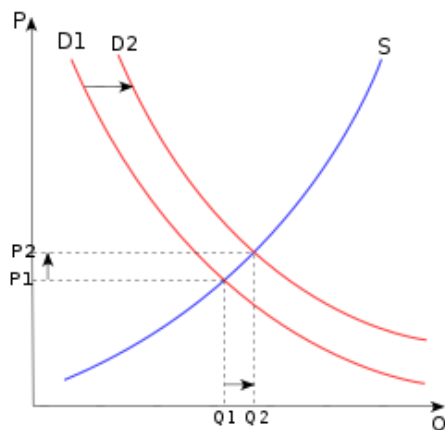
Related to environmental policy: Policies on harvesting practices (branches, leaves, machinery) and regulating forest fuel harvesting..

Related to agricultural policy: CAP (Common Agricultural Policy). Objectives: increase productivity, guarantee of secure supply of food, reasonable retail price to the consumer.

Related to energy policy: Creation of alternative technologies and fuels to reduce direct dependency on oil imports. RES Directive (EU) gave the targets and then each country decided how they were going to achieve those targets. Objectives: Secure energy supply, environmental protection, promote competition.

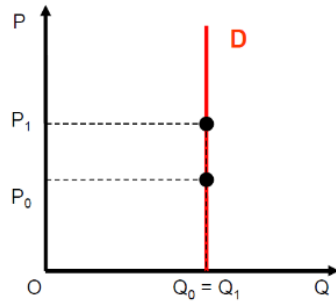
### 3. Economic instruments

The market is shaped by the demand and supply of commodity where the market price is set by the demand and supply curve. 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.

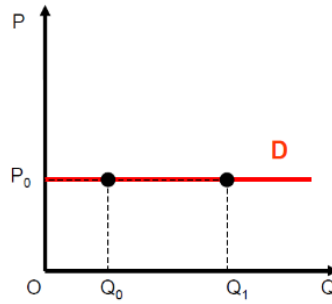


The law of supply is the opposite of the law of demand. The law demand: quantity demanded is inversely proportional to price. And the law supply: quantity supplied is directly proportional to price. Consumers want to pay as little as they can and they will buy more when the price drops. On the other hand, producers want to be able to charge as much as they can for their service/commodity, therefore their willingness to make more and sell more will increase as the price goes up.

The elasticity is the change of the price on the demand or supply, the supply and the demand curve can be elastic or inelastic.



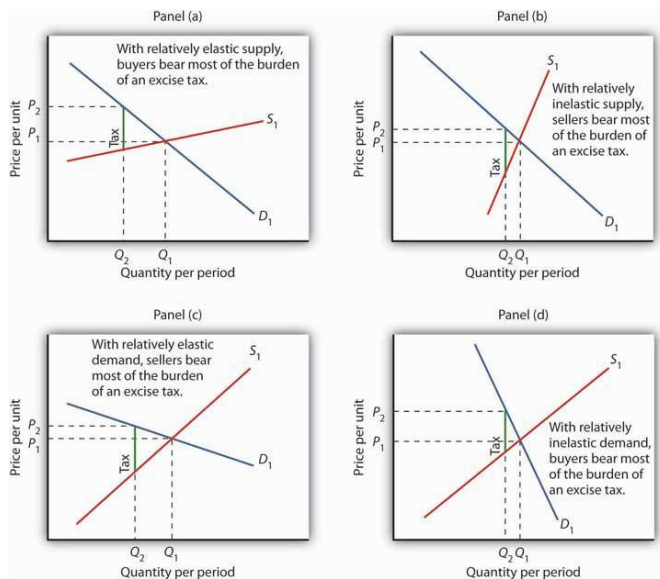
*Inelastic*



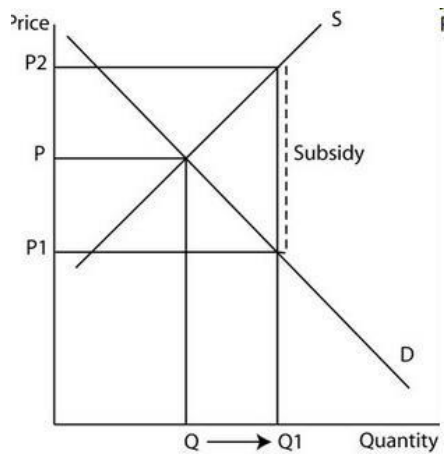
*Elastic*

As an example when we are taxing oil, most of the tax goes to the producer.

Decreasing taxes on oil will benefit producers and not consumers. If you tax a lot, it will be a burden for the producer and he is going to revolt.



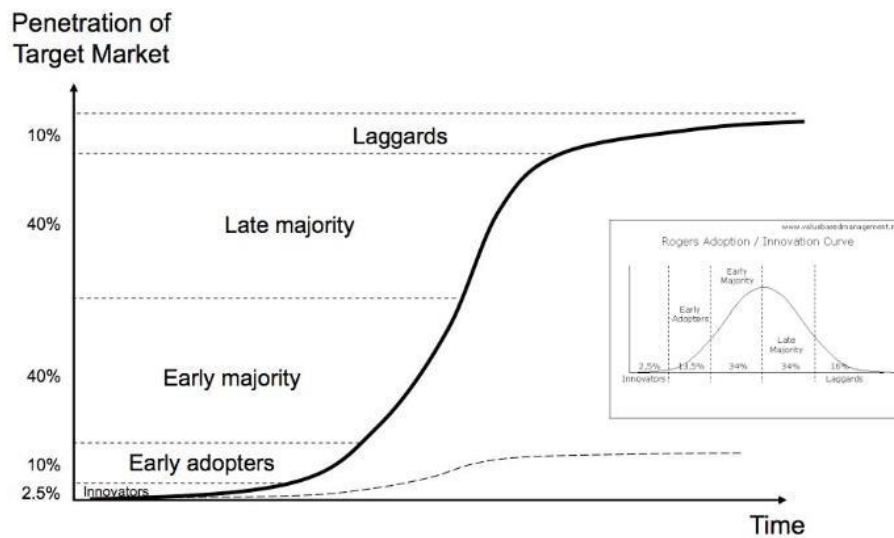
A subsidy is a form of financial support extended to an economic sector generally with the aim of promoting economic and social policy. Although commonly extended from government, the term subsidy can relate to any type of support – for example from NGOs or as implicit subsidies.



#### 4. Adoption dynamics

In bioenergy market has been observed certain patterns in the development of new product or technology, and how people respond to it. So there are 5 stages of adoption dynamics in bioenergy market:

- 1<sup>st</sup>: Innovators (penetrating the smallest part of the market).
- 2<sup>nd</sup>: Early Adopters.
- 3<sup>rd</sup>: Early majority.
- 4<sup>th</sup>: Late majority.
- 5<sup>th</sup>: Laggards.



As an example the case of Sweden, where the government to promote willow plantations as a bioenergy solution they have used a set of instruments such as researching grants and funding, subsidies (1330€/ha + 530ECU/ha for fencing) for innovators (risk compensating), and taxes have been applied to heat producers that emit CO<sub>2</sub> and sulphur.

Starting with 1991 a set of subsidies were given to the farmers that changed their cereal crops to willow plantations and they were also exempted of some taxes. Also, usage of biomass in heat production exempted the producers of certain taxes, therefore promoting production and consumption of biomass.

## 5. Biomass market behaviour

Biomass market is composed by the following components:

- The forest owners (producers): decides the price that they want to sell (trying to obtain the maximum benefit), however he cannot sell lower than the production cost of that commodity.
- Wood biomass (dealers): dealers buys and sells the wood in order to bring it to the plant and the bioenergy plant buys the wood in order to make bioenergy, the limit of the consumer in this example is the profit that it makes out of selling energy.
- Bioenergy plant:
- Buys wood to produce energy where price cannot be higher than energy profit.

Some conditions such as policy influence, free market competition and certain regulations can cause serious impacts in all market behaviour.

## 6. Governance

The governance is the 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.

The Public acceptance is the key factor influencing the broad implementation of renewable energy technologies. Significantly expanding bioenergy will not be possible without social acceptance, which is primarily established through public trust and support, and this requires a policy frame-work for efficient and interactive communication between stakeholders.

The factor that influences in the social acceptance of bioenergy:

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

Regarding to ENGO (Environmental Non-Governmental Organization) their environmental goals include: 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 and managing projects implemented to address issues affecting a particular area.



## 7. International markets

The main product to export in Finland are wood chips (short distance markets), waste wood where Norway is a net importer and pellets that came from different sources but mainly sawmills. They are used for heating plants, domestic or medium scale market. So far, wood pellets of dedicated qualities are dominating and are delivered and consumed in two different markets, on one hand 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. On the other hand in the residential heating sector, they are widely used as a convenient solid biofuel application in automatic stoves and boilers.

The pellets market in Finland has not a big market for domestic pellets compared to the market in central Europe. The pellets plants are usually located close to sawmills.

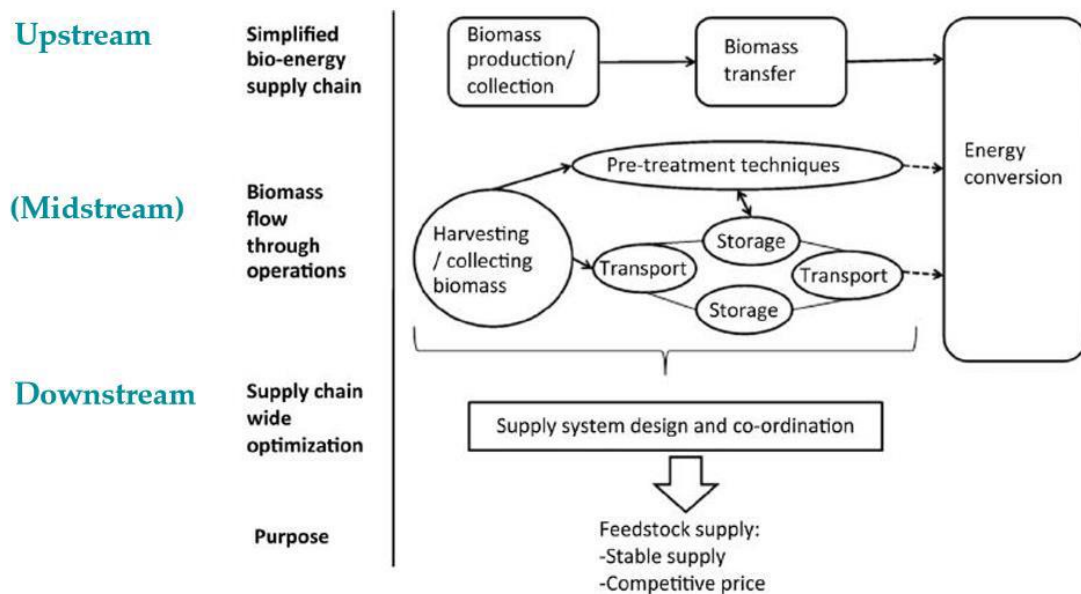
Regarding to **pellets production**, the bigger producers of pellets in Europe are Sweden (19%) and Germany (20%). And Sweden is also the bigger consumer of pellets in Europe. Other countries as Canada and US are exporting a lot of pellet.

Related to **Bioenergy policies for EU and Nordic regions** there are policy tools like command and control, subsidies, tax and emissions trading where there are three important steps the reduce of greenhouse gases emissions, increase carbon stock and comprise the emission into the bioenergy production. The main policy in EU for promoting bioenergy is European Union Emissions Trading System (EU ETS). This trading system sets a cap on emissions and requiring entity to keep a permit for each tonne of emitting CO<sub>2</sub>.

## 8. Bioenergy market supply.

The feedstock for bioenergy are plantations, agricultural and forest wastes. Also municipal waste (less common) can be used as a raw material for bioenergy.

During this lecture students had to discuss a supply chain of a certain resource for bioenergy including upstream, midstream and downstream and potential difficulties when applying the product on the market.



## 9. International policies.

The European Energy and Climate Change establishes that the following objectives have to be achieved by 2020:

- 20% improvement in energy efficiency.
- Use of renewable energies by 20%.
- Reduction of greenhouse gases by 20%.

However the percentage of reduction of greenhouse gases could increase, reaching 30% by 2020.

In the following table different types of policy tools to promote bioenergy in Europe is shown.

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		

The main policy tools to reach political goals are:

- Tax: payment per ton of carbon emitted, carbon tax determines level of emission.
- Subsidies: a bioenergy company receives EU funding for improving the efficient of technology,

The ETE is the opposite of carbon tax that is the price that determines the level of emission. The companies are required to report their carbon emissions. Companies can trade their allowances, providing an incentive for them to reduce their emissions.

## 10. Future trends.

It is obvious that we are moving forward renewable resources. In the past years the natural gas, wind and solar energy has increased, while energy from nuclear power, coal and oil is decreasing.

I would say that the most important trend are the renewable energies growth, decreasing production costs, eliminate diesel car, combination of oil with renewable energies. Investments in bioenergy depends strongly on price level of other ways of energy production, competition in land use and price level of feedstock.

The possible reasons of the slow increase of bioenergy use could be the low prices for fossil fuels, sustainability problems, wind and solar energy are becoming cheaper.