LEARNING DIARY

BIOENERGY MARKETS & POLICIES

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Introduction

There are two main events that have changed international policies and contributed to the development of bioenergy systems:

1. The first oil crisis in 1973, when members of the *Organization of Arab Petroleum Exporting Countries* announce an oil embargo targeted at those countries helping Israel in the war. Among those countries were USA, Canada, the Netherlands, UK.

2. The second oil crisis in 1979, when demand for oil exceeded the supply. There was a reduced oil supply after the Iranian Revolution, followed by the Iran – Iraq war in 80's.

This was a triggering point in changing the energy policies & markets - **to decrease the dependency on oil**. That is how renewable resources came into consideration, not because of the ecological concerns, but because of geopolitical decisions.

Undoubtedly, economic forces affect energy market. Market conditions for renewable energy and bioenergy are created and shaped by policy. In fact, policy measures are often required for the development of markets for renewable energy (including wood biomass), especially in the early stages.

The role of policy – EU level

There are three main policy fields on the EU level related to and influencing the development of bioenergy systems:

- ENERGY POLICY

- AGRICULTURAL POLICY

- ENVIRONMENTAL POLICY (climate)

The lack of policy integration might be a barrier for bioenergy development. For example, instruments for energy plantations are in the Common Agricultural Policy (CAP), while the goals are included in energy policy.

Energy Policy

Since 90's there were many guidelines and regulations regarding energy policy, like Commission White Paper, Directive on the promotion of Electricity produced from Renewable Sources (RES-E), and Biofuels Directive etc. However, the most important one is the Renewable Energy Directive (RED).

According to Renewable Energy Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (subsequently repealing Directives 2001/77/EC and 2003/30/EC), a set of binding legislation was implemented to ensure that European Union meet following targets:

- 20% reduction in greenhouse gas emissions (from 1990 levels)
- 20% of EU energy comes from renewable sources
- 20% improvement and increase in energy efficiency

All EU countries must also ensure that at least 10% of their transport fuels come from renewable sources by 2020.

The RED Directive determines national renewable energy targets for each country, taking into consideration its starting point and potential for renewables. The lowest target of 10% is in Malta, and the highest of 49% is in Sweden. In Poland the target is 15% by 2020.

Agricultural Policy

The most important set of regulations in the field of agricultural policy is the Common Agricultural Policy (CAP). Among main goals are as follows: securing food supply, increasing productivity, equal living standards for rural area population.

Table 1. Types of operations that can be supported by the Member States to enhance the renewable energy production (source: https://ec.europa.eu/agriculture/bioenergy/cap).

Types of operations	Articles and measures	Potential effects
Biogas production – anaerobic digestion plants using animal waste (on farm and local production)	Article 26: modernisation of agricultural holdings Article 53: diversification into non-agricultural activities	Substitution of fossil fuel; reduction of methane (CH4)
Perennial energy crops (short rotation coppice and herbaceous grasses)	Article 26: modernisation of agricultural holdings	Substitution of fossil fuels; carbon sequestration; reduction of nitrous oxide
Processing of agricultural/forest biomass for renewable energy	Article 28: adding value to agricultural and forestry products	Substitution of fossil fuels
Installations/infrastructure for renewable energy using biomass	Article 53: diversification into non-agricultural activities Article 54: support for business creation and development Article 56: basic services for the economy and rural population	Substitution of fossil fuels

One of the provisions of this policy is the level of subsidies for energy crops, that can't exceed the 50% of installation cost. It had a significant impact on the development of

willow plantations in Sweden. After joining the EU, Sweden had to comply with this rule, so the amount of subsidies decreased significantly. Thus, farmers were not encouraged anymore by those incentives as before.

Environmental Policy

Under environmental policy related to climate issues there is **Kyoto Protocol** 1997 and **Paris Agreement** 2015. They are both international agreements assigned under the United Nations Framework Convention on Climate Change (UNFCCC). They both share the same goal of reducing GHG emissions and restricting global temperature rise. The commitment time of Kyoto Protocol will end in 2020 and from this time Paris Agreement will come into effect. Despite similarities, there are different approaches to achieve the set aim. The difference is in the way these agreements make developed and developing countries commit to take actions to oppose climate change. In case of Kyoto Protocol, it binds only developed countries to reduce the emissions (By 5% in 2008-2012, and by 18% in 2013-2020), while it doesn't bind developing countries. On the other hand, Paris agreement attempts to reduce the division between the developed and the developing nations.

Advantages and disadvantages of developing the bioenergy sector

Reasons to support bioenergy production

- Environmental concerns: phytoremediation, positive impact on soil and water
- Availability of resources (availability of wood biomass resources in Finland)
- Supports local economy (new jobs, new profits, taxes etc.)
- There is an existing technology, that simplify the process
- Diversification of used resources
- Energy independence (from other countries)
- Carbon neutrality

Reasons not to support bioenergy production

- Costs
- Lower energy density than, for example, fossil fuels
- Deforestation
- Food security
- Carbon neutrality

The analysis of the markets and policies related to wood energy can become more complex when some structural factors are considered:

- First structural factor is related to **many diversified and mutually competitive final uses of solid biomass** in energy sector: - biomass utilized for electricity production or heat generation; - biomass used in small scale family boilers or in large scale energy plants. It is also connected to alternative non-energy uses, like pulp production. Analyzing policy-related aspects, while implementing different sector policies, presented **competition in the use of solid biomass may introduce coordination problems**. Furthermore, there are known examples of policy conflicts, where

incentives for biomass heating installation and investments in gas distribution in remote rural areas were available at the same time (those actions are contradictory). **In relation to the market analysis, this factor is providing stability to demand**. Additionally, it is also reducing the costs of logistics and promoting innovations in technology saving raw material.

- Local-scale value chains related to small enterprises and household consumption of wood biomass keep on playing double role: 1. positive factor in policy analysis, 2. Problems in data collecting and monitoring market developments.
- Wood biomass utilization is strictly associated with relevant externalities, both positive and negative, concerning environmental and social impacts. The topic of externalities is described widely below.

Externalities produced by forestry sector and bioenergy utilization

There are many **positive externalities** that can be gained in forestry sector. For example:

- Better air quality; trees acting as filters that capture pollutant particles,
- Enhanced landscape quality; scenic beauty of forests,
- Improved water quality by minimizing soil erosion (reduced sediment in water bodies) and filtering water pollutants,
- Trees store carbon, thus they change general climatic conditions, forests as carbon sinks,
- Changing microclimate conditions in surrounding areas,
- Forests are habitats to many endangered species of flora and fauna; biodiversity hotspots.

For many countries around the world forests are important not because of the profit obtained from timber & pulp production, but because of positive externalities that they provide.

One of the example of externality and shadow price obtained from forests is the case of **Spanish dam**. The project included reforestation of mountainous slopes to decrease a risk and delay the deposition of sediments at the bottom of dam. The value of forest that protect the area from landslide could be economically evaluated, as it prolongs the use of dam by many decades.
Another example presents a *Pinus radiata* plantation, where wood sold as a normal good gives 4,5 % of profitability. At the same time, if we include externalities and public good inside investment the profitability increases to 6,18 %. Moreover, if you can add rural development with job generation, it gives 7,13 % of profitability in total.

Most of the reason supporting bioenergy production come from the concept of externalities. It is the basis to justify policies based on promotion. Most of the externalities implemented in 70's they were oriented to procure energy in a safe way, not dependent on geopolitical context.

As mentioned before externalities can produce positive and negative externalities that are associated with biomass utilization:

positive externalities	negative externalities
Biomass utilization can promote active management of forests, otherwise abandoned habitats that are exposed to high risks of fire and pest attacks	At the same time, bioenergy consumption can stimulate the forest degradation and land conversion from natural and seminatural systems to required plantations
Bioenergy consumption affects carbon fossil fuel substitution as well as carbon sequestration in the growing forests and the harvested wood products	Relatively low added values and limited employment is provided by the use of wood for energy generation
Local chains based on bioenergy utilization can provide positive externalities in the form of better quality life and increased income of rural populations	

There are existing simultaneous cultivation of annual crops and plantations around the same area. Thus, energy crops are used not only to produce biomass, but also to produce better quality water - it is also a positive externality, some additional commodity. Willow can filter water and absorb nitrates. Moreover, it has ability to absorb cadmium very efficiently. It is called phytoremediation. Leaching of nitrates in the groundwater is substantially lower from SRC. It has also positive impact on soil, because carbon storage in soil organic matter is higher under energy crops than under conventional agricultural crops (it supports carbon sequestration). Plantations can play certain role in landscape ecology, when they are planted as border areas, stripes (to block noise from road) etc. Willow plantations may also contribute to improve biodiversity in area, it can be a habitat, place of rest or forage searching for different animals like birds, deer.

Enköping, Sweden is an example of successful bioenergy system where the combination of multifunctional uses were applied. In the early 1970s the town constructed a district heating system based on oil boilers. However, due to the oil crisis and energy security concerns the use of domestic bioenergy supplies were suggested. Market conditions for bioenergy were strengthened in the 90's because of the carbon tax forced by the Swedish government. Taxation included CO_2 emissions from fossil fuel combustion to produce heat. The level of the carbon tax promotes bioenergy over fossil fuels in district heating systems. Thus, due to changing politics, a CHP plant with only biofuels resources was established. Nevertheless, the risks of biofuels price fluctuations from forestry in the surrounding region encouraged local energy companies and municipality to explore agricultural options, like energy crops. They developed willow plantations. Certain goals were set: transportation distance less than 20 km; plantations

larger than 10 ha; and digested sludge & the nitrogen rich water from the Waste Water Treatment Facility should be used as fertilizer (which is delivered free of charge to farmers). Eventually, the Waste Water Treatment Facility financed the irrigation pipes, and the willow plantators signed an agreement with the local energy companies to provide biomass. Energy crops are located close to CHP plant to reduce cost, as well as to control price fluctuations from forestry by-products, and to avoid the import of wood biomass from different regions. This bioenergy system created a chain of activities that offer employment and opportunities for business, because it requires harvesting, transporting, and distributing.

Policy measures

Most common policy instruments to promote bioenergy development

Bioenergy has the potential to provide a significant contribution in achieving RED targets and realizing a larger share in the overall energy mix. However, to accomplish that support mechanisms for bioenergy must be developed. Most common policy instruments to promote biomass use in energy growth are presented below.

Measures that **support investment & production**, for example:

- regulations
- subsidies (direct transfer of funds, direct payments)
- taxes
- soft loans (low-interest, below the commercial rate loans and/or a longer repayment period)
- feed-in tariffs
- feed-in premiums
- renewable energy quotas with tradable certificates (e.g. green certificates)
- investment tax allowance
- exemptions from fuel taxes
- mandates with sustainability requirements
- capacity-building programmes (e.g. training initiatives developing learning processes)
- R & D grants

Grants represent one form of financial incentives. They can be used by governments, for example, to support good practices or to promote research, development of bioenergy technologies.

"**Feed-in premiums**: In a feed-in premium scheme, plant operators have to sell their renewable energy on the market and receive an additional payment on top of the market price. This payment may be either fixed or adapted to changing market prices to limit the price risks for plant operators."

"**Feed-in tariffs**: In a feed-in tariff (FIT) system, power plant operators receive a fixed payment for each unit of electricity, heat and/or biogas generated, independent of the market price for these energy products."

Mandates (quota) with sustainability requirements –for example biofuel mandates, which assign minimum share of liquid biofuels that has to be mixed with fossil-based fuels. Moreover, mandates in some countries include also certain sustainability requirements that biofuel producers have to respect.
To give an example of implemented bioenergy policy measures within EU, the case of Germany & the United Kingdom will be described.

EXAMPLE FROM GERMANY
Bioenergy policy characteristics:

- Focal point: promotion of energy-related biomass use in small to medium scale heat and/or power installations.
- No co-firing of biomass is supported for generating renewable electricity.
- Shift from fiscal instruments towards more regulations in the recent years.
- Bioenergy policy on regional and national level.

Financial instruments:

- Market incentive programme – **investment subsidy**
- RES Act – feed-in tariff for electricity from biomass – **operational subsidy**
- **Tax exemptions and deductions** for certain biofuels

Regulations:

- Renewable Energies Heat Act – **building regulation**
- Biofuels Quota Act – **quota obligations**

In Germany the expected share of biomass by 2020 accounts for almost 10% out of the total energy consumption. However, to obtain this threshold the necessity of importing biomass has been pointed. Two main reasons are: a lack of resources and too short timeframe for policy implementation.

Example from United Kingdom
Bioenergy policy characteristics:

- Strong support of co-firing of biomass in coal-fired power plants
- Electricity market reform
- Shift from green certificates to feed-in tariffs

Financial instruments:

- Renewable Heat Incentive for non-domestic installations – **operational subsidy**
- Renewable Heat Premium Payment for domestic installations – **investment subsidy**
- Feed-in Tariff – **operational subsidy**
- Renewable Obligation Certificates – **operational subsidy**

Regulations:

- Renewable Transport Fuel Obligation – **quota obligation**

The main policy measures implemented within the power sector, in order to achieve a higher share of renewables, are feed-in tariffs (explained above) and green certificates.
'Green certificates' are awarded to power generators to certify that the electricity has been generated using renewable sources. In other words, producer of green electricity (coming from renewable resources) receive so called green certificate for each pre-defined unit of electricity produced that is put on the grid. These certificates can be traded at a certificate market and can add an extra profit for producers.
On the other hand, consumers of electricity are assigned with certain targets related to the consumption/sale of electricity from renewable sources. Thus, in order to prove that they meet those targets, they have to return certificates at a given point in time. To control it, penalties are set for the consumer that are not able to fulfil obligations. Consequently, consumers have an encouragement to buy certificates from the producers and the certificates become valuable.
The price of green certificates depends on the market: on supply and on demand that is fixed by the mentioned target. In case of low supply of green certificates, price will increase (higher price). This can be a certain type of incentive for new producers who can provide energy from renewable resources. At the same time, those producers who can ensure renewable electricity at the lowest price, they will be able to sell certificates. ()

<u>example from Poland:</u>
To give an example of implementation of green certificate system and the consequences the Polish case will be presented. Certification system have been implemented in this country in 2005. It was used to promote the production and use of renewable energy. Applied Energy Law control electricity generators and suppliers that provide this electricity to end users to comply with a specified annual quota of green electricity. However, in 2016 there was a change in Polish law. This quota system was replaced with auction system.
Results: Even though applied system was mostly successful in developing wind energy, it didn't work in other sectors. Those mechanisms didn't stimulate investments in new type of technologies. To meet the target without any bigger investment, the producers realized that it was more profitable to expand combustion of biomass together with coal in existing power plants. In result, too many green certificates were issued (high supply) for biomass co-firing. This weakened the price of green certificates. In consequence they became unattractive to investors in newer technologies. Moreover, the renewable energy mix became unbalanced.

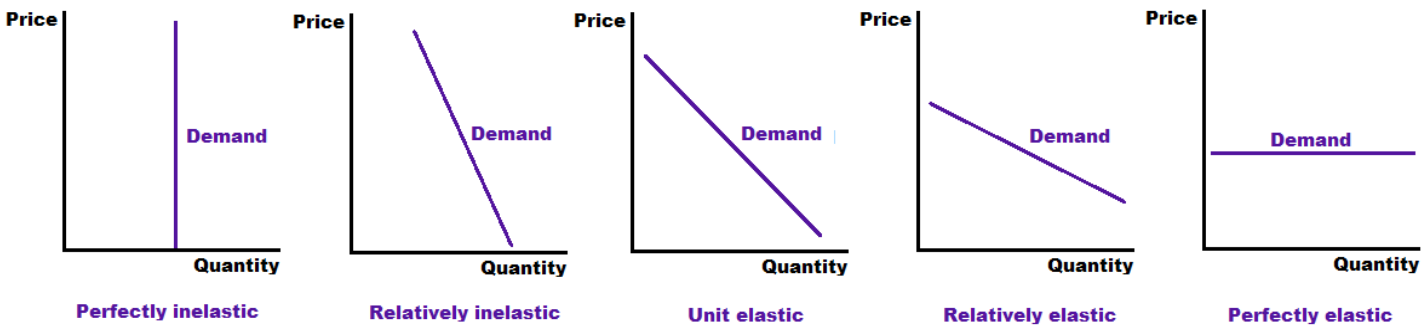
Economic instruments

In general, the market condition (including bioenergy market) is shaped by the supply and the demand curve of a given product or service. Those curves are created by defining the relationship between price and quantity. In case of bioenergy the demand is shaped by district heating sector, local actors & consumers, while supply is formed by forest biomass or energy crops availability.

Government policy usually has a predefined (expected) impact. For example, the government might provide subsidies to farmers to encourage them in investing in new solutions or crops. On the other hand, government might also want to discourage certain behaviors, for instance, by implementing tax on cigarettes and alcohol. These government policy measures come in many forms, including tax policy, regulations, tariffs, subsidies, etc. **They manipulate the costs and benefits that individual actors face.**

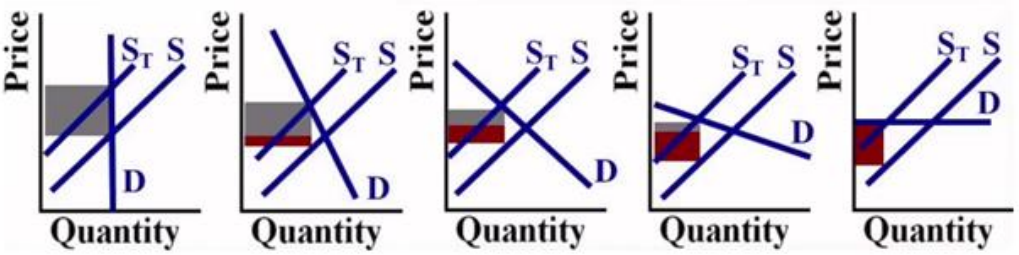
ELASTICITY

Who incurs more of the tax or who receives more of the subsidy (producer or consumer) might differ and it depends on the price elasticities of supply and demand curve. Attached graph below represents elasticity of the demand curve – from perfectly inelastic, to perfectly elastic. Price elasticity of demand is a measure to show the responsiveness, of the product quantity demanded to a change in its price. An example of perfectly inelastic curve includes products like oil, energy and food. Why? Because there is a demand for those goods, like food.



EFFECTS OF TAXES

With relatively elastic supply consumers bear most of the burden of a tax, whereas with relatively elastic demand, producers incur most of the burden of tax. In case of relatively inelastic supply producers bear most of the tax burden, while with relatively inelastic demand, consumers incur most of the tax burden. For better understanding of the proportion of burden carried by producers and consumers, the graph below is presented. **Taxes, move the supply and demand curve to the left, in contrast to subsidies that work opposite.**



EFFECTS OF SUBSIDIES

As previously mentioned, there are different forms of policy measures that government can provide. One of them are **subsidies** that might work in two ways: to promote the production **(supply-side)** or to promote consumption of a certain good **(demand-side subsidy).**

With supply-side subsidies given to the producers **the supply curve shifts to the right** and the demand curve remains the same. The shift of a curve last until the vertical distance between those two curves is equivalent to the per quantity unit subsidy. **Due to applied subsidies, producers are supported to produce more of a product.** Moreover, they are able to do it with lower costs. In result, the price of a good decreases, whereas a demand for specific product increases.

In a similar way works the demand-side subsidy given to consumers. **A shift of a demand curve to the right side will appear**, while the other things remain equal (supply curve). This will decrease the price paid by consumers, because they can buy more products for the same price. At the same time it will increase the price received by producer for the same quantity of a good. This type of subsidy encourages consumers to purchase subsidized product.

Because consumers will be paying less, producers can actually increase the price and charge more. Thus, at some point consumers are being artificially encouraged to buy. The end result is that the lower price that consumers pay and the higher price that producers receive will be the same, regardless of how the subsidy is administered.

SUMMARY

When "the supply curve is less elastic than the demand curve, producers bear more of the tax and receive more of the subsidy than consumers as the difference between the price producers receive and the initial market price is greater than the difference borne by consumers. Where the demand curve is more inelastic than the supply curve, the consumers bear more of the tax and receive more of the subsidy as the difference

between the price consumers pay and the initial market price is greater than the difference borne by producers."

Adoption dynamics in bioenergy

Even though we might see a plantation as a managed crop on agricultural land, for a policy maker it has a completely different dimension, linked with different objectives and goals. Plantations provide certain advantage, because they can be treated as a buffer for forestry. In case if there is a demand for biomass we can cut plantations more frequently. On the other hand, if there is no need or there is too much biomass on the market then we can wait with cutting for better opportunity. Thus, you can control supply/demand flow. It is also an alternative for forestry, because **it is not a by-product** of another activity, like in case of forestry sector where the biomass we get might be a residue from clear cuts or from wood-processing industry. Plantations can be a certain buffer that stabilizes the prices.

All in all, we have to combine knowledge from natural science (technology, engineering & biology) together with social science (economics, social studies & policy making) to reach predetermined goals. The goals for bioenergy usage might be defined in MJ or kWh, to reach that we need certain amount of area planted and efficient yield.

example from Sweden:

The adoption dynamics in bioenergy sector can be described on the willow plantations example in Sweden. **Sweden was the first country in northern Europe who started plantations on a larger scale**. It all started in the 80's and still is considered as an important crop for the production of wood biomass for the energy sector. In the best moment there were more than 15 thousands of hectares of short rotation willow plantation in Sweden. It covered around 0,5% of the total arable land. That made Sweden the leader in willow plantations at that time.

The history behind the evolution of bioenergy sector in Sweden:

- In 1970 there was an oil crisis (first one in 1973 associated to issues in Israel, second in 1979 related to Iran). Sweden is dependent mostly on oil at that time, so they restrict heating oil and gasoline, with penalties implemented.
- The reaction to changing conditions was the beginning for research grants and investments on bioenergy developments, like short rotation plantations. Policy makers not only established research programmes, but also established a projects to start those plantations in reality.
- First commercial plantations set in 1980s
- In 1990 programmes with financial incentives for plantations have started.
- Next big change occurred in 1995, when Sweden joined the EU. Thus, the certain policy strategies had to be implemented, like CAP (Common Agricultural Policy).

To promote willow plantations Swedish government proposed a set of instruments, like **research grants, subsidies & taxation**. From 1991 there were subsidies granted for those farmers changing their cereal crops to other cultivation (main aim was to diversify the agricultural sector), as well as certain subsidies for those who will specialize specific in willow crops. Parallel to these subsidies taxation was applied. Taxes on sulfur and CO_2, where the biofuels were exempted.

Swedish system and applied measures were **promoting the supply of biomass**, not oriented towards a demand. Most of the subsidies are transferred to the producer. Taxes concerns also producers, but the producers of a heat.

At the beginning of century some scenarios predicted that willow plantations in Sweden will reach 300 000 ha in 2020. Without a doubt, the policy measures resulted in expansion of willow plantations across those years from 1989 till 1996. The final coverage of plantations is nowadays not sufficient (all in all, rather unsuccessful, but not a total failure either).

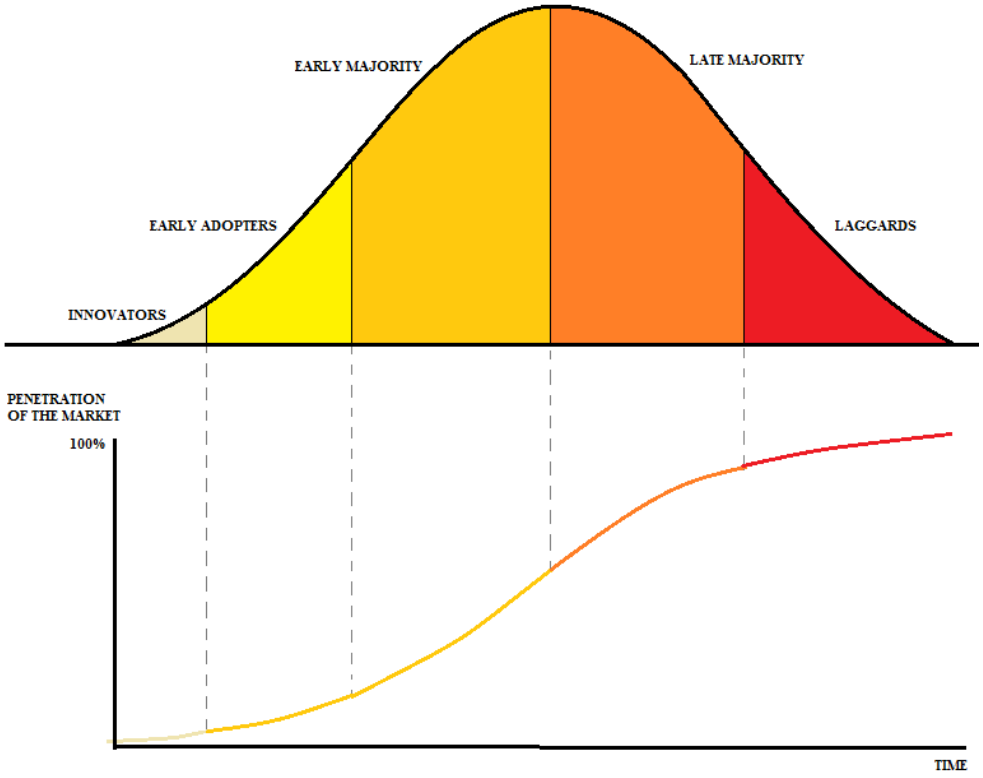
In 1995 there was a changing point, when Sweden joined the EU. It meant that Sweden had to consider CAP, which doesn't allow subsidies for more than 50% of the establishment cost. However, taxes kept on raising over the years. With reduction of subsidies, the development of willow plantations wasn't that encouraging and got stagnated. It was a failure in the context of previous expectations.

Main stages of adoption dynamics

No matter what kind of product join the market, regardless if it is a new technology, new harvester machine, or even a willow plantation it follows a certain dynamic (presented on the figure below.

1. **Innovators (~2%)**
2. **Early Adopters (~14%)**
3. **Early Majority (~34%)**
4. **Late Majority (~34%)**
5. **Laggards (~16%)**

Innovators: Risk takers that follow new products and technologies, before nobody tried.
Early adopters: Not innovators, but they decide to adopt new product. They are rather risk taker. "Typically this will be a customer who, in addition to using the product or technology, will also provide considerable and candid feedback to help the vendor refine its future product releases, as well as the associated means of distribution, service, and support."
Early majority: Is the first bigger segment of a population that will adopt a new product or technology after seeing it used successfully by two previous groups that they know personally.
Laggards: Like older people or people who are not prone to new products or technologies.



We can use exactly the same scheme for energy crops. However, **it works when there is a stability in the framework.**

Spatial adoption dynamics

In the case of Sweden, while analyzing spatial distribution of willow plantations over 20 years (1986 – 2005) one can observe changes in the south of Sweden and around Stockholm city. Density of energy crops is increasing over those years, especially after implementing subsidies. However, after 1996 when the incentives were minimized we can observe stagnation in the development of willow plantations. New farmers and people who didn't have experience with willow were not growing it. But people who already had plantations they continued.

Even though subsidies play an important role, but supply and demand are also important factors. Demand also pushes people to make certain decisions.

Profiling of farmers adopting SRC

Some researchers conducted study about farmers who adopted willow plantations in their agricultural land. There are a few factors that have positive or negative influence on this adoption.

Positive impact:

- Farm size: People with small lands were more prone to establish willow plantations, because those lands were not their main source of income. Thus, usually they were working additionally, so having an energy crop was more convenient because of the rotation period etc.

- Forest land: People who also had a forest land were more eager to plant willow crops.
- Age: Farmers of around 50 – 65 years old were more willing to have energy crops. Surprisingly, younger people were rather reluctant.
- Also, people who leased to others and institutional owners (municipalities) were more keen for this new willow plantations.
- Those farmers who had more mechanized structure and irrigation system were prone to establish energy crops.

Negative impact:
- Pasture & animal: Those farmers who had pastures and animal breeding were not eager to start plantations. They prefer to use that land for pasture and feeding purposes.
- As already mentioned very young or very old people were rather unwilling to plant willow.

While analyzing the economics of adoptions one can see that whenever there is a success there is a decrease in the cost. One study compared costs for willow plantations in Northern Ireland which was pioneer and costs in Sweden which was already experienced. Establishment, fertilization spreading, harvest was more expensive in Northern Ireland. **The first planters who establish crops, they pay an additional risk**. **Because they don't have enough knowledge, experience, necessary machinery, and other limitations.**

One side effect of subsidies in Sweden was that many farmers were more interested in the subsidy than in establishing energy crops. In result, after they got financial support and after they planted it, they didn't take care of it at all.

Undoubtedly, those following factors positively affect the willow plantation (improve), like new varieties, experienced farmers, and better overall methods. All in all, the most reasonable way is to follow the experience of other countries.

<u>The model of implementing the product can be composed of the following elements:</u>
Adoption of plantations, which is affected by the **market forces** (demand, opportunity cost, and alternatives), **local perceptions and attitudes** (psychological factor), and **yield**. It all influences the total planted area. In turn, yield is directly affected by **local factors** (climate, soil), **biotic events** (pests, diseases), **management** (local practices & experience, improvements), **research & development innovations** (new varieties, better efficiency machinery etc.). Additionally, to run this engine there are more interactions. The innovations affect the **total production costs** and it affects the **profitability**. The **wood chips prices** play an important role on profitability. **Policy**, not only affects the profitability, but also affects market forces, management and R & D.

Development of pellet markets in Europe. Main threats and future trends

Wood pellet industry in Finland

The potential for wood pellet market development is extensive due to material potential related to high forest cover. During the last decades, pellet consumption and production in Finland increased steadily. Main barrier for Finnish pellet industry development are the lack of policy support with suitable regulation. Thus, pellets are not highly competitive with other fuel sources. If challenges related to competitiveness and high cost for raw materials are solved, then it might the market might be promising. If the proper regulatory framework and policy support will be addressed, then Finland have a potential to become bigger consumer and producer of wood pellet across Europe.

Pellet trade flows

In Europe, the largest operating pellet plants are located in the Germany, with the capacity of 256 tonnes per year (each plant). Production and consumption patterns have been changing over past few years. However, few years ago main consumers of wood pellets were: the Netherlands, Belgium, Denmark, France, UK, Ireland, Norway. Whereas main producers were: Germany (20%), Sweden (19%), Italy (9%), Austria (8%), Finland (5%), Poland (5%).

Main barriers for pellet market development in Europe

- Raw material supply. To produce pellets, we need a material – sawdust, the availability of sawdust from wood-processing industry might be limited to certain locations. The production very often is localized and dependent on resources, new feedstock and imports.
- Logistics. The logistic of pellet distribution might also me a limitation, especially compared to fossil fuels that are easier to transport. Location affects development.
- Sustainability concerns. Bioenergy might threaten the food supply (food vs food), it takes the land that might be used for other purposes.
- Fuel quality. Nowadays, it is not that big issue, but in the past there was a problem with lack of pellet certification and common standards across the European market. Lack of quality control and efficiency.
- Lacking financial policy support. Lack of policy support and certain measures are one of the reason for low pellet market development.
- Unfair competition with fossil fuels.

Bioenergy regions

Renewable energy utilization started with a debate about sustainable development. Furthermore, energy transition from oil and coal into more sustainable resources came into discussion. Also energy resource trade became a global process.

At the EU level exists a set of renewable policies like:
- Renewable Energy Directive (RED) with its sustainability criteria
- National Renewable Energy Action Plans (NREAPs), which every member state have to prepare

Most policies in the EU are rather market based, for instance, they are related to incentives, feed-in tariffs. At the same time they are the policies to create markets. Partly, those developments come from environmental governance, where the importance of transition towards low-carbon technologies is emphasized.

It is very crucial to understand how the bioenergy & environmental governance interact with each other, and what the effects on market development are. Since usage of bioenergy is related to climate & environmental issues, the debate on its effects is continued. Mainly, mentioned debates come from eNGO protests (like Greenpeace, WWF etc.). Those campaigns and events have created so called **'relational reflexivity'** among consumers, politicians and society in general. This relational reflexivity created a demand for sustainable energy. One of the solutions proposed was the bioenergy. On the other hand, other actors presented different, negative rationalities, against the usage of bioenergy (food vs. energy conflict).

When we come to the bioenergy policy in Europe (or for renewable energy in general) it is made to be mobile. Those policies, even though created in Brussels, they have to be applied and useful in many different countries, and many different regions. It has to be designed not as a fixed structure, but in adjustable way (also to national legislation). Surely, it needs to be applicable in many contexts. Moreover, it has to be coherent as one aim, but at the same time it should be mutable so it can be implemented in various context. Policy is changeable, so the new ideas could be applied in different countries.

In practice, translation loops of bioenergy policy works on a few different dimensions:

- rules and regulations
- soft incentives (suggestions, ideas, subsidies etc.)
- empty governance space (up to the national translation, it requires a filling in)
- translation & mutation based on regions (where the national policies are translated into regional context)

example from Germany:
To present this theory into more practical example let's look on bioenergy regions in Germany and its translation loops. In 2009 there was a competition organized by the Ministry where 25 regions were chosen out of 210 applicants. The idea of this was to create regional showcases of what is possible for the remaining regions, how this works and how the bioenergy development can be done in the future. It was supposed to be a knowledge transfer between those regions. In those regions certain EU (EC Biomass Action Plan, Renewable Energy Directive etc.) and national (NREAP, EEG etc.) policies were translated.

The general aim of Germany was to increase bioenergy utilization within sustainable limits. Secondly, supporting creation of added value in region, as well as enhancing local energy transitions and rural development.
Results of this programme finish with different outcomes, create different markets and also follow different aims. Thus, one can observe how similar political decisions are giving different outcomes. There was observed different socio-economic environment between south and east of Germany, regarding unemployment rate, as well as financial capacities & income. Moreover, rural areas differed in forest resources, ownership structure, and agriculture lands. These bioenergy regions also had diversified organizational structures and initiating actors. Thus, different policy approaches were designed and applied; and different results appeared in return.
What was found in the case of Germany, that there was a lack of common sustainability guidelines and multiple perspectives were applied. For example, there was no common supply area rule. Many times their definition of sustainability was just used because it was 'bio'.

The promotion of knowledge is shaped by those regions and institutions. It might result in aims not necessary congruent with initial aims and thereby result in shifting rationalities of the policies. At some point policy changes, and the idea behind it.

Very often regional actors faced the problem, because even though they wanted more 'green' & environmental friendly energy solutions, and they would find some enthusiast who would be willing to pay more for it. However, the main part of society wouldn't agree with that idea. In this case the success was partially dependent on entrepreneurial focus and approach in the negotiation processes.

Results of what have been functioning and what not on the EU and national level:

- entrepreneurial focus strengthened
- sustainable use of bioenergy for climate was not actually developed

Example of the local bioenergy development:

- Germany: A farmer wanted to build a biomass plant on his land. Thus, he analyzed supply chain, the resources etc. The investment would be financed by his funds, with the help of state subsidies. However, his neighbours didn't like him. You might wonder what it has to do with bioenergy markets. According to environmental impact assessment they found out that this biogas plant is harmful and will pollute the river, where the Red Listed species were found. After the reconsideration of the case, one specialist realized that those organisms couldn't live in this kind of river (neighbour threw those organisms there), so the investment could be completed.

- Norway: More than 90% of electricity comes from hydropower. Despite this, the government agreed to enlarge bioenergy usage. Most of the things in Norway run on electricity, like heating etc. There was a project to start wood based local district heating. The municipal support was provided, and plenty of local resources with healthy tree growth were available. Also there were strong, innovative networks. Although, those many conducive factors, there were some obstacles.

In result, we can observe that not only policy instruments has an impact on the development of bioenergy sector, but the human factor is also very crucial.

Important factors for translation of bioenergy materialization are:

- acceptance
- social & local aspects
- experience
- knowledge on international policy, business environment & local infrastructure

European Union Emission Trading System (EU ETS).

In 2005, the EU started the Emissions Trading System (EU ETS) as one of its strategy to reduce carbon dioxide and other greenhouse gases emissions at the least cost. **This system is based on emission limits set on certain installations and it works on the 'cap-and-trade' principle** (quantity mechanism). The limit is reduced each year, and within it, companies can purchase and sell emission allowances on a market. The EU ETS systems include around 11000 power & heat generation plants, energy-intensive industry sectors, and aviation activities in European countries. In total, approximately 45% of total EU GHG emissions are regulated by this system. Moreover, the cap-and-trade approach provide opportunity for companies to reduce the emissions in the most cost-effective way. "By putting a price on carbon and thereby giving a financial value to each tone of emissions saved, the EU ETS has placed climate change on the agenda of company boards across Europe. Pricing carbon also promotes investment in clean, low-carbon technologies." In ETS system, if company emits more than the threshold, then it has to buy emission allowances from others, draw allowances they saved from previous years. However, within limits the company can also purchase credits from certain emission-saving projects located around the world.

Except cap-and-trade approach the baseline-and-credit approach exists too. In this system companies earn credits for emission reductions if the emissions were below their baselines.

Carbon tax

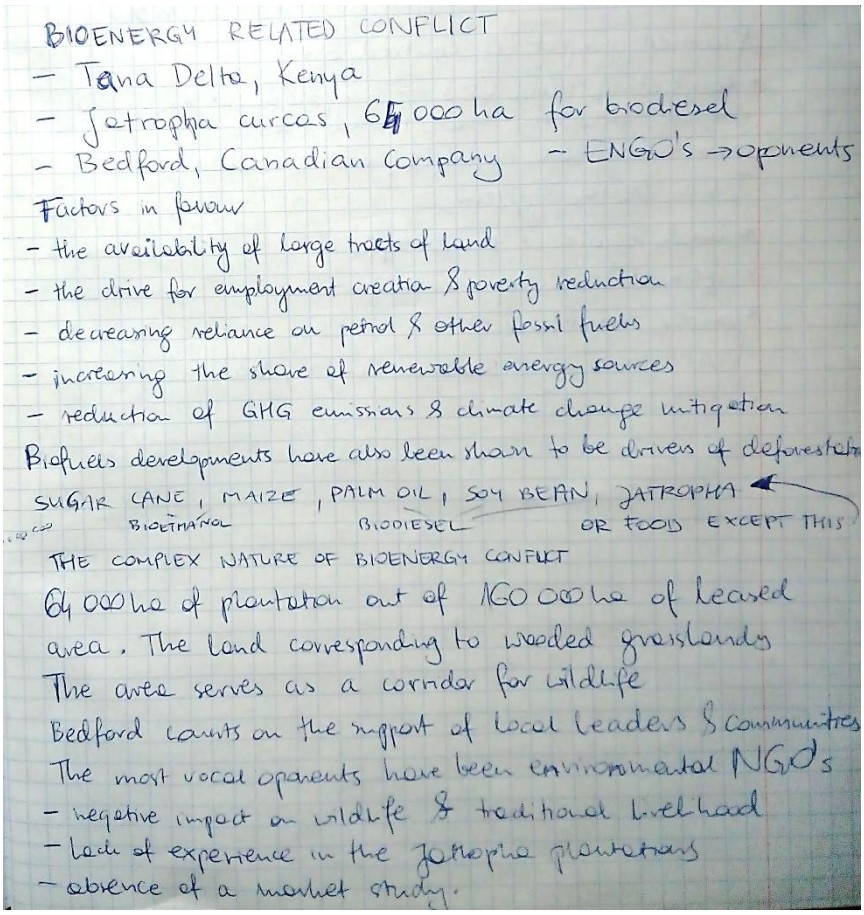
Adopted by around 20 countries in the world (eg. Sweden, Finland, Chile, France, RPA, Poland, Portugal etc). **It is a form of putting a price on carbon emissions**, where companies pay fee on the use, production, or distribution of fossil fuels like coal, natural gas (price mechanism). It is also called a '*tax on everything'*, because it affects the prices of many goods that are produced through burning fossil fuels. The tax is based on how much carbon their combustion emits. The government sets a price per ton on carbon, then translates it into a tax on electricity, oil, gas etc.

Carbon tax is supposed to improve energy efficiency, encourage the use of renewable sources, as well as reduce the consumption, because it makes the fossil fuel more expensive. It also makes alternative energy more cost-competitive. However, **with carbon tax you don't have a control over emissions because they are not limited, like in the case of cap-and-trade system**. Thus, it does not actually cap the emissions level. In theory, it is supposed to reduce the production but there is no guarantee.

<u>Pros and cons of cap-and trade system</u>
+ can set a quantity limits based on science
+ can adjust the amount of emission permits for certain companies
+ create a unit of exchange on international arena
+ could raise profit if the auctions are used
- determining how to allocate the initial credits (you can reward bad behavior)
- distribution controlled by politicians (possibility of lobbying)
- need for set up a market where permits can be purchased and sell
- it can't be used for all type installations, like vehicles, homes, small-scale industries etc.

<u>Pros and cons of carbon tax:</u>
+ easier to administer, because we don't have to set up an entire market
+ avoid changeability of a market
+ can generate large amount of revenue
- does not limit or cap emissions, reduction of consumption/production is not guaranteed
- even if it is easier to administer, there might appear legislative battles between actors on the level of the tax, who should be exempted etc.

Bioenergy related conflict

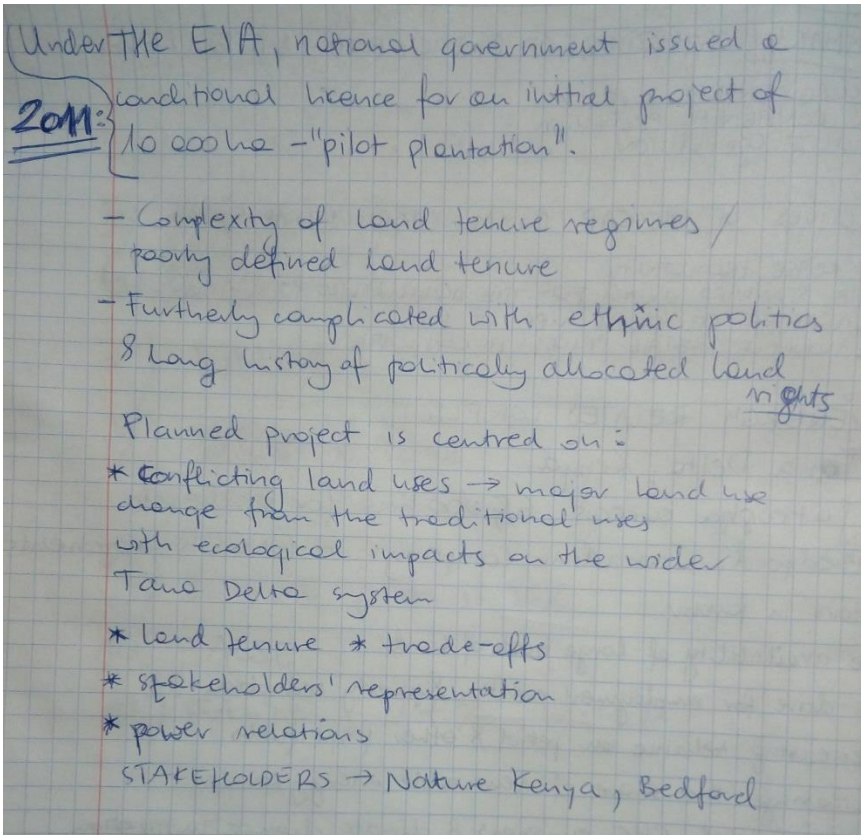


BIOENERGY RELATED CONFLICT
- Tana Delta, Kenya
- Jatropha curcas, 64 000 ha for biodiesel
- Bedford, Canadian Company - ENGO's → opponents

Factors in favour
- the availability of large tracts of land
- the drive for employment creation & poverty reduction
- decreasing reliance on petrol & other fossil fuels
- increasing the share of renewable energy sources
- reduction of GHG emissions & climate change mitigation

Biofuels developments have also been shown to be drivers of deforestation
SUGAR CANE, MAIZE, PALM OIL, SOY BEAN, JATROPHA
BIOETHANOL BIODIESEL OR FOOD EXCEPT THIS

THE COMPLEX NATURE OF BIOENERGY CONFLICT
64 000 ha of plantation out of 160 000 ha of leased area. The land corresponding to wooded grasslands
The area serves as a corridor for wildlife
Bedford counts on the support of local leaders & communities
The most vocal opponents have been environmental NGOs
- negative impact on wildlife & traditional livelihood
- lack of experience in the Jatropha plantations
- absence of a market study.



Under THE EIA, national government issued a conditional licence for an initial project of 10 000 ha - "pilot plantation".
2011:

- Complexity of land tenure regimes / poorly defined land tenure
- Further complicated with ethnic politics & long history of politically allocated land rights

Planned project is centred on:
* conflicting land uses → major land use change from the traditional uses with ecological impacts on the wider Tana Delta system
* land tenure * trade-offs
* stakeholders' representation
* power relations

STAKEHOLDERS → Nature Kenya, Bedford

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