



UNIVERSITY OF
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LEARNING DIARY
BIOENERGY MARKETS AND POLICIES

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Introduction

Bioenergy in general meaning is the production of energy in the form of heat, light, electricity and even the biofuel, mostly from the plant biomass like forest products and its side streams, agriculture products and its byproducts, and other biological wastes. The conversion procedures and technologies involved to convert biomass into the biofuels and other forms of energy depends on the state and nature of the biomass resource. It is explained schematically in figure 1.

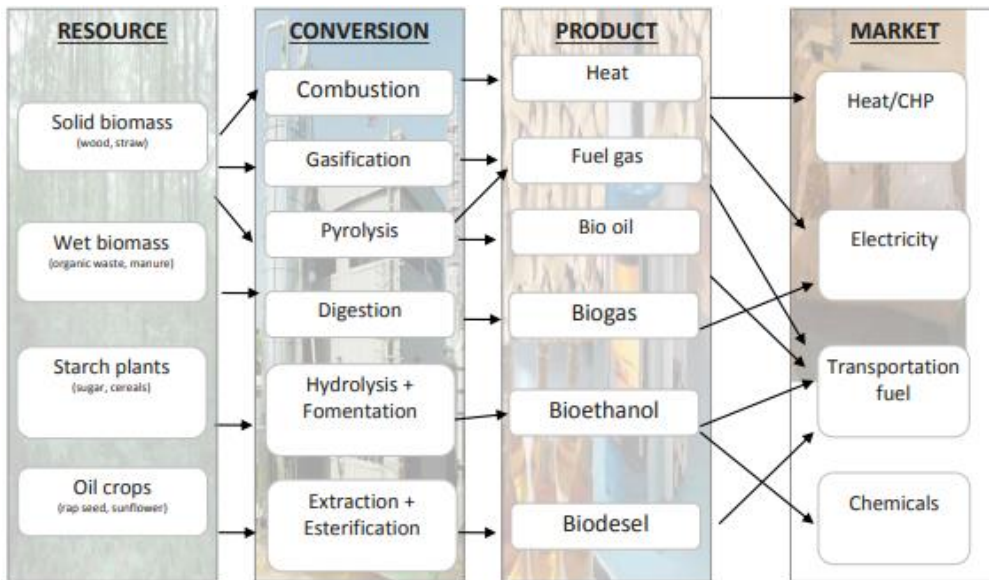


Figure 1: Conversion of biomass into different forms of energy/products

During the early and late 70s, the dispute in the major fossil oil exporters - middle east countries, had heavy impact in the energy consumption pattern of American and European countries. The oil crisis for almost a decade resulted in the socio-economic frustrations among those countries. As a well-known proverb “necessity is the mother of invention”, it was truly applicable in the research and development of tools and technology in the alternative energy so called bioenergy.

European countries specifically Sweden and Finland are the world’s leading countries in the bioenergy sector. The reason behind it, is the availability of huge forest biomass resources, research and development of the high technology and their determination to reduce the dependency on the fossil fuel. As I have understood, one of their main agenda so called climate change mitigation is just a part of their marketing strategy in order to enhance their economic growth through abundantly available local resources. And it makes a good sense.

The over exploitation of the forest trees as it is the main source for biomass, however, may cause the environmental degradation and many other issues. Therefore, finding the alternative source is of great

concern. Many different species of shrubs and fast-growing plants have been trailed through out the globe. Willow plantation specially in Sweden has a successful story. In the other hand, utilization of bioproducts and waste products from agriculture and municipality can contribute significantly.

While thinking about the efficiency in energy production, from plantation to product, logistics is another crucial factor in the whole value chain system. It can be clearly understood from figure 2.

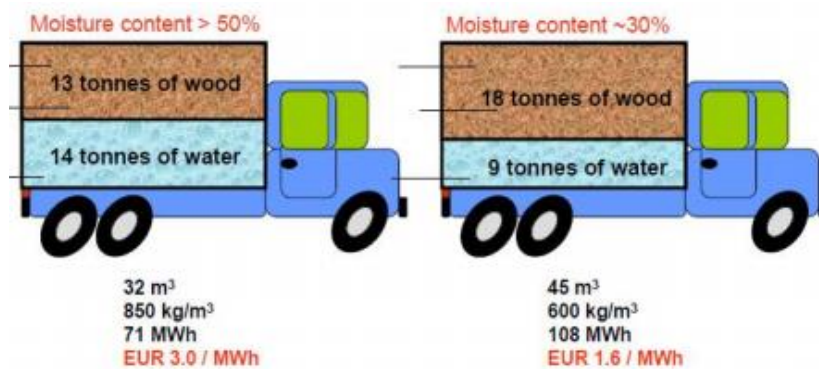


Figure 2: Differences in transporting wet and partially dry feedstocks

The role of policy

It is a policy that creates a system of principles to guide decisions in achieving rational outcomes. But there are many different factors influencing in policy making. These influential factors should be study and analyzed in detail to avoid any kind of conflicts in the future. One of the tools for analyzing is PESTE analysis which includes economic, social, environmental, political, and technological aspects.

There are three main policies regarding the bioenergy sector:

- 1. Energy Policy:** The main aim of this policy is to secure energy supply by increasing the use of local renewable resources and reducing in importing fossils fuel. Numbers of concepts, targets and guidelines have been introduced since 90s. In 1997- Commission White Paper, 2001 – Renewable or RES-E Directives, 2003 – Biofuels Directive, 2007 - Renewable Energy Roadmap, 2008, 2009 – Renewable Energy Directive repeals 2001 and 2003 Directives and strictly plans to use at least 20% of total energy consumption from the renewable source by 2020.

2. **Agricultural Policy:** Also known as CAP (Common Agricultural Policy). Its main objective was to secure the supply of food at reasonable price while securing the economic value for the agriculture population.
3. **Environmental Policy:** Kyoto Protocol 1997 and Paris Agreement 2015 assigned under the United Nations Framework Convention on Climate Change (UNFCCC) shares the common goal to reducing GHG emissions and restricting global temperature rise. In 2008 EU set 20-20-20 target, which means reducing greenhouse gases by 20% below the 1990 levels, increase the share of renewable energy to 20% and improve energy efficiency by 20% by 2020. Most of the EU states are near to the target while Finland has already met the goal.

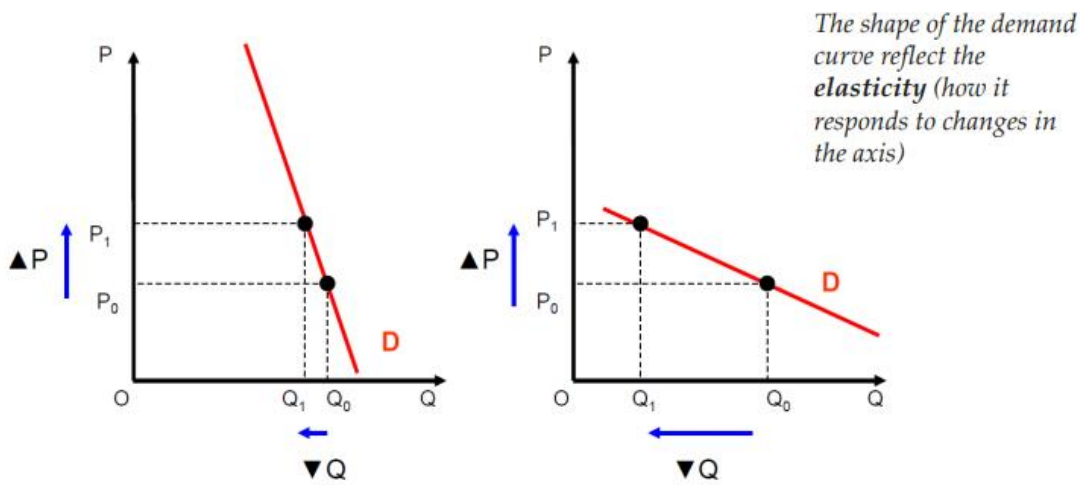
Economic Instruments in energy policy

The market conditions mainly depend on two factors: supply and demand. In bioenergy sector, supply means the biomass like energy crops, forest chips and pellets, and demand means the energy production for consumers and local dealers. They are very closely inter-related to each other.

The factors affecting the market economy are for example taxation, tariffs, subsidies and energy policies. The curves or graphs created by defining the relationship between the price (P) and the quantity (Q) for demand and supply is influenced by the above-mentioned factors. It can be further simplified by the elasticity of the curve which is defined as

Elasticity = (% change in quantity) / (% change in price)

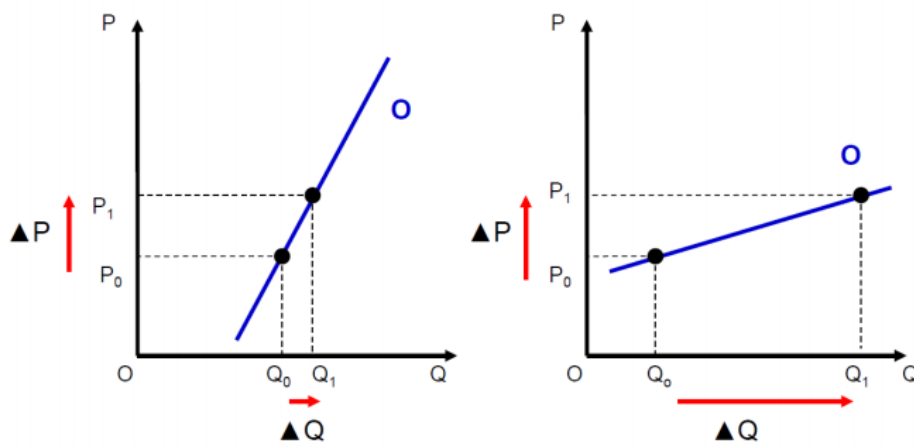
The shape of the demand curve in graph 1 and graph 2 reflects the elasticity and inelasticity (i.e. response to the change in the price). It depends on the products and services. For example, in case of oil, energy, and food, the curve is inelastic where as in case of highly competitive market the curve is highly elastic.



Graph 1. Elasticity

Graph 2. Inelasticity

Whereas, the supply curve may look quite opposite to the demand curve as shown in graph 3 and graph 4.



Graph 3. Elasticity

Graph 4. Inelasticity

The demand curve is inelastic in the energy market because any way the consumers have to use it for their survival and also due to the lack of competitive market. Whereas, in the case of supply curve it can be both elastic and inelastic. But, again these curves of demand and supply are influenced by the energy polices.

Adoption dynamics

Bioenergy market is no longer a brand-new concept in most of the countries, but the energy crop plantation may be still a complex issue even in the well-established bioenergy market countries. It is obvious to be in a state of confusion of avoiding or adopting the new plantation specially for the new farmers and the investors. Plantations off course provides benefits to the nature in many ways, but when it is related with the income generation then, many questions arise. The main reason for this is, it makes them bound for a longer period and there might not be the good profits during the initial time or not even a local neighbor to compare with. These kinds of issues can be making easier with the support of the government policies through the tax, subsidies. The complexity in adoption is clearly visualized in the figure 3. But it again depends on every country's own system.

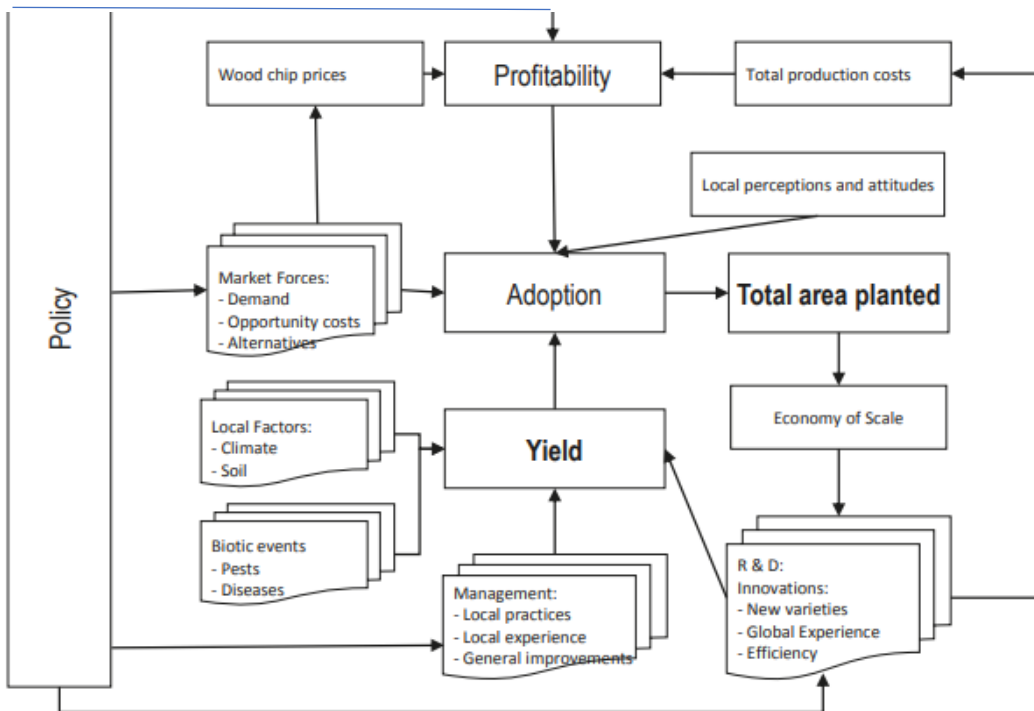


Figure 3. Complexity in adopting new plantation

Sweden is an example of a successful story in adopting the willow plantation as an energy crop. The government took a bold step to encourage the plantation. During 1991-1996, farmers were heavily subsidized (1330 EUR/ ha +530 ECU) for shifting from cereal to the willow plantation including fencing. On the other hand, taxes on Sulphur and carbon-dioxide in heat production was increased. There is a significant quantity of plantation throughout the country.

Market behavior

Three key characters of the bioenergy market are the forest owners, the dealer and the bioenergy plant owners. The forest owner has the authority to decide the price based on his experiences, knowledge and the negotiating skills. But he cannot sell in the price lower than his investment. Now, the dealer plays a role where he buys the wood from the owner and sells the wood to the bioenergy plant making some profits in between based on the buying price, location and his experiences and skills. The final character is the plant owner who buys the wood with the certain price. But he cannot buy higher than the profit he makes from selling the energy.

To make the things more clear and practical understanding, we played a game in the classroom. Students on the first, second, third and the fourth column were in the act of chain order of owner, first dealer followed by second dealer and the plant owner. The initial price and quantity for the wood owners were confidential. The price and the quantity of the plant owner was finally revealed after the game of about 4 minutes. Students were also displaced in different positions to make it more realistic. After every round there was a change in policy or strategy.

It was clearly understood how taxes and subsidies for costumers and producers effects the market behavior. Also, the monopoly had a huge impact on the price. If the market is not well governed by the policy maker and regulated in a discipline manner, then there might not be a sustainability in the market.

Governance

Governance is an effort or process involved in the legal binding rules as well as customary social arrangements in any local, national or international institutions, instruments and processes ranging from short term operational management to long term policy development. There are various influential factors regarding bioenergy governance. For examples:

- Carbon balance (savings of GHGs over fossils fuels)
- Production of bioenergy crops
 - (1) land use, deforestation, biodiversity, community's rights
 - (2) effects on food availability and price

- Market forces like
 - i) Global price fluctuation
 - ii) Out grower's schemes, boycotts
- Technological issues (equipment, efficiency,)
- Cross-cutting: gender, poverty, health
- Society perceptions/acceptances

In the figure 4, the influence of international governance in the domestic policy processes is clearly visible. Therefore, governance must be understood in a wide perspective.

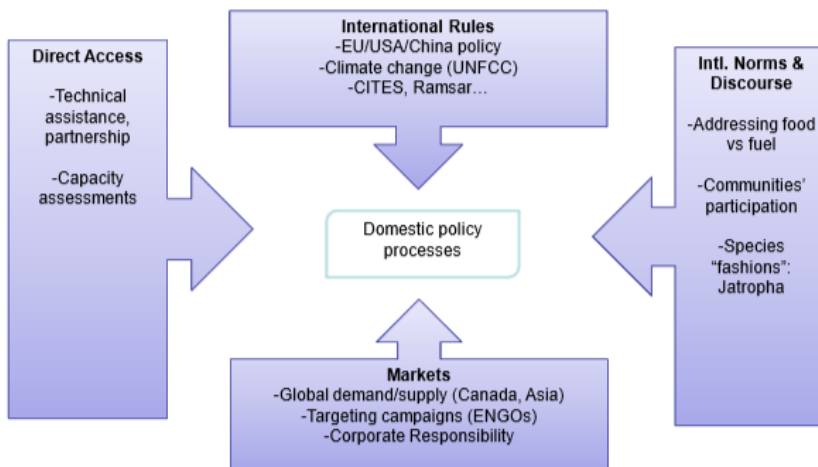


Figure 4: **Influence of international governance in the domestic policy processes**

If something goes wrong in any part of the chain specially in the environmental and social perceptions, it will give rise to a conflict which will have a significant effect on the whole project. A case study of forest conflict between the indigenous group (Saami) and the company called Metsähallitus in Inari, Finland is explained below.

Saami/Metsähallitus Forest Conflict, Inari, Finland

Background

Inari is among the most tourist's destiny in Finland and lies in the northernmost part of the country. It is a home for indigenous Saami people and the [1]. The forest is of great importance for sustainable socio-economic development of Saami people and maintaining the biodiversity of the forest. The tree's annual growth rate in this region is very slow and may takes more than 5 decades to reach its maturity. The forest might take several hundreds of years to regrow again as it was before. So, protecting their forest land against industrialized harvesting was priority concern during early 2000s.

A Finnish state-owned forestry company so called Metsähallitus, was unable to address the indigenous rights in forestry practices. As a result, there was a serious conflict in the biomass and land use between two bodies.

Evaluation of the conflict

In 2002, the Saami people together with EJO known as Greenpeace started protesting campaigns to safeguard about 107,000 ha of their forest land [2]. Many concern people including local researchers, scientists, medias, national and international NGOs, UN Human Rights Committee actively supported the conflict victims. Furthermore, one of their major costumers so called Stora Enso also responded, by not using the wood from the conflict areas.



Figure 5: Saami reindeer herder and Greenpeace activist demarcating the forest. Photo © Greenpeace/Patrik Rastenberger

The protests occurred in several European countries (Finland, Germany, Netherland, Belgium, Italy, and Switzerland) followed by street demonstrations, death threats and violence including several arrests. It prolonged because of lack of strict government policy and action, also the company did not want to back off as they have huge investment on the project.

After 8 years of struggle in various processes, and pressure from everywhere, the company was forced to negotiate with the local Saami people as a deal to protect 80% of their forest land to next 20 years or more.

The conflict necessarily does not have to be a negative driving force, or something always understood as an obstacle, but sometimes in some cases it happens for a good reason.

International bioenergy markets

The concept of global village has opened the opportunities of trades through out the globes. The development of well transportation and communication system allows to connect overseas and do business in any sector and in any part of the world. Bioenergy in the form of raw material or the product, which is of global concern is a good example of the demanding international trade market.

Wood pallets, wood chips and bio fuels (bio ethanol and bio diesel) are gaining popularity specially in the Scandinavian countries. European countries like Finland, Sweden, Germany, Austria and North American country like Canada are the leading countries in terms of producers and consumers.

During 2016, wood pellets has a demand over 21,7 million tonnes only in the EU states while the production was only 14 million tonnes. EU states still import about 35% of their total demand from the north American countries. To meet the target so called 20-20-20, pellets play an important role to contribute the energy demand. Production of pallet in EU states are given in the figure 6.

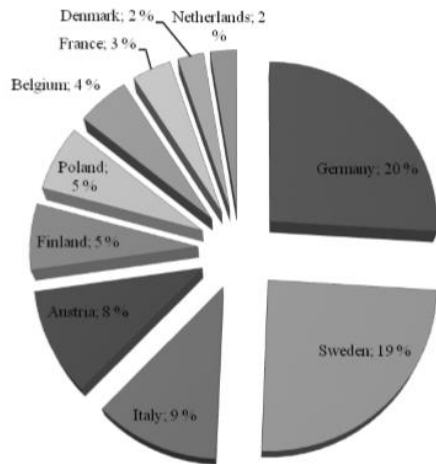


Figure 6: **Pallet production in EU states**

Bioenergy Market Supply

The flow of the bioenergy market supply comprises supply from the upstream, midstream and the downstream, and all of them are inter-connected to form a good network. The upstream is the main source for all variety of products. For example, the woody and non-woody biomass, agriculture and forest residues. The midstream is mostly the by-products produced during the conversion process. For example, sawdust, wood chips. The downstream is the final product for example, bio fuels, heat, electricity or any other form.

Whole supply chain is greatly influenced by the price and availability of the feedstocks and products, logistics' efficiency, technology used, buyers and sellers' attitudes. An ideal supply chain in bioenergy market is represented diagrammatically in the figure 7.

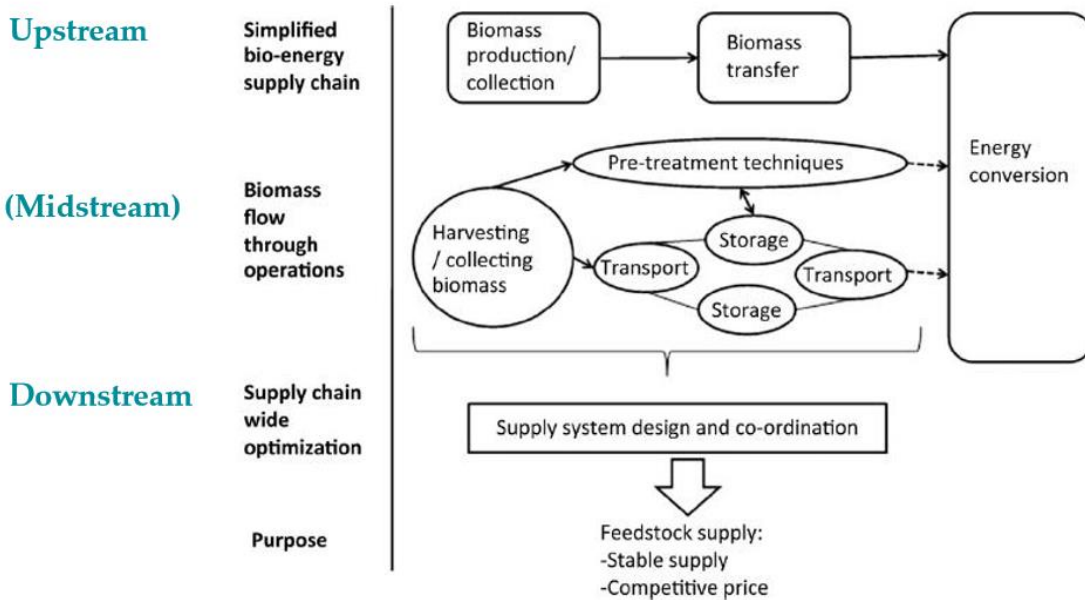


Figure 7: Diagrammatic representation of supply chain in bioenergy

Policies for EU and Nordic Bioenergy market

The Climate and energy package so called “20-20-20” aim is to reduce 20% of GHG emissions as compared to 1990, increase the share of renewable energy to 20% of total energy consumption, and improve the energy efficiency to 20% by the end of 2020.

The Climate and energy framework for 2030 targets to achieve a more competitive, secure and sustainable energy system to meet its long term GHG reduction by at least 40% as compared to 1990. Further, utilization of renewable energy in EU states at least by 27% of total consumptions and increase the energy efficiency to 30% by 2030.

Different types of policy are applied for promoting bioenergy as shown in the table 1. However, it seems R&D and Mix policies to be the outstanding solution as it provides more flexibility and detailed studies.

Table 1: Approach to promote bioenergy

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	Labeling, Certification programs
		Compensation Schemes	Payment for environmental services
Implicit	Regulatory policies & Voluntary agreement	Agriculture and Trade policies, Vehicle policies	CAP
Best solutions	R& D policies		
	Mix Policies		

In the case of Nordic countries, they prefer the subsidy structures. Finland and Denmark started carbon-based tax since 1990s. For the bioenergy production, Finland started using the peat soil whereas Sweden started investing on the short rotation energy plantations.

Recent and future trends in bioenergy

The perception of bioenergy now and comparing to past 50 years is so different that it is hard to predict the next 50 years. The availability of natural resources was abundant, and the population was comparatively very less during past centuries that people were not so aware of many factors as they are now. In the future, the condition will be worst, and people must be more aware for the things they are not now. Therefore, this constant changing in the whole system will always give rise to some dominating factors or elements. A very long time ago wood was a dominating source of energy, today it is a fossil fuel, tomorrow it be something else who knows. However, we have traced the pattern in development and consumption in the bioenergy sector from the past 40-50 years and is surprising. It gives some hope that there will be a constant development in this sector.

At present, the renewable energy represents about 50% of new power generation, 23% of all power and 14% of all energy, and the percentage is constantly increasing. This reflects that the people are

becoming more aware of the valuable environment. More R&D in the development of technologies, policies, and finding new efficient resources is key of hope for sustainable development in the bioenergy sector.

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