

# Portfolio of Bioenergy Markets and Policies.

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## **What is Bioenergy?**

Bioenergy can be defined as the energy that comes from renewable biological resources. The main source of bioenergy is the organic matter and bioenergy stores from sunlight as chemical energy. Others source are manure, wood chip and sugarcane. Currently, researcher also found many other sources of bioenergy.

In the past the wood was used to produce heat as biofuel. Biofuel can be considered another source of bioenergy. The main source of biofuel is manure and wood pulp which is called biomass. Biofuel also extracted from biomass. Bioenergy is mainly produced from biomass and the biomass is the by product of some agricultural residues.

The corn, soybean and sugarcane also used to produce bioenergy. At present the agricultural residues and the housing waste also used for bioenergy production. The methane gas also produced from the garbage, human waste, excess crops and other types of vegetable waste (Energy).

**District Heating:** District heating is a system for distributing heat from a centralized location by a pipe for a residential or commercial heating. The heating is produced from the combination of fossil fuel and biomass. District heating system can be considered one of the cheapest heating systems and that pollutes less than boilers. It produces less carbon when burning and good for the environment.

## **Generation of District Heating:**

There are four generation of district heating-

### **First Generation:**

It is based on the coal and first introduced in US in 1880s and also become popular in the European Countries. It was popular until 1930s as there was no option for heating. Here , high temperature is

used and was a risk for operators. So, it is become less popular gradually and now a days it is rarely used in USA.

### **Second Generation:**

This technology was introduced in 1970s and used widely until 1970s. the raw materials wad coal and oil and the heat was transferred by water at 100-degree centigrade temperature.

### **Third Generation:**

It was developed in 1970s and become popular all over the world. This generation is also called the “Scandinavian district heating technology”, because a lot of the district heating component manufacturers are based in Scandinavia. The third generation uses prefabricated, pre-insulated pipes, which are directly buried into the ground and operates with lower temperatures, usually below 100°C.

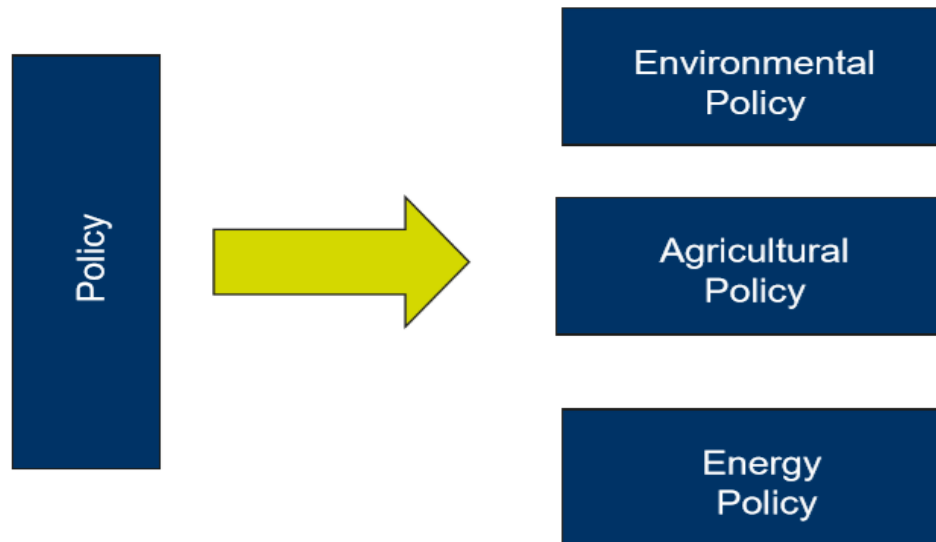
### **Fourth Generation:**

Currently, the 4th generation is being developed<sup>[4]</sup>, with the transition to 4th generation already in process in Denmark. The fourth generation is designed to combat climate change and integrate high shares of variable renewable energy into the district heating by providing high flexibility to the electricity system.

### **Policy Related to Bioenergy**

**Policy:** A policy is a deliberate system of principles to guide decisions and achieve rational outcomes. A policy is a statement of intent and is implemented as a procedure or protocol. Policies are generally adopted by the Board of or senior governance body within an organization whereas procedures or protocols would be developed and adopted by senior executive officers.

# Policy related to Bioenergy



**Figure-1: Policy related to Bioenergy.**

## Why Policy?

- Reasons to support bioenergy production.
- Reasons not to support bioenergy production.
- Changes on climatic conditions in the nearby areas.
- Changes on general climatic conditions (CO<sub>2</sub> pool)
- CO<sub>2</sub> markets, market price CO<sub>2</sub> tn.
- Soil conservation
- Soil losses: ~27 EUR/ha yr (in Spain, 1998 prices)
- Potential Risks: ~24 EUR/ha yr (insurance companies est.)
- Water quality: 0.03-0.36 EUR/m<sup>3</sup> + 0.06 EUR/m<sup>3</sup>
- Dams: 2.5-4% profitability investment
- Landscape and Biodiversity Conservation.

## **Energy Policy:**

The earlier energy policy goals are oriented towards the creation of alternative technologies and fuels to reduce direct dependency on oil imports from OPEC countries. From 1980-1990s the polluting effects of fossil fuels (coal) gets relevant and in 1990s the Acid rain (soil, water and forest health) and from 1990-2000s the Economic trends. Competition. Restructuring and deregulation of electricity markets.

## **Energy Policy EU level:**

### **The European Union implemented the policy in the following stages: -**

1997: Commission White Paper 'Energy for the future: renewable sources of energy - White Paper for a Community Strategy and Action Plan' , sets EU target of increasing the share of renewable energy to 12 per cent of total energy consumption by 2010.

2001: EU adopts the Directive on the Promotion of Electricity produced from Renewable Energy Sources ('Renewables or 'RES-E' Directive'). The directive sets an EU-wide target of 21% of renewables share in electricity production by 2010.

2003: EU adopts the Biofuels Directive setting "reference values" of 2% market share for biofuels in 2005 and 5.75% share in 2010.

2006: European Parliament calls for 25% target for renewables in EU's energy consumption by 2020.

2007: Commission presents "Renewable Energy Roadmap " as part of its "energy-climate change" package.

2008: Directive (...) on the promotion of the use of energy from renewable sources. COM (2008) 19 final

2009: Renewable Energy Directive (2009/28/EC)

2020: Later developments. Sustainability of bioenergy

**Climate Policy:** This policy is about to reduce carbon concentration in the atmosphere and encouraging to green practice and technologies which reduce carbon concentration. Moreover, to create employment in the rural areas. The Kyoto protocol, European Union emission trading scheme (EU ETS) and some of other organizations working in climate or environmental sector.

**Agricultural policy:** The European Union has created this policy for increasing the production of food and their supply. Moreover, they maintain a standard for agricultural production. The most important agricultural policy in Europe is the CAP (Common Agricultural Policy).

**Table 1:** Example of rural development measures for biomass and mobilization during the CAP 2007-2013 programming period. B = Biomass Specific and W = Wood Mobilization in General.

Measure			B	WM
No	Description	Examples and notes		
121	Modernisation of agricultural holding	Short rotation coppice for biomass production, mostly with reference to bioenergy production (minor part of total allocated amounts).	X	
122	Improving the economic value of forests	Pre-commercial thinning and replacement of low value forest stands.		X
123	Adding value to agricultural and forestry products	For micro-enterprises only: support for harvesting machinery, (portable) sawing mills, and other processing facilities (e.g. woodchip and pellet production).	X	X
124	Cooperation for development of new products processes and technologies in the agriculture and food sector and the forestry sector	Initiatives for the substitution of fossil fuels.	X	
125	Infrastructure related to the development and adaptation of agriculture and forestry	Building and/or improving forest roads.		X
221	First afforestation of agricultural land	Afforestation for productive or protective purposes.		X
223	First afforestation of non-agricultural land			X
225	Forest-environment payments	Ex-ante or ex-post forestry practices such as vegetation control, thinning, diversification of vegetation structure.		X
226	Restoring forestry production potential and introducing prevention actions			X
227	Non-productive investments	Thinning and pruning to improve the ecological value of forests.		X
311	Diversification into non-agricultural activities	Bioenergy production as one of the possible actions.	X	
312	Support for business creation and development	It may cover the processing of forest products, and bioenergy production and related actions.	X	
321	Basic services for the economy and rural population	Increase of the share of decentralised produced and used heat energy out of biomass.	X	

Source: Mauro at al. Forest – Related Policy affecting Bioenergy Market in Finland, Forest Bioenergy in Europe, Page- 23.

### Plantation of willow species in Sweden:

Willow Species has been planted for last two decade in Sweden For the source of energy and fuel. It is considering to be agricultural crops in Sweden and it has a larger growth capacity. There were about 14000 ha of short rotation of willow species has been planted in Sweden and that's make Sweden for the best willow plantation in Europe. The plantation period was 1986 to 2006 and area was most of the agricultural land.

### Productivity:

**Short Rotation:** The short rotation was 3 to five years and it is found in various research in Sweden since 1975 that the annual growth was about 10-20 tons, odt per hector during the first cutting cycle.

Now, various research has been done on willow species and already invented various diseases resistance species for better growth.

**Plantation of willow species with other species:**

Willow species may be planted with other species. Willow species grows faster than other species so other species like slow growing species may be planted with willow species. Spruce species grows very slowly in the early stage of their growth and their rotation period is 15 to 20 years, So, willow species can be planted 3 to 4 times with slow growing species and owner get intermediate benefits from harvesting willow species.

**Planting:** Willow species is planted by machine and three to four people is require in the back of the machine for supporting. Still no automatic machine is not invented.

**Harvesting:** There are several types of machine for harvesting of willow species. The harvesting system is more modernize and automatic harvesting system.

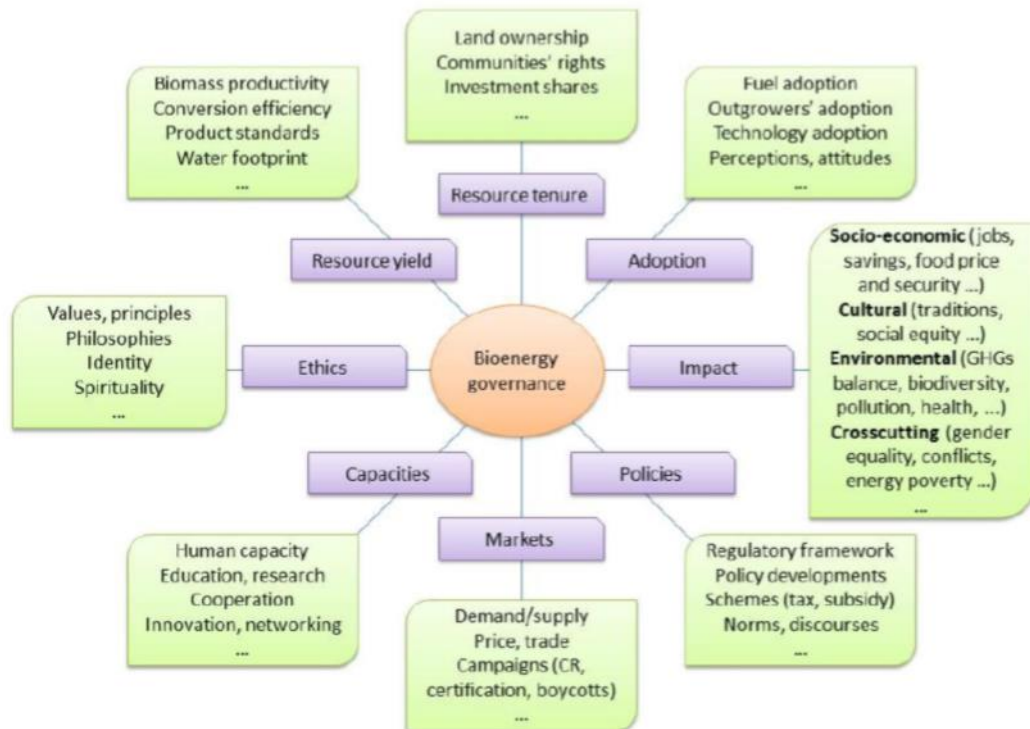
**Swedish Experience:** The growth rate willow species is higher in 1 to 2 years. The yield is increasing day by day because the yield was 1.00 to 2.5 odt during 1986 to 2006 but at present the growth rate is 6 odt ha year.

**What is Governance?**

Governance involves the activity or process of governing include people charged with the duty of governing, the manner, method and system by which a society is governed.

It has international, national and local dimensions. It includes legally binding rules as well as customary social arrangements. It is widely used nowadays to cover institutions, instruments and processes ranging from short term operational management to long term policy development and planning and from conventional forms of administration to modern forms of participative decision-making processes.

# Framework for bioenergy governance



J. Arevalo, 2013

**Source: Class Lecture.**

## Issues of Bioenergy Governance:

- Carbon balance (how much saving of GHGs over fossil fuels)
- Bioenergy crops
- land (LUC, ILUC), deforestation, biodiversity, communities' rights
- impact on food availability & price
- Market forces
- Biofuel as global commodities (price fluctuation...)
- Out growers' schemes, boycotts
- Technology issues (conversion, efficiency...)
- Cross-cutting: gender, poverty, development, health
- Across disciplines [e.g. involving Ministerial departments of: Environment, Energy, Livestock, Lands, Agriculture, Trade, Transport...]

## Climate and energy framework for 2030

### Objectives:

- to achieve a more competitive, secure & sustainable energy system to meet its long-term 2050 GHG reductions target.

### 2030s Target:

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

### Proposed policies for 2030:

- A reformed EU ETS
- New indicators for the competitiveness and security of the energy system (ex. price differences with major trading partners, diversification of supply and interconnection capacity between EU countries)
- A new governance system (based on national plans) for competitive, secure, and sustainable energy. These plans will follow a common EU approach.
- 30 November 2016, EC released a package of draft legislative proposals designed to help achieve these targets.
- The measures include draft proposals on electricity market design, renewables, and energy efficiency.
- The EU aims to achieve an 80% to 95% reduction in greenhouse gases compared to 1990 levels by 2050.
- European Commission (EC) to take three crucial steps: Reduce GHG emission, Increase carbon stock and Comprise the emission into the bioenergy production.
- A threatening factor is related with the utilization of forest biomass for energy production- the 'payback' time.

### What is Carbon Tax?

A carbon tax is a fee that a government imposes on any company that burns coal, oil, or gas. The World Bank reports that 40 countries and 20 municipalities use either carbon taxes or carbon emissions trading. That covers 13 percent of annual global greenhouse gas emissions.



## How It Works

First, the government must determine the external cost for each ton of greenhouse gas emission. This is difficult because scientists and economists must first agree on which assumptions to use.

One group, the U.S. Interagency Working Group on Social Costs of Carbon, did develop an estimate of \$40 per metric ton. A tax reflecting this social cost would increase gas prices by 36 cents a gallon. It would add \$0.02 average price of a kilowatt-hour of electricity.

A United Nations report said the price should be much higher to keep temperatures from rising above 1.5 C by 2030. It recommended a carbon tax of between \$135 and \$5,500 per ton.

A recent report from the Organization for Economic Cooperation and Development found that the average carbon price across 42 major economies was around \$8 per ton in 2018.

The price differential means governments find it politically difficult to charge enough to reduce emissions significantly.

## Advantages:

- The tax reduces the emissions in two ways. First, increasing the cost of carbon-based fuels will motivate companies to switch to clean energy. These include solar, wind, and hydro-powered sources.
- The carbon tax will also increase the price of gasoline and electricity. Consumers will then become more energy efficient, further reducing greenhouse gas emissions.
- Taxes allow industries to find the most cost-effective ways to reduce carbon emissions. That's a better alternative to free-market economies than government regulation.
- A carbon tax can also boost economic growth. For example, Sweden's carbon tax has reduced its emissions by 23 percent in the past 25 years.
- During that same period, its economy grew 55 percent.
- A carbon tax could also raise substantial revenue. The Congressional Budget Office estimated that a carbon tax starting at \$20 per ton and increasing to \$34.4 per ton in 10 years could have raised \$1.2 trillion. That's on par with the amount raised by all other excise taxes.
- The revenue could be used to reimburse federal agencies tasked with dealing with the effects of climate change.

**Disadvantages:**

- To meet the Intergovernmental Panel on Climate Change's temperature-rise targets, the United States must reduce fossil-fuel-based energy demand by 85 percent. To do that, the prices of those sources should increase by 44 times. Since it is so expensive, the government should use a carbon tax along with other alternatives.
- Doubling the price would be enough to shrink energy use by 29 percent. If gas prices were \$5 or \$6 a gallon, 29 percent of the users would find alternatives. But quadrupling the price would not reduce usage by 58 percent, as you would guess. It would only reduce it by 50 percent. Some people don't have alternatives and others would not give up their vehicles. That's called the price elasticity. Energy is relatively inelastic.

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Carbon Tax, Its Purpose, and How It Works

<https://www.thebalance.com/carbon-tax-definition-how-it-works-4158043>