

Learning Portfolio
Bioenergy Markets and Policies
3513019

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Submitted to

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1 INTRODUCTION

The biomass has been used since when prehistoric human first discovered fire. However, the modern technological and systematic use of this resource of energy is more recent. The major development of bioenergy happened after 1970s when the global recession because of tensions and war between Israel and Egypt and Syria took place. Several other countries and world powers like USA and Soviet Union got involved in the situation and oil producing nations cut down their supply of oil to the western world including Europe popularly known as Arab Oil Embargo 1973. This incident uncovered the reality of energy supply system in the Europe and other parts of the world and the extent of their dependency on the oil from the middle east countries. That was the time when new resources were explored and more of the concept of the energy mix and diversification of energy resources was done. However, the momentum got halted after the embargo was released and the oil price dropped. New energy policies were developed and many countries looked forward to diversify their attitude towards bioenergy. In Finland and Sweden, the policies were developed for promotion and research on bioenergy. Both the countries have a very successful bioenergy systems in place and bioenergy shares over 20% of total energy demand of Finland now, which is the largest in the EU. In more recent years there is uncertainty about the continuous supply of the

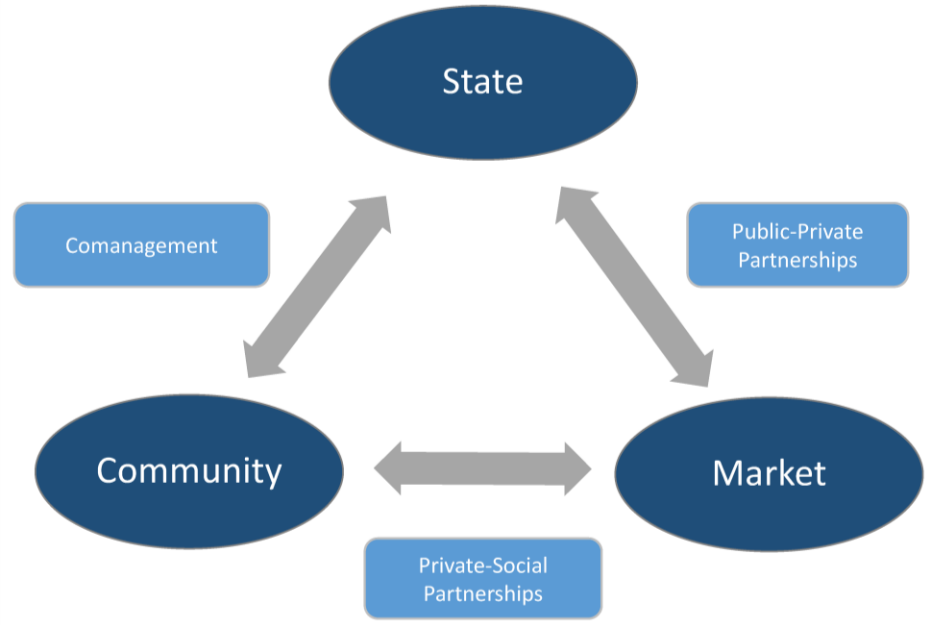


Figure 1 The Governance Triangle¹

According to International energy Agency (IEA) the energy demand of the world is expected to rise by 30% and most of the rise is going to happen in the developing world². Increase in population and growing energy demand and climate concern on the use of the fossil fuels have increased attention on the use of bioenergy. However, there are number of concerns related to the land use, food-energy conflict among others.

Internationally, there is shift in the way people are taking the fossil fuels and there is gradual shift away from fossil fuel driven economies to renewable energy-based economies.

Currently, cost of production of the energy from bioenergy sources is one of the concerns, however the cost of production may come down when the industrial production of biofuels gets organized and supply chain becomes more efficient.

The continuous energy demand from the population that is largely getting urbanized is a challenge, the governments of the countries around the world are

However, there are always number of underlying details that need to be taken into account when we deal with the bioenergy, and when we talk about the its sources and end use.

OEPC (Organization of the Petroleum Exporting Countries)

OEPC is an intergovernmental organization of major oil exporting nations. The international bodies like OEPC play important role in the regulation of the oil supply in the world. They largely control the supply and the price of the world oil market, somewhat creating a control over the whole supply chain of the oil in the world.

2 THE ROLE OF POLICY IN BIOENERGY

The best public policy is made when you are listening to people who are going to be impacted – Elizabeth Dole

According to Collin's dictionary the "A policy is a set of ideas or plans that is used as a basis for making decisions, especially in politics, economics, or business".

Role of externalities in the market prices

Forest is one of the basic and major sources of bioenergy in the world, and it is subject to different externalities. In the same manner, other sources like bioethanol, biodiesel and other sources are also affected by the external factors.

Major externalities for forest in bioenergy are;

- Change in climatic conditions
- Climate change
- Soil conservation
- Water quality
- Landscape
- Biodiversity

All, of the above-mentioned issues can have varied degree of influence on the policies and on its impact on the bioenergy supply. For an instance, the role of biodiversity conservation might be far less in country like Finland with vast stretch of forest with homogenous vegetation in comparison to a forest in a tropical region where biodiversity component of the forest plays strong role in defining policies.

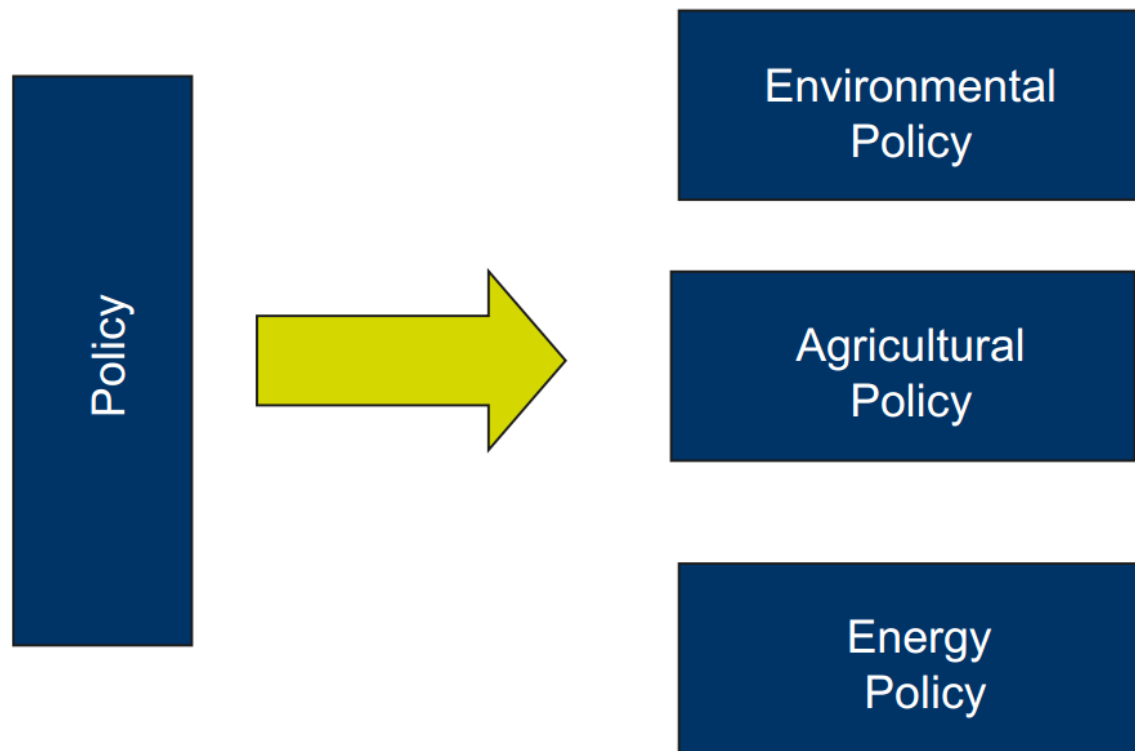


Figure 2 The policies that affect bioenergy promotion³

Basically, environmental policies, agricultural policies and energy policies play important role in defining the policy influence on the bioenergy system. The synergy between the policies for the promotion of bioenergy is required. For example, budget allocation, subsidies in particular sector might influence the overall influence. Policy incentives create market and promote change in the behavior of consumers and producers.

EU policies for Energy

EU aims to ensure secure, affordable and sustainable energy supply to the EU citizens. And, at the same time the commission aims to become a carbon neutral economy by 2050. The list of policies that influence the energy supply in the EU are;

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) ³

In addition to that, the international policies and commitment of the EU to those policies also influences the energy dynamics. The most important international policies that influence energy use are climate policies. The United Nations Framework Convention on Climate Change (UNFCCC) and International Environmental Treaty at Rio (1992), Kyoto Summit (1997) are some of the conventions that *aim at stabilizing GHG emissions in the atmosphere at a level that would prevent potential dangerous anthropogenic interference with the climate system.*

The national policies regarding forest regulation also play important role in defining the bioenergy from the forests.

3 ECONOMIC INSTRUMENTS IN ENERGY POLICY

Economics is driven by the basic concepts of the demand and supply, however, it is lot more complicated that this, there are several factors that affect the demand and supply of the system they are often called the externalities or external factors. The policy influences both the demand and supply of the market system. In case of conventional bioenergy system;

Demand – District heating sector, local customers, electricity consumers

Supply – biomass from the forest, energy crops and plantations

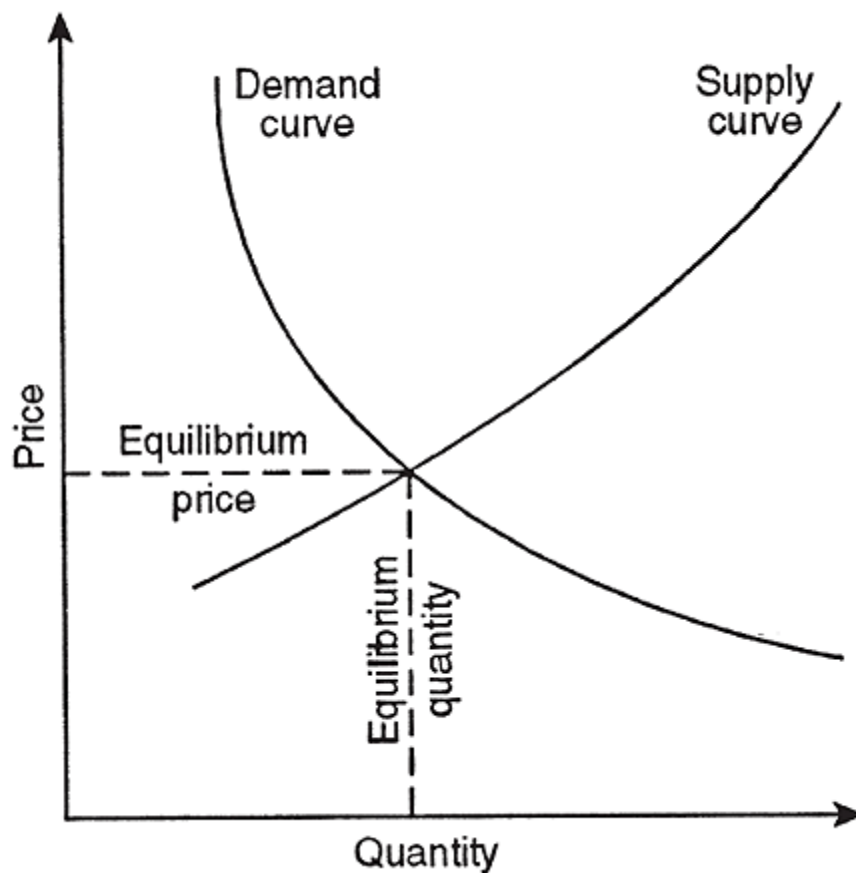


Figure 3 Supply and Demand Curve ⁴

The price of a commodity (in this case bioenergy) is set by the market that is driven by the demand and supply curve. Temporal and spatial affect the supply and demand curve.

Demand Curve

Demand curve is a graphical representation of the product price and the quantity of the products demanded.

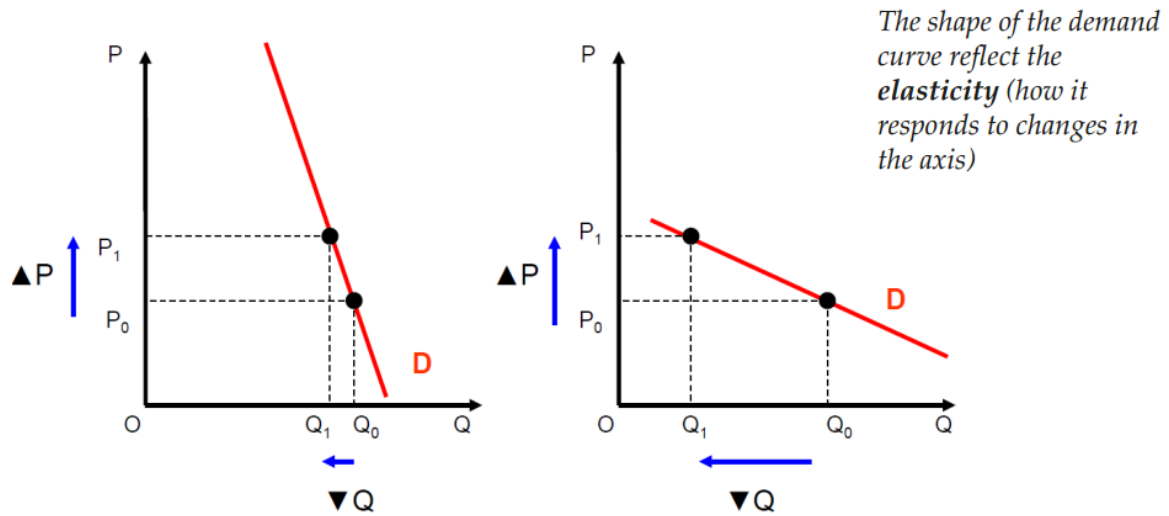
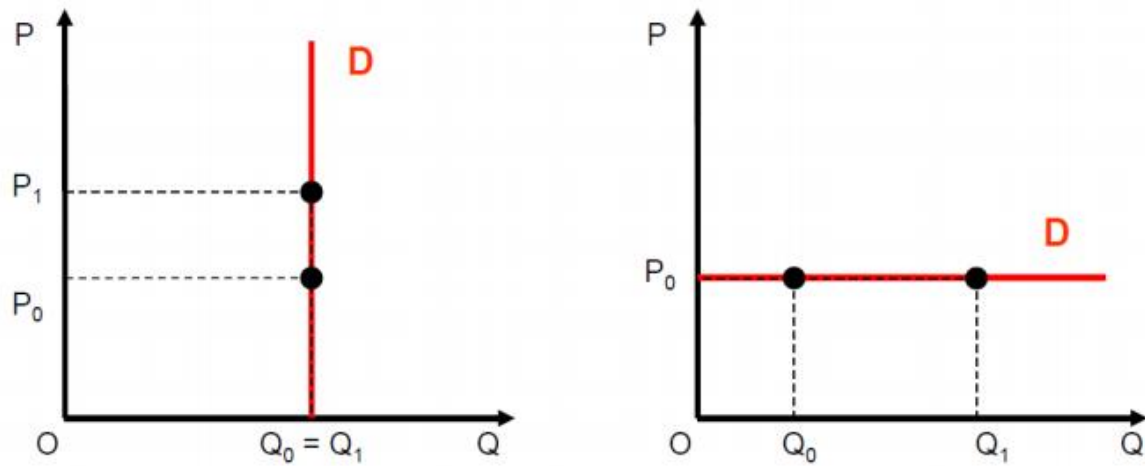


Figure 4 Graph showing elasticity in demand curve ⁵

Elasticity in the demand curve is defined as how sensitive quantity demanded is to the change of price. In the above figure the left curve is less sensitive towards change in the price, whereas the right graph is highly sensitive to the change in price.



Inelastic
(Oil, energy, food)

Elastic
(highly competitive market)

Figure 5 Conditions of completely inelastic and elastic market ⁵

The elasticity in the supply curve also works in a similar manner.

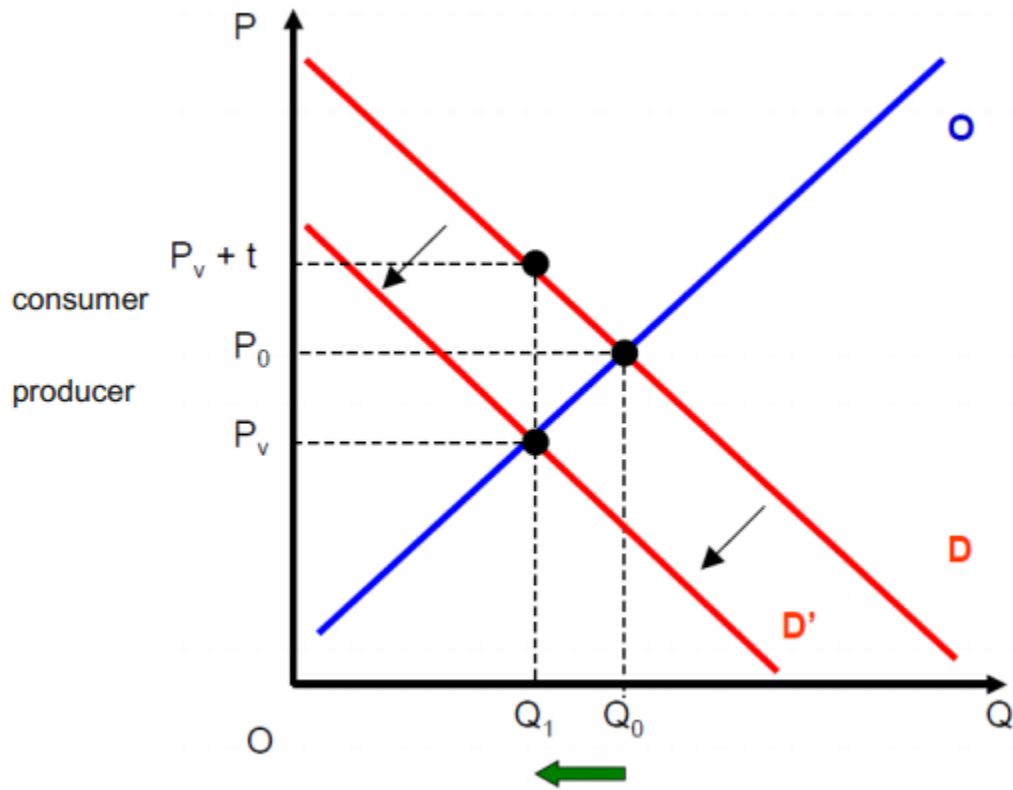


Figure 6 Graph showing effect of tax on the demand ⁵

The taxes reduce the demand of the commodity and the demand curve moves towards the origin value, irrespective of the supply curve.

Effect of subsidy in bioenergy promotion

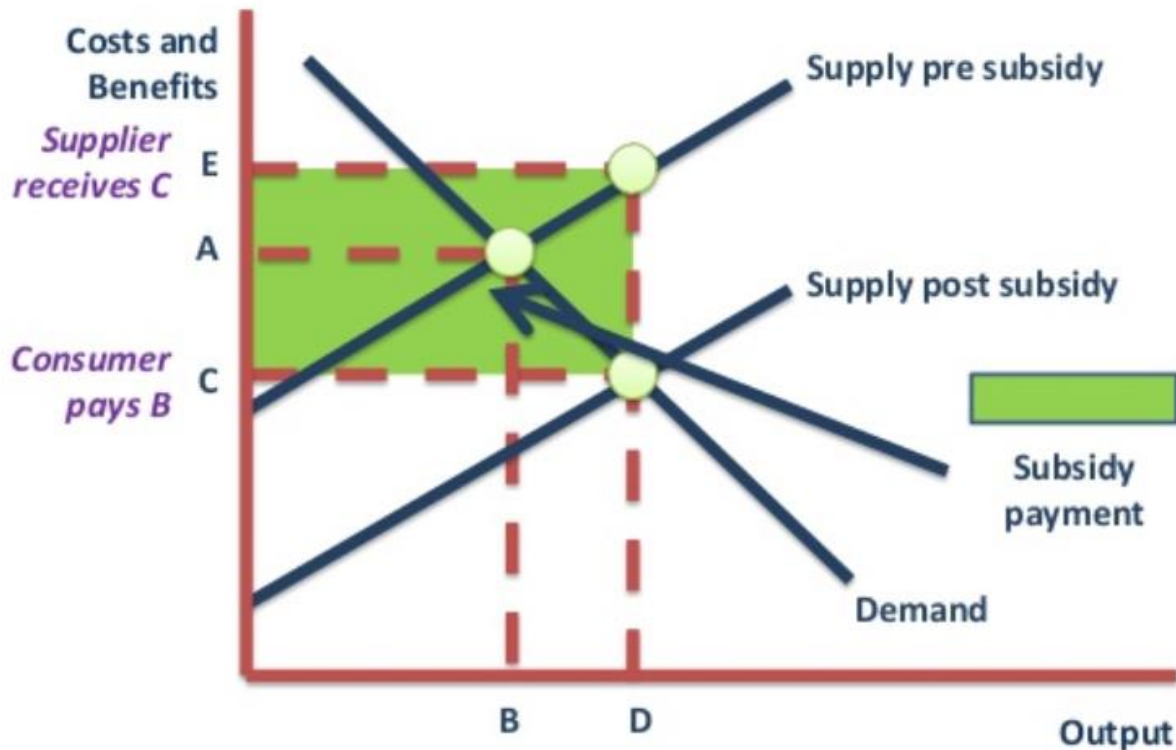


Figure 7 Effect of subsidy in bioenergy promotion

In the subsidized system, the government or the subsidizing body gives incentive in some form so that it reduces the price for the commodity to the customers. This is important especially in the initial phase of introduction of some form of services.

Subsidy to encourage the development of the market. Tax in oil and gas is huge. Translating the services from the plantations and monetizing it to give the subsidy to the farmers involved is a way to promote bioenergy. Ecosystem services can also be considered in this case, like ground water recharge, soil remediation, waste water treatment.

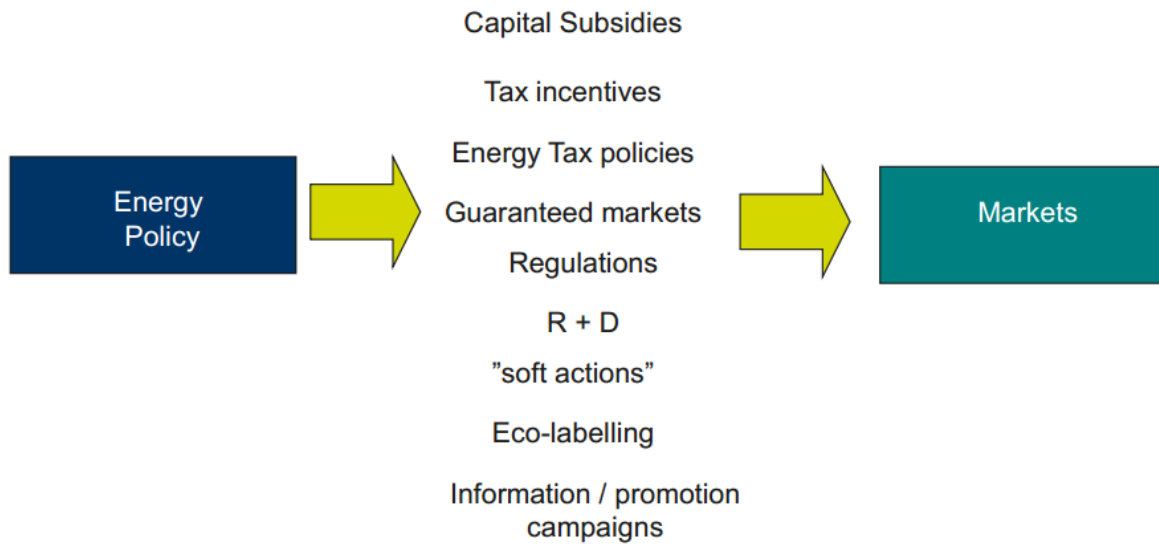


Figure 8 The parameters playing role in the market promotion of energy policy ⁵

4 ADOPTION DYNAMICS IN BIOENERGY MARKETS

The policies play important role in promotion of new practice in a region. However, the proposed practice should be in one way or the other beneficial and more profitable to the adopters, otherwise it will fail.

Penetration of Target Market

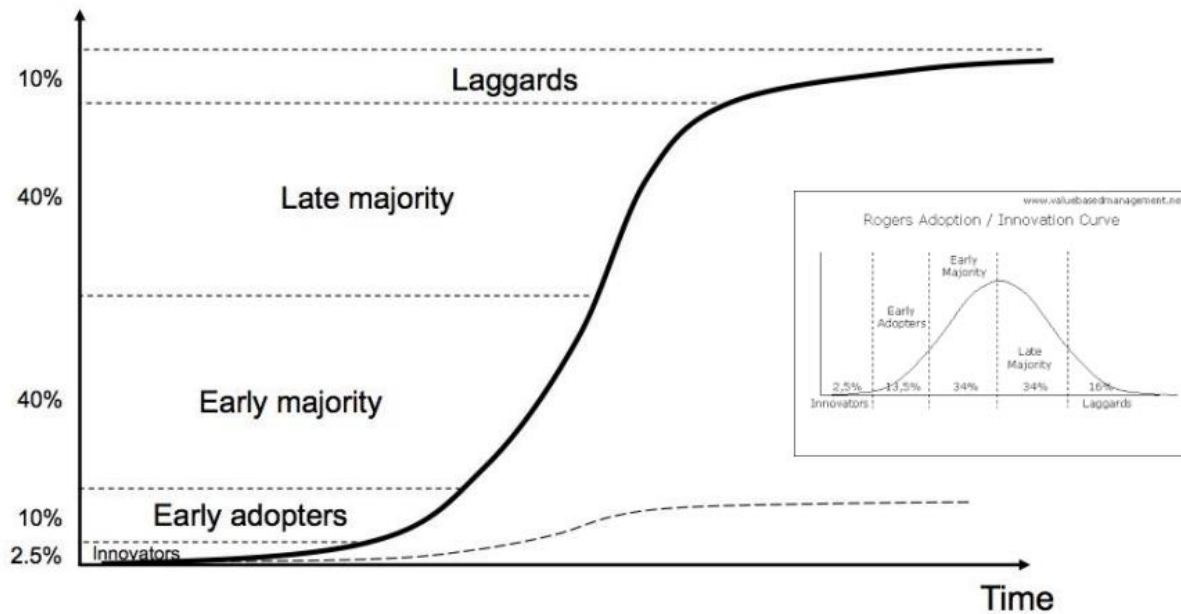


Figure 9 Roger's Adaption Curve

Rogers adaption and Innovation Curve explains how the number of adopters grow with time. And, how the market penetration takes time to reach its optimal state. However, the rate of adaption and the rate of market penetration depends on number of factors.

Stability in the policy and incentives creates good environment for the promotion. For example, Swedish promote the willow plantation through subsidies and Tax Exemption at the initial phase of bioenergy promotion. Improved yield by using clones of the energy crop plantations. Ex. Eucalyptus plantation in Brazil, they are increasing production by improving the variety.

There is no bioenergy or forestry policy in the EU, however there is policy related to renewable energy, and agriculture policy, climate change with emission obligations that affect the forest management and bioenergy policy.

Risk and revenue analysis is important to calculate the promotion of bioenergy crops. Compensation for the risk, and compensation for the change that the farmer is making to promote energy crops. Adopters are (early adopters, early majority, late majority, laggards)

5 CONCEPTS AND APPROACHES TO BIOENERGY GOVERNANCE

There is rise in the number of incidences of conflict related to tenure, management and utilization of natural resources. The conflict resolution methods vary greatly in different geographies and different communities of different interest groups. Foreign investment is often at a larger scale and looked down upon by the local people. There is always a debate about use of the crops such as sugarcane for bioenergy production and alternative use of the land that could be possibly used for the production of food crops instead of bioenergy.

Conflict analysis tools

There are several ways to analyze conflicts, few methods are listed below.

1. Conflict wheel
2. Conflict Tree
3. Conflict mapping
4. GLASL's Escalation Model
5. INMEDIO's Conflict Perspective Analysis
6. Needs-Fears Mapping
7. Multi-causal Role Model

International Governance and Bioenergy

Global priorities and interests of different countries especially the world powers play vital role in defining the set of global policies however, it affects all the countries. Bioenergy sector is also heavily influenced by the global governance issue. Many a times several multi-disciplinary policy measures influence the bioenergy governance.

What affects the policy formulation?

Social perceptions of the general public and the political leadership plays vital role in the policy of a country. More informed and climate positive attitude of public in general benefits the bioenergy, whereas critical overview on the issue creates negative and adverse policy environment for its development.

Environmental Non-Government Organizations (ENGOS)

ENGOS play vital role in creating a public perception on different environmental issues, however, the public might not always be aware of the details about the particular issue hence the perception (that can be negative) might develop in public.

5.1 FOREST CONFLICT

“If two people agree on everything, one of them is unnecessary” — Winston Churchill

Background

The human society is diverse, diverse in number of ways, we grow up in different societies, have different needs, our social customs differ across the geographies. The diverse nature of the communities across the world are the result of different growing conditions across the planet. So, the basic nature of the difference between the communities reveal in the form of conflict when there is an interaction between the communities. Different perspectives of different groups of people can bring in different opinions regarding a subject matter that eventually results conflict. In very simple words, conflict is the very basic fundamental of human existence. However, through the management techniques we can reduce the magnitude and frequency of such incidences, so that the conflict does not affect the wellbeing of the people living in the region.

The forests have the resources that can readily generate revenue even as a raw material, and there is great demand of the forest products across the world, which is creating a market pull effect that drives the people in getting involved in activities or exploiting the resource that can bring in conflict either with the people to people or people and the government. There are incidences of conflicts across the geographies. Especially in the developing world where governance is poor and government presence is minimum, for example, in the tropical forests (2).

5.1.1 Governance and Forest Governance

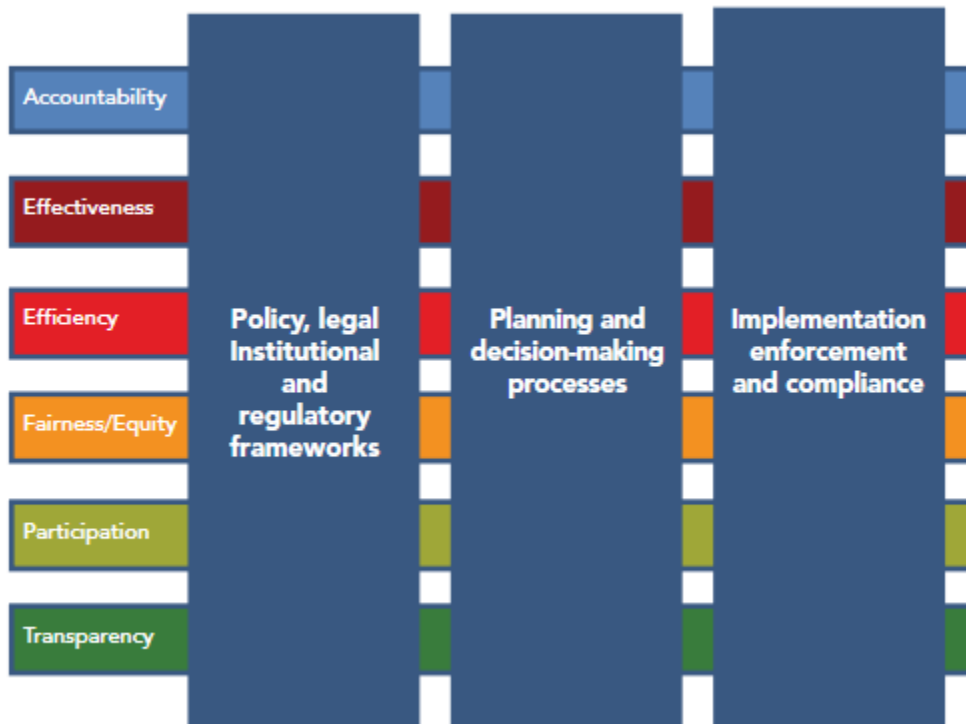
The set of rules (formal and informal), organizations and process through which private and public actors articulate their interests and make and implement decisions is governance.

According to FAO the forest governance is defined *“as the way in which public and private actors, including formal and informal institutions, smallholder and indigenous organizations, small, medium-sized and large enterprises, civil-society organizations and other stakeholders negotiate, make and enforce binding decisions about the management, use and conservation of forest resources. The concept of forest governance has evolved to engage multiple (public and private) actors at multiple scales, from local to global”*.

A good forest governance is characterized by the following elements;

- Adherence to the rule of law
- Transparency and low levels of corruption
- Stakeholder participation in decision making
- Adequate equal rights for stakeholders
- Accountability
- Low regulatory burden
- Coherent set of laws and regulations
- Proper implementation of laws;
- Political stability; and
- Sound capacities to govern efficiently and effectively ⁶.

Several social qualitative approach can be applied to assess the governance in forestry, the FAO has developed an analytical framework to assess and monitor forest governance. This framework identifies three major pillars of the governance, the basic pillars are subdivided into 13 basic components. This framework clearly defines the details of how-to of conducting the assessment based on number of indicators in detail and can be found in the following [link](#) ⁷. These sets of components and indicators define the forest governance in its practical terms.



What is forest conflict?

According to CIFOR, the two major reasons behind the conflict in the tropical regions are illegal activities and poor governance.

The key to find sustainable solution to the problem is to come to an agreement where both the parties have win-win situation. However, that might not always the case and the conflict is largely defined by the commitment of the government to protect the peoples right and how the conflict is resolved through mutual dialogue.

Conflict can be of varied degrees (in terms of intensity) that are represented by different responses from the parties involved in the conflict.

- Restrained conflict (anxiety feeling, critiques and debates, lobbying and persuasion)
- Open conflict (protests and campaigns, access restrictions, court)
- Violent conflict (intimidation and physical exchange) ⁸

How to resolve the conflict?

The conflict can be resolved by following seven steps⁹

1. Understand the conflict
2. Communicate with the opposition

3. Brainstorm possible resolutions
4. Choose the best resolution
5. Use a third-party mediator
6. Explore alternatives
7. Cope with stressful situations and pressure tactics

5.2 ETHICAL ANALYSIS

Different perceptions about the situation creates conflict among different group of communities, these perceptions might be based on the interests, values, and principles of concerned. Ethical analysis helps to map the interests, values and principles of the conflicting parties presenting the core drivers of the conflict. It helps to enhance the understanding of the parties of the reality on principles, values and moral norms, this self-reflection helps in improving mutual understanding and encourages conflict resolution.

6 BIOMASS MARKET BEHAVIOR

The components of whole supply chain of the bioenergy play important role in the demand supply system. In a forest-based bioenergy system there are three major components; (1) Forest owner, (2) Wood biomass, (3) Bioenergy plant

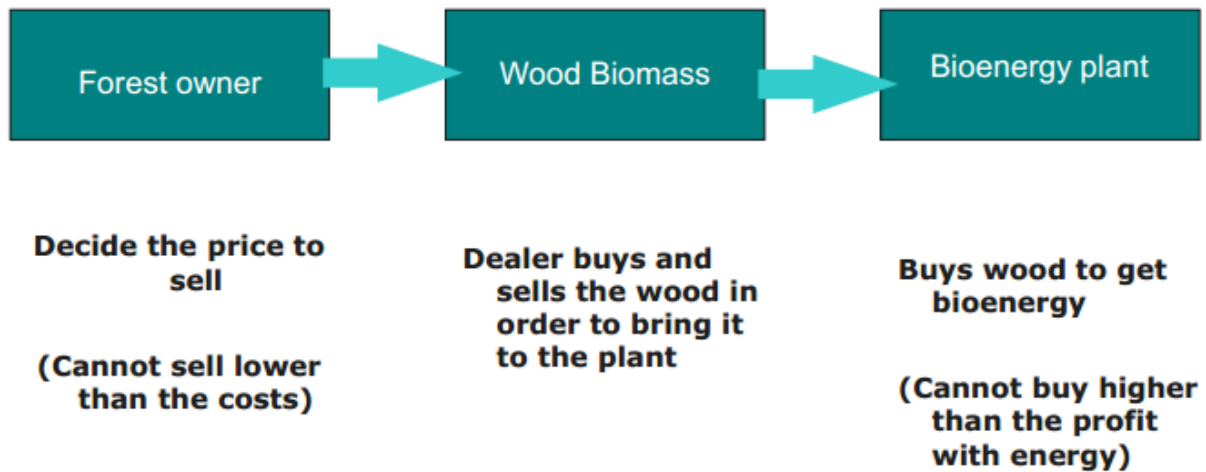
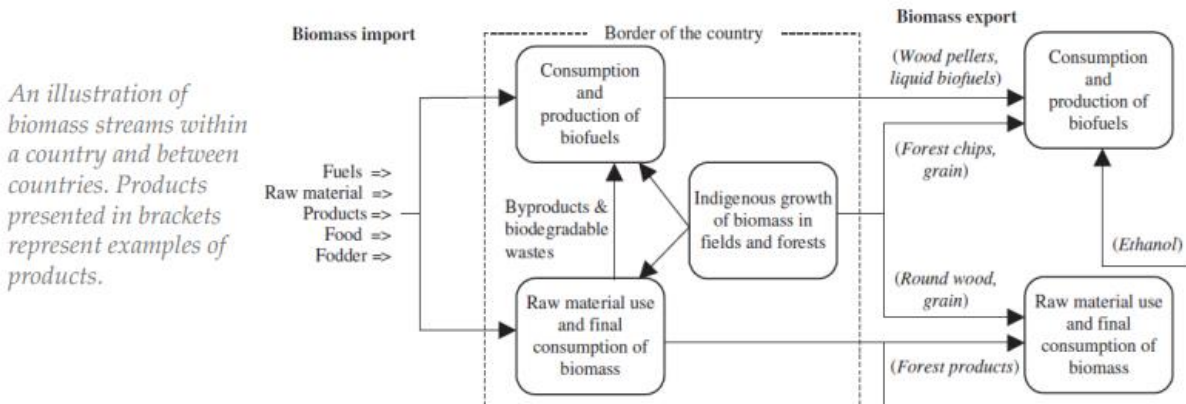


Figure 10 Simplified version of actors of the bioenergy systems and their relationship ¹⁰

7 INTERNATIONAL BIOENERGY MARKETS

Pellets is one of the most preferred forest-based biofuel commodity because of its homogenous nature, high energy density and low volume. Pellets can be developed from different sources of wood, like waste wood chips from saw mills, energy plantations etc. The end quality of the pellets depends on the type of the feedstock used during the manufacturing process.



Mostly, the pellets are used in automated small-scale heating system, also as a backup for the conventional heating powerplants. The pellet use is expected to grow all over the world, especially in Europe where government subsidy and environmental need play key role in its promotion.

Major barriers for the pellet promotion are;

- Raw material supply: sawdust, localized production, new feedstocks, imports
- Logistics: limitation (vs e.g. fossil fuels), location
- Sustainability concerns: food vs wood, rising price, land
- Fuel quality: lack certification, standards, quality control
- Lacking financial policy support: subsidy, stability of policy
- Unfair competition fossil fuels: VAT tariffs

8 BIOENERGY MARKET SUPPLY CHAINS

Concept of upstream and downstream in market value chain.

Upstream

Supplier of the raw materials

Midstream

Big plantation, timber harvest, saw dust, mushroom pellets

Downstream

Products, what are the products that you want to produce,

Sellers,

Self-employment

Consumers,

Households, company, big scale project

Influencing factors of price

- Season
- Logistics
- Product characteristics
(Safe, easy to use, clean)

Feedstocks for biomass = Sources

Products = Characteristics, price, season

Logistics = Transport, distance, weather

Sellers = Competition among sellers' service

Consumers = Preferences

Others = Technology, knowledge, information

8.1 EXERCISE

The Scenario

Pellet production at the industrial level

Upstream

Forest owner, Forest raw product supplier, Wood mills, By-products of Timber/Furniture Industry etc., Short rotation coppice species like poplar tree.

They produce raw for the pellet industry.

Midstream

Chipping of wood, Transportation of wood chips, Manufacturing process of the Pellets

Downstream

Positive aspects

Standard in quality depending upon the raw material, easy to store high energy content

More preferable as the backup fuel for industries that use boilers, can be used with other fuels such as wood chips or coal.

Can be used for space heating purpose using certain stoves in places that require shorter time period of space heating.

Negative aspects

Requires standard stoves that feed on pellet, can have sustainability issue if the source of the feedstock is not sustainable.

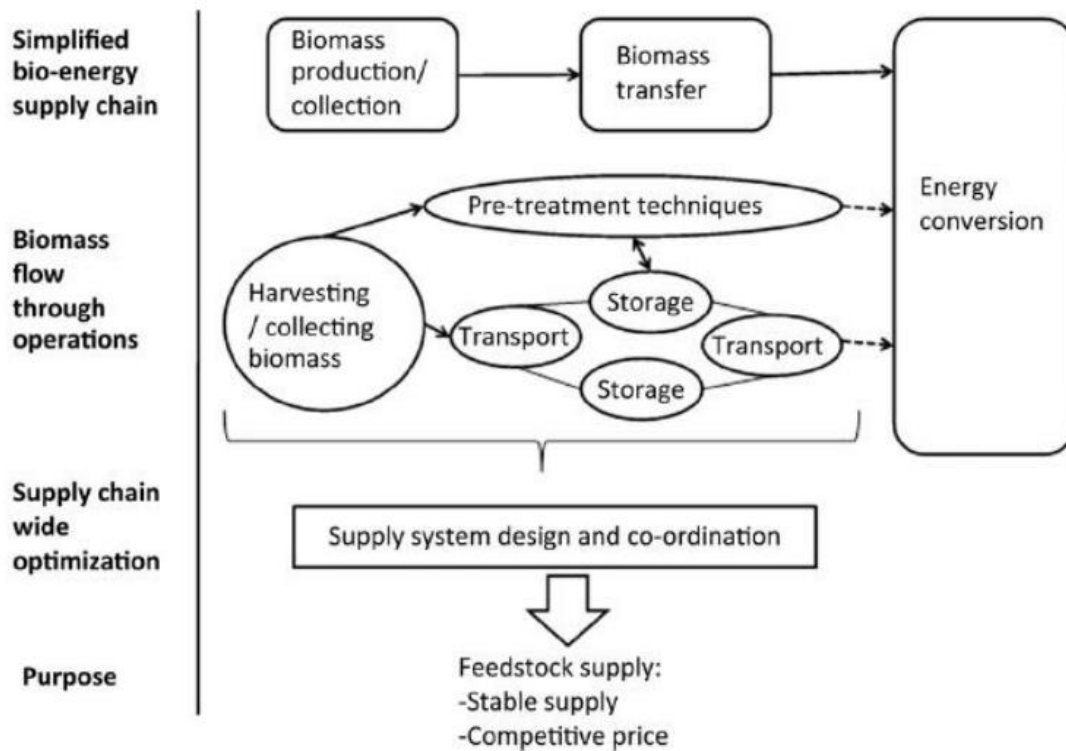


Figure 11 Biomass flow in the bioenergy chain

9 POLICIES FOR EU & NORDIC BIOENERGY MARKET

Different types of policies have been in practice in the EU and Nordic countries in order to ensure that bioenergy production does not adversely affect the environment.

- a) Command and control (t/year)
- b) Subsidies (EUR/investment)
- c) Tax (EUR/t)
- d) Emissions Trading (EUR/t)

The last two are the economic policy tools based on the emissions market value.

Command and control policies are stricter and more traditional in nature, it does not consider associated costs and compliance options. It does not promote innovation and incentives to the firms that innovate and promote emission reduction technology.

Market based environmental policies are more flexible and help achieve the overall environmental objectives at low cost. They give incentives to the inventors, investors who develop low emission technology. It is more dynamic system where market price governs different aspects.

Carbon tax price determines the level of emissions.

European Union Emissions Trading System (EU ETS) is the world's Oldest and largest multi-sector GHG trading program. Currently in its 3rd phase (2013- 2020). Consistent with the emission reductions targets included in the Kyoto Protocol. It sets a cap on emissions and requiring entity to keep a permit for each tonne of emitting CO₂.

If entity doesn't have a permit it must either cut back on their emissions or buy a permit from another entity (who already cut back on their emissions).

Creates a market of tradable allowances for emissions among the EU member states.

Cost on Emission= Price of buying/ selling a permit

The level of the cap determines the level of emissions (the required cuts in emissions cause the price) & the number of available permits.

The policies need to be more localized in bioenergy because the CHP plants, that optimize the production of heat and electricity is found to be most effective, hence this can have positive impact on the local economy that requires heat (regions with extended winter and cold climate).