UNIVERSITY OF EASTERN FINLAND

Learning Diary Bioenergy Markets and Policies

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1. Background

Basic concepts in Bioenergy

Biomass has been defined as “the sleeping giant” by the international energy agency due to its potential especially when compared to other renewable energy sources. This refers to both fundamental roles played by biomass as being the first renewable energy source that is available at global level and also its potential in the energy budget.

At the moment wood is the first renewable energy in the EU and a study shows that it is on a uprising trend that projects an additional demand up to 200 million cubic meters in the next 10 years. But nowadays many other sources of biomass can now be used, including plants, residues from agriculture or forestry and the organic component of municipal and industrial wastes.

Biomass generates about the same amount of carbon dioxide as fossil fuels, but every time a new plant grows, carbon dioxide is removed from the atmosphere. Some experts consider bioenergy from biomass as being carbon neutral while others think that it is not due to a lot of factors which are plausible. However, this is a debate that at the moment can go forever since there is lack of common ground in some terminologies and also in being able to measure at the full extent the implications of producing energy from renewable sources versus fossil fuels.

Biomass can be used in several ways, here are some example of biomass energy technologies and its applications:

- Biofuels ➡ Converting biomass into liquid fuels for transportation (e.g. ethanol and biodiesel)

- Biopower ➡ Burning biomass directly, or converting it into a gaseous fuel or oil in order to generate electricity or heat (biomass plants that use bioenergy feedstocks)

- Bioproducts ➡ Converting biomass into chemicals for making products that typically are made from petrol. (e.g biosynthesis gas that can be used to make plastics and acids, pyrolysis oil that can be of help when extracting phenols for wood adhesives, molded plastic and foam insulation)

2. The role of policy on bioenergy markets

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 Directors or senior governance bodies within an organization where a procedures or protocols would be developed and adopted by senior executive officers.

There are 4 types of policies

- **Distributive policies** extend goods and services to members of an organization, as well as distributing the costs of the goods/services amongst the members of the organization. Examples include government policies that impact spending for welfare, public education, highways, and public safety, or a professional organization's benefits plan.

- **Regulatory policies**, or mandates, limit the discretion of individuals and agencies, or otherwise compel certain types of behavior. (e.g speed limit policy)

- **Constituent policies** create executive power entities, or deal with laws. Constituent policies also deal with Fiscal Policy in some circumstances.

- **Redistributive policies** are slightly different from distributive policies as the former, as the name suggests, goods or services can be redistributed to benefit particular/certain section of the society from the common resource while distributive policies are set of policies to benefit the commons.

Very often, I can hear people the same question in the society and that is “Why do we need policies?” The answer I think its quite simple and easy to see and is to be able to have a system that is capable of taking rational decisions that will guide the society towards progress.

As an example of policies are the targets that has been established by the EU for renewable energies share from total energy consumption grid is the known 2020 which sets up specific targets for each EU member country.

Eurostat reports in 2015 that Romania has reached 24.8% which surpasses the initial goal that was set at 24% by the year 2020. However out of the share of renewable energies, biomass takes about 4% of the total but poses a massive potential but there is little interest for the investors.

This situation is a typical example of policies effect on the market because based on the renewable energies and green certificates system, the state offered incentives for solar and wind energy in detriment of biomass. This is easily controlled by the green certificates policies because if the government will give 3 green certificates/unit of energy produced from biomass and 1 green certificate/unit of energy produced from solar/wind this will create the opposite of the situation and will make the biomass market expand.

Policies that are related to Bioenergy are part of the Energy policies, Agricultural policy and the Environmental policy. Each of these three with emphasis on the mentioned area however they have the most influence in the bioenergy sector.

From the Agricultural policies at EU level the objectives of the CAP (Art. 39) are:

– Increase productivity

– fair standard of living for the agriculture population

– guarantee of secure supply of food – reasonable retail price to consumers

Definitions:

Gross inland energy consumption = Total quantity of energy resources used for all purposes (Primay energy production + Import – Export +- Stock changes)

Gross final consumption of energy = The energy comodities delivered for energy purposes to industry, transport, households, services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production as well as loses of electricity and heat in distribution and transmission.

Externalities

In forestry, externalities are everywhere and they play a more or less important economic role depending on how they are accounted, measured and given economical value. A good example are the protected areas from which society benefits however the owners of the forest in those areas do not, therefore policies that give incentives for owners to protect externalities such as recreation, landscape and pollution reduction needs to step in.

A very frequent question is whether environmental management accounting includes all externalities. It is possible to say that environmental accounting does not include all externalities, but only those based on legislation. Other externalities are of no important effects on the environment. Legislation guarantees the internalization of externalities which is reflected in environmental management accounting. The internalization can theoretically take the form of legal requirements, market mechanisms or ethical pressure (Csutora, 2008).

3. Economic instruments of policy

Supply and demand

The market is shaped by the demand and supply of a commodity/service. The price is established by the curves.

What is demand? Demand is comprised of three things:

- Desire
- Ability to pay
- Willingness to pay

The Law of Demand: "quantity demanded is inversely proportional to price"

Simply put, the higher the price, the lower the demand and the lower the price, the higher the demand. However this has to have all of the three elements of the demand.

The Law of Supply: "Quantity supplied is directly proportional to price"

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

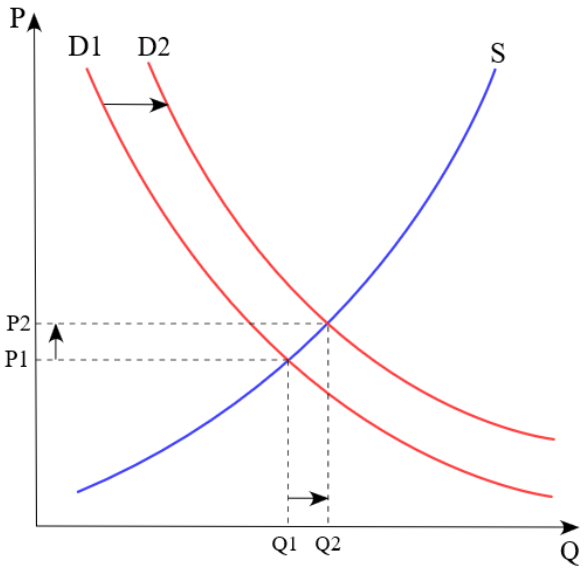


Figure 1 – Supply and demand curves (Wiki.org)

The price P of a product is determined by a balance between production at each price (supply S) and the desires of those with purchasing power at each price (demand D). The diagram shows a positive shift in demand from D1 to D2, resulting in an increase in price (P) and quantity sold (Q) of the product

We can see from the graphical representation that once the supply meets the demand, the demand is covered 100% by the supply and the market reaches an equilibrium (P1;Q1 and P2;Q2)

The effects of taxes and subsidies on the market

The supply and demand of a commodity or service, based on the curves mentioned above, they set the price in a certain market. Usually after a while, if the laws of the demand and the supply are met, the market will reach equilibrium and that sets up the price.

The government heavily influences all the markets, including the bioenergy market. The policy makers, depending on the interests, can manipulate the demand and supply chains in a market using different instruments such as taxes, subsidies, regulations, quotas, tariffs, green certificates, etc.

Taxing and subsidizing the consumer or the producers have different effects in the market and these can change the supply and demands curves, based on their elasticity. The demand curve can vary from inelastic (vertical curve) to perfectly elastic (horizontal curve). As an example, the oil market is very inelastic because there is a high demand for it.

It is predominately used to assess the changes in consumer demand as a result of a change in a good or service price. Simply put we can use the following formula:

Elasticity = % changes in quantity / % changes in price

The effects of taxes usually it translates in moving the supply and demand curves to the left. Depending on the elasticity of the market, taxation will occur on different market levels, for example if the demand is elastic then the producers will take most of the taxes but if the supply is elastic then taxation will occur on the consumer part in order to regulate it.

Subsidies, as mentioned above, are also part of one of the policy instruments and they are used in two ways:

- subsidizing the demand (providing incentives for producers to produce more)
- subsidizing the supply (promote consumers to buy more from a certain commodity)

In terms of bioenergy, there are different types of subsidies and each country has adopted its own tools and strategies in order to reach their targets. One of these can be the implementation of green certificates, which can shift the production of energy from wind and solar to biomass plants investments.

Subsidies are most of the time used when you want to promote production or consumption of a certain good or service (move supply and demand curves to the right side) and taxes are used when you want to reduce the demand or the supply (therefore move the curves to the left)

4. Adoption dynamics in bioenergy

In the history of markets, there has been observed certain patterns in the behaviour of developing a new product or technology, adopting it and how the people respond to it. The same goes with the bioenergy markets and a good example is from it the willow plantations market. This has followed same steps however and also very similar dynamic to market of electronics (example investing in Apple of Bitcoin).

When analysing the dynamics of the bioenergy market, we see the following pattern:

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

There are different point of views and for the policy maker the bioenergy sector is just a number or a percentage in the total grid. Depending on the motivation of the policy makers there the above stages can change percentages quite a lot. For example, if a new technology is needed to be developed in order to achieve a certain threshold or if the willow plantations sector needs to be made more efficient but the risk is too high the Innovators will be very few or none. Subsidies can come into place here and if they are enough to compensate for the risk that the innovators take when investing for a new product then the percentage will increase and therefore, basis for developing new products are set.

A very good example is the case of Sweden, where the government to promote willow plantations as a bioenergy solution they have used a set of instruments such as researching grants and funding, subsidies for innovators (risk compensating). Starting with 1991 a set of subsidies were given to the farmers that changed their cereal crops to willow plantations and they were also exempted of some taxes. Also, usage of biomass in heat production exempted the producers of certain taxes, therefore promoting production and consumption of biomass.

5. Market behaviour

Market economics follow certain rules concerning price, those are known, as discussed in the previous topics, supply and demand.

As an example, a biomass market is composed out of the following three components:

- The forest owner (producers)
- Wood biomass (dealers)
- Bioenergy plant (consumers)

The forest owner decides the price that he want to sell, however he cannot sell lower that the production cost of that commodity. The dealers buys and sells the wood in order to bring it to the plant and the bioenergy plant buys the wood in order to make bioenergy, the limit of the consumer in this example is the profit that it makes out of selling energy)

However, the markets need to be controlled otherwise local monopoly can occur, either on the demand part or on the supply part. Government has to step in to prevent also illegalities such as cartels and promote an equal chances to all actors in the market.

In the biomass market the initial amounts can vary (the supply), and how it was in the exercise from the class, the positioning can pose as being a limiting factor for your options and price and also for the risk of not being able to sell what you produce. The position or distance from a point A to B can be a limiting factor on each level of the market (producer, trader or consumer).

Other factors such as individual skills and experience have an influence on the positioning and sometimes can compensate. The government usually tangles with the controllable factors such as amounts that can be traded at a time and set specific rules to even the chances for the actors or to put pressure on specific market levels.

6. Governance

The global dimension of bioenergy trade has grown parallel to new challenges. Biomass is based on the extraction of natural resources, such as wood, that are not equally distributed along the geography. When this extraction fulfils sustainability criteria, in the environmental, economic and social dimensions, their impacts are minimal and contribute to several benefits. However, the policy frameworks that regulate these operations is variable along countries and geographies, creating unequal conditions: often the production of wood is located in one place, operated by a company from a different place, to be transported and consumed in another location. The subject of governance focuses on these "coordination mechanisms that rest outside the authority of states"

According to Wikipedia, governance is all of the processes of governing, whether undertaken by a government, market or network, whether over a family, tribe, formal or informal organization or territory and whether through the laws, norms, power or language of an organized society.

Governance is the way the rules, norms and actions are structured, sustained, regulated and held accountable. The degree of formality depends on the internal rules of a given organization and, externally, with its business partners. As such, governance may take many forms, driven by many

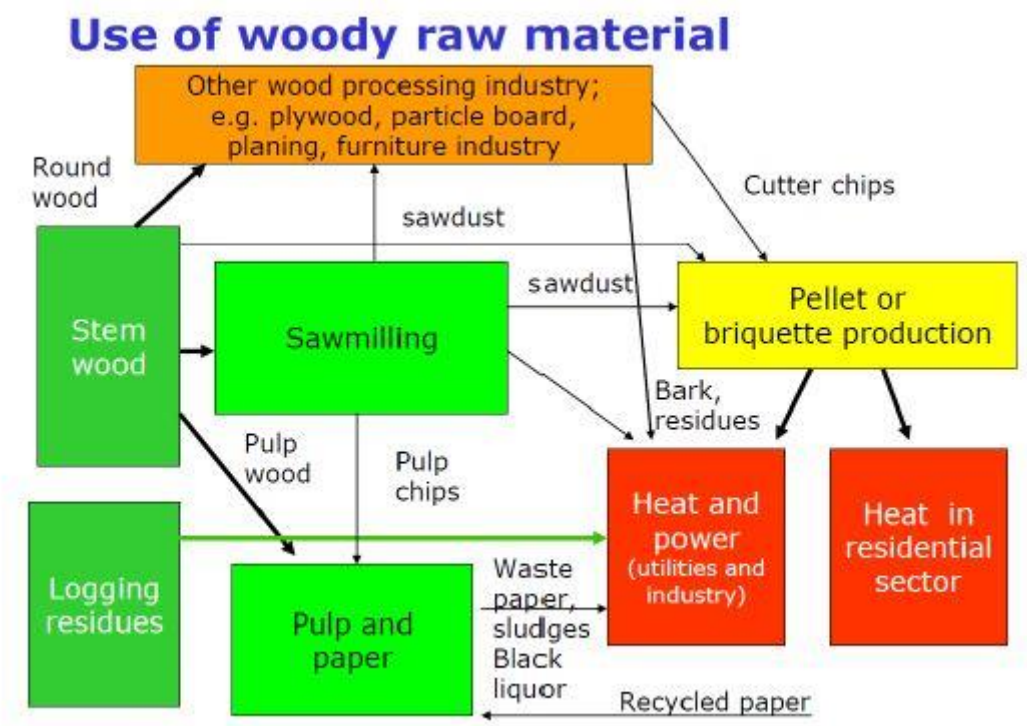
different motivations and with many different results. For instance, a government may operate as a democracy where citizens vote on who should govern and the public good is the goal, while a non-profit organization may be governed by a small board of directors and pursue more specific aims.

In the bioenergy governance there are different issues that need to be covered, such as:

- Carbon balance (bioenergy crops and its impact of food availability)
- Market forces (biofuels as global commodities)
- Technology issues (conversion, efficiency…)

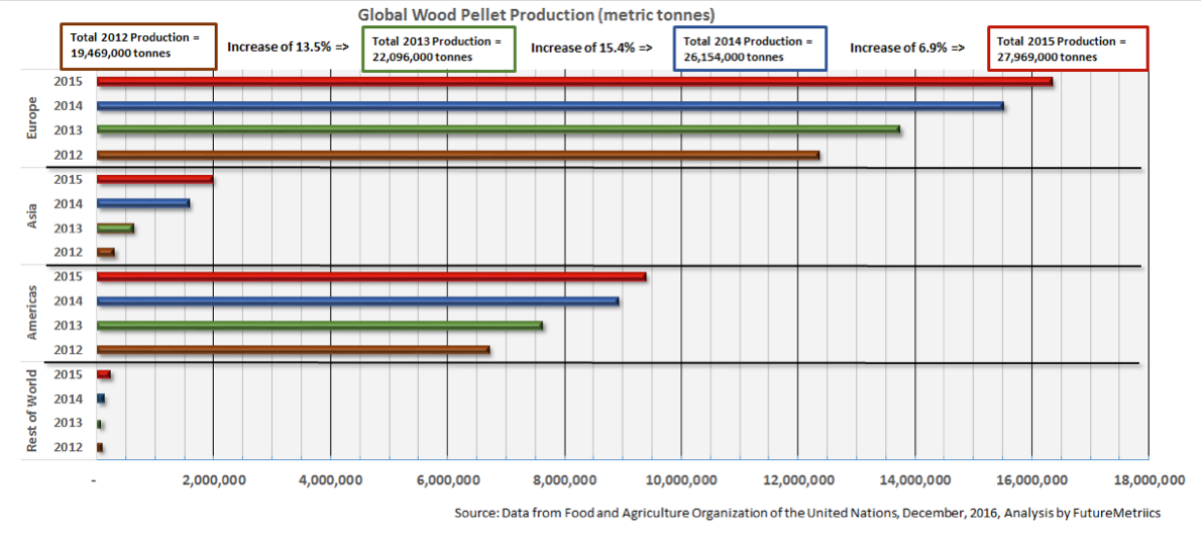
7. **International Markets**

Pellets



The past few years have been challenging for wood pellet producers and pellet production project developers. A temporary plateau in demand growth for new co-firing or full conversion power plant projects in the industrial pellet market has led to an excess of production capacity. To this situation a more factors have contributed, from political point of view and as part of the weather influences. As an example, a series of warm winters in Europe compounded by low fossil fuel prices have depressed demand for pellets and new pellet stoves and boilers in the heating pellet markets.

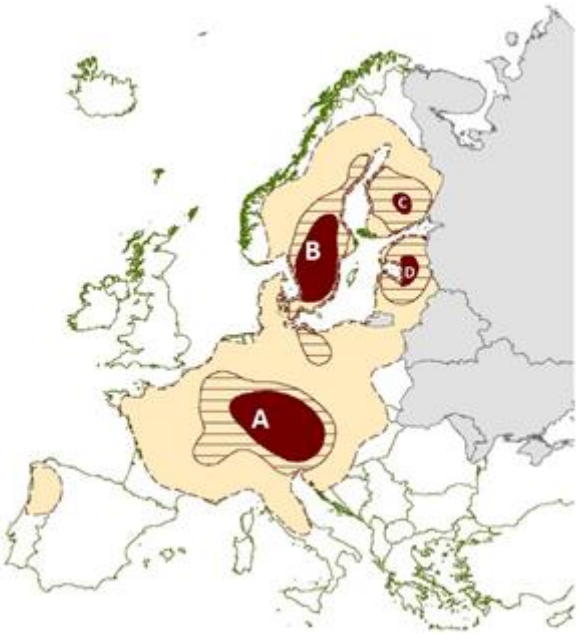
Wood pellet markets comprise two primary sectors: industrial wood pellets that are used as a substitute for coal in power plants, and premium pellets used in pellet stoves and pellet boilers for heating.



Global wood pellet markets, both the heating and industrial sectors, have had significant growth in the past decade. Growth rates over the most recent four years of data has been about 10 per cent annually; from about 19.5 million metric tonnes in 2012 to about 28 million metric tonnes in 2015.

The industrial pellet oversupply is compounded by increased production in eastern Europe and decreased demand for heating pellets in Europe due to above average temperatures the last three winters. But with several large power stations – Lynemouth and MGT in the U.K. and Langerlo in Belgium – coming online in 2018, the oversupply will be soaked up by the new demand.

According to the forecast presented by FutureMetrics on pellet.org, the supply/demand disequilibrium that currently exists in the market is corrected after several large pellet-consuming projects described above come on line. The forecast also assumes that production capacity will not exceed demand and that the heating markets absorb normal quantities (i.e., normal winter temperatures), therefore the market will reach an equilibrium.



Main pellet production cores in Europe (Mola-Yudego et al., 2014)

Now in Europe, Germany is leading the production market with 20% followed by Sweden with 19%, Italy 9%, Austria 8%, Finland 5%, Poland 5%, Belgium 4%, France 3%, Denmark 2%, Netherlands 2%.

However, on the other side, Sweden is the biggest consumer per capita of pellets followed close by Denmark with almost 200 kg/capita. We can see the big difference within Nordic countries and the rest of Europe if we compare just the 3rd largest consumer which is Belgium with about 90 kg/capita.

8. Bioenergy Regions

Bioenergy represents energy from biomass, therefore the logistics costs of transporting it on longer distances make it inefficient, therefore the bioenergy is considered more of a local resource and we can translate it in talking about Bioenergy Regions.

The need of changing the traditional energies and a transition from coal, oil, gas, etc is driven to more sustainable or at least low-carbon economies drives the growth of more efficient ways of producing energy from biomass.

The EU has set some renewable sources policies such as RED, Sustainability criterias, National Renewable Energy Action Plans.

What is translated?

- EC Biomass action Plan (2005)
- Renewable Energy Roadmap (2007)
- Renewable Energy Directive (2009)
    - NREAPs from EU members with own targets and approaches.

The general aims of these directives in the European Union is to promote a sustainable development/low carbon energy, security of supply, rural development, Energy Union.

Renewable Energy Directive (2009) establishes an overall policy for the production and promotion of energy from renewable sources in the EU. It requires the EU to fulfil at least 20% of its total energy needs with renewables by 2020 – to be achieved through the attainment of individual national targets. All EU countries must also ensure that at least 10% of their transport fuels come from renewable sources by 2020.

A good example of Bioenergy Regions is Scandinavia and more specifically we can take a look on Norway's local bioenergy governance and targets:

- 67,5% renewable energy by 2020; 10% in transport
- Electricity grid: 95% hydropower
- Various support schemes (investments funds, chipping grants, etc)
- Relatively weak forestry sector (GDP%)
- Very strong electric appliance sector

There is need of local interest and involvement in order for bioenergy development and to make it sustainable, however in the context of very negligible rural development and employment benefits, in Norway, people ask if there is really a need for developing an alternative source of energy, especially since there is no financial incentive for a change.

Another important reason to know why there is so much pressure on the internal capability of energy production is that forecasts predicted that the EU in the current pace will have 70% of its energy need by 2030 to be imported from outside Europe. Therefore, seeing the renewable energy action plans from a geo-political point of view, aside of its environmental reasons, can pose to be a very interesting part to analyse and account for future forecasts on investments and policy making.

As in all policies and strategies, conflicts arise in the context of bioenergy since there are several NGO's that condemn is as being unsustainable and unreasonable in the contexts of land-use change dilemma and population growth prognostics.

9. Models for Energy Systems

By reducing fuel consumption, increasing fuel efficiency, using cleaner fuels and adopting new technology, businesses and individuals can reduce the amount they pay in carbon tax, or even offset it altogether.

Carbon tax is a policy instrument that aims to put stress on carbon emission from coal, oil and natural gas, so is basically a fee for greenhouse gas pollution. The cost of this tax is calculated per ton on carbon translated it into a tax for fossil fuels, therefore the polluter has to pay.

The idea of the carbon tax is to encourage alternative energy sources, such as biomass or biofuel and to reduce fossil fuel use and CO2 emissions.

On one hand, I think that putting a global polluting is a good idea and it promotes internationally fair pricing, whereas the taxes collected from the tax can be invested in clean energy and technology or research on the area. On the other hand, I am afraid that if put in practice the tax will not have the desired effect but just bring a economical disadvantage to adopting countries since the most probable thing to happen is that industrial production will shift to countries with no tax carbon or a low one. If this strategy cannot be applied globally I don't think it is a good decision only in specific areas.

10. Bioenergy Policies for EU

EU bioenergy policy has been the subject of fierce debate for over a decade, with much of the controversy stemming from a failure to distinguish between whether something is sustainable in an ecological or commercial sense and whether it is 'low carbon' (i.e. delivers GHG savings over the short to medium term, in pursuit of the 1.5°C goal).

European Commission proposals:

Under the Commission's proposals, the EU's approach to bioenergy sustainability in the recast Renewable Energy Directive would rest on three main pillars:

- A requirement that bioenergy deliver a certain level of GHG savings relative to fossil fuels;
- A requirement that forest bioenergy come from forests that are 'sustainably managed';
- A requirement that forest bioenergy come from countries or areas subject to some form of LULUCF accounting.

<u>Sustainability criteria</u>

The European Commission has issued non-binding recommendations on sustainability criteria for biomass. These recommendations are meant to apply to energy installations of at least 1MW thermal heat or electrical power.

They:

- forbid the use of biomass from land converted from forest, and other high carbon stock areas, as well as highly biodiverse areas
- ensure that biofuels emit at least 35% less greenhouse gases over their lifecycle (cultivation, processing, transport, etc.) when compared to fossil fuels. For new installations this amount rises to 50% in 2017 and 60% in 2018
- favour national biofuels support schemes for highly efficient installations
- encourage the monitoring of the origin of all biomass consumed in the EU to ensure their sustainability

Climate and energy framework for 2030 has set an objective to reduce the greenhouse gas (GHG) emissions by 40% by 2030 as well as reducing global warming level below 2°C when compared to 1990. This includes an estimated 27% of renewable energy in EU will be applied thereby increasing the efficiency up to 30%. Moreover, the policy measures are implemented in order to achieve the set goals (2030) which also supports the EU's GHG reduction plan from 80-95% by 2050.

For bioenergy to be accounted towards the EU's 2030 renewable energy target and to be eligible for financial support, its use and production should meet the criteria listed below, irrespective of whether the raw materials are sourced within or outside the EU:

1. There should be an overall limit on the amount of bioenergy used to meet 2030 targets

2. Bioenergy should not be produced from the following high risk sources of biomass

    a. Biomass from areas designated for nature protection
    b. Crops from agricultural land
    c. Stumps and Roundwood
    d. Invasive alien species grown to supply bioenergy
    e. Biomass from land with high biodiversity value or high carbon stock

3. Soil, water and biodiversity should be protected during the harvesting of agricultural and forestry residues for bioenergy

4. Production and use of all biomass sources for energy should respect rights to land tenure, free prior and informed consent of affected communities, food security and human and labour rights

    a. Respect for local community access and control over natural resources
    b. Protect food security
    c. No systematic violation of human and labour rights

5. Use of biomass for energy should not cause displacement of other uses of biomass and be in line with the principles of cascading use and the waste hierarchy

a. Energy use should not displace other uses of biomass
b. Use of waste based biomass is in line with the waste hierarchy
c. Waste based biomass is separated from other sources of waste

6. Bioenergy should only be produced in the most efficient applications

(A new EU sustainable bioenergy policy)

11. Recent and future trends in bioenergy sector

Teacher: Jakob Donner

Most important trends/surprises

- Renewables growth + decreasing production costs
- Changing subsidies with auctions
- Natural gas development (one reason is because USA is a very large producer and export

- Phase out of diesel cars?

Consequences for bioenergy?

- In heating/cooking?
- In road transport
- Slight increase

Explanations/background (reason/factors)

- Only technology or economy/businesses

A shift has taken place: from "knowing/predicting the future" to "exploring and preparing for unknown futures"

Nobody really knows the future, but everybody can gain from preparing for it, both for the typical and for surprising alternatives ("Plan B")

What if? … Is the key question

Most important implication: consider many unexpected factors

Experts are not always good at predicting future developments!

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