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Biofuel policies for dynamic markets

Policy Paper 5 – April 2010

"Lignocellulosic markets special"

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- Lignocellulosic biomas trade

Intelligent Energy Europe

Elobio: a very short introduction

I. The problem:

Increased demand for biofuels could have significant long-term impacts on several commodity markets. Current disputes on this issue (with rising prices in today's markets) require responsible policy.

II. The objective:

Formulation of efficient and low-disturbing policy options that enhance biofuels while minimizing the impacts on e.g. food and feed markets and biomass for power and heat.

III. The activities:

- Review of current experiences with biofuels and other renewable energy policies and their impacts on other markets;
- Iterative stakeholder-supported development of low disturbing biofuels policies;
- Model-supported evaluation of these policies' impacts on food & feed and lignocellulosic markets;
- Assessment of selected optimal policies' impact on biofuels development, potentials and costs.

The Elobio Policy Paper series

In the course of the project (November 2007 – April 2010), the Elobio team will prepare a short series of Policy Papers presenting Elobio results and news in the context of the actual policy debate on biofuels. Key target audience are policy makers at the EU and EU member state level. Contributions will largely be based on (intermediate) results of the project.

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Markets for biofuels and lignocellulosic biomass

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1 Introduction

Biofuel use in the transport sector has been heavily criticised by a range of stakeholders as the production chains of some liquid biofuels are perceived to cause considerable risks to the environment and society. Moreover, the potential impact of increased demand for cereals and oilseed crops on commodity prices has led to the biofuels industry being scrutinised. This was particularly evident when a combination of effects – including biofuels demand – contributed to significant price hikes during 2007 and 2008. Land use change (including indirect land use change) due to biofuel expansion and the subsequent marginal green house gas emission performances in addition to price impacts have shifted the enthusiasm from the so called first generation biofuels to biofuels derived from lignocellulosic feedstocks (such as agricultural residues, dedicated energy crops, and wood residues) .

Biofuel production from lignocellulosic biomass could indeed reduce some of the concerns related to flow-on effects to agricultural commodity markets, and on environment. However, these feedstocks are also demanded by other sectors. For instance, a large share of the woody biomass derived from forests is currently used by the forest-based industries (saw-mills, pulp and paper, particle and fibre board industries) and the residues are converted to heat and electricity to supply the energy demand of the wood processing industry. Agricultural residues (i.e. straw) are used for animal bedding or are left on the ground in the field to protect the soil from erosion and preserve soil organic matter. More importantly, the renewable energy targets that Europe has stipulated for 2020 indicate a rapid increase in biomass use for electricity and heat purposes. With the further advancement in second generation biofuel technologies and the possible government support, the competition for feedstocks within lignocellulosic markets may well be intense in the next decades.

As an attempt to illustrate such pressure, this paper[1] focuses on the relationship among stationary energy use of lignocellulosic biomass resources, second generation biofuel demand and the demand from European forest-based industries.

2 Forest sector and forest-based industries in Europe

European forests and other wooded land cover 42 % of EU27 land area (117 Million ha) and fulfil many functions- from amelioration (improving the landscape and helping the local economy), to nature conservation, the preservation of biodiversity, recreation, CO_2 sequestration and commercial wood production. Forest-based industries – including pulp and paper, sawmill, and wood based panel industries – followed by the energy production, are the largest forest-based raw material consumers in Europe.

In 2008, Europe's annual roundwood production was around 420 million m^3 of which around 79 % was industrial wood and the rest fuel-wood (see Figure 1). The largest producers of round-wood were Sweden (69 million m^3), France (57 million m^3), Germany (55 million m^3), Finland (52 million m^3) and Poland (34 million m^3). These together accounted for nearly two thirds of EU27 production.

[1] This paper is based on work within Elobio and within the project Pathways to Sustainable European Energy Systems, commissioned by the Swedish Energy Agency and Vattenfall AB.

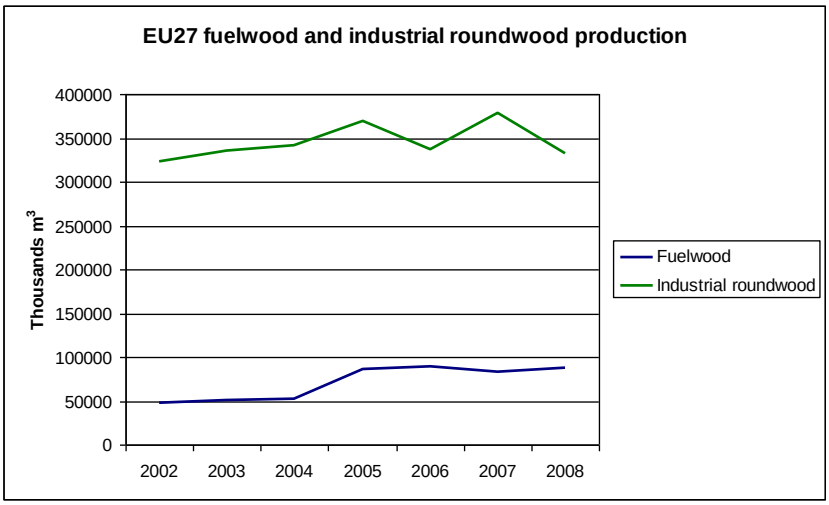


Figure 1 EU27 fuelwood and industrial roundwood production between 2002 and 2008[2]
Source: Eurostat, 2010.

While the sawmill sector depends entirely on roundwood supply, pulp and paper and wood-based panel industry also use by-products, for instance, sawdust and wood chips that are produced during the sawn wood production. Recovered paper and board are also major sources of raw material for the paper industry.

European forest-based industries also use the biomass to generate energy for their own purposes and for external customers. For example, the pulp and paper sector is the largest producer and user of renewable energy sources with 50 % of its primary energy consumption coming from bioenergy, in particular from wastewood, bark and black liquor.

Even though these industries in the EU are generally competitive they are facing a number of challenges, in particular as regards the access to raw materials (EC, 2008a). The raw material availability at a competitive price is a critical factor for their market competitiveness as woody raw material comprises a substantial part of the total variable production costs – more than 30 % of total costs in paper making and reaching up to 65 to 70 % in the sawmill industry (EC, 2008a). While the developments in wood based energy production may have positive effects on sawmill industry as they can get a higher price for secondary products (slabs, chips and sawdust), the wood based panel industries are likely to be negatively affected due to the increasing competition for slabs, chips and sawdust from the sawmills as well as for roundwood. Exacerbating challenges for this industry is the fact that they have little or no secondary products to be fed into the burgeoning energy markets.

3 Demand from stationary energy sector and the transport sector

In 2007 almost 100 Mtoe of primary biomass was consumed for energy in Europe, of which about 70 % was from wood and wood wastes (Eurostat, 2010). This amount comprises around 5 % of EU27 total final energy consumption and some two-thirds of the renewable energy consumption in 2007. The most important EU policies behind the growth of bioenergy in Europe are the Promotion of Renewable Electricity (RES-E), Biofuels and Landfill Directives, the EU Emissions Trading Scheme (EU-ETS) and parts of the Common Agricultural Policy (CAP). The recent Renewable Energy Directive (2009/28/EC) in particular has potential to trigger step-changes in the development of the bioenergy policy. Among other things, it requires each Member State to develop and adopt a national renewable energy action plan. These plans are to be based on Member States´ national targets for 2020

[2] The statistical basis for woody biomass used for energy is weak, especially regarding stumps, tops and branches, and rejected industrial round wood

for the share of energy from renewable sources as stated in the Renewable Energy Directive. The rates differ for various Member States calculated as follows: Part of the increase will be a fix rate in addition to present levels of renewable energy; another part will be based on the GDP.

To achieve the 20 % renewable energy target by 2020, practically all sorts of biomass resources will be required. In its Communication document, the EU assumes the European bioenergy demand to be around 230 Mtoe[3] (corresponding to about 1.2 billion m^3 roundwood[4]) . This would require more than a doubling of wood supply for energy by 2020 compared to the 2007 level of wood and wood waste use for energy.

3.1 Second generation biofuels

The growth of the liquid biofuel industry is highly dependant upon a combination of the environmental and social sustainability of producing and using biofuels – and the perceptions that stakeholders have on the 'sustainability performance' of the sector. The EU imposes a 10 % renewable energy target rate for 2020 regarding final energy consumption in the transport sector. Biofuel supply however, will only be counted towards the target if its production has been deemed to fulfil the criteria for sustainability. The Renewable Energy Directive includes a range of sustainability criteria that address agricultural practices, biodiversity, land use and land cover issues, and targets for green house gas (GHG) emission saving (savings from 35% to 60% in 2017). 2nd generation biofuels are especially incentivised in that as the contribution of such biofuels towards the target will be counted as twice their real contribution (EC, 2009).

The Renewable Energy Directive and Fuel Quality Directive require the Commission to submit a report to the European Parliament and to the Council reviewing the impact of indirect land use change on greenhouse gas emissions and addressing ways to minimise that impact (please see the Policy Paper 4 for further discussion). This must be delivered by December 2010 at the latest.

As a positive note when considering the challenges posed by sustainability certification requirements; 2nd generation biofuels based on lignocellulosic feedstocks promise access to a greater range and volume of feedstock resources with much higher GHG reduction potential. However, the technologies to produce 2nd generation biofuels currently exist only at 'pilot' and 'commercial demonstration' scales and the transition to commercial biofuel production is therefore expected to occur over the next 1-2 decades. The share of 2nd generation biofuels depends on many factors, of which policy support and technology development play key roles. Assuming that the EU 2nd generation biofuel industry provides 25%, i.e., somewhat above 10 Mtoe, based on domestic wood resources, about 100 million m^3 of roundwood would be required. For comparison, the EISA[5] Title II Renewable Fuel Standard requires 36 billion gallons per year of renewable fuels by 2022 (USDOE, 2008), which corresponds to about 70 Mtoe[6].

4 Impacts on forest-based industry

As indicated earlier in this document, increased demand from a growing bioenergy sector is likely to put pressure on forest based industry and increase feedstock costs for a number of wood products such as sawdust and wood residues. This will affect a number of products currently made from sawdust, wood residues, and low-grade timber, including pulp and paper, panel making, and some other manufactured wood products.

[3] The impact assessment of the Renewable Energy Roadmap mentions "Among the "20%" scenarios, the highest biomass contribution anticipated is 230 Mtoe (SEC(2007) 12).

[4] 1 toe = approx 5 m3 roundwood equivalent

[5] Energy Independence and Security Act, also known as Public Law 110-140.

[6] Calculated based on assuming 1 gallon biofuel = approx 80 MJ

The demand for biomass in the energy sector, and thus, biomass paying capacity, will depend on (i) the fossil fuel prices, (ii) energy and climate change policy measures applied (i.e. the amount of taxes, subsidies applied, the CO_2 prices), and (iii) the development of other renewable energy technologies on the market.

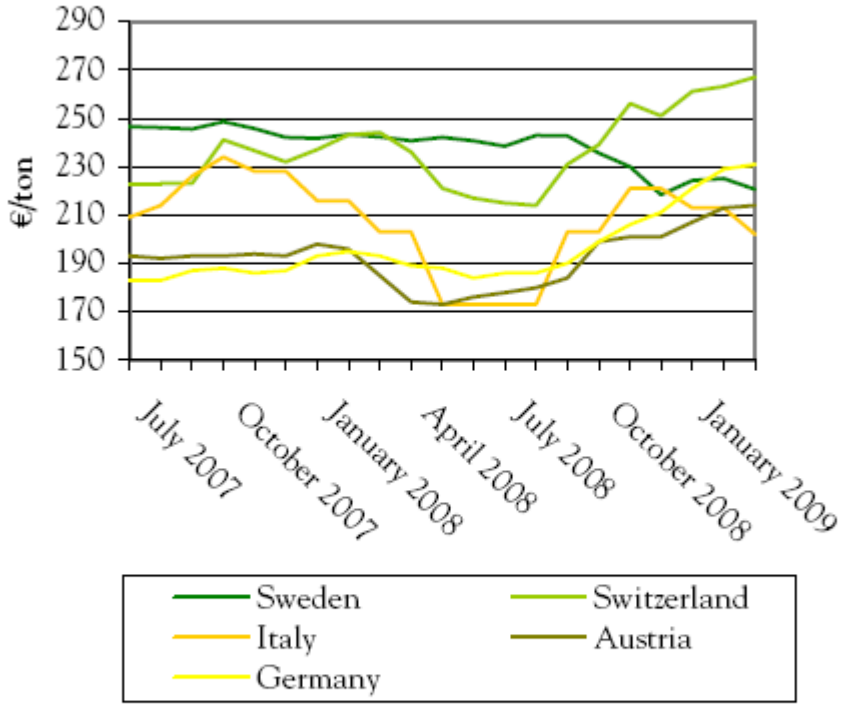
Even though the stationary energy sectors currently make use of residues and wastes with zero or limited other value in local markets, increased demand driven by factors such as policy interventions and higher energy price levels has the potential to drive up wood fibre prices. Although, there will always be an endogenous price cap built in by the requirement that bioenergy maintain compositeness with the alternatives.

The demand for biomass from the 2nd generation biofuel technologies is negligible at present. However, when technologies become commercially available and penetrate the market the demand volume and the paying capacity from that sector can be significant. A high 'ability to pay' is related to the economies of scale of 2nd generation biofuel plants – where the feedstock cost share is relatively smaller than for 1st generation biofuel plants – and the policy measures supporting them. On top of that, possible future oil price increases will increase the competitiveness of these biofuels.

As an example of how competition for feedstocks has affected prices to date, is presented in the Austrian country report to IEA Task 40(Austria, 2009). From 2001 to 2005 sawdust prices nearly doubled because of the increased competition between pellet producers and the pulp and panel industries for the same raw material. Pellets have also experienced significant price increases in Austria (reaching up to 265 €/tons) from average prices of 183 €/tons, mainly due to high demand from heating sector combined with the shortage of round wood

Figure 2 presents the European wood pellet price change between July 2007 and January 2009. The economic downturn however played a significant role in the price fluctuation as sawmills decreased their production, including sawdust. The raw material shortage led to increased prices for wood pellets in Europe.

European residential wood pellet prices, 2007-2009



Notes: Prices include value-added tax. The drop in Swedish wood pellet prices in late 2008 was heavily influenced by the weakening of Swedish currency relative to the Euro.

Source: Pellets@las, 2009.

Figure 2 European residential wood pellet prices, 2007-2009

As a comparison, the CIF price in Rotterdam for imported pellets was around €130 in 2009 (excluding VAT). Thus, for many users in Europe imported pellets were cheaper. Most of the imported pellets were used in large power plants.

5 Biomass trade

Wood has been traditionally traded for the forest industry to be used as raw material. The major wood importing countries are Japan and the Nordic countries. Finland for instance has for a long period of time imported large quantities of raw wood (logs, pulpwood and chips) especially from Russia, but also from the Baltic States and Sweden. A few years ago, Russia imposed export tariffs on logs and certain categories of pulp wood, resulting in a drastic reduction of import.

As the roundwood in form of pulp wood and saw logs normally is imported with the bark on this provides opportunities for the forest industries to utilize the "imported" bark for energy purposes. Additionally, a portion of the roundwood import consists of energy wood for direct use for energy generation. Moreover, a significant amount of the raw wood in the manufacturing process ends up in energy production or is converted to by-products utilized in energy production. As a consequence, it is quite difficult to approximate and define the amount for biomass traded for energy purposes.

On the other hand, energy policies promoting bioenergy and increasing energy prices have driven the demand for imported chips and pellets for energy. As a consequence wood pellets trade increased

significantly (e.g. between 2004 and 2006 traded pellet volumes increased by an about 50 % (IEA, 2009). In 2008, about 8 million tonnes of pellets was produced in 30 European countries and more than 1 million tonne was imported from North America. 95% of the produced and imported volumes were consumed in EU 27. For 2009, total imports in Europe are estimated at about 3.4 million tonnes, of which roughly half is estimated to be EU intra trade (Pellets@tlas, 2009).

Even though the biomass demand from the energy sector will depend on the level of support the sector receives from the governments and its competitiveness with other renewables, a number of studies (i.e. Mantau et al., 2007) indicate a shortfall of wood supply in Europe to meet both the energy and the industry demand. Even if more wood resources would be mobilised in Europe the predicted deficit in wood supply will mainly have to be compensated for by imports.

In other regions of the world, e.g. South America and Africa, abundant biomass quantities can be produced and developed at reasonable costs. The physical export biomass potential from these regions is large and can under enabling conditions become sufficient to fill future import demand for biomass fuels in Europe and elsewhere. These opportunities have been subject to numerous analyses and the results are published in several independent reports (e.g. Smeets et al. 2007; Hansson et al. 2005). While production capacity and land availability in tropical and subtropical regions of the world could provide a basis for large scale biomass trade opportunities to make such endeavours happen and be successful a number of obstacles and problems need to be overcome. Obviously a systematic approach would be needed to handle a wide spectrum of social, political, logistic, cognitive, financial, managerial, etc. problems. This means, that each project obviously need to be of reasonably large scale, with the involvement of dedicated, large, and financially strong stakeholders. (Peck, Hektor, Berndes, 2010).

6 Conclusions

The markets for biomass for the stationary energy sector, transport fuels, and the forestry based industries are becoming increasingly dependent. The increasing demand from the energy sector is changing the nature of wood fibre markets with important implications for the traditional forest industries. Since the production of 2nd generation biofuels is as yet negligible its impact on commodity markets is insignificant at the current time. Nevertheless, a combined effect of both the stationary energy sector and the transport sector on the market for raw material to the forest-based industries could be significant. Large demand for wood can increase prices to levels at which they become higher than present wood prices for first the paper and pulp industry, and then for low grade logs for the sawmill industry. If this would happen only in Europe and not for competing forest industries in other regions, European mills will lose competitive edge, which may lead to slower growth and even reduction of capacity and production.

On the other hand, the forest-based industries account for a production value of € 365 billion, with a value added of around € 120 billion and have more than 3 million employees in Europe (EC, 2008a) Their competitiveness in the global market is essential for Europe's economy. Some of these industries are also energy intensive and the climate change policies will have an important impact on them - by driving up raw material costs but also the cost of energy. This is particularly the case for pulp, paper and some wood panel production. However, pulp and paper industry (chemical pulp mills) can become net energy producers. In fact, a large portion of primary energy used is produced internally by these industries from wood biomass. Further improvements in terms of energy efficiency measures and energy self sufficiency should be promoted in those sectors. Thus, the policy objectives should ensure a coherent approach for strengthening the competitiveness of the forest-based industries, while integrating climate change and energy objectives into the sector's industrial strategy.

A number of studies have identified a wide gap between supply and demand for biomass in Europe in the coming decades, mainly due to increasing demand from energy sector. Drastic and intensive measures are called for to make this gap to be reduced, and its negative influence ameliorated through (i) mobilizing forest resources (energy markets can offer more income for forest owners and thus

catalyze harvest in new forest areas and adjusted management to increase biomass output), (ii) enhancing paper recovery and recycling, (iii) encouraging efficient suppliers of lignocellulosic crops – short rotation plantations could play an important role, and (iv) facilitating the import trade in wood raw materials and other biomass.

Furthermore, biofuels can be produced along with wood-based chemicals and other products in bio-refineries that optimize biomass use and outputs according to market trends.

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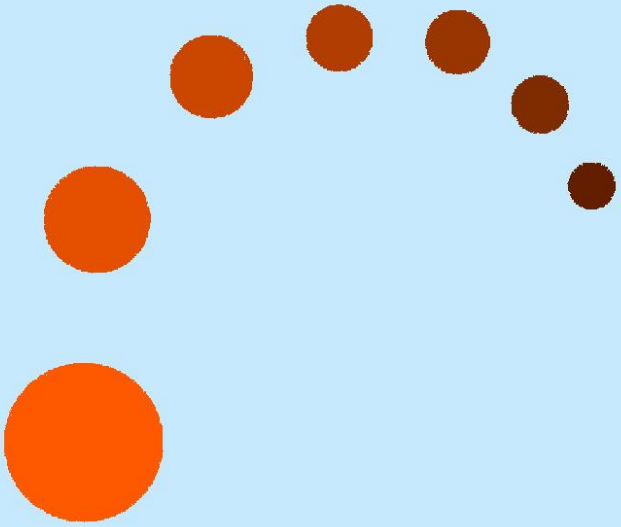

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