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Implications of EU renewable energy policy for wood use in Europe

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Abstract

The European Union is aiming to substantially increase the use of renewable energy. In 2007, the EU set a target of 20 % of the overall energy consumption should be derived from renewable sources by 2020. National targets based on this figure were agreed upon at the beginning of this year. As wood is currently the most important source for renewable energy, the new targets can be expected to have strong implications for wood use in Europe. In this paper, the current situation of both the material use and energy use of wood is considered, as well as the possible impacts of increased utilization of wood energy on European wood demand. The situation is analyzed from the perspective of 29 European countries as well as from the specific viewpoint of Finland and Sweden. The study shows that the availability of wood for both material and energy use will prove a major challenge for the EU if its energy targets are to be met primarily by wood.

Keywords: Wood use, wood supply, wood energy, wood resource balance, energy policy, renewable energy

Introduction

In the Kyoto Protocol many developed countries committed themselves to reduce greenhouse gas emissions and in January 2007 the EU disclosed new climate and energy targets for 2020. Important for reaching these targets are an increase in energy efficiency and energy savings on EU and national levels. Another important policy component is renewable energies. In 2007, targets were announced for 2020, by when 20% of the energy consumed should come from renewable sources.

These targets have to be seen in the context of the current state of renewable energies. In 2005, renewable energies accounted for only 8.5 % of energy consumption in the European Union. Biomass constitutes the largest source of renewable energies in the EU (66%), and wood is the major source for biomass (89%). Thus, wood is currently the major source for all renewable energy generation in the EU.

The paper is based on a study carried out by the University of Hamburg and the Timber Section of United Nations Economic Commission for Europe (UNECE/FAO). More detailed results are reported by Mantau et al. (2008) and Hetsch et al. (2008). The study is seen as a contribution to increase the understanding between the forest based and the energy sector and their policies. The main objective of the study is to draw a better picture of the current (2005) supply and use of wood and, on the other hand, to estimate possible implications of new EU energy targets for the wood use in Europe. Metsäteho, a participant in the study, has reviewed the results in this paper from the viewpoint of Finland and Sweden.

Methods

The structure of "wood resource balance" developed by Mantau (2005) is used in the study. A wood resource balance compares the entire supply of wood fibres with its use for material and energy purposes in a national economy. It is a consistency check of national wood flows that counter-checks the balance sheet total all sources of woody material against the independently derived balance sheet total of the consumption side (Figure 1). It is important to note, that the figures in wood resource balance include all cascade (multiple) use for raw material.

The method includes also wood fibres import and export at national level. It considers only publicly available information and data from international databases. Important sources of information on the wood sector are:

- The Joint FAO/ UNECE/ ITTO/ Eurostat Forest Sector Questionnaire (JFSQ)
- Joint FAO/ UNECE/ IEA/Eurostat Wood Energy Enquiry (JWEE)
- MCPFE/ UNECE/ FAO enquiry on quantitative indicators of sustainable forest management.
- Energy information comes from European commission (Eurostat, DG TREN), World Energy Outlook 2006 (IEA 2007) and the EurObserver.

- Information on post consumer recovered wood derives from the results of the COST E31 on recovered wood.

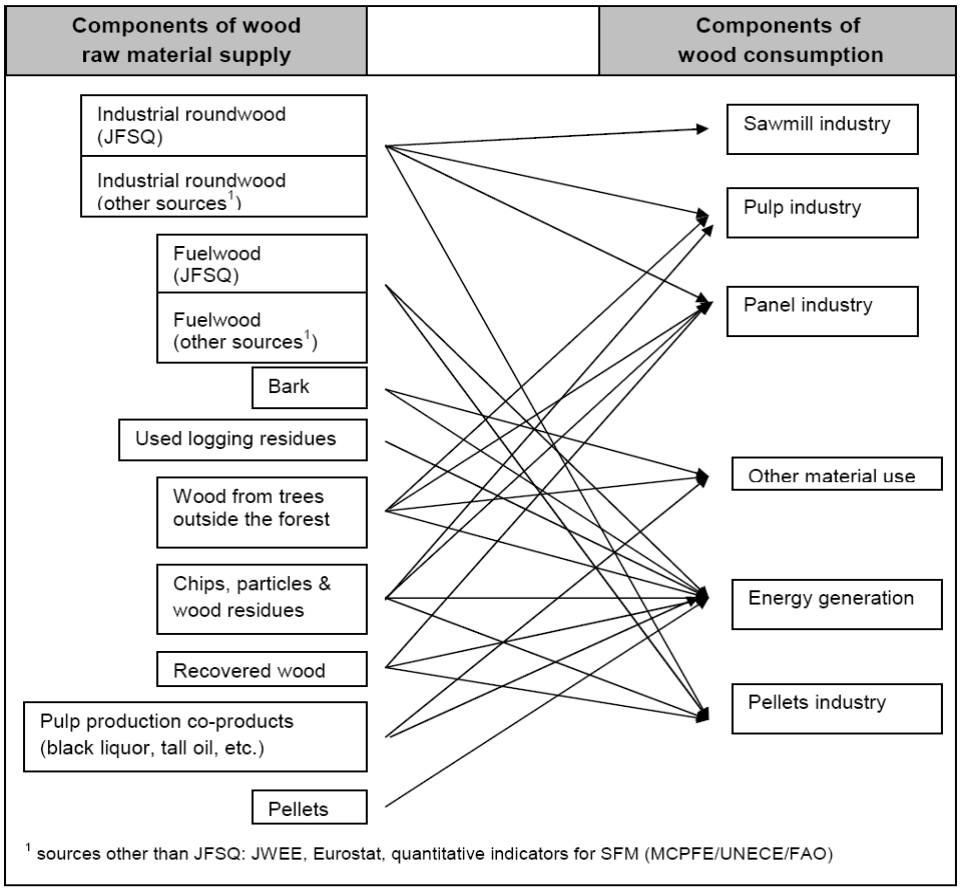

Figure 1. Wood flows in the wood resource balance

In order to compare all different commodities, a common unit is needed. Therefore, all figures in the balance are converted into roundwood equivalent (cubic metre of solid volume under bark). On the use side each wood processing technique of the different forest based sector industries requires individual conversion factors to calculate the sector specific solid wood equivalent of the recorded production. The apparent cascade use is counteracted by including certain flows on both sides

In the second part of the study national and EU policy targets for renewable energy are gathered and transparent scenarios are build to "translate" these policy targets into volumes of wood possibly required to meet the targets. Furthermore, the study calculates wood consumption by

the wood-based industries for 2010 and 2020, based on the European Forest Sector Outlook Study (UNECE 2005). The wood requirements from EFSOS and the policy targets are then added up, to estimate wood requirements in 2010 and 2020 of both, the energy and wood-based industries.

Results

Wood supply 2005

The European wood resource balance covers wood flows in 27 member states of the European Union (EU 27) and two EFTA states - Switzerland and Norway. The total wood volumes extracted from the forests including industrial roundwood, fuelwood, bark and logging residues, add up to 512 Million m³ (EU 27) respectively 531 Million m³ (EU/ EFTA) (Table 1).

Wood from the forest is the most important source of wood raw material, providing 2/3 of the total wood supply. Woody biomass outside the forest, industry co-products, recovered wood or processed wood fuels provide 1/3 of the total supply.

Table 1. Wood sources 2005

	Wood supply from forest (direct)	**Wood supply from other sources**	**Total**
	Million m³		
EU-27	512	237	749
EU/EFTA	531	244	775

Wood use 2005

Material use is any process where wood is used to produce goods like sawnwood, pulp and paper, wood-based panels and other products. All these processes have in common that the wood fibres or particles contained in the products and co-products can be reused in downstream processes, recovery or recycling processes. In EU/EFTA the material use of wood accounts for 58% of the total wood use from all sources (Table 2).

Table 2. Wood use 2005 (EU/EFTA)

	Material use		**Energy use**		**Total use**
	million m³	%	**million m³**	**%**	**million m³**

EU-27	**462**	*58*	**332**	*42*	**794**
EU/EFTA	**481**	*58*	**341**	*42*	**822**

The energy use of wood is smaller than the overall material use by all wood based sectors. However, most countries have a much higher proportion of wood use for energy than recorded in international energy statistics. About 42 %, or 341 million m³ (EU/EFTA) of the total wood volumes available are already nowadays used for energy generation.

Among the wood-based industries' sector, the sawmill industry is the biggest wood consumer of solid roundwood for material purposes using 217 million m³ – corresponding to 26% of total consumption. The pulp and paper producing industries are second accounting for 155 million m³ (19% of total consumption) followed by the panel industry (11%) consuming 88 million m³ respectively.

Balance 2005

In the national wood resource balances, available wood volumes often do not match volumes of wood use. Summing up the supply and use balanced of all 29 countries, the regional wood resource balance comes to a final difference of 47 million m³ - corresponding to 5% difference (Table 3). The imbalance is probably due to by weak and missing data on both sides of the balance (e.g. data on woody biomass supply from outside the forest, supply of post consumer recovered wood, use of logging residues), different ways of data calculation as well as problems with conversion factors.

Table 3. Wood resource balance 2005 (EU/EFTA)

Sources				Uses	
	[mil. m³]	%	%	[mil.m³]	
Industrial Roundwood - JFSQ	381	49%	26%	217	Sawmill industry
Industrial Roundwood - other	16	2%	11%	88	Panel industry
Fuelwood - JFSQ	79	10%	19%	155	Pulp industry
Fuelwood - Maximum other	6	1%	1%	7	Pellets, briquetts, etc.
Bark	25	3%	2%	14	Other physical utilization
Used logging residues	23	3%	6%	49	Power and heat genertion
Woody biomass outside forest	20	3%	8%	65	Industrial internal energy use
Chips, particles & co-products	118	15%	11%	92	Energy in private households
Pulp production co-products	70	9%	16%	135	Undifferentiated energy use
Recovered wood	29	4%			
Processed wood fuel	7	1%			
Σ supply total:	**775**	**▲ 47**		**822**	**Σ use**

Future wood demand

The European Forest Sector Outlook Study (EFSOS) presents long term trends for supply and demand of forest products (roundwood, sawnwood, panels, pulp, paper, non-wood products) and services and outlook to 2020 (UNECE 2005). According to the baseline scenario of EFSOS, the wood-based industries will consume 483 million m³ in 2010 and increase to 523 million m³ in 2020 (Table 4). It is important to note, that these figures include intentional cascades for raw material, as explained earlier.

Table 4. EU/EFTA future wood required to fulfil EFSOS scenario and renewable policy objectives

	Material use (EFSOS scenario)	Energy targets (RES scenario)	Total use
	million m³		
2005*	466	341	807
2010	483	426	909
2020	523	696	1,219
2020 /"75% scenario"	523	538	1,061

*actual figure

The analysis concerning future wood demand for energy is based on national and EU targets for renewable energy, bioenergy and wood energy (if available). These targets have been translated into wood volumes, by applying a number of assumptions (each referring to the situation at country level):

1. For *future final energy consumption*, it was assumed that it would stay at the level of 2005. In cases were countries had official scenario for future energy consumption, it was used.
2. The official policy targets for *the share of renewable energy to* final energy consumption were applied according to the EU or national targets.
3. *The amount of wood needed for energy* (wood energy) was calculated by assuming the same share of wood to renewable energy as in 2005 (55% contribution of wood for EU 27).
4. *The 75% scenario* for 2020 assumes relative decrease of wood by 25% in the overall renewable energy mix (41% contribution of wood for EU 27)

Applying the assumption listed above, the target for renewable energy in final consumption in the EU/EFTA is 150 mtoe in 2010, of which 74 mtoe would originate from wood energy. To produce this amount of energy 426 million cubic meters wood equivalent were needed (Table 4). In 2020 even 696 million cubic meters wood were needed for energy production. The results for each country on EU/EFTA area are presented in figure 2.

Wood energy has the highest share of all renewable sources in 2005 in most countries. Therefore, an increase in renewable energy would affect wood energy the most, if the relative shares of different energies would remain constant. However, in particular this assumption seems unlikely in the long term, since other renewable energies will develop further and faster (on the basis of much lower absolute figures) and become more competitive. Therefore, the study suggests a scenario, where the relative share of wood compared to all other renewable energy sources decreases to 75% of the percent share in 2005 by 2020.

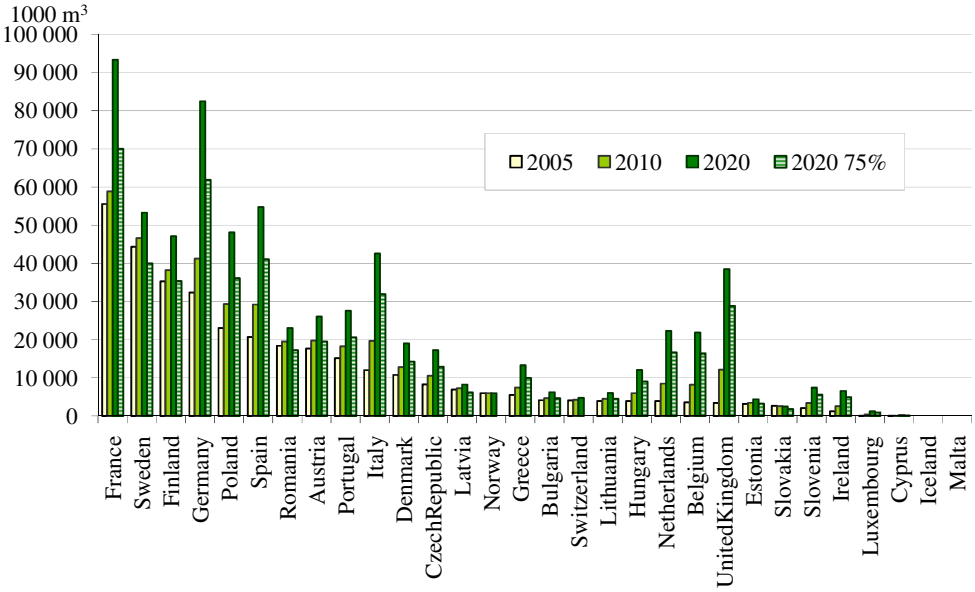

Figure 2. Wood required to fulfill energy policy targets in EU/EFTA countries

If the energy objectives were achieved and the wood-based industries would develop as forecasted in EFSOS, a steep increase in wood raw material supply would be required: 102 million m³ wood until 2010, compared to 2005, corresponding to an increase of 13%; and another 310 million m³ (compared to 2010) in 2020 (+34 % compared to 2010). The 75% scenario would require less wood: an increase of 152 million m³ would be needed between 2010 and 2020 (+17%).

Future wood supply versus wood demand

The EFSOS baseline scenario proposes that industrial roundwood removals from the forests in EU/EFTA will increase to 536 million m² in 2010 and 569 million m³ in 2020. The total supply comprises wood from forest, from outside the forest as well as all sorts of co-products from the wood-based industries. Future wood supply from fuelwood, trees outside forests and unregistered wood removals were assumed to remain unchanged, as no information is available in EFSOS. The calculated total amount of wood supply will sum up to 783 million m³ in 2010 and 824 million m³ in 2020 (Table 5). The future total wood supply is estimated to increase by 10 million m3 in 2010 and by 44 million m³ in 2020 (both compared to 2005).

Assuming that both, EFSOS and the policy targets, developed as outlined in this study, much more wood would be required than available in the supply scenario (Table 5). The difference would be 126 million m3 in 2010 and 395 million m³ in 2020 (or 237 million m³ in the 75%-scenario).

Table 5. Wood supply versus wood required to fulfil EFSOS projections and policy objectives (EU/EFTA)

Year	Total wood supply *	Wood demand **	Difference
	million m³		
2010	783	909	126
2020	824	1,219	395
2020/75%	824	1,061	237

* direct from the forest and indirect (EFSOS forecast)
** required to fulfil EFSOS projections and policy objectives

However, these numbers have to be interpreted very carefully. The supply data predicts actual roundwood removals from the forest (and not a theoretical potential), based on the EFSOS wood supply model, as well as forecasts for wood processing co-products. The EFSOS supply model is a conservative estimation on wood supply, based on the assumption (from 2000) of only slowly increasing wood demand until 2020. The figures of this study can therefore be seen as minimum potential wood supply, the "real potential" is likely to be higher, and has to be determined given the changing circumstances. But anyhow, the difference between supply and demand gives a rough estimate of additional amount of wood that can be needed into the market in the future.

In the light of existing estimates of Europe's total fuelwood supply potential, this additional raw material requirement presents a substantial challenge. According to recent report, the EU's total annual harvestable forest energy potential stands at 187 million m^3 (Asikainen et al. 2008). It should be furthermore noted that a part of this potential is already in use.

Finland and Sweden at a glance

Finland and Sweden account for some 30% of total wood consumption within the EU. The two countries also stand alongside Germany and France as Europe's biggest users of wood energy. In 2005, Finland and Sweden used some 80 million cubic metres of wood for energy production. The renewable energy source utilisation targets for Finland and Sweden set by the European Union are 38% (28.5% in 2005) and 49% (40.8% in 2005) respectively of overall final energy consumption by 2020. If wood's share of the total renewable energy sources is kept at its current levels, this constitutes an increase in energy wood use of 12.4 million m^3 for Finland and 5.6 million m^3 for Sweden (Figure 2). These targets will require Finland to raise wood energy use more sharply than its neighbour Sweden, where other forms of renewable energy, water power in particular, play a bigger role.

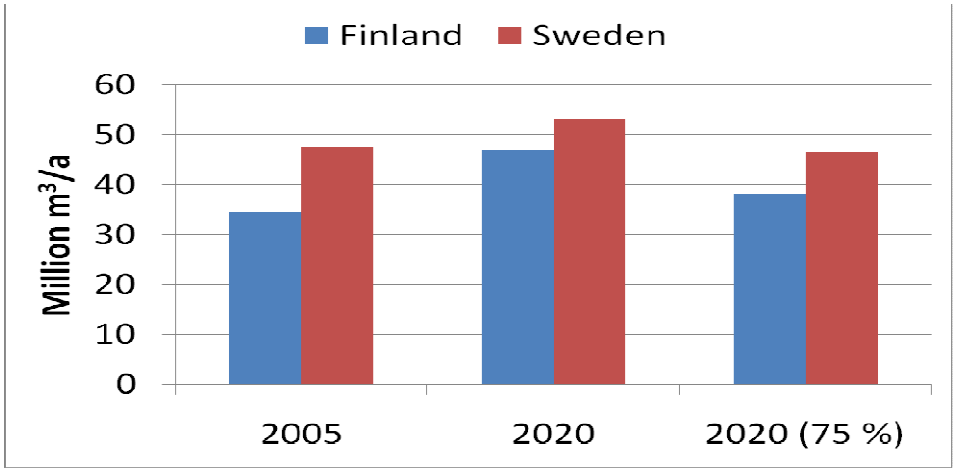

Figure 2. Utilisation of wood energy in Finland and Sweden in 2005 and its development according to two different study scenarios

In Finland, around 75% of all wood energy is derived from co-products of the forest industry such as black liquor, bark and sawdust. Opportunities to increase wood energy utilisation are therefore highly dependent on the overall level of wood consumption. Finland's latest National Forest Programme sets a goal of increasing the annual roundwood cuttings by 10–15 million m^3 which, due to the country's forest reserves, would appear to be a viable target with regards sustainable wood production (Nuutinen et al. 2007). A key incentive for increasing domestic removals is reduced dependency on imported timber. Russian roundwood imports to Finland have in recent years reached about 15 million m^3 per year, totalling about one fifth of the country's total wood consumption. However, Russia

has decided to raise timber export tariffs to EUR 50/m^3, effectively putting an end to imports of Russian wood to Finland. Even if domestic timber were to be successfully mobilised to cover these import volumes, the increase in domestic fellings would not, however, increase the amount of wood energy obtained from industrial co-products. On the other hand, increased domestic fellings would certainly boost the harvesting possibilities of logging residues and stumpwood.

The techno-economical harvesting potential of logging residues, stumpwood and non-commercial small-diameter wood has been estimated by several studies in Finland (e.g. Hakkila 2004, Puupolttoaineiden ... 2007). According to them the harvestable potential of forest chips is 10 – 15 million m^3 per year. However, this represents the ceiling level, the real usefulness of which is dependent for example on the location of the energy plants, on the amount of the domestic roundwood removal and the willingness of forest owners to sell logging residues and stumps. Finnish forest chip production currently stands at around 3.5 million m^3 per year.

In summary, Finland's renewable energy targets are very challenging if they are to be fulfilled predominantly by wood energy. The outlook for growth in roundwood consumption and co-products production by the Finnish forest industry is minimal to negative. In practice, therefore, the entire wood energy increase must be achieved through forest chips and small-scale household use, meaning that virtually the entire harvestable forest chip potential of Finland would have to be mobilised and cost-effectively supplied to its users. This is not realistic. The development of other forms of renewable energy does, therefore, appear to be of vital importance.

Conclusions

The wood resource balance for 2005, at the national and EU/EFTA levels shows the broad pattern of wood supply and use in demand. Unevenly distributed data weaknesses on both sides of the wood resource balance confirm clearly that further empirical research is needed at national level. Nevertheless, the regional wood resource balanced allows some first conclusions:

Wood energy is the most important regional renewable energy source at present. Where available, results from empiric studies on wood energy at country level (France/Germany/Norway/Austria) confirm that direct energy use of wood is much higher than previously assumed. The supply for unrecorded use of energy wood is mostly not recorded either. Therefore,

these removals have to be taken into account when estimating the available potential wood supply.

Traditional analysis of wood supply and demand, centred on wood removals from forests and wood input to industries seems to be inadequate, since not all sources and uses of wood is considered. Therefore, an up-dated, more complex approach, based on comprehensive wood resource balances, is necessary. Many of the elements for such a wood resource balance are already available, even at the international level, but several other elements need original research and data gathering, notably the following:

- Unrecorded sources of wood supply, in particular trees outside the forest, logging residues, and post consumer recovered wood.
- Unrecorded use of wood, in particular for energy in private households and small CHP plants.
- Input/output conversion factors for wood using industries

Projecting the wood resource balance approach forward to 2010 and 2020 shows that the foreseeable demand for wood is considerably higher than the supply forecast by EFSOS. Although the size of the increase in wood demand is open to discussion, this development is likely to have major impacts on the forest sector. As a matter of urgency, the sector should focus on reviewing and confirming the outlook for wood demand for all uses.

There is an equally urgent need to analyse in quantitative terms future potential wood and fibre supply, focussing not only on wood supply from the forest (stem wood and other woody biomass), but also on other sources:

- Woody biomass from outside the forest (arboricultural arisings, urban trees etc)
- Co-products from the forest-based industry
- Post-consumer recovered wood and paper

When assessing potential wood supply, it is important to take local realities into account influencing the availability of these potentials, such as costs, ownership patterns, quality requirements, infrastructure etc.

Another option to increase wood supply would be to increase imports of wood from outside Europe. In this context the sustainability issues of potential supplying regions must also be taken into account.

At present, the forest outlook for Europe is for much stronger demand than forecasted even a few years ago, as energy needs, influenced

by policy, are added to the projected raw material demand. There is potential to increase wood supply, which is at present still below its sustainable maximum. However, very considerable uncertainty surrounds both the strength of the increased demand and the limits to sustainable wood supply. This uncertainty is harmful to the sector and to rational policy formulation

In order to adequately assess future wood demand and supply, a comprehensive outlook study for the forest sector is needed, taking developments in the energy sector into account, as well as all elements of wood supply.

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