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Wood resources availability and demands II - future wood flows in the forest and energy sector

European countries in 2010 and 2020

Foreword

This study is addressed to decision-makers in the field of renewable energy, forestry and wood-based industries. The objective is to assess the current role of wood energy and its future potential to help to achieve political goals on renewable energy and climate change in Europe. The focus of the assessment so far is on the countries in the European Union and EFTA. However, its implications address all UNECE member countries, as the conclusion and policy implications drawn from this study might apply to their national situation as well.

The figures presented are the results of combining actual figures, forecasts of future raw material demand from the wood-processing sector, and scenarios for wood-energy requirements to meet policy targets for renewable energy. The figures presented are not meant to be a forecast of future wood demand, but should be a basis to discuss renewable energy policies and help in finding realistic targets for the future contribution of wood to the overall energy supply.

The assessment is based on the best data available and is seen as a step in an on-going continuous process of data improvement. A first draft of the study was presented at the UNECE/FAO Policy Forum on bioenergy policies in October 2007. Delegates and national specialists were invited to review and revise the data presented. The final version incorporates the revision and feedback received from the countries and European Commission.

The study is a joint effort: part I was lead by Udo Mantau and Florian Steierer, part II by Sebastian Hetsch, Florian Steierer and Kit Prins.

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Abbreviations

CHP	Combined heat and power generation
DG TREN	European Commission Directorate General for Energy and transport
EFSOS	European Forest Sector Outlook Study
EFTA	European Free Trade Area
EU/EFTA	EU-27 plus Norway and Switzerland
FAO	Food and Agriculture Organization of the Unites Nations
ITTO	International Tropical Timber Organization
IEA	International Energy Agency
JFSQ	Joint Forest Sector Questionnaire
JWEE	Joint Wood Energy Enquiry
MCPFE	Ministerial Conference on the Protection of Forests in Europe
Mtoe	million tons oil equivalent
NAI	net annual increment
PJ	Peta Joule
RES	Renewable Energy Sources
SFM	Sustainable Forest Management
TPES	Total Primary Energy Supply
UNECE	United Nations Economic Commission for Europe
UNECE region	North America, pan-Europe, Russia, Central Asia

Executive Summary

Having always been one use of wood raw material, energy did not play a major economic role in the last decades; material use of wood (for paper and wood products) had been the dominating use in most countries of the UNECE region[1]. Since the late 1990s, wood energy came back in the focus of society and policy-makers as a renewable energy source to tackle issues of secure energy supply and climate change. In particular the European Union and her Member States have set policy targets for renewable energy (12% by 2010 and 20% by 2020). Since wood energy is currently the major source for renewable energy, these targets are also of high relevance for the forest sector.

This study is divided in two parts. Part I aims at giving a comprehensive picture of current (2005) sources of wood supply and wood uses. Part II aims at providing first information on future wood demand for energy, and first input to a discussion on future wood availability.

Part I assesses in depth current wood supply and consumption in 29 EU/EFTA countries in 2005, using the structure of the "wood resource balance" developed by Mantau (2005). This methodology calculates independently the wood supply and use of wood fibres, it considers national import and export patterns as well as use and re-use of wood fibres for material and energy purposes.

At EU/EFTA level, the results of the study show a lower wood supply (775 million m^3), than wood consumption (822 million m^3). This difference comes unevenly forward at countries' level, and in some cases calculated wood supply is higher than the figure for wood use. The imbalance of 47 million m^3 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). The study rates data on wood use for energy in private households particularly weak in many countries. Hence the study can not conclude neither on the quality (supply deficit vs. unknown use), nor size of the difference of balance sheets totals - This can only be done by detailed empiric research at country level.[2]

Despite some data weaknesses, results of the first part are considered as best information available. They provide a solid basis for the assessment in the second part. National correspondents confirmed in a vital review process (response rate: 60%) data to be in the right order of magnitude. Only 6 out of 21 responses proposed changes, totalling to increasing supply by 17.6 million m^3 (+2%) and increasing use by 10 million m^3 (+1%).

Results of the 2005 wood resource balance indicate that 68% of the EU/EFTA wood fibres supply comes directly from forests, 3% of the woody biomass derives from outside the forest, 24% from co-products of the forest based industries (including chips, particles and black liquor), 4% from post consumer recovered wood and 1% from processed wood fuels (such as pellets

[1] North America, pan-Europe, Russia and Central Asia

[2] Experiences from international (Joint Wood Energy Enquiry) and national level (e.g. household surveys in Germany, France, Norway) have also shown, volumes of wood used by the forest-based industries and in particular for energy generation are sometimes much higher than published in national and international statistics. Therefore empirical research is needed to gain a better picture of the actual situation of wood supply and demand, as well as the current contribution of wood to energy supply.

and briquetts). With 58% material use dominates the energy use of wood fibres (42%) on the wood use.

In **part II**, national and EU policy targets for renewable energy (and if available for bio-energy and wood energy) are gathered and simple, 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[3] 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. The combined wood requirements shows a difference to the EFSOS wood supply forecast of 134 million m^3 wood in 2010 and 237 / 436 million m^3 wood in 2020 (75% scenario and "business as usual" scenario). Since these calculations are based on two different scenarios and methods, not interacting with each other, the figures cannot be taken as forecasts for future wood supply, but rather identify an order of magnitude. The results should be an input and first step for discussion on future wood demand both for the forest based industry and energy, as well as for future work on wood availability and potential wood supply.

The study shows that there is a need to analyse future potential wood supply, focussing not only on wood supply from forest, but also on other sources like woody biomass outside the forest, post-consumer recovered wood and supply of co-products from the wood processing industries. In order to adequately determine future wood demand an outlook study for the forest sector is needed, taking current developments in the energy sector into account. This knowledge is crucial for policy decision on the future role of wood as raw material for the wood-processing industry and energy generation.

[3] Wood-based panels, sawmilling and pulp & paper industries

1. Introduction: forest and energy - a new story?

Currently, more than half of the wood harvested and removed from European forests is used for industrial processing purposes, where, on top of the carbon storage effect, it generates substantial added value as construction elements, interior finishing applications, furniture, packaging products, etc.

On the other hand, the use of wood for energy has become increasingly important. Although wood is the oldest form of energy, used for thousands of years, it has recently gained new attention. Rising prices for fossil fuels, the increasing dependency on energy imports from insecure regions, and the effects of climate change are challenges that society and policy makers are tackling by various measures:

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. More precisely, in 1997 the EU set a target for 2010 of having 12% of its primary energy consumption derived from renewable energy sources, such as wood. 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. Similar patterns are found in most other European countries.

To close the gap between the current share of renewable energies and the targets, countries are elaborating diverse strategies. The EU has developed a Biomass Action Plan (EC 2005 a), looking at all kinds of biomass (forest-based, agricultural and municipal) and many other countries are designing similar plans or strategies. The EU Biomass Action Plan suggests doubling the production of bioenergy by 2010. This raises the question: where are these resources supposed to come from? According to the EU Biomass Action Plan:

- The use of wood from the forest for bioenergy can be expected to more than double.
- Bioenergy from waste is foreseen to increase more than twofold. However, looking more closely at this number, most of this category is co-products and waste from the wood-processing industry, so actually this is wood as well.
- Finally, energy crops from agriculture are expected to increase dramatically from 2 to 44 mtoe (million tonnes of oil equivalent).

New players might get interested in wood, once second-generation biofuels - producing ethanol and biodiesel from ligno-cellulosic material - are developed and are economically viable. These players are new to the forest sector and might change behaviour in the forest sector as well, since the energy sector is a fast moving, rapidly evolving sector with huge financial capital and potential.

Energy policies are of highest priority for all countries' and regions' economies and society, while forest policies often play a minor role in the overall policymaking. However, given the circumstances, energy policies will have a strong influence on the forest-based sector and wood-based industries. Therefore, it is important to develop outlooks for the forest-based sector in the light of this rapidly changing picture and to analyse the impacts and opportunities. However, this must not be done just in the forest-based sector, but a cross-sectoral approach is essential. The forest-based sector has to understand the developments in the energy sector, driven by society and economical demands, but also the energy sector and policy makers should understand the forest-based sector, its opportunities and limits. Linking at least these two sectors and ensuring a good mutual understanding, will help ensure a successful, sustainable development of both sectors and achieving society's demand for green and clean energy.

1.2 Framework and Objectives of the study

Framework of the study

This study has to be seen in a larger context of activities on "monitoring and forecasting European wood resources and demands" by the UNECE/FAO Timber Section and partners. It builds in particular on information gathered on wood energy (mainly through the Joint Wood Energy Enquiry, Steierer et al 2005). The University of Hamburg contributed in particular through its methodological work on wood resource balances and monitoring wood flows, which is explained and discussed in part I.

This study is meant to be an input to the current discussion on bioenergy policies and their interactions with the forest sector. Following its presentation as a draft at the UNECE/FAO Forest Policy Forum (10th October 2007), national correspondents, specialists and stakeholders were invited to review and to help refine the results.

The study should encourage stakeholders at national and international level to continue collecting better (empirical) information as a basis and input for policies and policy targets for bioenergy and wood energy. Future wood demand and potential supply are crucial information to determine the impacts and opportunities when designing these policies.

Objectives of the study part II: future scenarios for wood demands and supply

This study is seen as a contribution to increase the understanding between the forest-based and the energy sector and their policies. The second part of the present study collects information on policies for renewable energy and forecasts for the forest-based sector in order to analyse possible future interactions.

Various countries have started to conduct national studies on the interaction of forest sector and renewable energy polices, and different stakeholders made analysis on the impacts of these polices on their sector. However, so far no comprehensive study has been carried out on a pan-European level. Therefore the main objective of the study is:

To produce scenarios of wood demand and supply for 2010 and 2020 by using the existing European Forest Sector Outlook Study (UNECE 2005 a) scenarios for future wood supply and demand; and incorporate national policy targets for renewable energy to adjust the EFSOS model to incorporate increasing demand for wood energy.

The methodology to compare future sources and uses of wood is the wood resource balance; this approach is extensively explained in part I of the study (Mantau et al 2008).

Basis for the outlook for wood supply and demand in the future are two different sources: On the one hand the European Forest Sector Outlook Study (UNECE 2005) is used for information of wood supply and wood demand by the forest sector, on the other hand an analysis of renewable energy policies is done to estimated future wood requirements for energy. As will be explained below, these two different approaches should not be simply added together to estimate future wood demand, since a simple addition lacks interaction between the two approaches, which will occur in reality[4]. However, since there is no model or tool to incorporate the development of the forest sector and the renewable energy policies, this crude method of simple addition will be used to deliver a first estimate, providing a possible order of magnitude of future wood demand in Europe. In medium term an updated outlook for the forest sector in Europe is needed to address the question of future wood demand more precisely.

2. Forecasting wood demand by the forest-based industries: the European Forest Sector Outlook Study - EFSOS

In order to build scenarios for future wood supply, forecasts are needed. One main source for future forest products demand and supply is the European Forest Sector Outlook Study (UNECE 2005).

The European Forest Sector Outlook Study 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, in western and Eastern Europe and four major CIS countries, including Russia. It reviews trends for the forest resource, trade, markets and recycling. It stresses the future shift in the balance of the sector to the east, and the importance of cross-sectoral issues, notably consequences for the forest sector of energy, environment and trade policies, which are examined in some detail. The EFSOS study is based on a major collaborative effort by experts in the countries covered by the study, under the auspices of the UNECE Timber Committee and the FAO European Forestry Commission. The study identifies a number of major policy issues and proposes some policy recommendations, as a basis for future debate.

The analysis of policies affecting the sector included an assessment of historical trends in policies and an inquiry of expert opinion on future trends in policies and their likely impact on important variables such as: forest area; production; trade; and consumption. This resulted in the elaboration of a number of possible future scenarios: a baseline scenario, conservation scenario and an integration scenario.

[4] It is likely that higher demand will further increase prices for certain wood assortments. It is more likely that this development will low quality assortments (bark, recovered wood, etc.) adopt their price level according to their energy content. It is difficult to foresee how this might impact the future development of the forest based industry, as it is unclear if prices can be handed on to consumer and buyer of wood products.

The baseline scenario assumes that the long-term historical relationships in forest products markets will remain the same in the future. In terms of forest resources, it assumes that future developments in the bio-physical characteristics of Europe's forests will be largely determined by the existing status of forest resources. Constant prices and the baseline economic growth projections were used to produce the forest product market forecasts under this scenario.

The conservation scenario assumes that there will be an accelerated shift towards environmental enhancement and conservation of forest resources in the future. This will be driven by an increase in public awareness of and demand for environmental benefits and will be supported by policies that will move society in this direction. Under this scenario, it has been assumed that forest products prices may increase slightly and that economic growth will be slightly slower in the future.

The integration scenario assumes that there will be more rapid economic integration and market liberalisation across all of Europe. This will result in higher economic growth, so the higher economic growth projections have been used to produce the forest product market projections under this scenario. These will tend to exert downward pressure on forest prices, so an assumption of a small decline in forest product prices has also been used to produce the market projections.

In this study, the baseline scenario of EFSOS was used since it is considered to reflect best the expected growth rate of the forest-based industries if energy industries enhance competition for the raw material.

2.1 Updating EFSOS

The reference data (production, net trade, prices, etc) for the EFSOS model is the average of 1999 - 2001. The annual growth of production, net trade and consumption in the model is determined by the various input variables to the model. As shown by Schulmeyer (2006) the EFSOS model predicts the international developments in forest products demand and supply mostly correctly. However, in some countries, most notably in Germany, the production has increased substantially more than predicted by EFSOS. Therefore, the reference data for production and consumption of forest products (sawnwood, panels and pulp) was updated on the basis of the average data from 2004 - 2006. The annual growth rates (2005 - 2020) for production and net trade were considered to remain unchanged. These growth rates were applied to the new reference data, to obtain forecasts for production and consumption of forest products for 2010 and 2020.

The assumption that material efficiency of the wood-processing industries (wood input per unit produced) would remain constant, may lead to a slight over-estimation of the wood consumption in this sector in the future.

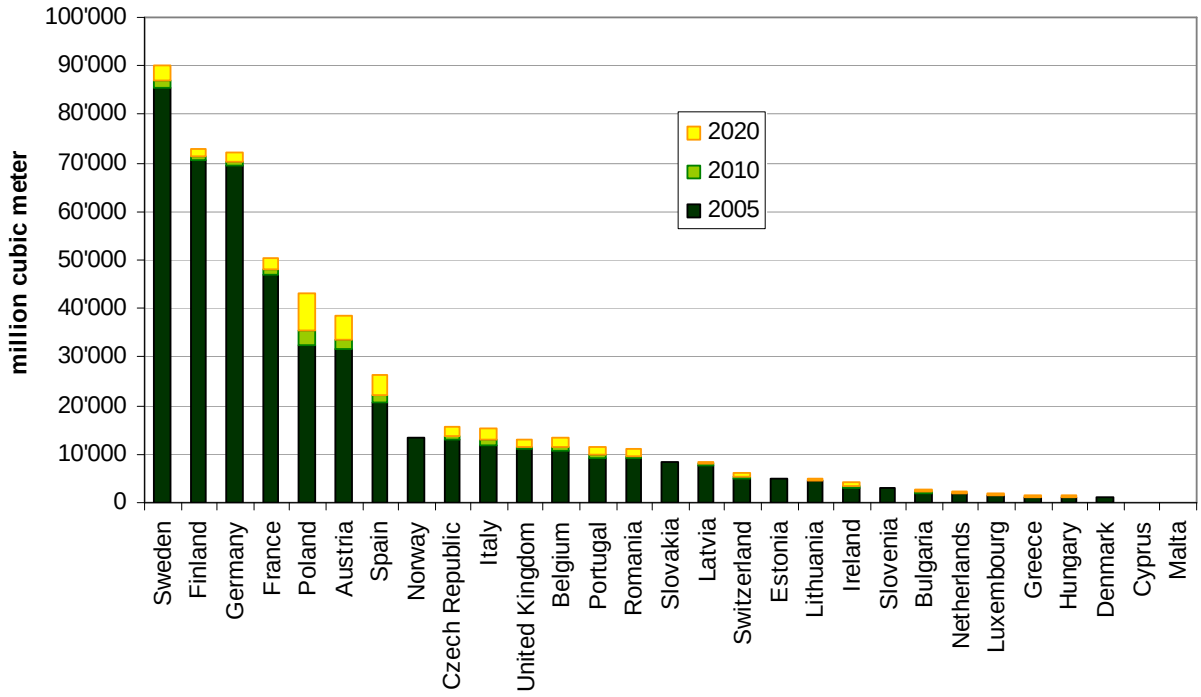
2.2 Future wood demand of forest based industries

According to EFSOS, the wood-based industries (sawmills, panel and pulp and paper industry) will consume 483 million m^3 in 2010 and increase to 523 million m^3 in 2020 (Table 1). It is important to note, that these figures include the intentional double counting for raw material, as explained in part I of the study (Mantau et al 2008)

Table 1: Calculated EU/EFTA future wood demand for forest based industries and other material use

Year	Material use - EFSOS calculation [million m³]
2005	466
2010	483
2020	523

Figure 1: Wood demand for forest based industries and other material use in EU/EFTA countries (based on EFSOS)



3. Building scenarios for future wood demand for energy

3.1 Methodology

Various paths can be chosen to predict the future demand of wood for energy generation. In this analysis it is assumed that the demand would be driven by policies objectives for renewable energy (assuming that respective support mechanism were in place to reach the targets). In the study, prices are not included. Thus, no conclusions are made on the price of reaching the policy targets, but rather on the amounts of wood needed under the given scenarios.

The analysis is based on national and EU targets for renewable energy, bioenergy and wood energy (if available) and translated them into wood volumes, by applying a number of simple transparent 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. Considering on the one hand economic growth (correlated with increasing energy consumption), and on the other hand the 20% energy efficiency target, a level overall energy consumption seems to be reasonable. In cases were countries had official scenario for future energy consumption, it was used[5].
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 biomass needed for energy (bioenergy) was calculated by assuming the share of bioenergy to other renewable sources would be as in 2005. National target for bioenergy were applied if available.
4. The amount of wood needed for energy (wood energy) was calculated by assuming the share of wood to bioenergy would be as in 2005.

The assessment integrates national targets for the EU member states as released in the climate and energy package of the European Commission in January 2008 (EC 2008). These targets are based on percentage of final energy consumption. In order to be consistent with these renewable energy targets, final energy consumption was used as basis for calculating the share of bioenergy and wood energy.

However, when focussing on the forest sector, the crucial variable is the wood needed for energy production. As mentioned above the targets are given in final energy consumption. In order to convert from consumption to production it was assumed that 12% energy is lost (grid losses and consumption during energy generation). [6]

3.2 Wood energy demand in 2010 and 2020?

Detailed figures for national future energy consumption and renewable energy targets can be found in annex II and III. The results are summarised in figures 3 and 4.

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[5] Germany and France

[6] 12% is the EU average value between the figure reported in the wood resource balance 2005 for wood consumed for energy production, and the final energy consumption derived from wood energy in 2005, as reported by Eurostat

Future final energy consumption

Policy objectives or targets are mostly set for renewable energy sources in general. Most countries, especially including the European Union, have expressed these targets as percentage of final energy consumption and not in absolute figures (like volumes of wood used for energy production). Thus, the total amount of renewable energy needed to fulfil the targets depends on the overall energy consumption in the country. Therefore, it is essential to determine first of all the future overall energy consumption. The EU has also set targets for the overall energy consumption, namely 20% energy saving by 2020 (EC 2005 b). EU Member States are starting to adopt their national strategy to achieve this goal. In the past, energy consumption was driven by economic growth and influenced by energy price. In future, the cost for carbon might also influence the overall energy consumption, as part of the energy cost.

For most countries, it was assumed that the future final energy consumption would remain constant compared to 2005. Only in two countries (France and Germany), energy efficiency / saving scenarios were found with values for future energy consumption significantly below the 2005 values.

2010 renewable energy targets

Policy targets for the share of renewable energy in 2010 in countries in the European Union were calculated based on the formula suggested in the EC draft directive on the promotion of the use of energy from renewable sources, Annex I. (EC 2008). [7]

For non-EU countries, policy targets for renewable energy and bioenergy were derived from national strategies and plans. In cases were no targets were found the 2005 figures were kept.

Applying the assumption listed above, the target for renewable energy in final consumption in the EU 27 is 132 mtoe in 2010, of which 72 mtoe would originate from wood energy. To produce this amount of energy 415 million cubic meters wood equivalent were needed.

2020 renewable energy targets

For all EU member states, the targets of the draft directive (EC 2008) were used. No specific targets for biomass or wood were found, taking these newly set targets into account. Therefore, the same share of wood to renewables as in 2005 was assumed. When summing up the national targets for all 27 EU member states, 685 million m^3 of roundwood equivalent would be required to meet these objectives under the given assumptions.

The "75 % scenario" for 2020"

Wood energy has the highest share of all renewable sources in 2005 in most countries (wood energy constitutes over 50% of all renewable energy over the EU as a whole). Therefore, an increase in renewable energy would affect wood energy the most, if the relative shares of different energies would remain constant (as suggested in assumptions 3 and 4). However, in particular this assumption seems unrealistic in the long term (2020), since other renewable energies will develop further and faster (on the basis of much lower absolute figures) and become

[7] Average for the two year period 2011 to 2012 = $S_{2005} + 0.25 (S_{2020} – S_{2005})$
S_{2005} : target for share of energy from renewable sources in 2005
S_{2020}: target for share of energy from renewable sources in 2020

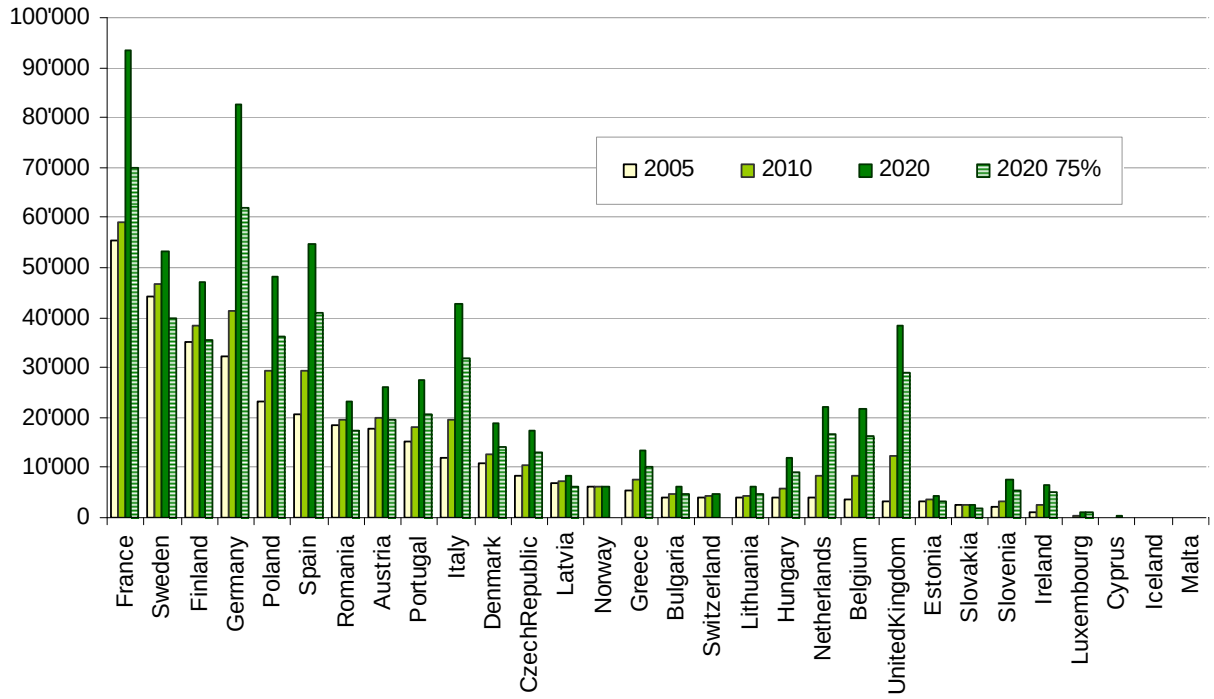
more competitive. In addition, the availability of wood raw material is likely to be decreasing, leading to a wood price increase.

Therefore, the study suggests a scenario, where the relative share of wood compared to all other renewable energy sources decreases to 75%[8] of the percent share in 2005 by 2020. However, the scenario made the assumption that despite the decrease in relative share of wood energy compared to other renewable sources, the absolute figures would not be less than 2010.

Table 2: Wood required to achieve national policy objectives for renewable energy

	2005 [million m^3]	2010 [million m^3]	2020 [million m^3]	2020 "75% scenario" [million m^3]
EU 27	332	415	685	528
Sum EU/EFTA	341	425	696	538

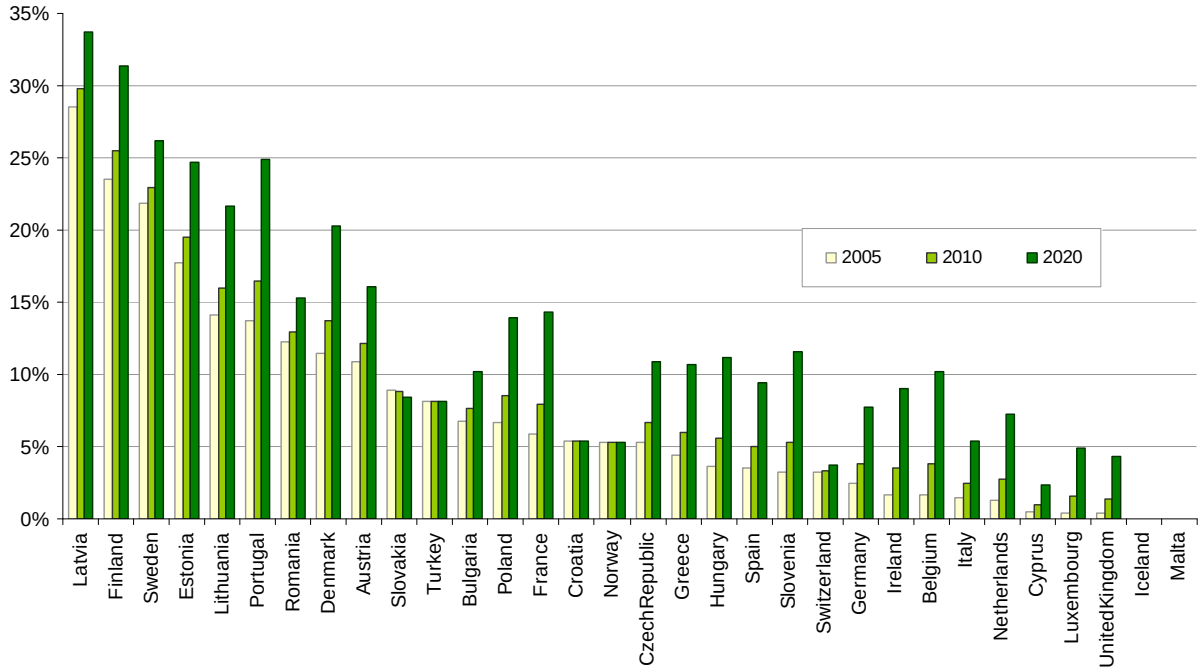
Figure 2: wood required in 2005, 2010 and 2020 to fulfil energy policy targets [9]



[8] 75% is an arbitrary figure between the baseline scenario (100%) and 50% (which would be less than in 2010 in absolute figure, and thus less realistic).

[9] Assuming the relative share of wood energy to other renewables remains as in 2005. In the "75% scenario" the relative share of wood energy to other renewables decreases to 75% of the level in 2005

Figure 3: Percentage wood energy of total energy consumption in 2005, 2010 and 2020 according to the scenario [13]



3.3 Reality check

Achieving the renewable energy targets depend on various variables. One major component is the success of energy efficiency and saving measures: High overall energy consumption will make it much more difficult to fulfil the policy targets, which are based on a relative share. Lower overall energy consumption but unchanged energy production from renewable sources would increase the relative share of renewable energy even without increasing the absolute production. The study is based on an energy-efficient scenario, by assuming the overall energy consumption in countries would not increase above the level of 2005. However, depending on the real future developments, the need for renewable energy might be higher or lower.

The study assumes that the contribution of wood to renewable energies would be the same as in 2005. This assumption might however be unlikely, since research and development in other renewable energies will progress and they are likely to become more competitive. Furthermore, mobilisation of additional wood resources is limited or at least connected with greater difficulties; thus raw material prices are likely to rise in the long term, which could decrease the competitiveness of wood energy. Therefore, even the scenario considering 25% less contribution of wood to renewable energy compared with other sources may over-estimate the possibilities (still assuming that the 2010 and 2020 targets are being met).

It is important to point out, that the figures presented in this section are not meant to be realistic forecasts of future wood demand for energy, but a picture of the consequences for wood demand of current energy policies and what this may imply for the forest sector. The numbers can and should be revised according to realistic national energy targets, taking the potential wood supply into account - inside and outside the forest, domestic and imports, and being aware of economic, environmental and social implications of these decisions.

4. EFSOS scenarios for wood supply in 2010 and 2020

The EFSOS wood supply scenario is a conservative approach to determine wood supply. It is based on the assumption that increasing demand as predicted in the different scenarios can be satisfied with slightly increasing removals from the forest. These future removal scenarios were approved by countries and national experts. Therefore the figures have to be seen as minimum potential wood supply, the "real potential" is likely to be higher, and has to be determined given the changing circumstances. Further, EFSOS does not model or predict supply from biomass outside the forest or post-consumer recovered wood, which is needed when discussing future wood supply. However, it is currently the best available data for future roundwood supply. Improved information on potential future wood supply is needed.

4.1 Calculated supply from the forest

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. EFSOS does not contain information on the development of future fuelwood removals. Forecasts of future roundwood removals from the forests were derived from the future demand of wood raw material for the wood-based industries, and were then validated by country correspondents.

Table 3: EU/EFTA: Calculated future wood supply (based on EFSOS)

	Wood supply directly form the forest	Total wood supply (wood from inside and outside the forest, co-products and recovered wood)
	[million m^3 u.b.]	[million m^3 u.b.]
2005	531	775
2010	536	783
2020	569	824

4.2 Calculated total supply

The total supply comprises wood from forest, from outside the forest as well as all sorts of co-products from the wood-based industries (wood chips, black liquor, etc). It was assumed that co-products are directly derived from the wood processing and it was further assumed that efficiency of the sectors remains unchanged, and thus the relative production of co-products would remain constant. Annual growth rates for each wood-processing sector (sawmill, panel and pulp industry) were taken from the EFSOS baseline scenario. The share of wood co-products from the different material uses remains stable and contributes 1/3 of the total supply. 18 million m³ of recovered wood are still being landfilled or reported with unknown use in 2005. Even though it is likely that a part of these amounts will be recovered and used as a raw material in the future, no development was calculated or assumed in the future. 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 based on the EFSOS baseline scenario will sum up to 783 million m³ in 2010 and 824 million m³ in 2020.[10]

5. Combining forest sector outlooks and energy policy objectives

As discussed earlier (section 1.3) two different methodological approaches were used to determine the future demand of the forest based industries, and the energy sector. So far there is no model combining both the renewable energy objectives and the development of the forest based industries on international level. Therefore, the results of the two analyses (described in section 2 and 3) are merged by simple addition. The result of this calculation has to be interpreted carefully, since this is not a realistic scenario for future wood demand. Such a scenario has to be developed in a model taking the interaction between the forest based industries and wood energy demand into account, and as well the future availability of wood.

Nevertheless, the figures presented here should deliver a first estimate for future wood demand in Europe. It should be rather seen as a probable order of magnitude than as a precise estimate. The figures should serve as input to a discussion on future development of the forest sector, future potential wood supply, and how much forests and wood can contribution to renewable energy supply. In medium term an updated outlook for the forest sector in Europe is needed to address the question of future wood demand more precise.

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 m^3 (compared to 2010) in 2020 (+34 % compared to 2010). The 75% scenario would require less wood: an increase of 152 million m^3 would be needed between 2010 and 2020 (+17%). (Table 4)

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

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

*actual figure

Material use of wood accounts for 58% of the total wood fibre use in 2005 (Mantau et al 2008). This percentage would decrease to 53% in 2010. If the renewable energy objectives were reached in 2020 according to our assumptions, the former ratio will be turned around and more wood fibre would be used for energy in 2020 than for wood and paper products. (Table

[10] Including intentional double counting of wood fibre when it is used in different processes (e.g. wood used in sawmills, residues (chips) being used in panels, which are being recycled or burned after their life cycle)

5). Following the assumptions of this study, the energy sector will take the lead of wood consumption in the future and becomes the main driver for the increased wood demand.

Table 5: Main user of wood fibres in the future (EU/EFTA)

	Material use (EFSOS scenario)	Energy targets (RES scenario)
2005	58%	42%
2010	53%	47%
2020	43%	57%
2020 "75% scenario"	49%	51%

5.1 Wood supply as forecasted by EFSOS

Based on EFSOS, the future total wood supply is estimated to increase by 10 million m^3 in 2010 and by 44 million m^3 in 2020 (both compared to 2005). These figures include both the wood supply directly from the forest and the supply of wood raw material from co-products from the wood processing industry (wood chips, particles, black liquor, etc). Assuming that both, EFSOS and the policy targets, developed as outlined in this study, much more wood would be required than available in the EFSOS supply scenario (Table 6).

The difference would be 134 million m^3 in 2010 and 436 million m^3 in 2020 (or 237 million m^3 in the 75%-scenario). However, theses numbers have to be interpreted very carefully. As mentioned, the supply data is derived from EFSOS, predicting actual roundwood removals from the forest (and not a theoretical potential), as well as forecasts for wood processing co-products. However, some sources of wood are not included in these figures, which might play a bigger role in future supply of wood raw material for the energy sector.

Table 6: Wood supply versus wood required to fulfil EFSOS projections and policy objectives (EU/EFTA)

year	Total wood supply * [million m³]	Wood demand ** [million m³]	Difference
2010	775	909	134
2020	783	1,219	436
2020 75%	824	1,061	237

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

Comparison with increment data

As already discussed in section 4, the EFSOS supply model is a conservative approach to determine future wood supply. Realistic studies or models are needed to determine future wood supply on national and international level. One simple option to determine wood supply is by looking at net annual increment (NAI) of wood in the forest, which indicates that in many countries there is still a significant wood resource that can possibly be utilized. However, using NAI as an indicator for potential wood supply is limited by a number of factors:

- NAI is reported for forest areas available for wood supply, this is however not the potential of wood that can be mobilised, but just a physical potential. The potential of wood that can be mobilised is limited by a variety of reasons (economic, forest tenure, etc.).
- NAI only reports stem wood in the forests. However, woody raw material can come from other sources, which have to be assessed as well, when determining potential wood supply:
  - Other biomass in the forest, e.g. branches, tops and stumps, sometimes referred to as harvest residues
  - wood raw material outside the forest (other wooded land, trees outside the forest, orchards, hedgerows, arboricultural arisings, etc)
  - Post-consumer recovered wood
  - Co-products and residues form the forest based industry (chips, particles, and black liquor as raw material for energy)
- Harvesting NAI in the long term is not necessarily sustainable. NAI is a dynamic figure that may change over time as it refers to age structure of the forest as well as potential rotation age. Therefore harvest can be higher than NAI and still be sustainable (like in Germany), or has to be less like in Finland and Sweden due to the forests age structure. However, this issue will not be assessed in details in this study.

It is important for countries to conduct studies on national level to assess the potential wood supply, including wood from the forest (used and currently unused sources), woody biomass from outside the forest, wood residues, recovered wood and other sources. Importing wood raw material (or wood products) is another option, which has to be considered, and its impacts have to be taken into account.

Following-up on this study, more detailed work will focus on assessing potential wood supply. A first summary will be given at the Joint FAO/UNECE Working Party on Forest Economics and Statistics on 2 April 2008.

6. Summary and conclusions

1. Projecting the wood resource balance approach forward to 2010 and 2020, using EFSOS scenarios and policy targets for renewable/biomass energies, shows that the foreseeable demand for wood is considerably higher than the demand 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.
2. 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:
    a. Woody biomass from outside the forest (arboricultural arisings, urban trees etc)
    b. Co-products from the forest-based industry (e.g. chips, particle, black liquor)
    c. Post-consumer recovered wood and paper
3. 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.
4. Another option to increase wood supply would be to increase imports of wood, (roundwood, products or wood energy sources) from outside Europe (Canada, Russia, tropical countries). In this context, it should be noted that the extensive use of non-wood biomass and/or imports from other regions might well compound problems rather than solving them, as the basic drivers, notably for renewable energy, are global in nature. One example could be the use of agri-energy crops which might take land needed for growing food or feed. In short, for imports, the sustainability issues of potential supplying regions must also be taken into account.
5. There is a need for the forest sector not only to understand better the forces driving its long term development, but also to communicate the limits of sustainable wood supply, and what measures would be necessary to expand those limits.
6. 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

Glossary

Bioenergy: Energy derived from any sort of biomass.

Biofuel: Solid, liquid or gaseous renewable energy sources from biomass.

Co-products: The volume of roundwood that is left over after the production of primary forest products in the forest processing industry (i.e. forest processing residues) or that has been reduced to chips or particles. It includes sawmill rejects, slabs, edgings and trimmings, veneer log cores, veneer rejects, sawdust. It comprises wood that has been reduced to small pieces and is suitable for pulping, for particleboard and/or fibreboard production, for use as a fuel, or for other purposes. It excludes wood chips made either directly in the forest from roundwood or made from residues (i.e. already counted as pulpwood, round and split or wood chips and particles).

Forest-based industries: Forest-based industries consist of the wood products industry (sawn wood, wooden panels, plywood, wooden boards, joinery industry, house-building and wooden furniture), pulp, paper and paperboard industries, and the printing industry. The forestry sector is an essential part of the forest-based industries.

Other Wooded land: Land not classified as forest, spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5–10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use (MCPFE 2007 / FAO 2004).

Post consumer recovered wood: Recovered wood includes all kinds of wooden material that is available at the end of its use as a wooden product (“post-consumer” or “post-use” wood).

- Recovered wood mainly comprises
- Packaging materials,
- Demolition wood,
- Timber from building sites and
- Fractions of used wood from residential, industrial & commercial activities.

Processed wood fuel: Wood pellets and briquetts.

Removals: The volume of all trees, living or dead, that are felled and removed from the forest, other wooded land or other felling sites. It includes natural losses that are recovered (i.e. harvested), removals during the year of wood felled during an earlier period, removals of non-stem wood such as stumps and branches (where these are harvested) and removal of trees killed or damaged by natural causes (i.e. natural losses), e.g. fire, windblown, insects and diseases. It excludes bark and other non-woody biomass and any wood that is not removed, e.g. stumps, branches and tree tops (where these are not harvested) and felling residues (harvesting waste). It is reported in cubic metres solid volume underbark (i.e. excluding bark). Where it is measured overbark (i.e. including bark), the volume has to be adjusted downwards to convert to an underbark estimate.

Roundwood: All wood removed with or without bark, including wood removed in its round form, or split, roughly squared or in other form (e.g. branches, roots, stumps and burls (where these are harvested) and wood that is roughly shaped or pointed. It is an aggregate comprising wood fuel, including wood for charcoal and industrial roundwood (wood in the rough). It is reported in cubic metres solid volume underbark (i.e. excluding bark).

Woody biomass outside the forest: Any woody biomass originating from other than forest and other wooded land. This includes urban and amenity trees, hedgerows, trees from fruit orchards, rail and roadside green and trees.

Material use: Wood fibres feeding into production processes of the forest based industries that lead to physical products. Wood fibres or particles contained in the products and co-products can be reused in downstream processes, recovery or recycling processes.

Energy use: Wood fibres used for energy (heat and/or electricity) production.

Total Primary Energy Supply: Total primary energy domestic supply (sometimes referred to as energy use) is calculated as production of fuels + inputs from other sources + imports - ex-ports - international marine bunkers + stock changes. It includes coal, crude oil, natural gas liquids, refinery feedstocks, additives, petroleum products, gases, combustible renewables and waste, electricity and heat. Domestic supply differs from final consumption in that it does not take account of distribution losses. The supply and use of energy commodities are converted to Kg. oil equivalent using standard coefficients for each energy source.

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Annex I: Renewable energy targets 2010 and 2020

	2005	2010				2020				
	RES share	RES target	mtoe RES	mtoe wood	million m3 wood	RES target	mtoe RES	mtoe wood	million m3 wood	million m3 wood 75% sc
Austria	23.0%	25.8%	7'219	3'417	19'754	34.0%	9'527	4'510	26'070	19'754
Belgium	2.2%	4.9%	1'805	1'416	8'182	13.0%	4'824	3'784	21'873	16'405
Bulgaria	10.6%	12.0%	1'261	805	4'653	16.0%	1'684	1'075	6'215	4'661
Cyprus	2.9%	5.4%	94	17	97	13.0%	224	40	233	175
Czech Republic	6.3%	8.0%	2'167	1'822	10'532	13.0%	3'547	2'982	17'238	12'928
Denmark	17.0%	20.3%	3'284	2'220	12'832	30.0%	4'866	3'290	19'016	14'262
Estonia	18.0%	19.8%	606	599	3'463	25.0%	768	759	4'387	3'463
Finland	28.5%	30.9%	8'008	6'616	38'245	38.0%	9'867	8'153	47'124	38'245
France	9.5%	12.9%	18'289	10'188	58'886	23.0%	26'017	16'149	93'345	70'008
Germany	5.8%	8.9%	18'559	7'131	41'221	18.0%	33'276	14'268	82'472	61'854
Greece	7.5%	10.1%	2'184	1'293	7'473	18.0%	3'886	2'300	13'296	9'972
Hungary	4.3%	6.5%	1'200	1'033	5'971	13.0%	2'420	2'082	12'037	9'028
Iceland	55.6%	55.6%	1'262	0	0	55.6%	1'262	0	0	0
Ireland	3.0%	6.3%	792	444	2'568	16.0%	2'026	1'136	6'567	4'925
Italy	4.8%	7.9%	10'746	3'403	19'671	17.0%	23'287	7'375	42'627	31'970
Latvia	35.5%	37.1%	1'571	1'260	7'284	42.0%	1'775	1'424	8'233	7'284
Lithuania	15.0%	17.0%	825	776	4'483	23.0%	1'113	1'047	6'052	4'539
Luxembourg	0.9%	3.4%	152	68	391	11.0%	488	217	1'252	939
Malta	0.0%	2.5%	14	0	0	10.0%	56	0	0	0
Netherlands	2.4%	5.3%	2'822	1'467	8'478	14.0%	7'411	3'851	22'261	16'696
Norway	65.6%	65.6%	12'817	1'036	5'989	65.6%	12'817	1'036	5'989	5'989
Poland	7.2%	9.2%	5'454	5'069	29'302	15.0%	8'960	8'328	48'138	36'103
Portugal	17.0%	20.5%	3'933	3'158	18'251	31.0%	5'937	4'767	27'554	20'666
Romania	19.2%	20.4%	5'317	3'384	19'560	24.0%	6'260	3'984	23'027	19'560
Slovakia	6.9%	8.7%	745	447	2'586	14.0%	712	428	2'472	2'586
Slovenia	14.9%	17.4%	1'269	589	3'407	25.0%	2'770	1'287	7'437	5'578
Spain	7.6%	10.7%	10'710	5'052	29'204	20.0%	20'086	9'475	54'768	41'076
Sweden	40.8%	42.9%	15'072	8'061	46'593	49.0%	17'237	9'219	53'288	46'593
Switzerland	17.8%	17.8%	4'154	745	4'307	17.8%	4'570	820	4'737	4'307
United Kingdom	1.3%	4.7%	7'403	2'108	12'184	15.0%	23'382	6'658	38'484	28'863
Sum EU 27	8.3%	11.2%	131'500	71'844	415'271	20.0%	222'406	118'589	685'465	528'132
Sum EU/EFTA			149'734	73'625	425'567		241'056	120'444	696'192	538'428

Annex II: Scenario: Wood supply and use 2010

2010	Industrial Roundwood		Fuelwood		Bark	Used logging residues	Woody biomass outside the forest	Chips, particles & wood residues	Recovered wood for material & energy use	Pulp production co-products updated	Processed wood fuel	∑ SUPPLY	∑ SUPPLY
1000 m³	JFSQ unchanged	Maximum difference unreported to JFSQ unchanged	JFSQ unchanged	Maximum difference unreported to JFSQ unchanged	updated	updated	unchanged	updated	unchanged		unchanged	FOREST	TOTAL
	(P'+I-X)	(P)	(P+I-X)	(P)	(P'+I-X)	(P')	(P)	(P'+I-X)	(P)	(P')	(P+I-X)		
Austria	14'639	0	5'100	1'805	3'062	0	7'000	9'645	0	4'046	1'218	**24'606**	**46'515**
Belgium	6'664	0	634	0	0	0	0	1'467	410	3'078	0	**7'298**	**12'253**
Bulgaria	2'985	1'497	2'555	0	0	0	0	447	196	281	0	**7'038**	**7'962**
Cyprus	6	3	4	0	0	0	0		0	0	0	**13**	**13**
Czech Republic	13'856	0	966	0	182	1'423	2'833	2'296	0	2'202	40	**16'428**	**23'800**
Denmark	1'251	0	1'549	0	0	0	0	1'565	0	0	1'347	**2'800**	**5'712**
Estonia	4'939	0	933	0	0	0	0	1'939	0	187	0	**5'872**	**7'998**
Finland	63'353	0	5'310	0	7'748	1'854	0	17'724	1'488	20'131	98	**78'265**	**117'706**
France	30'029	0	24'104	1'482	0	3'630	8'700	12'429	1'700	4'825	333	**59'246**	**87'234**
Germany	48'466	6'582	6'387	1'057	2'573	10'111	283	15'301	11'924	4'030	333	**75'177**	**107'048**
Greece	588	0	1'034	0	0	0	0	518	0	0	0	**1'622**	**2'140**
Hungary	2'167	646	3'003	0	0	0	0	642	19	0	0	**5'816**	**6'478**
Ireland	2'780	0	19	0	0	0	0	1'013	646	0	0	**2'799**	**4'458**
Italy	7'918	5'032	6'538	0	0	0	0	4'645	2'963	259	383	**19'487**	**27'737**
Latvia	8'948	0	608	0	0	0	0	2'122	0	0	0	**9'556**	**11'678**
Lithuania	4'247	1'027	1'118	298	750	69	0	1'993	0	0	141	**7'509**	**9'643**
Luxembourg	363	12	-39	0	0	0	0	216	0	0	0	**336**	**552**
Malta		0	0	0	0	0	0	0	0	0	0	**0**	**0**
Netherlands	705	0	263	0	134	0	0	1'949	600	258	880	**1'103**	**4'790**
Norway	11'075	0	1'287	1'753	0	0	0	3'077	369	2'059	41	**14'115**	**19'661**
Poland	31'669	1'194	3'404	0	0	237	636	4'032	31	2'427	17	**36'505**	**43'647**
Portugal	9'621	0	595	0	0	0	0	1'669	61	2'939	0	**10'216**	**14'886**
Romania	12'955	241	2'662	0	932	0	0	1'835	0	352	0	**16'790**	**18'977**
Slovakia	6'198	0	178	0	150	10	30	2'055	50	470	0	**6'536**	**9'142**
Slovenia	2'072	85	808	0	0	159	276	456	149	294	12	**3'123**	**4'310**
Spain	18'195	0	2'105	0	0	0	0	5'410	2'040	3'248	0	**20'300**	**30'998**
Sweden	72'154	0	6'135	0	10'007	6'191	0	19'066	1'450	21'903	1'836	**94'487**	**138'743**
Switzerland	3'016	0	1'219	0	219	521	240	1'353	0	374	0	**4'974**	**6'942**
United Kingdom	9'333	0	126	1	229	0	0	2'828	4'872	0	200	**9'688**	**17'587**
EU / EFTA	**384'925**	**16'318**	**78'606**	**6'396**	**25'987**	**24'206**	**19'998**	**117'694**	**28'968**	**73'363**	**6'880**	**536'438**	**783'341**
EU 25	**354'894**	**14'580**	**70'883**	**4'643**	**24'836**	**23'685**	**19'758**	**110'982**	**28'403**	**70'297**	**6'839**	**493'521**	**722'961**

Balance		∑ USE TOTAL	Material use					Energy use	2010	
			Sawmill industry	Panel industry	Pulp industry	Processed wood fuel industry	Other physical utilization			1000 m³
			updated	updated	updated	unchanged	unchanged	changed		
			(C')	(C')	(C')	(C')	(C)	(C')		
-6'870	-13%	53'385	18'185	4'647	8'778	2'021	0	19'754	Austria	
-7'449	-38%	19'702	1'941	3'659	5'920	0		8'182	Belgium	
1'114	14%	6'848	931	723	540	0		4'653	Bulgaria	
13	100%	0				0			Cyprus	
-351	-1%	24'151	6'940	2'185	4'192	193	109	10'532	Czech Republic	
-8'174	-59%	13'886	331	390	0	333		12'832	Denmark	
-311	-4%	8'309	3'821	764	262	0		3'463	Estonia	
8'182	7%	109'524	23'499	4'839	42'229	392	321	38'245	Finland	
-19'619	-18%	106'852	20'141	9'094	9'680	250	8'802	58'886	France	
-4'298	-4%	111'346	35'807	22'349	9'746	333	1'889	41'221	Germany	
-6'578	-75%	8'718	306	939	0	0		7'473	Greece	
-793	-11%	7'271	339	960	0	0		5'971	Hungary	
-1'433	-24%	5'891	1'795	1'528	0	0		2'568	Ireland	
-4'880	-15%	32'617	2'492	8'814	1'357	283		19'671	Italy	
-3'532	-23%	15'210	6'984	942	0	0		7'284	Latvia	
631	7%	9'012	2'949	734	0	352	494	4'483	Lithuania	
-1'530	-74%	2'082	899	792	0	0		391	Luxembourg	
		0	0	0	0	0		0	Malta	
-5'616	-54%	10'406	480	25	529	180	714	8'478	Netherlands	
163	1%	19'498	4'952	830	7'320	71	336	5'989	Norway	
-21'159	-33%	64'806	18'019	11'220	4'944	333	987	29'302	Poland	
-13'304	-47%	28'190	1'657	1'993	6'289	0		18'251	Portugal	
-10'176	-35%	29'153	6'708	2'209	677	0		19'560	Romania	
-1'760	-16%	10'902	4'302	1'381	2'593	40		2'586	Slovakia	
-2'032	-32%	6'342	1'410	786	565	58	116	3'407	Slovenia	
-20'409	-40%	51'407	7'059	8'228	6'883	33		29'204	Spain	
5'266	4%	133'477	36'279	1'138	47'867	1'600	0	46'593	Sweden	
-2'786	-29%	9'728	2'708	1'678	1'005	0	29	4'307	Switzerland	
-6'218	-26%	23'805	5'545	4'611	799	200	466	12'184	United Kingdom	
-139'177	-15%	922'518	216'478	97'457	162'177	6'674	14'262	425'470	EU / EFTA	
-127'492	-15%	857'292	201'179	92'018	152'634	6'603	13'897	390'961	EU 25	

Annex III: Scenario: Wood supply and use 2020

2020	Industrial Roundwood		Fuelwood		Bark	Used logging residues	Woody biomass outside the forest	Chips, particles & wood residues	Recovered wood for material & energy use	Pulp production co-products updated	Processed wood fuel	∑ SUPPLY	∑ TOTAL
1000 m³	JFSQ updated	Maximum difference unreported to JFSQ unchanged	JFSQ unchanged	Maximum difference unreported to JFSQ unchanged	updated	updated	unchanged	updated	unchanged	unchanged	unchanged	FOREST	SUPPLY
	(P"+I-X)	(P)	(P+I-X)	(P)	(P"+I-X)	(P")	(P)	(P"+I-X)	(P)	(P')	(P"+I-X)		
Austria	17'505	0	5'100	1'805	2'800	0	7'000	9'737	0	5'671	1'218	27'211	50'837
Belgium	7'177	0	634	0		0	0	1'230	410	3'708	0	7'812	13'159
Bulgaria	3'479	1'497	2'555	0		0	0	444	196	366	0	7'531	8'537
Cyprus	6	3	4	0		0	0		0		0	13	13
Czech Republic	15'223	0	966	0	175	1'365	2'833	2'182	0	3'116	40	17'729	25'900
Denmark	1'713	0	1'549	0		0	0	1'628	0	0	1'347	3'262	6'236
Estonia	4'897	0	933	0		0	0	1'840	0	232	0	5'830	7'902
Finland	64'918	0	5'310	0	7'625	1'825	0	17'133	1'488	21'024	98	79'678	119'420
France	33'615	0	24'104	1'482	0	3'440	8'700	12'430	1'700	5'258	333	62'641	91'063
Germany	50'721	6'582	6'387	1'057	2'520	9'900	283	14'779	11'924	3'594	333	77'167	108'081
Greece	529	0	1'034	0		0	0	518	0	0	0	1'564	2'081
Hungary	2'130	646	3'003	0		0	0	623	19	0	0	5'779	6'422
Ireland	3'422	0	19	0		0	0	1'140	646	0	0	3'441	5'227
Italy	8'372	5'032	6'538	0		0	0	4'378	2'963	303	383	19'941	27'969
Latvia	8'823	0	608	0		0	0	2'149	0	0	0	9'431	11'580
Lithuania	4'938	1'027	1'118	298	704	65	0	1'926	0	0	141	8'150	10'217
Luxembourg	357	12	-39	0		0	0	216	0	0	0	330	546
Malta		0	0	0		0	0	0	0	0	0	0	0
Netherlands	836	0	263	0	125	0	0	1'992	600	337	880	1'224	5'033
Norway	12'671	0	1'287	1'753	0	0	0	2'858	369	2'148	41	15'711	21'127
Poland	34'455	1'194	3'404	0	0	227	636	4'275	31	4'009	17	39'280	48'247
Portugal	9'837	0	595	0		0	0	1'637	61	3'361	0	10'432	15'492
Romania	14'866	241	2'662	0		0	0	1'675	0	505	0	17'769	19'949
Slovakia	6'198	0	178	0		10	30	2'055	50	470	0	6'386	8'992
Slovenia	2'072	85	808	0	0	159	276	456	149	294	12	3'123	4'310
Spain	20'076	0	2'105	0		0	0	5'324	2'040	4'130	0	22'181	33'675
Sweden	76'809	0	6'135	0	9'699	6'000	0	19'363	1'450	23'105	1'836	98'643	144'398
Switzerland	3'376	0	1'219	0	210	500	240	1'421	0	471	0	5'304	7'436
United Kingdom	12'211	0	126	1	200	0	0	3'154	4'872	0	200	12'538	20'764
EU / EFTA	420'251	16'318	78'606	6'396	24'058	23'491	19'998	116'562	28'968	82'102	6'880	569'120	823'630
EU 25	385'860	14'580	70'883	4'643	23'848	22'991	19'758	110'163	28'403	78'613	6'839	522'804	766'580

Balance		SUM TOTAL USE	SUM TOTAL USE (75% scenario)	Material use					Energy use (100% scenario)	Energy use (75% scenario)	2020
				Sawmill industry updated	Panel industry updatd	Pulp industry updated	Processed wood fuel industry unchanged	Other physical utilization unchanged			1000 m³
				(C')	(C')	(C')	(C')	(C)	(C')	(C')	
-13'886	-21%	64'723	58'406	18'358	5'969	12'305	2'021	0	26'070	19'754	Austria
-22'047	-63%	35'206	29'738	1'628	4'575	7'130	0		21'873	16'405	Belgium
-458	-5%	8'994	7'441	925	1'152	703	0		6'215	4'661	Bulgaria
-220	-94%	233	175				0		233	175	Cyprus
-7'172	-22%	33'072	28'762	6'592	3'007	5'933	193	109	17'238	12'928	Czech Republic
-13'956	-69%	20'192	15'438	344	499	0	333		19'016	14'262	Denmark
-1'432	-15%	9'334	8'410	3'624	997	326	0		4'387	3'463	Estonia
-620	-1%	120'039	111'160	22'715	5'386	44'102	392	321	47'124	38'245	Finland
-52'482	-37%	143'545	120'209	20'142	10'458	10'549	250	8'802	93'345	70'008	France
-46'456	-30%	154'536	133'918	34'584	26'565	8'693	333	1'889	82'472	61'854	Germany
-12'614	-86%	14'696	11'372	306	1'094	0	0		13'296	9'972	Greece
-7'316	-53%	13'738	10'728	329	1'371	0	0		12'037	9'028	Hungary
-5'372	-51%	10'599	8'958	2'020	2'012	0	0		6'567	4'925	Ireland
-29'899	-52%	57'868	47'211	2'349	11'021	1'588	283		42'627	31'970	Italy
-5'040	-30%	16'620	15'671	7'072	1'315	0	0		8'233	7'284	Latvia
-681	-6%	10'898	9'385	2'850	1'150	0	352	494	6'052	4'539	Lithuania
-2'593	-83%	3'139	2'826	899	988	0	0		1'252	939	Luxembourg
		0	0	0	0	0	0		0	0	Malta
-19'335	-79%	24'368	18'803	491	32	690	180	714	22'261	16'696	Netherlands
1'651	8%	19'476	19'476	4'600	844	7'637	71	336	5'989	5'989	Norway
-43'080	-47%	91'327	79'292	19'105	14'596	8'167	333	987	48'138	36'103	Poland
-23'342	-60%	38'833	31'945	1'625	2'463	7'191	0		27'554	20'666	Portugal
-14'230	-42%	34'180	30'713	6'123	4'058	972	0		23'027	19'560	Romania
-1'796	-17%	10'788	10'902	4'302	1'381	2'593	40		2'472	2'586	Slovakia
-6'063	-58%	10'373	8'514	1'410	786	565	58	116	7'437	5'578	Slovenia
-47'390	-58%	81'066	67'374	6'946	10'566	8'752	33		54'768	41'076	Spain
984	1%	143'414	136'719	36'842	1'189	50'494	1'600	0	53'288	46'593	Sweden
-3'576	-32%	11'012	10'581	2'845	2'137	1'263	0	29	4'737	4'307	Switzerland
-30'822	-60%	51'586	41'965	6'185	5'481	770	200	466	38'484	28'863	United Kingdom
-410'225	-33%	1'233'855	1'076'092	215'212	121'092	180'424	6'674	14'262	696'192	538'428	EU / EFTA
-393'613	38%	1'160'193	1'007'881	200'719	112'902	169'848	6'603	13'897	656'223	503'911	EU 25