06 February 2007

Wood energy in Europe and North America:

A new estimate of volumes and flows

Authors: Florian Steierer[1] (UNECE/FAO), Andreas Fischer-Ankern[2] (FAO)
in co-ordination with Michel Francoeur (IEA), Jeremy Wall (EC), Kit Prins (UNECE/FAO)

Summary:

The Joint Wood Energy Enquiry (JWEE) was carried out jointly by four international organizations (UNECE, FAO, IEA and EU) with the objective to respond to the following questions:

- How much wood is used for energy at present?
- …from what sources?
- …for what purposes?
- How important is wood energy for the national energy supply?

The data, from 12 European and two northern American countries, allow these first conclusions:

Harvested wood volumes, in particular wood for energy generation, seem to be significantly higher than reported by official international statistics. Wood used for energy generation is sometimes not captured by official trade and consumption statistics (e.g. informal wood market for private households/missing trade classification for wood pellets).

Most of the wood used for energy arises during the processing, or after the use, of forest products such as sawnwood, panels and paper. Wood energy supplied directly from the forest is smaller but plays an important role, especially in the European countries. However it is safe to assume that in most advanced countries there is limited scope to increase the energy use of co-products (residues) from the forest products industry. There are also clear technical limits on the use of recovered wood, although it is not yet clear how much this sector could expand.

Significant expansion of wood energy supply to meet ambitious biomass energy targets may therefore be focused on direct energy. This could take the form either of mobilizing a greater share of the existing resources and/or extending the forest area (for instance for energy plantations). The speed of growth will depend on economic circumstances and policy choices, notably about land use priorities.

The information of the enquiry complements studies on potential wood volumes for energy use. We hope that the data collected, if of sufficient quality, will be a baseline for future data collection.

Concerned sectors (e.g. pellets producing industries, recycling and waste management etc.) and specialists are the most welcome to join the cooperative effort to improve data.

[1] florian.steierer@unece.org, +49 (176) 294-00292
[2] andreas.fisherankern@fao.org

1. Background

For many decades it has been known that energy is an important and expanding use for wood, but that the data quality is inadequate for the significance of the policy decisions which must be made. Confirmation of this assessment may be found in the European Forest Sector Outlook Study (EFSOS – section 2.8) where it is acknowledged that the status around 2000 is not at all clear and that the EFSOS scenarios for the wood energy future are neither robust nor even plausible. This is confirmed by the recent of trends 2000-2005, compared to the EFSOS scenarios[3]. However, with rising policy interest in renewable energies, and the investments being undertaken in some countries in wood energy, the time seemed appropriate to make a concerted interagency effort to improve the quality of the policy relevant data available to the national and international community – whether of forest sector specialists or of energy sector specialists.

This paper summarizes the report on the enquiry carried out jointly by four international organizations with a mandate to monitor the situation and trends as regards wood energy: UNECE, FAO, IEA and EU. The statistics here are based on national administrations' submissions, collected in a common framework of terms and definitions, and drawing on the expertise of both the forest sector and the energy sector. In this respect, this study represents a significant advance on earlier international efforts in data collection on wood energy.

More information on the background to this study can be found in the document ECE/TIM/EFC/WP.2/2007/6, prepared for the 2007 meeting of the Joint FAO/UNECE Working Party on Forest Economics and Statistics[4].

2. Objectives

The objectives of the study are to:

1. develop and implement a method to monitor and analyze trends in the supply and use of wood for energy;

2. present the most complete picture possible of the wood energy situation around 2005 in Europe and North America, i.e. the UNECE region;

3. lay the foundations for future monitoring and analysis by the partner organizations.

3. Method

3.1. Structure of the enquiry:

3.1.1. Data collection structure:

The structure of the enquiry follows the "Wood Resource Balance" of Prof. Udo Mantau from the Federal Research Centre for Forestry and Forest Products in Hamburg, Germany[5]. Wolfgang Bittermann, Statistik Austria, provided practical suggestions to make it easier to cooperate with national energy specialists[6].

[3] EFSOS: http://www.unece.org/trade/timber/docs/sp/sp-20.pdf
[4] http://www.unece.org/trade/timber/docs/stats-sessions/stats-29/english/TIM-EFC-WP2-2007-06-WoodEnergy.pdf
[5] Wood resource Balance Germany: http://www.unece.org/trade/timber/docs/stats-sessions/stats-28/presentations/20_soergel_wrbgermany.pdf
[6] Presentation JWPFES 2006 : http://www.unece.org/trade/timber/docs/stats-sessions/stats-28/presentations/16_bittermann_woodenergy.pdf

The enquiry uses a detailed grid to collect disaggregate, precise national data (Annex I). The matrix format forced correspondents to bring together data from different sources, revealing in many cases inconsistencies, and data gaps, which had not been apparent before. This structure makes it easier for other sectors to supplement missing details and was particularly helpful in collecting information on post-consumer recovered wood through cooperation with the COST Action E31 on recovered wood.

Cooperation and joint effort at the national level were indeed objectives of the study method, as the authors believed that neither "sector" (forestry, energy) benefited from working in isolation on what is quintessentially a cross-sectoral issue.

Correspondents were invited to provide the best available information, making estimates where necessary to complete the matrix. This study brings together data of significantly different quality, in the interest of providing a comprehensive picture. Readers need to keep this limitation in mind and refer to the notes of the final report or to the original sources for questions about data reliability.

3.1.2. Data output structure:

The final presentation of the national and sub-national data aggregates the collected data in a harmonized structure that reflects the FAO Unified Bioenergy Terminology[7]. This simple grid indicates the major sources of wood fuel and the major consumers of the energy.

Sources of wood energy (Table 1):

S1 *Direct supply* - essentially wood directly from the forest.
S2 *Indirect supply* - (processed and unprocessed) co-products (residues) from wood processing industries (sawdust pellets, black liquor).
S3 *Recovered wood* supply- post consumer recovered wood products having served their purpose for at least one life-cycle (e.g. pallets, construction wood, furniture), which are then used for energy.

Uses of wood energy (Table 3):

U1 *Power and heat* - the generation of electric power for the grid and heat for sale, outside the producing (forest) companies (industries).
U2 *Industrial* - wood energy used internally by the forest industries.
U3 *Private households* - wood volumes used for energy generation in private households.

The results are expressed both in "physical" forest sector units (m^3, tons, m^3 roundwood equivalent) and energy terms (million tons of oil equivalent - Mtoe). To the extent possible, existing terminology used by IEA and UNECE/FAO was applied in the enquiry. The replies received were checked for internal consistency and "reasonableness", and compared with existing data for the forest sector (UNECE/FAO Joint Forest Sector Questionnaire) and the energy sector (IEA renewables data base[8]), as well as with input from other analysts (e.g. Eurobserver) and specialized research (e.g. COST Action E31on use of recovered wood). Comments were sought from interested experts, notably industry specialists and relevant units of the European Commission.

The authors and their institutions wish to express their profound gratitude to the many experts who advised on the enquiry and replied to the enquiry. They are listed in annex III, and involved in all future follow up work.

3.2. Data collection:

The enquiry was sent to correspondents of the 56 member states UNECE/FAO Timber Section. Additionally, IEA correspondents from 10 OECD countries agreed to provide input and cooperation at national level. The correspondents were asked to consider existing documents on wood energy in their

[7] ftp://ftp.fao.org/docrep/fao/007/j4504e/j4504e00.pdf
[8] Renewables and waste questionnaire : http://www.iea.org/Textbase/stats/questionnaire/Renques.pdf

countries, encouraged to reach out to national specialists and to communicate with the energy correspondents. Hence, the applied approach of using existing data and specialists' knowledge differed from the original procedure applied in the German "Wood Resource Balance", in which data assessment was based on own data collection through direct, comprehensive interrogation of the entire wood processing industries.

Despite the impressive progress, the collected data still has many shortcomings and inconsistencies, reflecting the small scale and non-market nature of many of the items being studied, the need for building up more cohesive communication between energy and forest sector institutions in many countries, and the lack of political will and resources to monitor developments in wood energy. For these reasons, this exercise should be considered an important step in allowing initial conclusions but not the end of the wood energy monitoring process. Our recommendations below address how we believe this problem should be tackled.

4. First results of the survey

4.1. Sources of Wood Energy

Altogether, 19 replies were received, of which those from 14 countries (12 in western Europe plus USA and Canada) have been used for this analysis. The five remaining replies have not been considered in the assessment presented below, as they did not contain enough information to be considered. The European respondents covered most significant countries in western and central Europe, except Poland, Estonia, Latvia and southern Europe (Spain, Italy). No usable data was received from south east Europe or the EECCA (Eastern Europe, Caucsus and Central Asia), which is regrettable, as it is known that wood energy plays a vital role in some of these countries, especially for rural populations ("Harsh winter conditions fuel the use of energy wood"[9]). The 12 responding countries however account for 63%[10] of total (UNECE) European wood removals or 70% of total EU 25 removals, and may be considered to give a strong and reliable indication of the situation in north west and central Europe.

[9] http://www.unece.org/trade/timber/Wood_energy_use_winter_2005.pdf
[10] Joint Forest Sector Questionnaire 2005

Table 1[11]: Sources of wood energy by country

	S1 Direct		S2 Indirect		S3 Recovered		Total
	1000 m³	%	1000 m³	%	1000 m³	%	1000 m³
Austria	6.929	48,0%	7.025	48,6%	488	3,4%	14.443
Czech Republic	5.036	63,4%	2.903	36,6%	n.a.	n.a.	7.939
Finland	6.803	20,7%	25.808	78,4%	303	0,9%	32.913
France	34.787	84,3%	4.979	12,1%	1.500	3,6%	41.265
Germany	13.023	43,0%	10.231	33,8%	7.017	23,2%	30.271
Lithuania	1.484	46,3%	1.724	53,7%	n.a.	n.a.	3.209
Netherlands	313	15,9%	1.387	70,7%	263	13,4%	1.962
Norway	3.128	54,2%	2.387	41,3%	258	4,5%	5.773
Slovenia	1.591	71,9%	596	26,9%	26	1,2%	2.214
Sweden	6.923	17,6%	31.760	80,7%	694	1,8%	39.377
Switzerland	1.935	51,1%	1.250	33,0%	600	15,9%	3.785
United Kingdom	580	37,1%	532	34,1%	450	28,8%	1.562
Total Europe	**82.531**	**44,7%**	**90.581**	**49,0%**	**11.599**	**6,3%**	**184.712**
Canada	3.080	6,4%	44.730	93,6%	n.a.	n.a.	47.810
USA	46.738	22,0%	163.231	76,8%	2.506	1,2%	212.475
Total Northern America	**49.818**	**19,1%**	**207.960**	**79,9%**	**2.506**	**1,0%**	**260.285**

Europe 12:

The reported roundwood consumption for the 12 European countries totalled 378 million m³. The reported roundwood equivalent for energy generation corresponds to 49 % of the volume of total roundwood consumption. Table 1 indicates that most of the wood (49 %) used for energy comes from one or more of the co-products (residues) from the wood processing industries (S2: indirect source). 45 % of the wood volume for energy in Europe come directly from the forest (S1 direct source). 6 % are supplemented by post-consumer recovered wood after at least one lifecycle (S3 post consumer recovered wood). However, there are large differences between countries.

North America:

A roundwood equivalent corresponding to 37 % of the total roundwood consumption is used for energy generation. The wood processing industries are by far the most important supplier for the wood raw material used for energy (80 %). Only 19 % of the wood volume used for energy, come directly from the forest. Recovered wood accounts for only 1 %, but note that no figures for that commodity were available for Canada.

Main observations:

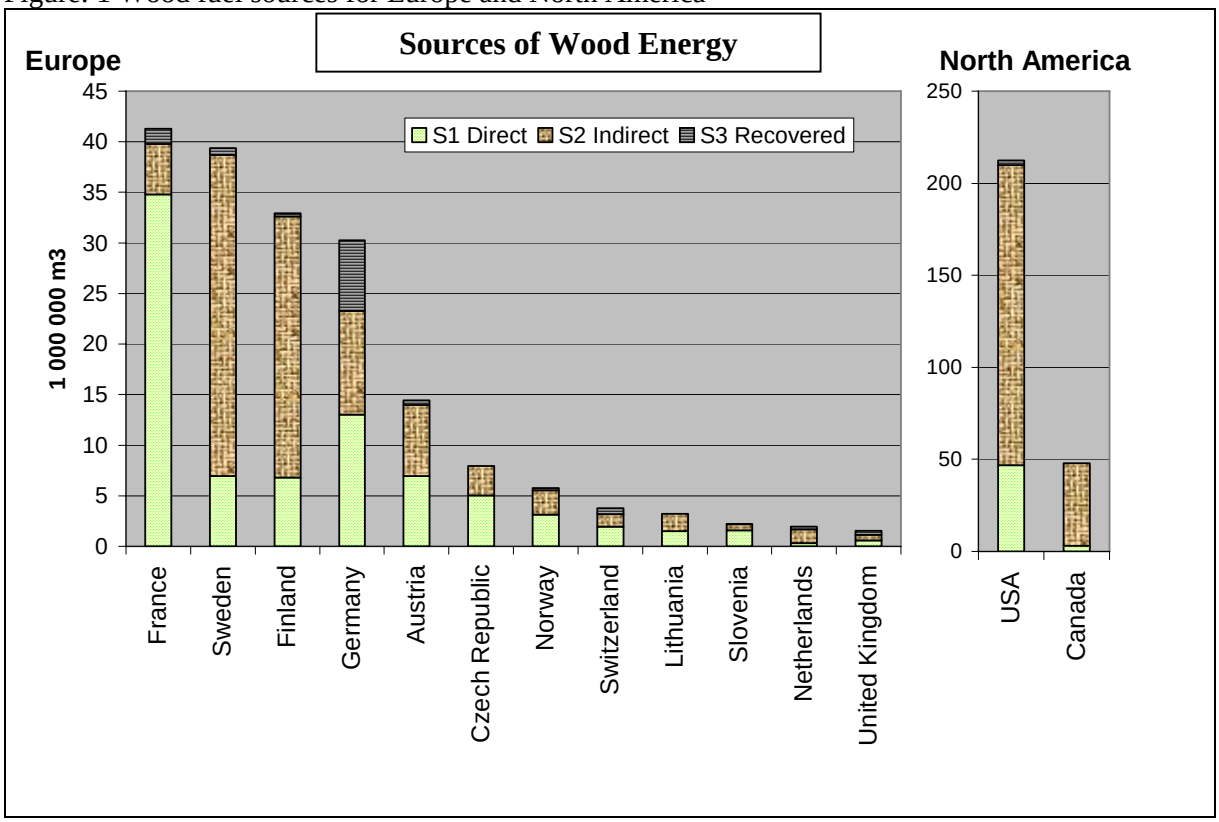
- Indirect wood energy is the most important source, notably in those countries with large and modern forest industries, such as Finland, Sweden, Canada and the USA, who heavily influence the regional totals. A large forest industries complex generates significant volumes of co-products (residues), which, if they find no "higher" use are typically used for energy. In most parts of the region, landfill or incineration without energy recovery is no longer an option, for legal and economic reasons, as well as environmental ones.
- Direct wood energy (traditional fuelwood) is relatively more important in European countries with smaller forest industries, as well as abundant forest resources, such as France the Czech Republic or Slovenia. A precise description of data sources in the French case confirms the impressive figures on wood energy generation by private households in France.

[11] In this document the decimal indicator is a comma (,) and the thousands separator a point (.)

- Recovered wood has been of relatively small importance as an energy source until quite recently, but in several urban industrial countries with strict rules on waste disposal it is now making a major contribution to energy supply. In Germany, recovered wood accounts for one fourth of wood energy and in the UK it accounts for nearly 29 % of total wood energy.

The pattern of supply varies widely between countries and regions (see annex II for graphs representing the pattern of each country.)

Figure: 1 Wood fuel sources for Europe and North America



It is worth pointing out that the volumes of wood and co-products (residues) used for energy are much larger than previously believed, or regularly recorded, because of the limitations of the purely trade statistics based information systems. The estimated volumes of wood energy supply in table 1 (184 million m^3 for the Europe 12 million m^3 and 260 million m^3 for North America) contrast with recorded fuelwood removals (JFSQ) of 86 million m^3 and 53 million m^3 respectively: it is usually the fuelwood removals data which is used by analysts new to the sector, so that a rather misleading view of the significance of wood energy prevails in many studies. Wood energy data may also be compared to data for total removals (table 2)

In Europe, energy use is equivalent to almost 50 % of recorded roundwood consumption, confirming that in volume terms, and including all types of wood energy, energy is the largest end use in Europe. However, most of the wood (apart from France) used for energy arises during the processing, or after the use, of forest products such as sawnwood, panels and paper. Direct wood energy supply (i.e. that part completely unconnected from, indeed mutually exclusive with, the raw material use of wood) is much smaller.

Table 2: Wood energy and roundwood consumption

1.000.000 m³	Roundwood consumption (JWEE)	Roundwood equivalent for energy generation (JWEE)	Energy use as % of roundwood consumption (JWEE)
Europe	378	184	49%
North America	697	260	37%
Total	**1.075**	**444**	**41%**

However it can be assumed that in most advanced countries there are not many opportunities to increase the energy use of co-products (residues) of the forest products industry. There are also clear technical limits on the use of recovered wood, although it is not yet clear how much this sector could expand. Significant expansion of wood energy use to meet ambitious biomass energy targets may therefore be focused on direct energy supply, potentially putting energy consumers in more direct competition with the consumers of wood for raw material, depending on the strategic approach that is taken. There are many forests and trees outside forests that are currently not supplying any of the existing wood markets.

4.2. Who uses wood energy, for what purposes?

Table 3: Uses of wood energy by country

	U1 Power and heat		**U2 Industrial**		**U3 Private households**		**Total**
	1000 m³	**%**	**1000 m³**	**%**	**1000 m³**	**%**	**1000 m³**
Austria	2.051	14,2%	3.855	26,7%	8.538	59,1%	14.443
Czech Republic	538	6,8%	2.270	28,6%	5.131	64,6%	7.939
Finland	8.594	26,1%	18.596	56,5%	5.724	17,4%	32.913
France	514	1,2%	3.825	9,3%	36.927	89,5%	41.265
Germany	15.364	50,8%	1.696	5,6%	13.211	43,6%	30.271
Lithuania	775	24,1%	422	13,1%	2.012	62,7%	3.209
Netherlands	1.400	71,4%	150	7,6%	412	21,0%	1.962
Norway	595	10,3%	2.011	34,8%	3.167	54,9%	5.773
Slovenia	28	1,3%	531	24,0%	1.655	74,8%	2.214
Sweden	10.995	27,9%	19.458	49,4%	8.923	22,7%	39.377
Switzerland	2.268	59,9%	224	5,9%	1.293	34,2%	3.785
United Kingdom	708	45,3%	235	15,0%	620	39,7%	1.562
Total Europe	**43.828**	**23,7%**	**53.272**	**28,8%**	**87.612**	**47,4%**	**184.712**
Canada	20.402	42,7%	24.178	50,6%	3.230	6,8%	47.810
USA	81.762	38,5%	87.470	41,2%	43.244	20,4%	212.475
Total North America	**102.164**	**39,3%**	**111.648**	**42,9%**	**46.474**	**17,9%**	**260.285**

The patterns of use of wood energy vary widely between countries, a factor of the strength of the forest industries, the number of rural households and policies for supporting generation of heat and power from renewables (e.g. the “feed-in” price to the grid for electricity generated from renewables such as wood). There may also be some data problems as to the classification of power and heat generated on site by the wood processing industries.

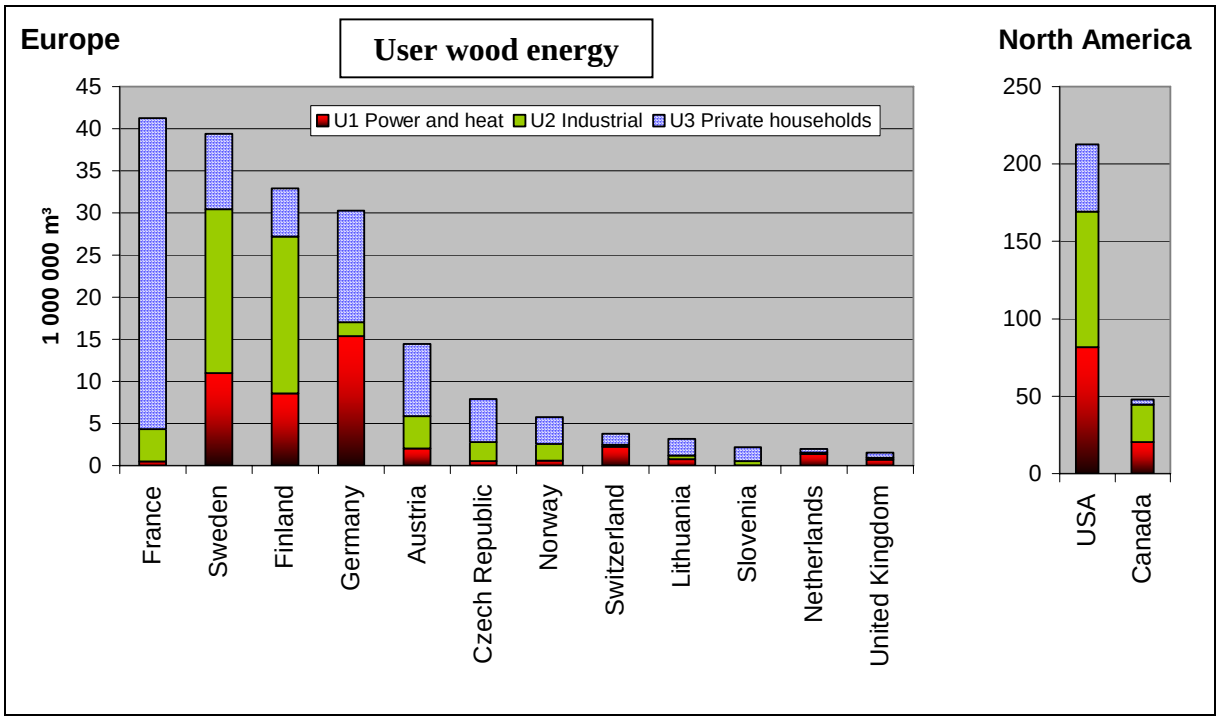
In Europe:

- private households account for 47 % of wood energy use (although this share is strongly influenced by the exceptionally high figure (37 million m^3) for France). The Czech Republic, Austria, Slovenia and Lithuania also have a high percentage of private household consumption.
- As would be expected, countries with large forest industries, especially pulp, such as Sweden and Finland have a high share of internal consumption by the forest-based industries.
- The share of "power and heat" which includes district heating based on wood energy is highest in the Netherlands, United Kingdom, Switzerland and Germany.

In North America:

- Industry is the dominant user of wood energy, followed by heat and power.
- In the USA a sixth of wood energy is used in private households, but just under 7 % in Canada. This may be due to the smaller and less dense population (but roughly equivalent forest-based industry) in Canada, or conceivably to cultural differences.

Figure 2: Wood fuel uses for Europe and North America



5. How important is wood energy in the energy supply picture?

In a few countries characterised by abundant forests, active forest industries and relatively small populations, wood energy accounts for over 5 % of total energy demand. In Finland, this share reaches 18 % and in Sweden almost 16 %, while in countries like Netherlands and the United Kingdom share is less than 1 %. For the 12 European countries as a group, wood energy represents 3.4 % of Total Primary Energy Supply. In North America, the corresponding share is 2 % with almost 4 % in Canada.

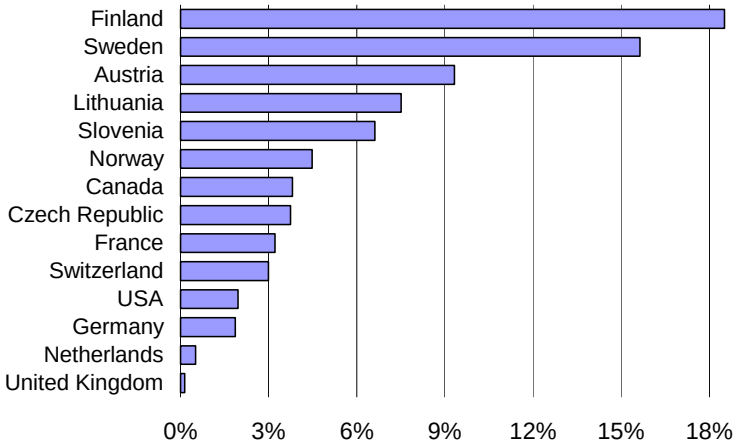


Figure 3: Role of wood energy in Total Primary Energy Supply

The trend in energy policy, with the objective of increasing security of supply, is towards diversifying types of energy supply. The figures above show that wood energy is already contributing to the diversity of supply in many countries. In a few countries (with forests, forest industries and relatively small and less dense populations, relative to their land area and forest resource), wood energy is already playing a significant role.

It should also be pointed out that wood is at present the dominant component of the category "renewables and waste" as defined by the IEA (which includes municipal waste, industrial waste and primary solid biomass but excludes other renewables such as solar and wind). If the data on wood energy resulting from this enquiry is compared with the IEA totals for "renewables and waste", in Europe 12, the share of wood is at least 73 % on average (96 % in Sweden and 61 % in Finland). There is a similar picture in North America where the share of wood in renewables and waste is 79 %. In view of the importance of the present contribution of wood to renewable energy, it is perhaps surprising that it has been receiving less policy attention and research funds than other renewables, such as solar and wind. This may be due to the fact that the main constraint to burning wood is not technical in nature, but related to social and environmental matters connected with forest management and wood utilization. The technical development in wood burning techniques and increased efficiency seems to be less promising to decision makers than might be the case for high-tech fields such as the development of highly efficient wind power generators or solar panels.

6. Conclusions

14 Replies with satisfying detailed information were received, 12 in western Europe and two North American countries.

The preliminary results contain many estimates and gaps but appear to be the best and most complete possible at the present. There is a considerable potential for improvement.

In the 12 western European countries, about 184 million m^3 roundwood equivalent / 40 Mtoe of wood were used for energy, and in North America about 260 million m^3 roundwood equivalent / 55 Mtoe. The pattern of supply varies widely between countries and regions. This is considerably more than previously believed.

Indirect wood energy is the most important source, notably in those countries with large and modern forest industries. Direct wood energy (traditional fuelwood) is relatively more important in European

countries with smaller forest industries, as well as abundant forest resources. Recovered wood has been of relatively small importance as an energy source until quite recently, but in several urban industrial countries with strict rules on biodegradable waste disposal it is now making a major contribution to energy supply.

Private households account for 47 % of wood energy use in Europe. As would be expected, countries with large forest industries, especially pulp, have a high share of industrial consumption. In Europe the share of "power and heat" which includes district heating based on wood energy, is highest in the Netherlands, Switzerland and Germany. In North America, industry is the dominant user of wood energy.

Wood energy is already contributing to the diversity of energy supply in many countries. In a few countries (with forests, forest industries and relatively small populations, relative to their land area and forest resource), wood energy is already playing a significant role (over five percent of national energy supply in five European countries). In Finland the share of wood energy reaches 18 %.

Wood is at present with 73 % the dominant component of the category "renewables and waste" in Europe 12. In volume terms, and including all types of wood and wood products, energy is, by far, the largest end use of wood.

Most of the wood used for energy arises during the processing or after the use of traditional forest products such as sawnwood, panels and paper. Direct wood energy supply is much less. However, it can be assumed that in most advanced countries there are not many opportunities to increase the energy use of residues of the forest products industry. There are also technical limits on the use of recovered wood, although it is unknown how much this sector can expand. Significant expansion of wood energy supply to meet ambitious biomass energy targets should therefore be focused on direct energy. This could take the form either of mobilizing a greater share of the existing resources and/or extending the forest area (for instance for energy plantations). The speed of growth will depend on economic circumstances, policy choices, and notably about land use priorities.

All data in this study refer to net energy value and take no account of efficiency of energy supply and consumption. Although not analyzed here, there are probably significant opportunities for energy efficiency, alongside expanding supply.

7. Recommendations:

1. The national data presented in this study should be widely circulated at the national level for review and checking. Revisions, corrections and additions should be communicated to the UNECE/FAO Timber Section.
2. All countries should make the necessary institutional arrangements and allocate the necessary resources to provide the necessary data in future, chiefly as a support to their own national decision making processes, but also as a contribution to better understanding of the broader international trends. This is particularly in view of the need to the respond to the rapidly changing markets.
3. All countries should explore the significance of post-consumer recovered wood in the national forest sector and national energy supply patterns. Countries should set up necessary arrangements that enable them to monitor and respond to changes in the forest and energy sector, including those caused by the rapid growth of wood use for energy purposes.
4. Both the "Core Group[12]" for this study and the FAO/ECE Joint Working Party on Forest Economics and Statistics and equivalent bodies in IEA and EU are asked to review the draft report of this study, and suggest improvements for data quality, data gathering and raising resources.

[12]Jeremy Wall (DG Enterprise), Michel Francoeur (IEA), Adrian Whiteman (FAO) and Christopher Prins (UNECE)

5. A second study, along the same lines but incorporating the lessons learnt from this study should be carried out in 2008, with the same partners, to identify trends. Additional partners should be involved if necessary.
6. Bearing in mind that further work in this area depends on new and adequate resources (financial and human) as well as political engagement and commitment from active partners, all interested parties are invited to contribute to the work.
7. The results of this study should be communicated to other interested bodies who are invited to consider using the data presented in this study in their research, and to provide feedback on this study, which might provide an improved foundation for future studies for the wider research field. Possible users of these data would include: the Global Forest Resource Assessment FRA and other FAO forest related databases, IEA energy balances, and carbon accounting e.g. in the framework of IPCC.
8. The data generated should be made available to researchers, presumably through a website, along with explanations of sources, estimations made and estimates of data quality.

VERSION 28 July 2006

Joint Wood Energy Enquiry

Sources and uses of wood material for energy production

YEAR: 200_

			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	
							USER																					
							non energy use by wood processors							energy uses														
														wood for commercial energy production							wood for direct energy use						
											production of energy carriers			Wood Input to produce ...				Energy Output			Industry						
		origin. unit	domestic production *) A	import B	export C	domestic availablity =A+B-C	sawmill Industry	panel prod.	pulp prod.	other prod.	pellets	charcoal	biofuel	heat	electricity	CHP	**Total wood**	heat (TJ)	electricity (GWh)	**Total energy (Toe)**	Forest based	Other	**Total**	house-holds	agriculture	services	**Total**	
1	SOURCES	Industrial Roundwood	m³ [scu]				0,0										0,0			0,0								1
2		Fuelwood	m³ [scu]				0,0										0,0			0,0								2
3		Logging residues	m³ [scu]				0,0										0,0			0,0								3
4		Thinnings	m³ [scu]				0,0										0,0			0,0								4
5		Short rotation energy coppice	m³ [scu]				0,0										0,0			0,0								5
6		Primary industrial residues	m³ [scu]				0,0										0,0			0,0								6
7		Secondray industrial residues	m³ [scu]				0,0										0,0			0,0								7
8		Wood from urban and amenity trees	t air dry				0,0										0,0			0,0								8
9		Post consumer recovered	t air dry				0,0										0,0			0,0								9
10		Bark	m³ [bv]				0,0										0,0			0,0								10
11		Charcoal	t				0,0										0,0			0,0								11
12		Pellets	t				0,0										0,0			0,0								12
13		Black liquor					0,0										0,0			0,0								13
14													**Total:**				0,0			0,0								14
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	

t = metric tons
m³ [scu]= solid cubic metre, underbark
m³ [bv] = [bulk volume]

= fill in these fields
= these fields have priority =>estimates if no data available
= No data required
*) if data for storage are available, they are directly added or substracted

Joint Wood Energy Enquiry 2006

Purpose

The purpose of this enquiry is to gain better information about national patterns of fuelwood and woodfuel supply and consumption. It is a joint effort undertaken by the energy and timber sector.

The enquiry was tested as an initial draft version that was sent to a few sample countries to test its feasibility. The experience gained from the replies in this first phase was integrated to set up this "Joint wood energy enquiry 2006".

In longer term, the purpose of this enquiry is to build up an annual questionnaire that can provide better information to decision makers and may enable the private sector to react to market developments.

Please Note

Please fill in the fields marked in yellow and orange (higher importance) in the worksheet "Joint Wood Energy Enquiry" with the most recent national data on wood energy. It would be ideal if you could provide data for 2005 and if available, for precedent years, too. If you use data from different years in one grid, please indicate the corresponding year.
Please use the units given in the worksheet, as far as possible. In case you are using other units, please indicate these by a short comment. If national data sets have to be converted, some conversion factors from the EFSOS report can be found below. [page 59: "conversion of product volume to initial volume of raw material"]

The energy content of wood highly depends on the moisture content of the raw material. The provided conversion factor can give only a first guideline for the conversion. Depending on the species, wood fuel may contain between 18 and 22 GJ per ton air-dry wood (water content 20-25 %).

If you need to use any other conversion factors give a short explanation about the changes that were made and which conversion factors were used. The structure of the table should remain unchanged. If you feel, that for your national woodfuel balance, there are important Items/Sources/Consumers missing (e.g. briquettes), indicate these

Procedure

The present structure has been conceived to set up an overarching enquiry that covers all sectors involved in wood energy production - in particular linking the energy with the timber sector. Wood raw material enters energy production in many different ways. In consequence all the sectors involved should contribute to improve the data on wood energy. This can only be achieved by good communication among the sectors involved.

Initially the enquiry is being sent to the national correspondents of the UNECE/FAO Timber Section who deal with the Joint Forest Sector Questionnaire. Wood energy might be beyond their personal area of expertise and therefore it will probably be necessary to reach out to national specialists in the field of energy.

In order to make the best estimates possible we recommend to contact national specialists for wood energy, waste, recovered wood and other fields concerned. The worksheet "Different statistical sources" indicates, which sectors might be concerned by the enquiry.

The UNECE/FAO Joint Forest Sector Questionnaire collects national information about wood energy on an annual basis. Fuelwood is often traded on informal markets, so that conventional statistics often underestimate the wood volume produced and consumed for this purpose. Therefore we would like to encourage you to assess realistically the quality of the official national data that are reported in the UNECE/FAO JFSQ.

Generally we encourage you to give priority to the most accurate and complete sources of information instead of the most official one. These may not derive from national statistics but could come from independent investigation or research, studies or estimations, which are equally accepted. In general we would strongly recommend you not to hesitate to make estimates for items instead of leaving blank fields. This is of particular interest for the highlighted fields. Please indicate the different sources of information by using background colour, footnotes etc.

The Joint Wood Energy Enquiry is undertaken as a special cooperation between UNECE/FAO with IEA. IEA agreed to provide the national correspondents of the Timber Section with the contact details of their national focal points. The aim is to improve the data quality and in particular to decrease the gap between the two databases. The Regional Overview on wood energy (see worksheet "Regional Wood Energy Overview") underlines the existing gap. Please make use of this offer to improve communication with the energy sector by getting in contact with your national counterpart in the energy sector to discuss how the data quality may be improved on the national level in each of the 27 countries covered by the regional overview.

Comments about this template will be welcome at any time along with any information you have about projects/studies going at the national level with a focus on fuelwood/woodfuel /biomass. This information and the contacts will help to avoid double work or overlapping with other sectors (especially energy sector). Our aim is not to reinvent the wheel, but to gather as much and as complete information available. Alliances and cooperation are most welcome.

DEFINITIONS

SOURCES:		Row number
Industrial Roundwood	All roundwood except fuelwood (called wood fuel in the JFSQ). It is an aggregate comprising sawlogs and veneer logs; pulpwood, round and split; and other industrial roundwood. It is reported in cubic metres solid volume underbark (i.e. excluding bark). (source: JFSQ)	**1**
Fuelwood - please include wood used to produce charcoal.	Roundwood that will be used as fuel for purposes such as cooking, heating or power production: it is reported in cubic metres solid volume underbark (i.e. excluding bark). This includes wood harvested from main stems, branches and other parts of trees (where these are harvested for fuel) and wood chips to be used for fuel that are made from roundwood directly (i.e. in the forest or chipped at a heating/power plant). Please also include roundwood that will be used for charcoal production (e.g. in pit kilns and portable ovens): estimate the volume of roundwood used in charcoal production by converting the weight (t) of charcoal produced to the solid volume (m3) of roundwood using a factor of 6.0. (source: JFSQ) This figure for the charcoal production should appear again in 'J1' and the amount of charcoal production, import and export should be given in row 11 columns 'A' to 'C'. Even if the volume of fuelwood used in private dwellings does not appear in national trade statistics, it would be helpful to include an estimate and to indicate how this was derived (interview, estimation etc.). IEA Bioenergy Task 31 "Biomass production for Energy from sustainable forestry" (www.ieabioenergytask31.org/). National specialists in: Belgium, Canada, Denmark, Germany, Norway, Sweden, UK, USA	**2**
Logging residues	Woody biomass by-products which are created during harvest of merchantable timber (Note: Logging residues include tree tops with branches and roots and they can be salvaged fresh or after seasoning). (Source: FAO: Unified Bioenergy Terminology) Unit: It is reported in cubic metres solid volume underbark (i.e. excluding bark). Please indicate if reported in metric tons.	**3**
Thinnings	Woody biomass by-products origination from thinning operations. (Source: FAO UBET) E.g. silvicultural and pre-commercial thinning and cleanings of trees. Please indicate if the reported unit is changed to metric tons.	**4**
Short rotation energy coppice	All woody biomass grown for specifically for their fuel value (Source: FAO: Unified Bioenergy Terminology. The raw material is grown for its energy content in short rotation forestry (SRF), often realized in short rotation coppice (SRC). (source: IEA Bioenergy Task) IEA Bioenergy Task 30 "Short Rotation Crops" specialists on that topic might be able to provide help in Canada, UK, USA and Sweden. See:http://www.shortrotationcrops.com/taskmembers.htm	**5**
Primary industrial residues	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). (source:JFSQ) It should be reported in cubic metres solid volume excluding bark but metric tons are accepted, too -Please indicate the value used	**6**
Secondary Industrial residues	Leftover from secondary wood processing and furniture industry - often contaminated residues. ISIC 2022, 2023, 2029 and 361(e.g. furniture production, packaging, windows, doors etc.)	**7**
Wood from urban and amenity trees	Gardening, landscape management, non-forest areas, agricultural land, city greening, etc.	**8**
Post consumer recovered wood	Used wood arising from construction of buildings or from civil engineering works. (Source: FAO: UBET). Recovered wood from transport (pallets), private households, as well as used wood arising from construction or demolition of buildings or from civil engineering works.	**9**
Bark	The loose volume of bark. Bulk volume ideal unit, but other units accepted. Please indicate.	**10**
Charcoal [metric tons]	Wood carbonised by partial combustion or the application of heat from external sources. It includes charcoal used as a fuel or for other uses, e.g. as a reduction agent in metallurgy or as an absorption or filtration medium. It is reported in metric tonnes. (Source: UNECE JFSQ)	**11**
Pellets [metric tons]	Densified biofuel made from pulverised biomass with or without pressing aids usually with a cylindrical form, random length typically 5 to 30 mm, and broken ends. (...) The total moisture of biofuel pellets is usually less than 10 % of mass.(Source: FAO UBET) Pellets made from industrial residues (sawmill rejects, slabs, edgings and trimmings, veneer log cores, veneer rejects, sawdust, residues from carpentry and joinery production, etc.).	**12**
Black liquor	Alkaline spent liquor obtained from digesters in the production of sulphate or soda pulp during the process of paper production, in which the energy content is mainly originating from the content of lignin removed from the wood in the pulping process. (Source: FAO UBET) As specific density and energy content are varying, no production is requested => see energy produced from black liquor (column P and Q)	**13**

USER:			**Column**
Non energy use by primary wood processors			
	Sawmill industry	Roundwood used by the sawmill industry to produce sawn products.	**E**
	Panel production	Production of veneer sheets, plywood, particleboard, and fibreboard.	**F**
	Pulp production	Pulp production from pulpwood, wood chips, particles or residues by mechanical and/or chemical process for further manufacture into paper, paperboard, fibreboard or other cellulose products. In JQ1 and JQ2, it is an aggregate comprising mechanical wood pulp; semi-chemical wood pulp; chemical wood pulp; and dissolving wood pulp. (Source: UNECE JFSQ)	**G**
	Other		**H**
	Wood based pellets production	Production of densified biofuel made from pulverised biomass with or without pressing aids usually with a cylindrical form, random length typically 5 to 30 mm, and broken ends. (...) The total moisture of biofuel pellets is usually less than 10 % of mass.(Source: FAO UBET) Pellets made from industrial residues (sawmill rejects, slabs, edgings and trimmings, veneer log cores, veneer rejects, sawdust, residues from carpentry and joinery production, etc.).	**I**
	Charcoal production	Wood carbonised by partial combustion or the application of heat from external sources. It includes charcoal used as a fuel or for other uses, e.g. as a reduction agent in metallurgy or as an absorption or filtration medium. It is reported in metric tonnes. Source: UNECE (JFSQ)	**J**
	Biofuel production	Amount of wood used to produce liquid or gaseous biofuels. Only biofuels are liquid fuels that derive from wood fibres should be considered (e.g. cellulose ethanol or 'sundiesel' or other product of bio-refineries) IEA Bioenergy has a group of specialists in Task 39: "Liquid biofuels from biomass". National specialist on the topic can be found in Austria, Canada, Denmark, Finland, the Netherlands, Sweden, UK, USA (http://www.ieabioenergy.com/Task.aspx?id=39) See also Task 33 "Thermal gasification of biomass" (http://www.ieabioenergy.com/Task.aspx?id=33) covering Austria, Denmark, Finland, Italy, the Netherlands, Sweden, Switzerland, United Kingdom, USA	**K**

Energy use

Roundwood volumes used for energy production (columns 'M' and 'N') ideally correspond directly to the reported energy output (columns 'P' and 'Q'). It is important that the numbers between 'Input' and 'Output' correspond to each other by a distinct correlation. The conversion factors are depending on the average efficiency of the heating and electricity production facilities. Therefore no standard conversion factors can be given. Please contact your national IEA correspondent concerning the correlation factors. In case of a too wide gap between the energy and the timber statistics we would like you to agree using the better data set (often the higher figures) and to calculate the corresponding part of the columns.
The different sectors are defined according to the UN International Standard Industrial Classification (ISIC) Revised version 3.1.

				Column
Wood for commercial energy production				
The energy producer is not the energy consumer.				
	Input for transformation to produce…		Wood used by the ISIC 'E'. Please use the original wood units.	**L**
		heat	Amount of wood used to produce heat.	**M**
		electricity	Amount of wood used to produce electricity.	**N**
		Total (wood)	SUM columns L+M+N in original units (per line). The total amount of wood used to produce any form of energy or energy carrier (heat, electricity and biofuels). This column is of particular interest for the enquiry. In case of no data coverage for the columns L-N please make estimates about the corresponding wood volumes based on the energy output. If estimates are used please indicate the methods used to derive the figures.	**O**
	Output after transformation		Please use the given energy units to describe the 'output after transformation'. The differing units refer to the type of energy produced to facilitate the work of the energy statisticians. IEA Bioenergy Task 32 "Biocombustion and cofiring" with specialists in Austria, Belgium, Canada, Denmark, Finland, the Netherlands, Norway, Sweden, Switzerland, United Kingdom, USA.	
		heat	Heat produced from the amount of wood reported in column 'L'. The unit is TJ. (1TJ = 23.884 Toe)	**P**
		electricity	Electricity produced from the amount of wood reported in column 'L'. The unit is GWh (1GWh = 85.984 Toe).	**Q**
		Total (energy)	SUM columns P+Q in Tons oil equivalent (Toe). The total amount of energy in column 'R' should directly correspond to the wooden raw materials reported in column 'O'. This column is of particular interest for the enquiry. In case of no data coverage for the columns 'P','Q' and 'R' please make estimates derived from the corresponding wood volumes. If estimates are used please indicate the methods used to derive the figures.	**R**
Wood for direct energy use				
The columns 'S'-'Y' ask for the original units of wood being used for energy production. The energy producer like wood processor, households, manufacturer, services and agriculture use the produced energy directly. The energy is not fed into any distribution facilities.				
		Industry		
			Forest based Industries	ISIC '20', '21' and '361' - If no information for the three digit code is available please use the two digit code ('36'). Please indicate the modification in a short explanatory note. e.g.: A sawmill burning part of its sawdust to produce heat for wood drying.	**S**
			Other industry	ISIC: 'C', 'D' and 'F' excluding '20', '21' and '361' : e.g.: Burning used wood products for heating (e.g. pallets)	**T**
			Total industry	SUM column S+T	**U**
		services		ISIC: 'G' to 'Q' : e.g.: Burning used wood and paper products for heating.	**V**
		agriculture		ISIC 'A' and 'B' (Rev.3.1.): e.g.: Self harvested fuelwood, burning horticultural waste or used wood products for heating	**W**
		households		e.g. Self harvested fuelwood , burning horticultural waste or used wood products for heating	**X**
		Total		**SUM colums S to X**	**Y**

Conversion factors used in the fuelwood analysis

Sub-region Product	Western Europe	Eastern Europe	CIS
Coniferous sawnwood	1.42-2.10	1.50-2.00	1.60-2.00
Non-coniferous sawnwood	1.46-3.52	1.40-2.10	1.45-2.00
Particleboard	1.20-1.80	1.40-1.80	1.40-1.60
Fibreboard	1.50-1.94	1.80-3.30	2.80-3.00
Plywood	1.50-3.10	1.80-2.90	2.50-2.70
Veneer sheets	1.20-3.10	1.70-2.90	2.00-2.90
Mechanical pulp	2.16-2.60	1.20-2.90	1.20-2.50
Chemical pulp	4.48-4.70	4.50-6.40	4.48-5.21
Semi-chemical pulp	2.20-2.90	2.30-3.20	2.86-2.90
Newsprint	3,2	3,2	3,5
Printing and writing paper	4	4	4,2
Other paper and paperboard	3.39-3.40	3.40-4.70	3,8
Recovered paper	3,8	3,8	3,8

Note: the above conversion factors show the amount of industrial roundwood (cubic metres underbark) required to produce one unit of output (one metric tonne of pulp or paper or one cubic metre of sawnwood or panels). Source: EFSOS main report page 59

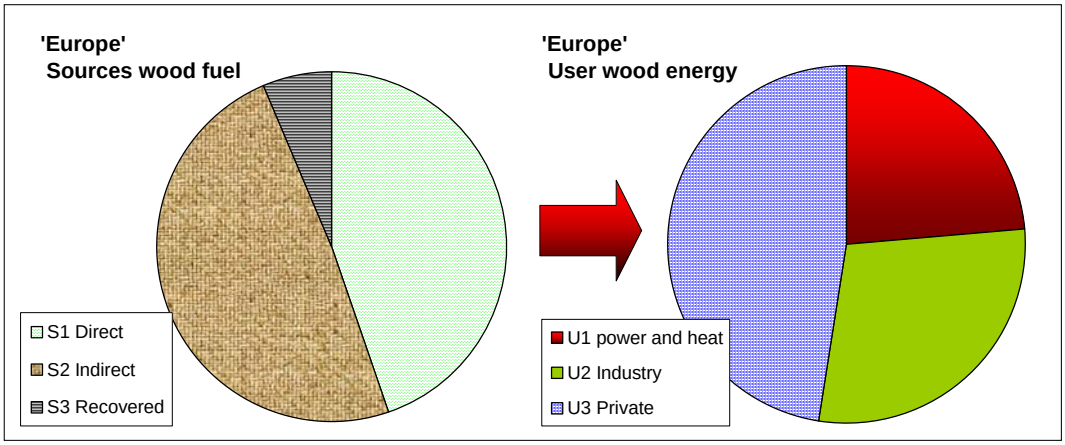
m^3 [scu]= solid cubic metre, underbark
m^3 [bv]: bulk volume/ loose volume (volume of a material including space between the particles)
t air dry (12-20 % moisture content in the wood)
t abs. Dry/bone dry ()

Europe

Inhabitants:	270.806.359
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,68

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	5.383	1.052	76.097	82.531	45%
S2 Indirect	29.486	52.192	8.903	90.581	49%
S3 Recovered	8.960	27	2.612	11.599	6%
Sum (S1+S2+S3)	**43.828**	**53.272**	**87.612**		
%	**24%**	**29%**	**47%**		
				184.712	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	378.383	100%
Wood equivalent for energy (thousand m3)	184.712	48,8%
...of which wood energy directly from the forest (thousand m3)	82.531	44,7%
... of which black liquor (thousand m3 roundwood equivalent)	45.794	24,8%
Direct fuelwood consumption per inhabitant (m3/a)	0,30	
Estimated Energy content (Mtoe)	39,59	
Total primary energy supply TPES (Mtoe)	1180,92	
Wood energy in TPES (%)		3,4%

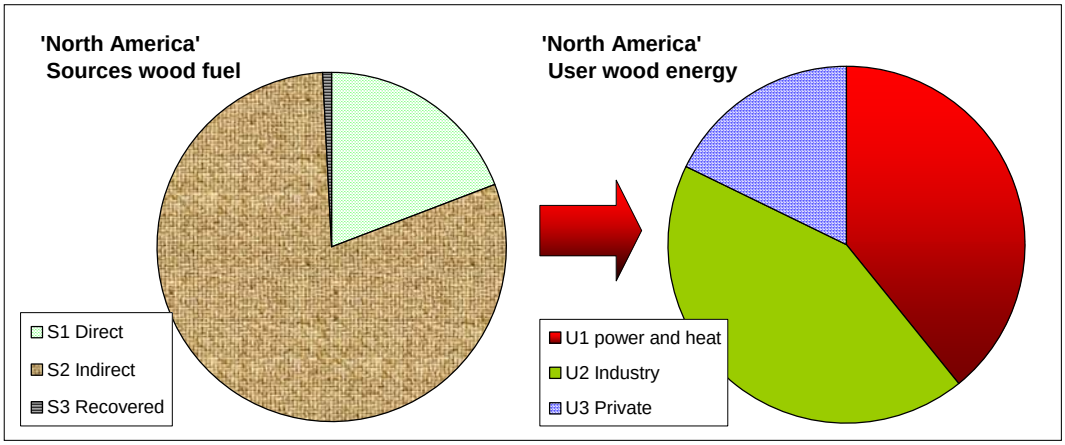


North America

Inhabitants:	331.543.147
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,79

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	5.321	0	44.497	49.818	19%
S2 Indirect	94.336	111.648	1.976	207.960	80%
S3 Recovered	2.506	0	0	2.506	1%
Sum (S1+S2+S3)	**102.164**	**111.648**	**46.474**		
%	**39%**	**43%**	**18%**		
				260.285	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	697.303	100%
Wood equivalent for energy (thousand m3)	260.285	37,3%
...of which wood energy directly from the forest (thousand m3)	49.818	19,1%
... of which black liquor (thousand m3 roundwood equivalent)	117.442	45,1%
Direct fuelwood consumption per inhabitant (m3/a)	0,15	
Estimated Energy content (Mtoe)	55,79	
Total primary energy supply TPES (Mtoe)	2594,94	
Wood energy in TPES (%)		2,1%

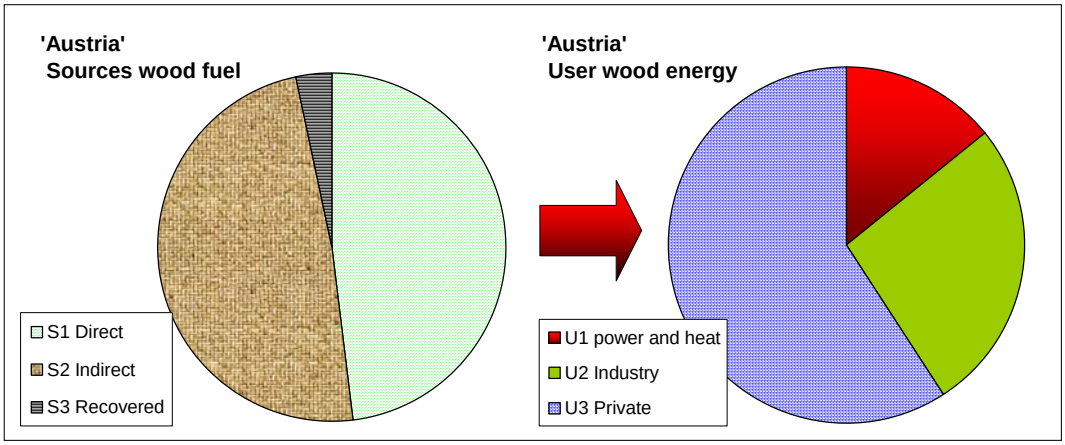


Austria

Inhabitants:	8.192.880
Total wood energy generation Roundwood equivalent m3 per inhabitant	1,76

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	6	160	6.763	6.929	48%
S2 Indirect	1.557	3.694	1.775	7.025	49%
S3 Recovered	488	n.a.	n.a.	488	3%
Sum (S1+S2+S3)	**2.051**	**3.855**	**8.538**		
%	**14%**	**27%**	**59%**		
				14.443	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	23.044	100%
Wood equivalent for energy (thousand m3)	14.443	62,7%
...of which wood energy directly from the forest (thousand m3)	6.929	48,0%
... of which black liquor (thousand m3 roundwood equivalent)	2.324	16,1%
Direct fuelwood consumption per inhabitant (m3/a)	0,85	
Estimated Energy content (Mtoe)	3,10	
Total primary energy supply TPES (Mtoe)	33,19	
Wood energy in TPES (%)		9,3%

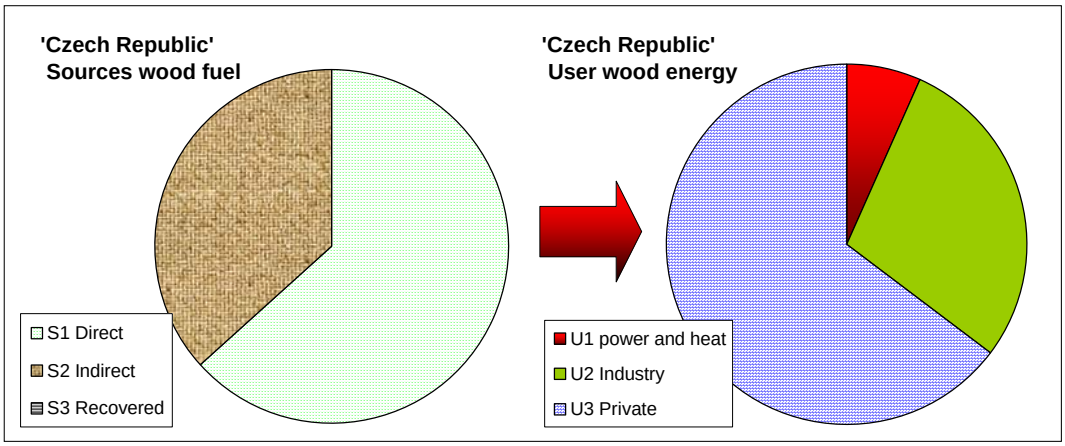


Czech Republic

Inhabitants:	10.235.455
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,78

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	n.a.	76	4.960	5.036	63%
S2 Indirect	538	2.194	171	2.903	37%
S3 Recovered	n.a.	n.a.	n.a.	n.a.	n.a.
Sum (S1+S2+S3)	**538**	**2.270**	**5.131**		
%	**7%**	**29%**	**65%**		
				7.939	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	15.156	100%
Wood equivalent for energy (thousand m3)	7.939	52,4%
...of which wood energy directly from the forest (thousand m3)	5.036	63,4%
... of which black liquor (thousand m3 roundwood equivalent)	975	12,3%
Direct fuelwood consumption per inhabitant (m3/a)	0,49	
Estimated Energy content (Mtoe)	1,70	
Total primary energy supply TPES (Mtoe)	45,53	
Wood energy in TPES (%)		3,7%

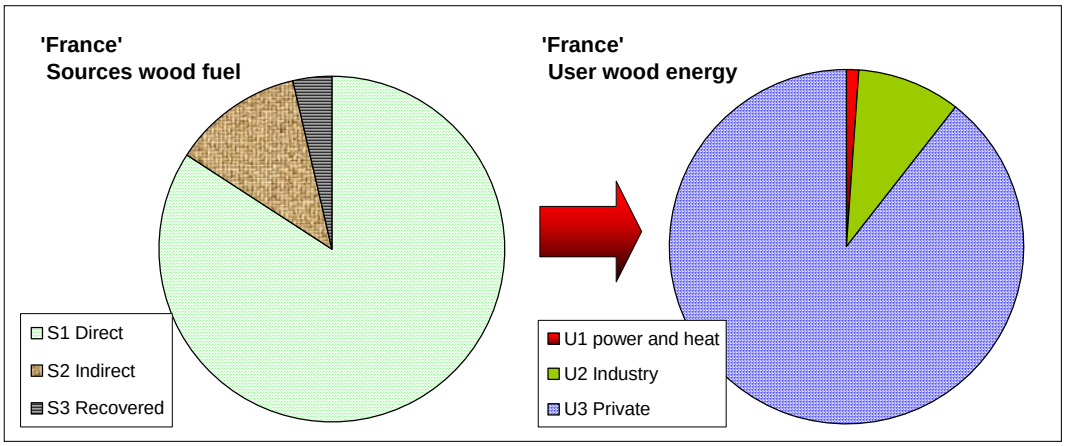


France

Inhabitants:	60.876.136
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,68

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	182	n.a.	34.605	34.787	84%
S2 Indirect	332	3.825	822	4.979	12%
S3 Recovered	n.a.	n.a.	1.500	1.500	4%
Sum (S1+S2+S3)	**514**	**3.825**	**36.927**		
%	**1%**	**9%**	**89%**		
				41.265	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	74.162	100%
Wood equivalent for energy (thousand m3)	41.265	55,6%
...of which wood energy directly from the forest (thousand m3)	34.787	84,3%
... of which black liquor (thousand m3 roundwood equivalent)	4.977	12,1%
Direct fuelwood consumption per inhabitant (m3/a)	0,57	
Estimated Energy content (Mtoe)	8,84	
Total primary energy supply TPES (Mtoe)	275,17	
Wood energy in TPES (%)		3,2%

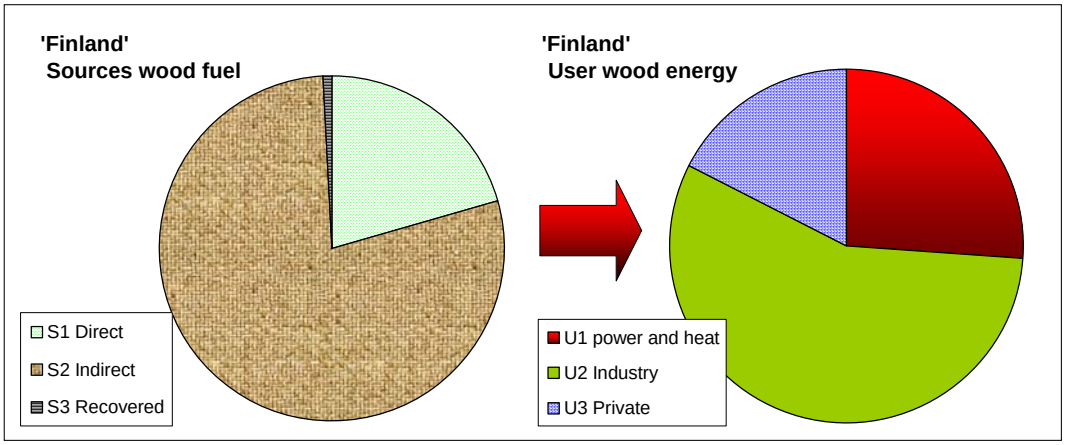


Finland

Inhabitants:	5.231.372
Total wood energy generation Roundwood equivalent m3 per inhabitant	6,29

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	1.579	570	4.653	6.803	21%
S2 Indirect	6.739	17.998	1.071	25.808	78%
S3 Recovered	276	27	n.a.	303	1%
Sum (S1+S2+S3)	**8.594**	**18.596**	**5.724**		
%	**26%**	**56%**	**17%**		
				32.913	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	63.579	100%
Wood equivalent for energy (thousand m3)	32.913	51,8%
...of which wood energy directly from the forest (thousand m3)	6.803	20,7%
... of which black liquor (thousand m3 roundwood equivalent)	19.120	58,1%
Direct fuelwood consumption per inhabitant (m3/a)	1,30	
Estimated Energy content (Mtoe)	7,05	
Total primary energy supply TPES (Mtoe)	38,09	
Wood energy in TPES (%)		18,5%

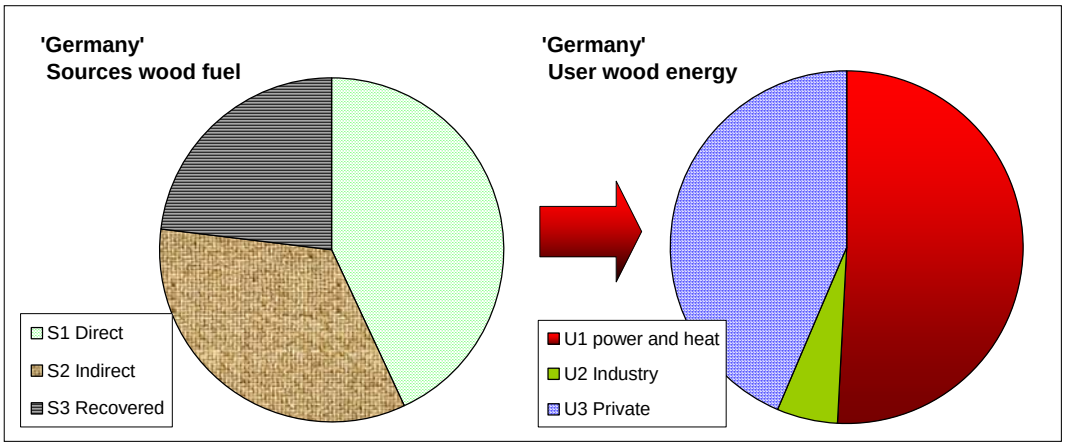


Germany

Inhabitants:	82.422.299
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,37

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	2.321	n.a.	10.702	13.023	43%
S2 Indirect	7.037	1.696	1.498	10.231	34%
S3 Recovered	6.006	n.a.	1.011	7.017	23%
Sum (S1+S2+S3)	**15.364**	**1.696**	**13.211**		
%	**51%**	**6%**	**44%**		
				30.271	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	61.922	100%
Wood equivalent for energy (thousand m3)	30.271	48,9%
...of which wood energy directly from the forest (thousand m3)	13.023	43,0%
... of which black liquor (thousand m3 roundwood equivalent)	1.696	5,6%
Direct fuelwood consumption per inhabitant (m3/a)	0,16	
Estimated Energy content (Mtoe)	6,49	
Total primary energy supply TPES (Mtoe)	348,04	
Wood energy in TPES (%)		1,9%

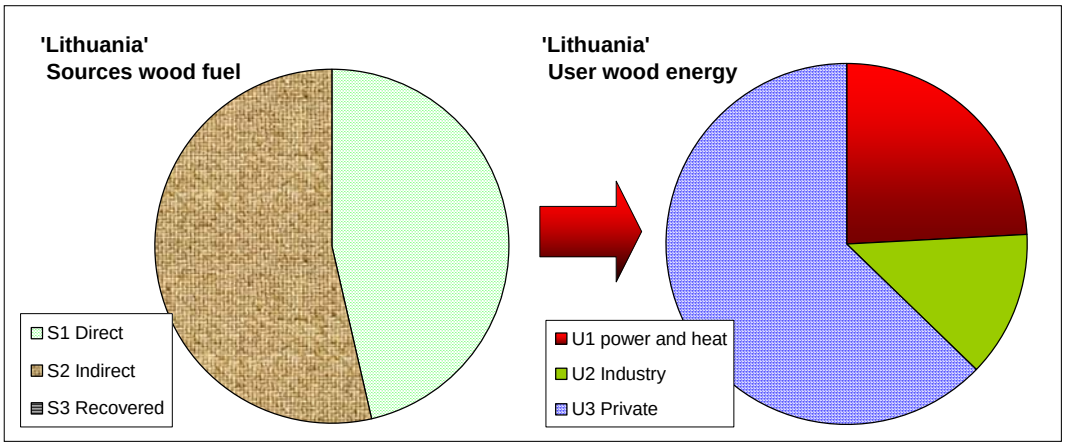


Lithuania

Inhabitants:	3.585.906
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,89

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	124	11	1.350	1.484	46%
S2 Indirect	651	411	662	1.724	54%
S3 Recovered	n.a.	n.a.	n.a.	n.a.	n.a.
Sum (S1+S2+S3)	**775**	**422**	**2.012**		
%	**24%**	**13%**	**63%**		
				3.209	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	5.226	100%
Wood equivalent for energy (thousand m3)	3.209	61,4%
...of which wood energy directly from the forest (thousand m3)	1.484	46,3%
... of which black liquor (thousand m3 roundwood equivalent)	n.a.	n.a.
Direct fuelwood consumption per inhabitant (m3/a)	0,41	
Estimated Energy content (Mtoe)	0,69	
Total primary energy supply TPES (Mtoe)	9,16	
Wood energy in TPES (%)		7,5%

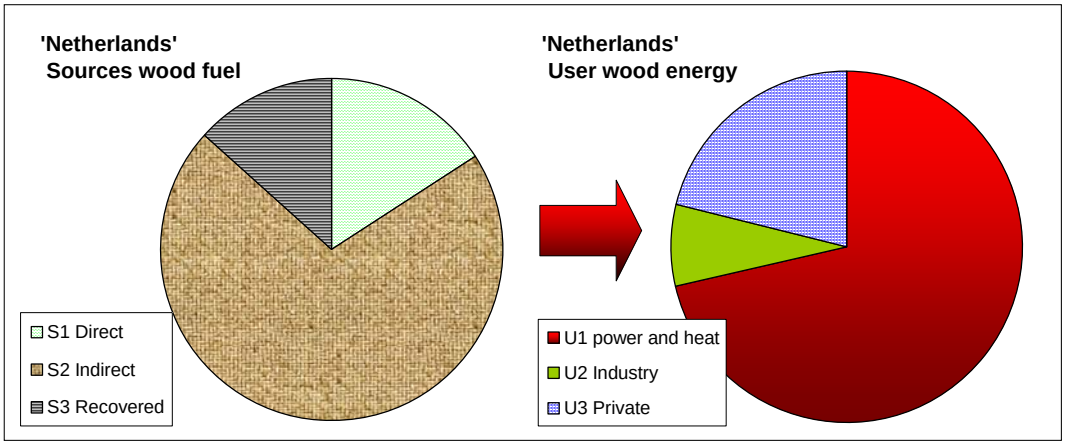


Netherlands

Inhabitants:	16.491.461
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,12

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	198	n.a.	115	313	16%
S2 Indirect	1.015	150	222	1.387	71%
S3 Recovered	188	n.a.	75	263	13%
Sum (S1+S2+S3)	**1.400**	**150**	**412**		
%	**71%**	**8%**	**21%**		
				1.962	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	950	100%
Wood equivalent for energy (thousand m3)	1.962	206,5%
...of which wood energy directly from the forest (thousand m3)	313	15,9%
... of which black liquor (thousand m3 roundwood equivalent)	n.a.	n.a.
Direct fuelwood consumption per inhabitant (m3/a)	0,02	
Estimated Energy content (Mtoe)	0,42	
Total primary energy supply TPES (Mtoe)	82,15	
Wood energy in TPES (%)		0,5%

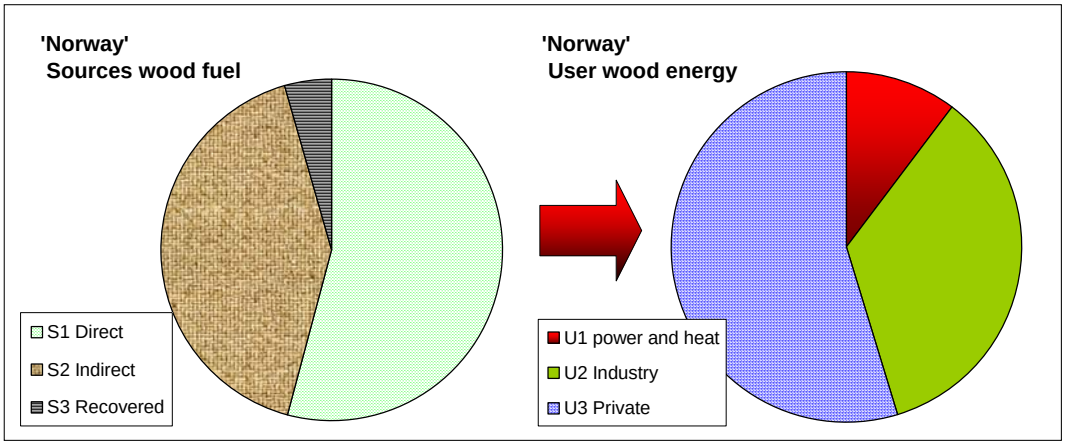


Norway

Inhabitants:	4.610.820
Total wood energy generation Roundwood equivalent m3 per inhabitant	1,25

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	n.a.	n.a.	3.128	3.128	54%
S2 Indirect	337	2.011	39	2.387	41%
S3 Recovered	258	n.a.	n.a.	258	4%
Sum (S1+S2+S3)	**595**	**2.011**	**3.167**		
%	**10%**	**35%**	**55%**		
				5.773	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	14.340	100%
Wood equivalent for energy (thousand m3)	5.773	40,3%
...of which wood energy directly from the forest (thousand m3)	3.128	54,2%
... of which black liquor (thousand m3 roundwood equivalent)	845	14,6%
Direct fuelwood consumption per inhabitant (m3/a)	0,68	
Estimated Energy content (Mtoe)	1,24	
Total primary energy supply TPES (Mtoe)	27,66	
Wood energy in TPES (%)		4,5%

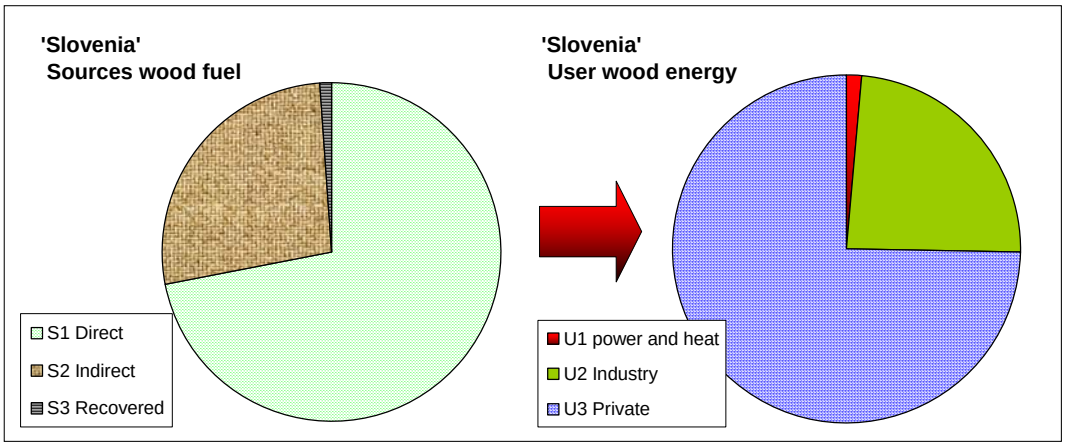


Slovenia

Inhabitants:	2.010.347
Total wood energy generation Roundwood equivalent m3 per inhabitant	1,10

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	n.a.	n.a.	1.591	1.591	72%
S2 Indirect	28	531	38	596	27%
S3 Recovered	n.a.	n.a.	26	26	1%
Sum (S1+S2+S3)	**28**	**531**	**1.655**		
%	**1%**	**24%**	**75%**		
				2.214	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	3.536	100%
Wood equivalent for energy (thousand m3)	2.214	62,6%
...of which wood energy directly from the forest (thousand m3)	1.591	71,9%
... of which black liquor (thousand m3 roundwood equivalent)	182	8,2%
Direct fuelwood consumption per inhabitant (m3/a)	0,79	
Estimated Energy content (Mtoe)	0,47	
Total primary energy supply TPES (Mtoe)	7,17	
Wood energy in TPES (%)		6,6%

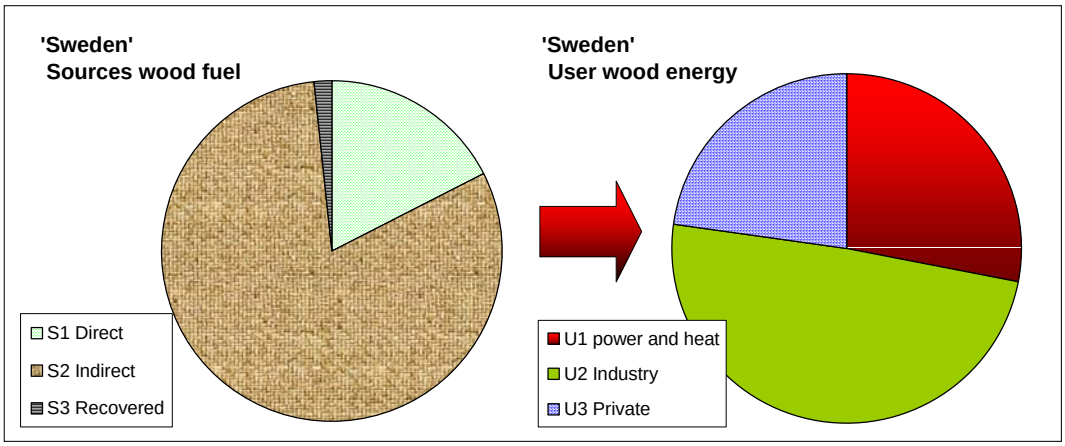


Sweden

Inhabitants:	9.016.596
Total wood energy generation Roundwood equivalent m3 per inhabitant	4,37

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	n.a.	n.a.	6.923	6.923	18%
S2 Indirect	10.302	19.458	2.000	31.760	81%
S3 Recovered	694	n.a.	n.a.	694	2%
Sum (S1+S2+S3)	**10.995**	**19.458**	**8.923**		
%	**28%**	**49%**	**23%**		
				39.377	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	103.791	100%
Wood equivalent for energy (thousand m3)	39.377	37,9%
...of which wood energy directly from the forest (thousand m3)	6.923	17,6%
... of which black liquor (thousand m3 roundwood equivalent)	15.452	39,2%
Direct fuelwood consumption per inhabitant (m3/a)	0,77	
Estimated Energy content (Mtoe)	8,44	
Total primary energy supply TPES (Mtoe)	53,94	
Wood energy in TPES (%)		15,6%

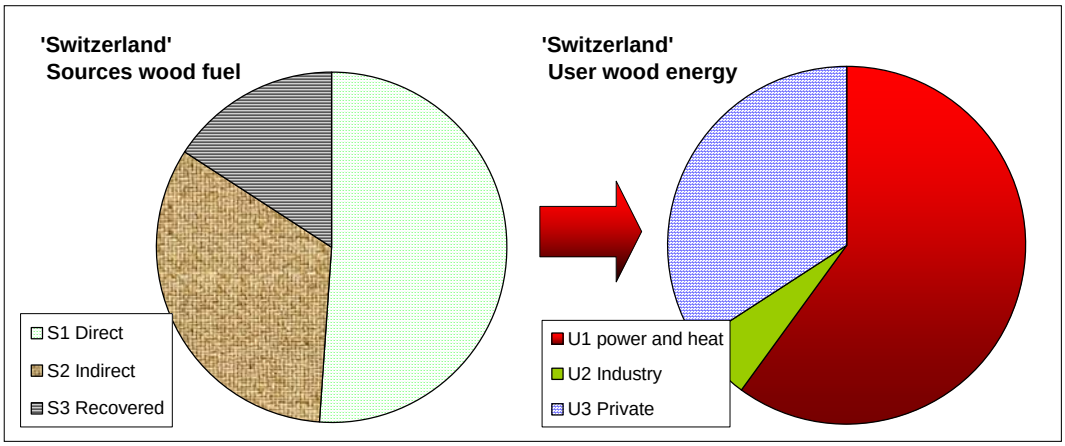


Switzerland

Inhabitants:	7.523.934
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,50

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	716	n.a.	1.219	1.935	51%
S2 Indirect	952	224	74	1.250	33%
S3 Recovered	600	n.a.	n.a.	600	16%
Sum (S1+S2+S3)	**2.268**	**224**	**1.293**		
%	**60%**	**6%**	**34%**		
				3.785	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	4.340	100%
Wood equivalent for energy (thousand m3)	3.785	87,2%
...of which wood energy directly from the forest (thousand m3)	1.935	51,1%
... of which black liquor (thousand m3 roundwood equivalent)	224	5,9%
Direct fuelwood consumption per inhabitant (m3/a)	0,26	
Estimated Energy content (Mtoe)	0,81	
Total primary energy supply TPES (Mtoe)	27,13	
Wood energy in TPES (%)		3,0%

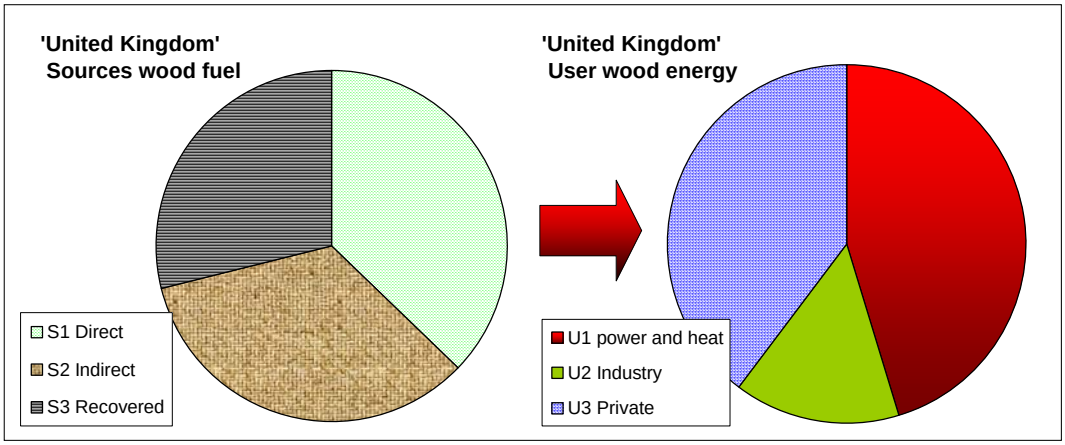


United Kingdom

Inhabitants:	60.609.153
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,03

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	258	235	88	580	37%
S2 Indirect	n.a.	n.a.	532	532	34%
S3 Recovered	450	n.a.	n.a.	450	29%
Sum (S1+S2+S3)	**708**	**235**	**620**		
%	**45%**	**15%**	**40%**		
				1.562	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	8.338	100%
Wood equivalent for energy (thousand m3)	1.562	18,7%
...of which wood energy directly from the forest (thousand m3)	580	37,1%
... of which black liquor (thousand m3 roundwood equivalent)	n.a.	n.a.
Direct fuelwood consumption per inhabitant (m3/a)	0,01	
Estimated Energy content (Mtoe)	0,33	
Total primary energy supply TPES (Mtoe)	233,69	
Wood energy in TPES (%)		0,1%

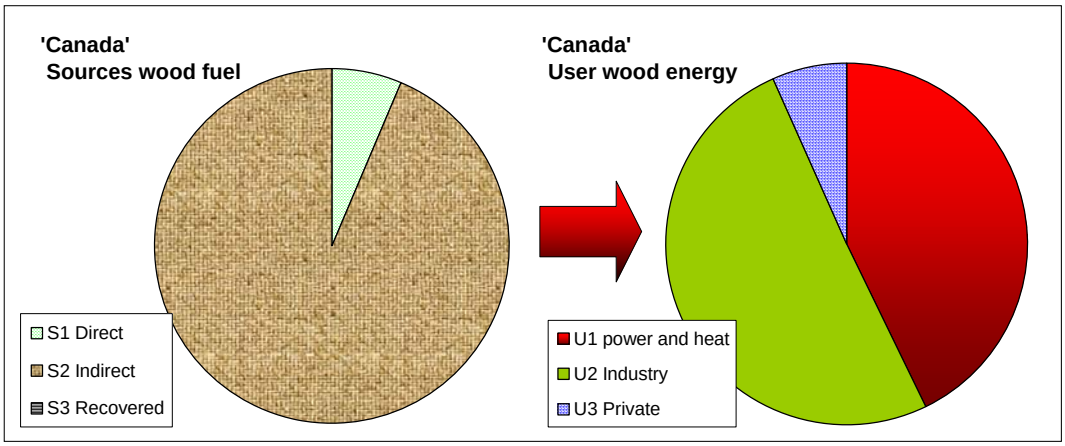


Canada

Inhabitants:	33.098.932
Total wood energy generation Roundwood equivalent m3 per inhabitant	1,44

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	n.a.	n.a.	3.080	3.080	6%
S2 Indirect	20.402	24.178	150	44.730	94%
S3 Recovered	n.a.	n.a.	n.a.	n.a.	n.a.
Sum (S1+S2+S3)	**20.402**	**24.178**	**3.230**		
%	**43%**	**51%**	**7%**		
				47.810	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	204.410	100%
Wood equivalent for energy (thousand m3)	47.810	23,4%
...of which wood energy directly from the forest (thousand m3)	3.080	6,4%
... of which black liquor (thousand m3 roundwood equivalent)	20.178	42,2%
Direct fuelwood consumption per inhabitant (m3/a)	0,09	
Estimated Energy content (Mtoe)	10,25	
Total primary energy supply TPES (Mtoe)	269,05	
Wood energy in TPES (%)		3,8%

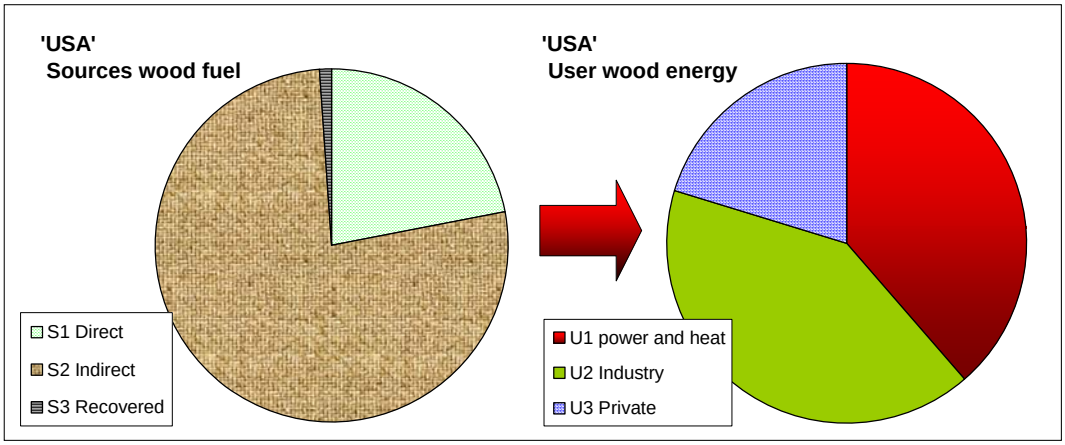


USA

Inhabitants:	298.444.215
Total wood energy generation Roundwood equivalent m3 per inhabitant	0,71

[1 000 m3]	U1 Power and heat	U2 Industrial	U3 Private households	Sum (U1+U2+U3)	%
S1 Direct	5.321	n.a.	41.417	46.738	22%
S2 Indirect	73.935	87.470	1.826	163.231	77%
S3 Recovered	2.506	n.a.	n.a.	2.506	1%
Sum (S1+S2+S3)	**81.762**	**87.470**	**43.244**		
%	**38%**	**41%**	**20%**		
				212.475	

	Total	%
Total volumes (thousand m³) of roundwood available (annually)	492.893	100%
Wood equivalent for energy (thousand m3)	212.475	43,1%
...of which wood energy directly from the forest (thousand m3)	46.738	22,0%
... of which black liquor (thousand m3 roundwood equivalent)	97.264	45,8%
Direct fuelwood consumption per inhabitant (m3/a)	0,16	
Estimated Energy content (Mtoe)	45,54	
Total primary energy supply TPES (Mtoe)	2325,89	
Wood energy in TPES (%)		2,0%



ANNEX III: Correspondents

Country	Full Name	E-mail	Type
Armenia	Mr. Ashot ANANYAN	armstat@sci.am	JFSQ
Austria	Mr. Adolf Merl	adolf.merl@chello.at	COST E31
Austria	Mr. Gerfried Jungmeier	gerfried.jungmeier@joanneum.at	COST E31
Austria	Mr. Johannes HANGLER	johannes.hangler@lebensministerium.at	JFSQ
Austria	Mr. Wolfgang Bittermann	Wolfgang.Bittermann@statistik.gv.at	JFSQ
Azerbaijan	Mr. Rafael S. SULEYMANOV	ssc@mednet.az, rafael@azstat.org	JFSQ
Canada	Ms. Susan PHELPS	sphelps@nrcan.gc.ca	JFSQ
Canada	Ms. Joanne Frappier	Frappier@NRCan.gc.ca	other
Canada	Mr. Rober Jones	RJones@NRCan.gc.ca	other
Canada	Ms. Annie Savoie	ASavoie@NRCan.gc.ca	other
Canada	Mr. Rob St-Jean	RStJean@NRCan.gc.ca	other
Canada	Mr. Christian Wolfe	CWolfe@NRCan.gc.ca	other
Cyprus	Mr. Aristides IOANNOU	planning@fd.moa.gov.cy	JFSQ
Cyprus	A. Horattas	planning@fd.moa.gov.cy	other
Cyprus	Andreas Stavrides	AStavrides@fd.moa.gov.cy	other
Czech Republic	Mr. Václav STRÁNSKÝ	stransky@mze.cz, Vaclav.Stransky@mze.cz	JFSQ
Czech Republic	Mr. Milan CINKA	milan.cinka@mze.cz	JWPFES
Finland	Mr. Mika MUSTONEN	mika.mustonen@metla.fi	JFSQ
Finland	Mr. Martti AARNE	martti.aarne@metla.fi	JWPFES
Finland	Mr. Esa Ylitalo	esa.ylitalo@metla.fi	other
France	M. Michel MOREL	Michel-Paul.Morel@agriculture.gouv.fr	JFSQ
France	M Alain CHAUDRON	alain.chaudron@agriculture.gouv.fr	JFSQ
France	Ms. Veronique Joucla	veronique.joucla@agriculture.gouv.fr	other
France	Ms. Helene Thienard	helene.thienard@industrie.gouv.fr	other
France	M Jean-Christophe Pouet	Jean-Christophe.Pouet@ademe.fr	other
France	Ms. Martine LECLERCQ	martine.leclercq@industrie.gouv.fr	other
France	M Benjamin BEAUSSANT	benjamin.beaussant@agriculture.gouv.fr	other
France	M Jacques ANDRIEU	jacques.andrieu@agriculture.gouv.fr	other
Germany	Mr. Sebastian Rüte	s.rueter@holz.uni-hamburg.de	COST E31
Kyrgyzstan	Mr. Djanbulat BAIJUMANOV	nsc_mail@stat.kg, icd@stat.kg	JFSQ
Latvia	Ms. Aija BUDREIKO	aija.budreiko@zm.gov.lv	JFSQ
Lithuania	Mr. Andrius KULIESIS	vmt@lvmi.lt	JFSQ
Lithuania	Mr. Andrius KULIESIS	vmt@lvmi.lt	JWPFES
Lithuania	Ms. Sandra Mileriute	milersandra@hotmail.com	other
Netherlands	Mr. Nico A. LEEK	nico.leek@probos.net	JFSQ
Netherlands	Mr. Jacob Jan Bakker	j.j.bakker@minlnv.nl	Other
Netherlands	Mr. Gerard Grimberg	g.t.m.grimberg@minlnv.nl	Other
Norway	Mrs. Hanne HAANAES	hanne.haanas@ssb.no	JFSQ
Norway	Mr. Harald AALDE	harald.aalde@lmd.dep.no	JWPFES
Norway	Mr. Trond Amund Steinset,	trond.amund.steinset@ssb.no	other
Slovenia	Ms. Irena TOMSIC	irena.tomsic@gov.si	JFSQ
Slovenia	Mr. Maksimilijan MOHORIC	maksimiljan.mohoric@gov.si	JWPFES
Slovenia	Dr Mitja Piskur	mitja.piskur@gozdis.si	other
Slovenia	Mr. Tomaz Remic	Tomaz.Remic@gov.si	other

ANNEX III: Correspondents

Country	Full Name	E-mail	Type
Slovenia	Ms. Nike Krajnc	nike.krajnc@gozdis.si	other
Sweden	Mr. Surendra JOSHI	surendra.joshi@svo.se	JFSQ
Sweden	Mr. Peter BLOMBACK	peter.blomback@svo.se	JWPFES
Sweden	Mr. Surendra Joshi		other
Sweden	Mr. Stefan Holm	Stefan.Holm@stem.se	other
Sweden	Mr. Jan-Olof Loman	jan-olof.loman@skogsstyrelsen.se	other
Sweden	Mr. Jan-Olof Backe	jan-olov.backe@skogsstyrelsen.se	other
Switzerland	Mr. David WALKER	david.walker@bafu.admin.ch	JFSQ
Switzerland	Ms. Claire-Luise Suter	Claire-Lise.Suter@bafu.admin.ch	JFSQ
Switzerland	Mr. Marco ZANETTI	marco.zanetti@buwal.admin.ch	JWPFES
The former Yugoslav Republic of Macedonia	Mrs. Lence PETROVA	lencep@stat.gov.mk	JFSQ
The former Yugoslav Republic of Macedonia	Ms. Mira Dojcinovska	mira.dojcinovska@stat.gov.mk	other
Ukraine	Mr. Yuri M. OSTAPCHUK	cooperation@ukrstat.gov.ua	JFSQ
Ukraine	Dr. Mykola Afanasyev	M.Afanasyev@ukrstat.gov.ua	other
United Kingdom	Mr. Simon GILLAM	simon.gillam@forestry.gsi.gov.uk	JFSQ
United Kingdom	Mr. Jim Dewar,	james.dewar@forestry.gsi.gov.uk	other
United Kingdom	Miss Sally Mercer	Sally.Mercer@dti.gsi.gov.uk	other
United Kingdom	Mr. Eric McRory	eric.mcrory@forestry.gsi.gov.uk	other
United Kingdom	Ms. Helen McKay	helen.mckay@forestry.gsi.gov.uk	other
United Kingdom	Mr. Notley Richard	Richard.Notley@dti.gsi.gov.uk	other
United States of America	Mr. James L. HOWARD	jlhoward@fs.fed.us	JFSQ
United States of America	Mr. Thomas WESTCOT	Thomas.Westcot@fas.usda.gov	JWPFES
United States of America	Mr. Kenneth E Skog	kskog@fs.fed.us	other
EU	Mr. Jeremy Wall	Jeremy.Wall@cec.eu.int	other
EurobservER	Mr. Gaetan Fovez	gaetan.fovez@energies-renouvelables.org	other
FAO	Mr. Adrian Whiteman	Adrian.Whiteman@fao.org	other
FAO	Mr. Arvydas Lebedys	Arvydas.Lebedys@fao.org	other
FAO	Mr. Andreas Fischer Ankern	Andreas.FischerAnkern@fao.org	other
FAO	Mr. Miguel Trossero	Miguel.Trossero@fao.org	other
Germany	Mr. Udo Mantau		other
IEA	Mr. Michel Francoeur	Michel.FRANCOEUR@iea.or	other
UNECE/FAO	Mr. Douglas Clark	Douglas.Clark@unece.org	other
UNECE/FAO	Mr. Alex McCusker	Alex.McCusker@unece.org	other
UNECE/FAO	Mr. Christopher Prins	Christopher.Prins@fao.org	other
UNECE/FAO	Mr. Florian Steierer	florian.steierer@unece.org	other