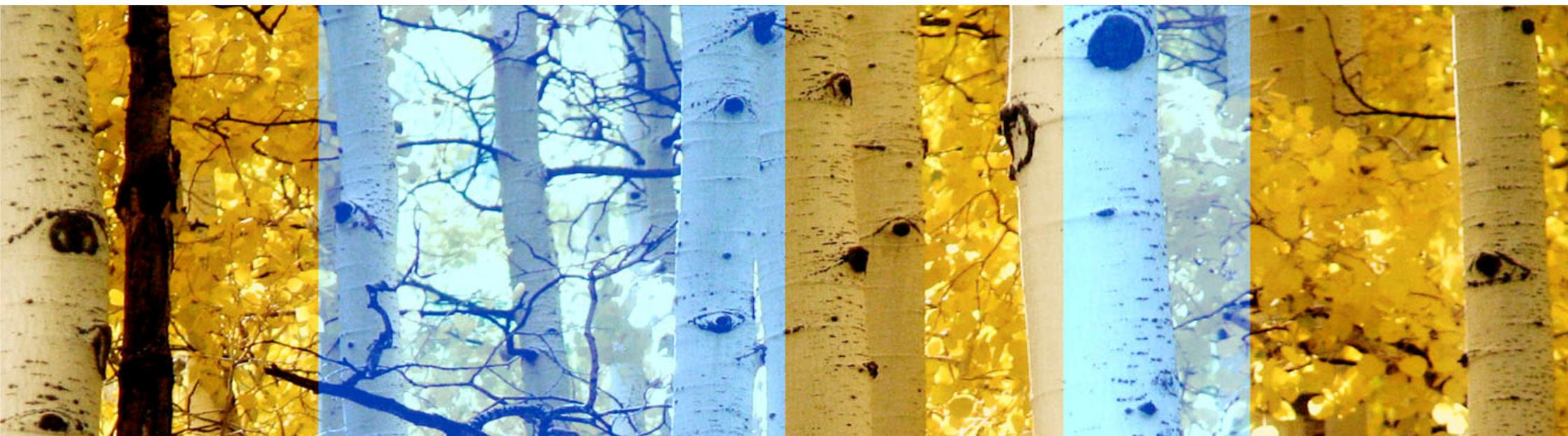


Outlook of Wood Biomass for Energy in the EU-28

Birdlife, FERN and Transport & Environment

Final Report

8090



23 June 2017

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1. Introduction

The new Renewable Energy Directive for 2020 - 2030 is now under discussion at the EU level. Today, bioenergy accounts for about 64% of all renewable energy. The energetic end-use by different sectors (heat, electricity & transport) is relatively well-known. However, very little is known about the quality or type of biomass used at the EU level, especially for solid biomass including wood.

Birdlife, FERN and Transport & Environment are Brussels-based NGOs working within the EU bioenergy and transport policies based on the principles of sustainable development at EU and global level. This report presents Indufor's findings of a study to gather data on what type of wood biomass is used for energy in Europe.

The objectives of this assignment were:

- To provide factual evidence on the types of wood biomass used at EU and member state level, and
- Review existing projections for how much harvesting will increase and whether this is due to bioenergy consumption or not.



2. Scope of Work

The survey focused on wood used for energy by categories and assortments as follows:

1. Main products
 - Roundwood
 - Short rotation wood
2. Primary residues
 - Tops and branches
 - Stumps
 - Energywood from young forests
 - Rejected logs
3. Forest industry by-products
 - Wood chips
 - Sawdust
 - Bark
 - Black liquor
4. Wood pellets
5. Waste wood.



3. Consumption of Wood for Energy in the EU-28 by Type

Data Sources

Data of wood energy consumption was screened from several sources including:

- National Statistics
- International statistics of wood and biomass consumption
- Sectoral studies of wood energy
- Indufor databanks.

If the time series for consecutive years was incomplete or had gaps the same data value was continued for the following years until the next actual data point.



3. Consumption of Wood for Energy in the EU-28 by Type

Conversion Factors of Wood Assortments

Statistics present the consumption of wood for energy or energy derived from wood in different units, typically volume, mass or energy.

To present and compare the shares of different types of wood used for energy in commensurable manner they needed to be converted to energy units based on their calorific value.

Following conversion factors were used to convert units of volume or mass to energy.

Wood type	Volume	Mass	Calorific value
	m³	tonne	MWh
Roundwood	1	0,45	2
Short Rotation Wood	1	0,45	2
Primary residues	1	0,42	2
By-Product Wood Chips and Sawdust	1	0,42	1,9
Bark	1	0,3	1,4
Black Liquor	3,1*	1	3,25
Wood Pellets	2,1	1	4,6
Waste Wood	1	0,45	2,1

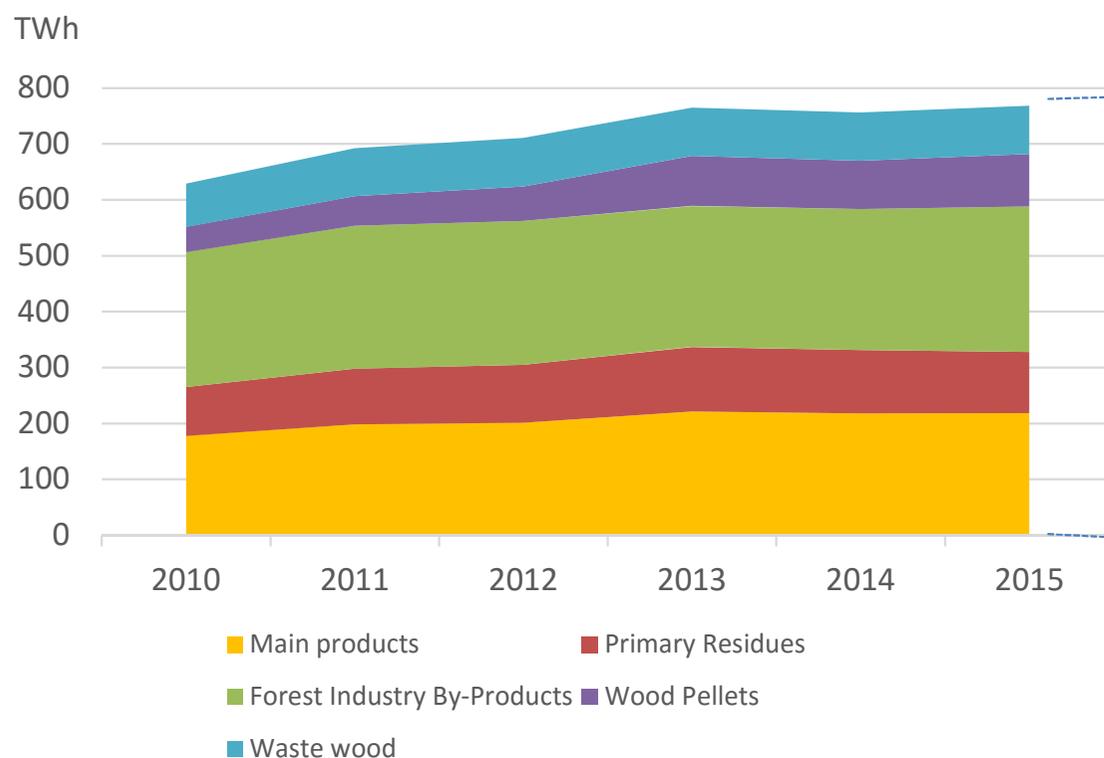
*m³ of roundwood equivalent



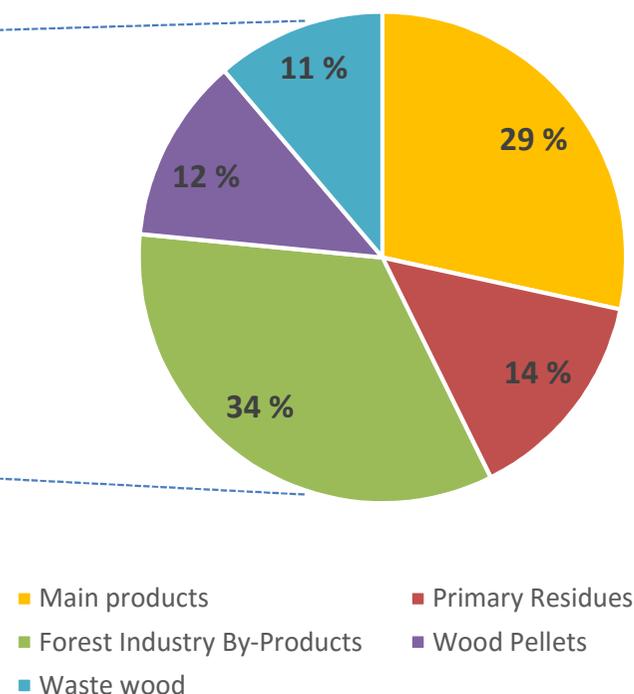
3. Consumption of Wood for Energy in the EU-28 by Type

On the EU-28 level forest industry by-products present the largest category of wood used for energy. Altogether 43% of energy is produced by main products and primary residues that have no previous use.

Consumption by Category 2010-2015



Consumption by Category 2015



3. Consumption of Wood for Energy in the EU-28 by Type

Development of Assortments for Energy

The share of wood pellets has doubled during the reference period. EU domestic production consists of about 2/3 of the total consumption, the rest is imported.

The consumption growth has been fast for primary wood biomass for energy i.e. firewood and primary residues, the first being the largest single wood assortment in the energy consumption.

Consumption of forest industry by-products have generally been following the trends of sawnwood, pulp, and paper production and have grown modestly.

Black liquor consumption has increased due to investments into new coniferous kraft pulp production capacity, especially in Finland and Sweden.

Development of Wood Consumption for Energy by Assortment 2010-2015

TWh	2010	2011	2012	2013	2014	2015	CAGR*
Roundwood (firewood)	178	191	194	212	208	209	2,7 %
Short Rotation Wood	n.a.	7	7	9	9	9	5,2 %
Primary residues	87	100	104	116	113	110	3,9 %
Residue Chips and Sawdust	82	87	88	78	77	84	0,4 %
Bark	45	55	54	56	56	56	3,8 %
Black Liquor	115	114	115	119	119	120	1,4 %
Wood Pellets	45	53	62	89	86	94	13,1 %
Waste Wood	77	86	87	86	87	86	1,9 %
Wood Total	629	692	710	765	756	769	3,2 %

*CAGR = Compound Annual Growth Rate



4. Consumption of Wood for Energy in the EU-28 by End-Use

Definitions

The consumption of wood for energy was estimated for the following end-use segments:

Power and Heat: The consumption in this segment refers to plants which are independently producing electricity/combined heat and power (CHP) or heat only. This excludes the heat and electricity production within the forest industries.

Industrial: The industrial consumption segment refers mainly to production and consumption of biomass for energy within the forest industries for their primary production activity (e.g. electricity for pulp production or heat for sawnwood drying).

Residential and Other: This segment refers to consumption of wood for energy in residential, household and other small scale applications.

Liquid Biofuels: This segment refers to consumption of wood for liquid biofuels (biodiesel, bioethanol, tall oil) that can be used in transport and combusted in power plants. Currently marginal segment, however estimated to grow in the future.

The estimate was based on the screening of JWEE (Joint Wood Energy Enquiry) data on end uses of wood per segment in specific countries. For the countries not included in the JWEE study AEBIOM average figures of biomass division per enduse segments were used.

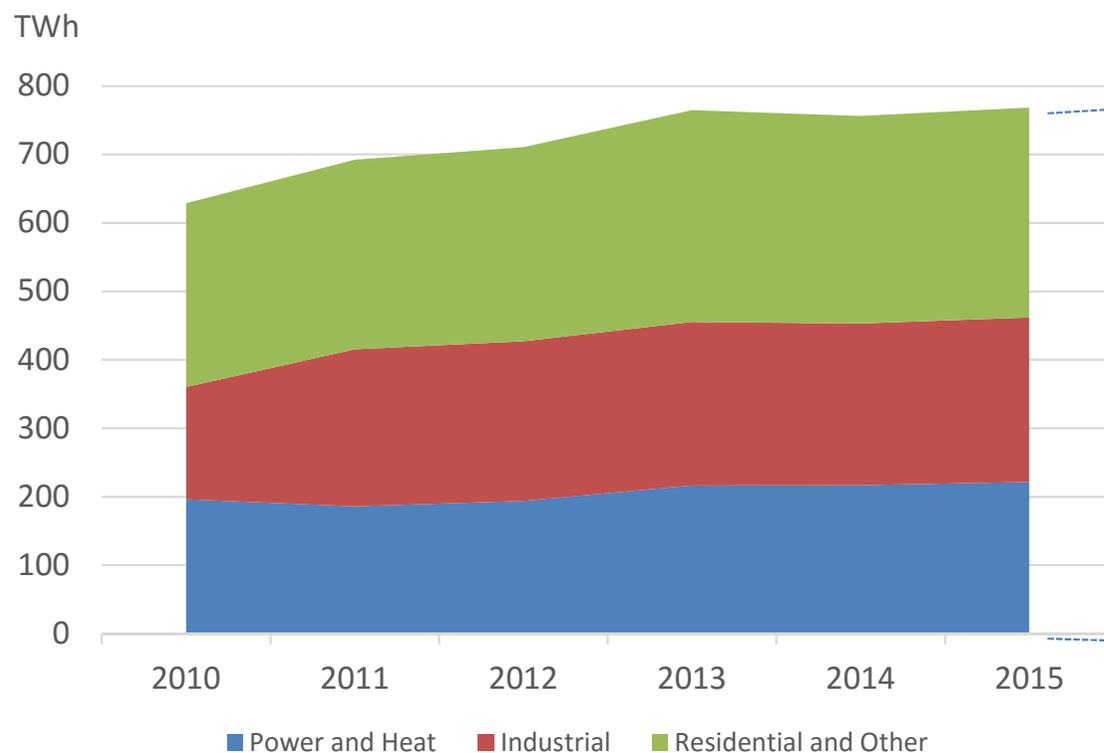


4. Consumption of Wood for Energy in the EU-28 by End-Use

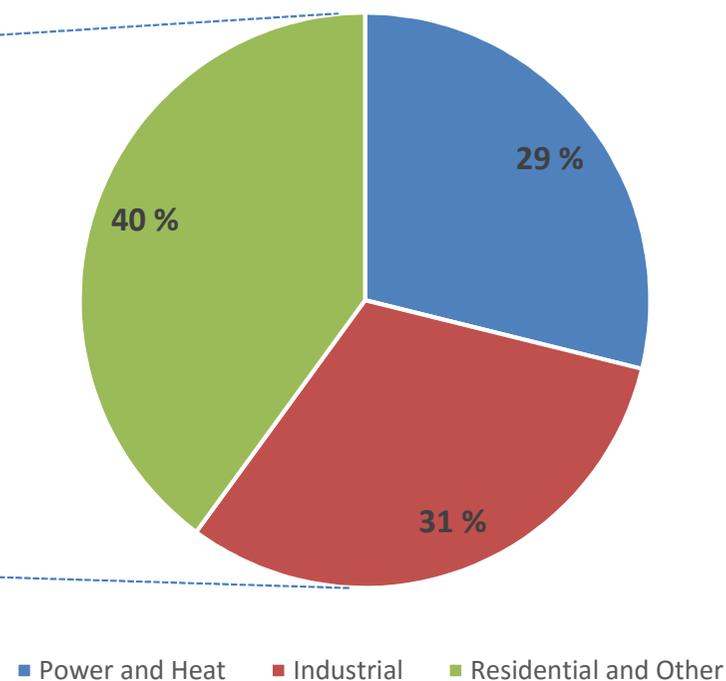
Residential consumption accounts the largest part of biomass energy consumption.

Input to power and heat production and consumption within the industrial segment comprise both about 30% of the consumption.

Consumption by End Use 2010-2015



Consumption by End Use 2015



5. Development of Wood Harvesting in the EU-28

Method and Data Sources

The Consultant reviewed existing data and projections on how much harvesting will increase for industrial roundwood and fuelwood.

Data sources for historical production volumes: Eurostat, FAOSTAT

The synthesis of harvest forecasts included the following data sources:

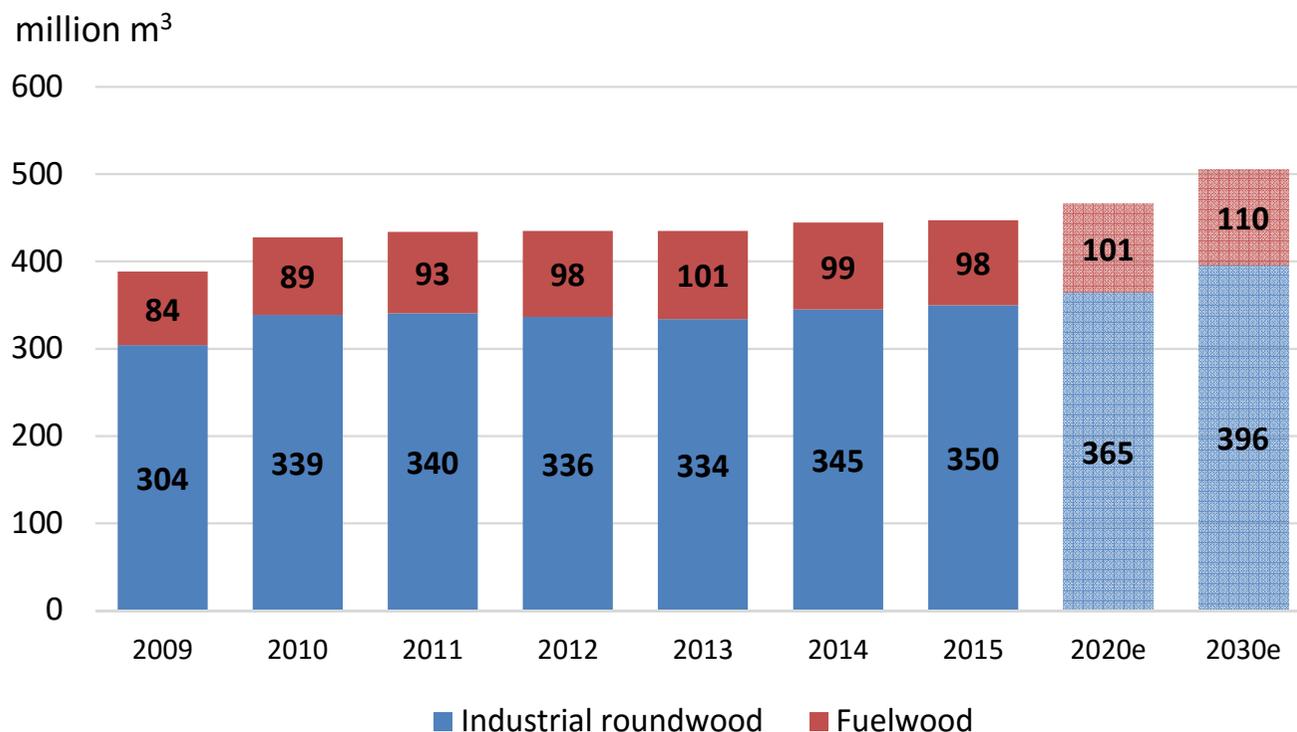
- 2016-2017 COFFI Market Forecasts (UNECE)
- Sweden: The IVL Scenario: Energy Scenario for Sweden 2050. Based on Renewable Energy Technologies and Sources; Production scenario
- Finland: National Forest Strategy 2025; Largest sustainable harvesting scenario (SK)
- Germany: Adapting the GFPM to local requirements (on the example of Germany) UNECE/FAO-ToS-Outlook-Workshop; Mean Dem scenario
- Poland: Development Simulation of Forest Resources in Poland
- France: Submission of information on forest management reference levels by France (UNFCCC)
- Other countries: Study on impacts on resource efficiency of future EU demand for bioenergy (ReceBio); Baseline scenario.



5. Development of Wood Harvesting in the EU-28

Recovered from a significant drop of demand for wood products in the EU in 2009, roundwood production started to stabilize in 2010 and has been gradually increasing since. The synthesis of the projection illustrates that the upward trend is expected to continue and by 2030 the total EU roundwood production is expected reach 500 million m³.

Harvest of Industrial Roundwood and Fuelwood in the EU-28, 2009-2030



CAGR	2009-2015	2015-2020	2020-2030
Industrial roundwood	2,0 %	0,7 %	1,4 %
Fuelwood	2,1 %	0,6 %	1,4 %
Wood total	2,0 %	0,7 %	1,4 %



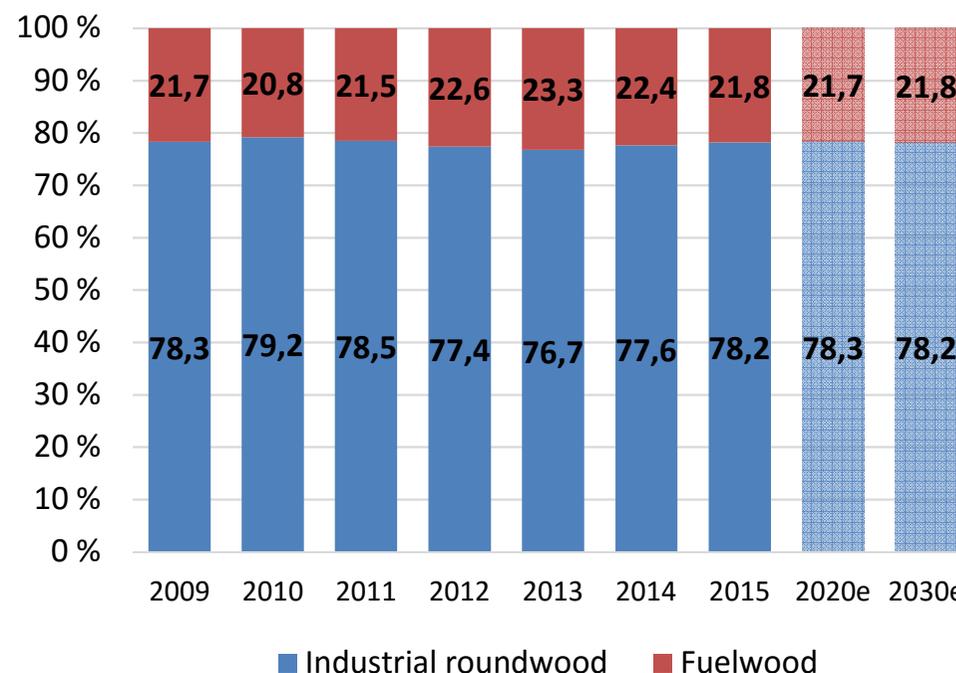
5. Development of Wood Harvesting in the EU-28

The share of fuelwood in total harvest has been slightly above 20%. Volume of fuelwood harvested has been increasing until 2013, but declined to the level of 21.8% in 2015.

Although the absolute harvesting volume of both industrial roundwood and fuelwood is expected to increase as projected in the previous slide, their shares are expected to remain stable.

The definition of fuelwood by FAOSTAT covers the wood types that in this study are defined as the main products and primary residues.

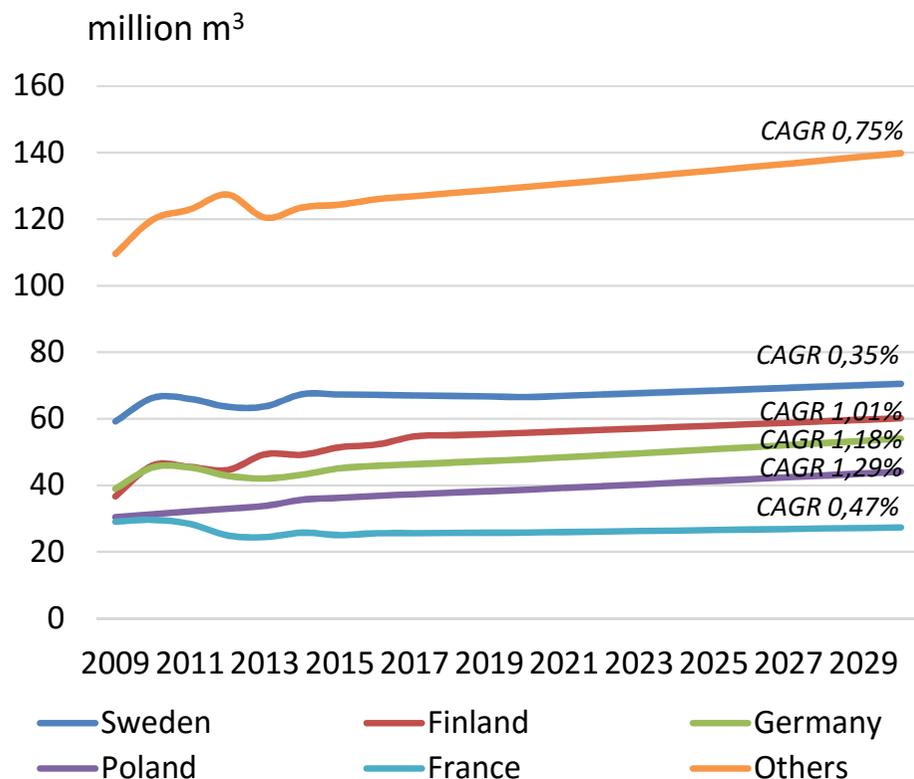
Development of Industrial Roundwood and Fuelwood Shares of Total Harvest in the EU-28, 2009-2030



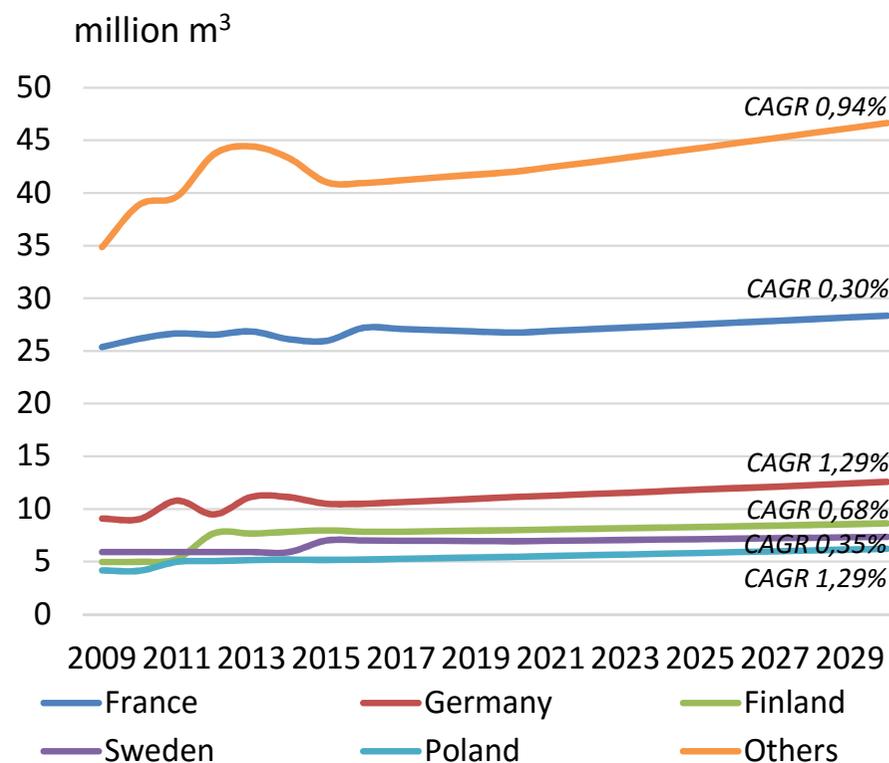
5. Development of Wood Harvesting in the EU-28

Top-5 EU producers of industrial roundwood are also the biggest producers of fuelwood, though their order is different. Together they produce nearly 65% of industrial roundwood and 60% of fuelwood in the EU. Based on various national and EU-level projections the expected CAGR for both roundwood categories over the course of 2016-2030 will be 0,74%.

Industrial roundwood 2009-2030



Fuelwood 2009-2030



5. Development of Wood Harvesting in the EU-28

Drivers of increased wood consumption

Poland:

- Increased consumption of wood biomass for bioenergy and construction, several published investment plans.
- Substantial investment plans into the forest industry - Egger's particleboard mill in Biskupiec, Forte's particleboard mill in Suwalki, Velvet Care's production halls at the tissue paper plant in Klucze, etc.

Germany:

- Increased consumption of wood biomass for bioenergy and construction, several published investment plans.
- Substantial investment plans into the forest industry – investments into recycling wood in Pfeleiderer's particleboard mill in Neumarkt, Homag Group's investment into modernising equipment in Calw-Holzbronn, SchwörerHaus' investment in expanding production of wooden-construction modules, etc.

Finland:

- Increased use of wood biomass in heating, CHP production and the manufacture of transport biofuels and other bioliquids.
- Substantial investment plans into the forest industry – Pulp mill in Äänekoski (start 2018), biorefinery in Kemijärvi, second generation biorefinery in Kemi, etc.

France:

- Increased consumption of wood biomass for bioenergy and construction
- Moderate investment plans into the forest industry and wood-based bioenergy, e.g. conversion of a coal-fired power station in Paris to co-firing with pellets

Sweden:

- Increased consumption of wood biomass for bioenergy and construction, several published investment plans
- Moderate investment plans into the forest industry, e.g. Södra and SCA investments in pulp mills and sawmills



6. Consumption of Wood for Energy - Country Cases

A detailed analysis of development of wood biomass types for energy has been done for four countries. The chosen countries present a variable sample of EU member states in terms of geography, forest types and structure of wood consuming industries:

- Estonia
- Germany
- Spain
- Sweden.



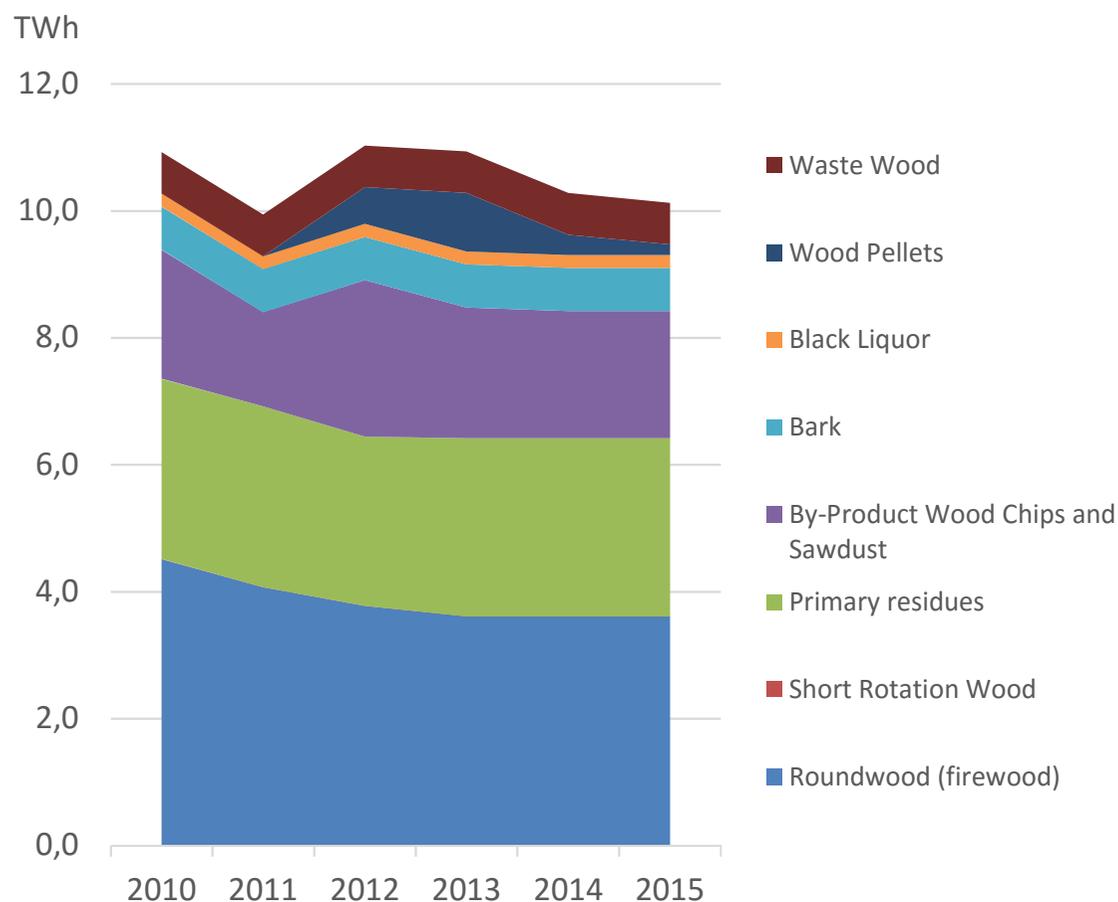
6. Consumption of Wood for Energy - Country Cases

Estonia

In Estonia, the energetic consumption of wood has stagnated during the reference period.

Roundwood and primary residues account almost for 2/3 of total energy consumption of wood.

Industrial residues together account for 28% of total energetic consumption of wood.



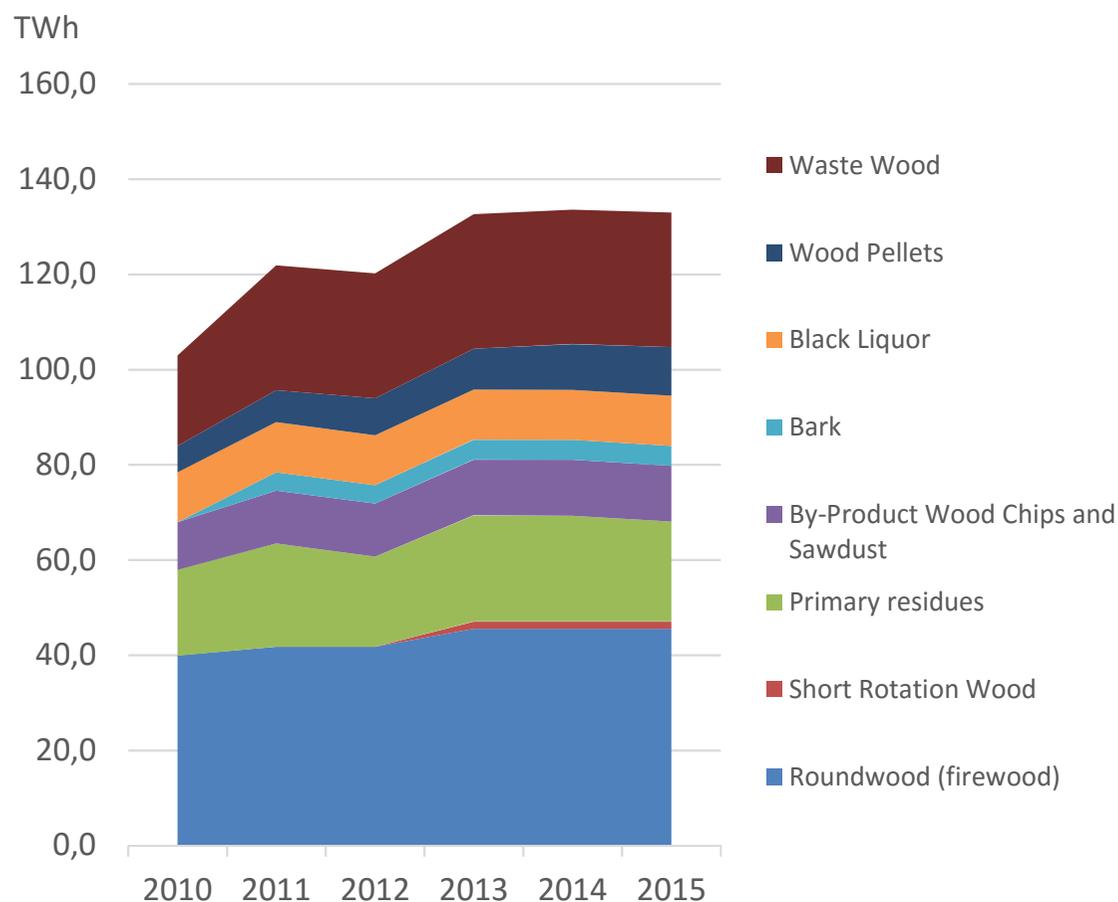
6. Consumption of Wood for Energy - Country Cases

Germany

In Germany, roundwood is the largest single type of wood used for energy accounting for about 1/3 of total

The use of wood pellets and waste wood has been increasing throughout the period.

Forest industry by-products comprise about 20% of the total.

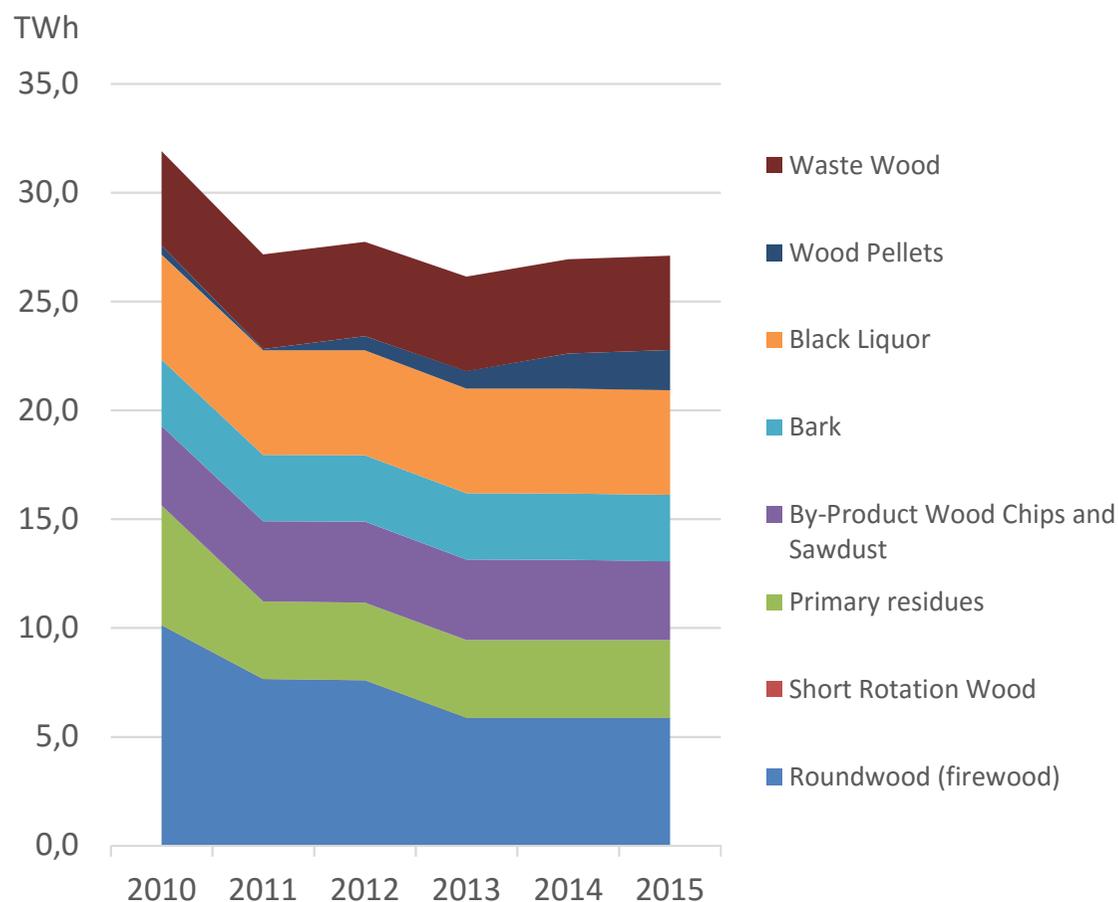


6. Consumption of Wood for Energy - Country Cases

Spain

In Spain, the forest industry by products are the largest type of wood used for energy.

The consumption of roundwood has been decreasing during the period.

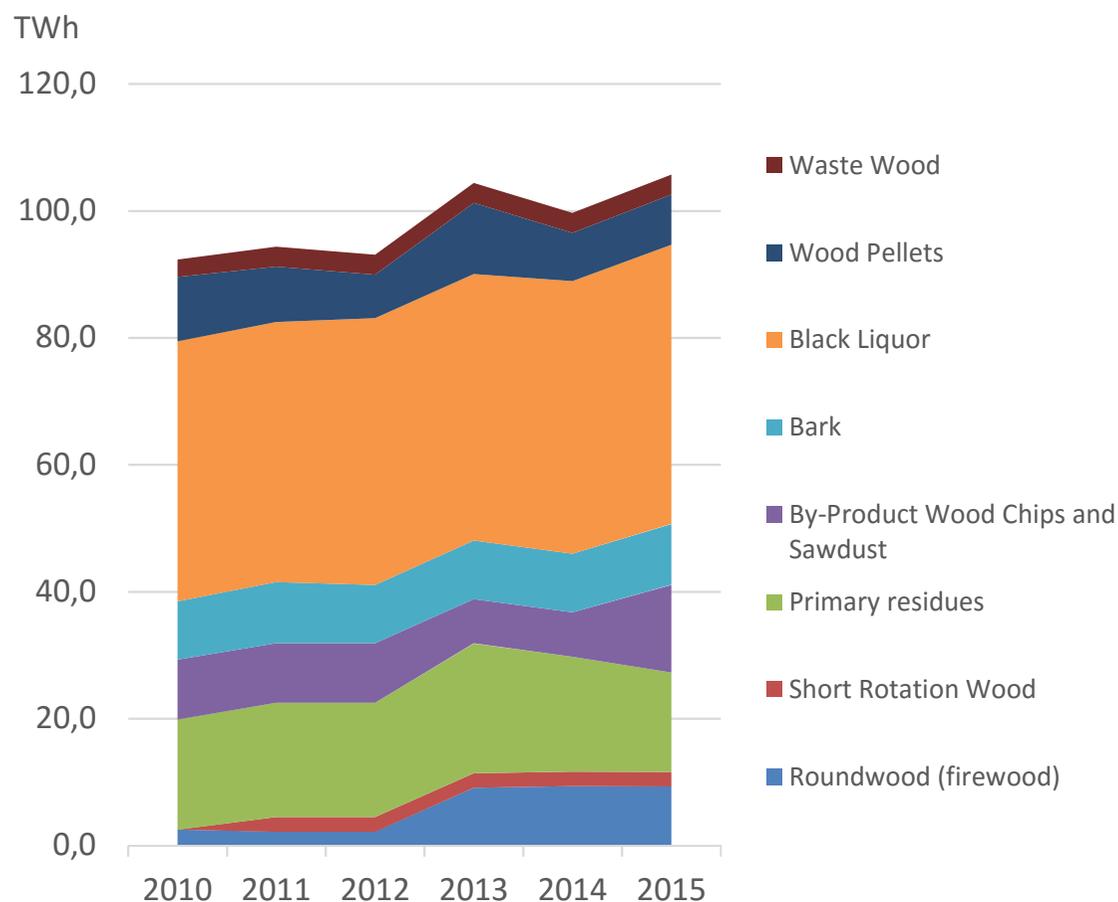


6. Consumption of Wood for Energy - Country Cases

Sweden

In Sweden, black liquor is the largest single source of wood energy comprising about 42% of total.

Primary residues have a major share in the Swedish wood energy pool with the share of 15% of the total.



Annex 1: Total Consumption of Wood Energy in EU-28

Consumption of Wood for Energy by Type and Assortment in the EU-28

TWh	2010	2011	2012	2013	2014	2015	% change (2010-2015)
Main Products	178	198	201	221	218	218	+ 23 %
<i>Roundwood (firewood)</i>	<i>178</i>	<i>191</i>	<i>194</i>	<i>212</i>	<i>208</i>	<i>209</i>	<i>+ 18 %</i>
<i>Short Rotation Wood</i>	<i>n.a.</i>	<i>7</i>	<i>7</i>	<i>9</i>	<i>9</i>	<i>9</i>	<i>+ 29 %</i>
Primary Residues	87	100	104	116	113	110	+ 26 %
Forest Industry By-Products	242	256	258	252	252	260	+ 8 %
<i>Residue Chips and Sawdust</i>	<i>82</i>	<i>87</i>	<i>88</i>	<i>78</i>	<i>77</i>	<i>84</i>	<i>+ 2 %</i>
<i>Bark</i>	<i>45</i>	<i>55</i>	<i>54</i>	<i>56</i>	<i>56</i>	<i>56</i>	<i>+ 25 %</i>
<i>Black Liquor</i>	<i>115</i>	<i>114</i>	<i>115</i>	<i>119</i>	<i>119</i>	<i>120</i>	<i>+ 9 %</i>
Wood Pellets	45	53	62	89	86	94	+ 109 %
Waste Wood	77	86	87	86	87	86	+ 12 %
Wood Total	629	692	710	765	756	769	+ 22 %



Annex 2: Consumption of Wood Energy in the EU-28 by End Use

Consumption of Wood for Energy in the EU-28 by End Use

TWh	2010	2011	2012	2013	2014	2015
Power and Heat	196	186	194	216	217	222
Industrial	164	229	233	239	236	240
Residential and Other	268	277	284	310	303	307
Wood total	629	692	710	765	756	769

Shares of Wood for Energy in the EU-28 by End Use

TWh	2010	2011	2012	2013	2014	2015
Power and Heat	31 %	27 %	27 %	28 %	29 %	29 %
Industrial	26 %	33 %	33 %	31 %	31 %	31 %
Residential and Other	43 %	40 %	40 %	41 %	40 %	40 %
Wood total	100 %					



Annex 3: Harvesting Projections of Industrial Roundwood and Fuelwood in the EU-28

Industrial roundwood

1 000 m ³	2016	2020e	2030e	CAGR%
Total	353 815	364 632	396 017	0,81%
Sweden	67 200	66 528	70 520	0,35%
Finland	52 272	55 796	60 172	1,01%
Germany	45 878	47 826	54 044	1,18%
Poland	36 860	38 703	44 121	1,29%
France	25 590	25 795	27 342	0,47%
Others	126 015	129 694	139 818	0,75%

Fuelwood

1 000 m ³	2016	2020e	2030e	CAGR%
Total	98 666	100 883	109 746	0,76%
France	27 200	26 741	28 345	0,30%
Germany	10 500	11 123	12 569	1,29%
Finland	7 831	7 988	8 614	0,68%
Sweden	7 000	6 930	7 346	0,35%
Poland	5 190	5 450	6 212	1,29%
Others	40 945	42 014	46 659	0,94%



Annex 4: Data Sources

Austria	FAOSTAT, Austrian Energy Agency , AEBIOM, Indufor
Belgium	FAOSTAT, AEBIOM, Indufor
Bulgaria	FAOSTAT, AEBIOM, Indufor
Croatia	FAOSTAT, JWEE , AEBIOM
Cyprus	FAOSTAT, JWEE , AEBIOM
Czech Republic	FAOSTAT, Czech Statistical Office , Ministry of Agriculture , JWEE , AEBIOM, Indufor
Denmark	FAOSTAT, UNECE, Statistics Danmark, JWEE
Estonia	METS 2014 Aastaraamat , AEBIOM, Indufor
Finland	Luke , AEBIOM
France	JWEE , AEBIOM, Indufor
Germany	Holzmarktbericht , JWEE , Indufor, AEBIOM
Greece	FAOSTAT, UNECE, AEBIOM, Indufor
Hungary	FAOSTAT, UNECE, AEBIOM, Indufor
Ireland	JWEE , AEBIOM, Indufor

Italy	JWEE , AEBIOM, Indufor
Latvia	CSB Latvia , AEBIOM, Indufor
Lithuania	Statistics Lithuania , AEBIOM, Indufor
Luxembourg	JWEE , AEBIOM
Malta	FAOSTAT, AEBIOM
Netherlands	FAOSTAT, JWEE , Indufor
Poland	Central Statistical Office of Poland , AEBIOM, Indufor
Portugal	FAOSTAT, AEBIOM, Indufor
Romania	FAOSTAT, AEBIOM, Indufor
Slovakia	JWEE , FAOSTAT, AEBIOM, Indufor
Slovenia	JWEE , FAOSTAT, AEBIOM, Indufor
Spain	Spanish Ministry of Agriculture, Food and Environment, IDEA - Spain, AEBIOM, Indufor
Sweden	Swedish Energy Agency , Skogsstyrelsen , AEBIOM, Indufor
United Kingdom	JWEE , AEBIOM, Indufor



Annex 5: Product Definitions (1/3)

Main products

- **Roundwood:** Roundwood that is not usable for industrial purposes and harvested for residential use as non industrial activity. Usually consumed in small scale applications as chopped and split firewood.
- **Short rotation wood:** Short rotation wood is produced from rapidly growing tree species that are grown in plantations established specifically for that purpose with typical rotations of 5-10 years.

Primary residues

- **Tops and branches:** Biomass accumulated from final fellings of forest stand. After crosscutting sawlogs and pulpwood proportion of the tree the residual tops and branches are collected and forwarded for chipping and transport to the plant.
- **Stumps:** Stump are tree's underground part of biomass. They are collected from the stand after final felling with an excavator, stored, dried and crushed to be used in the plant.
- **Energywood from young forests:** Includes small whole trees and small diameter stemwood from thinnings that are collected from thinning operations.
- **Rejected logs:** Include large diameter roundwood that is rejected from industrial processing due to decay or other defect (curve or mechanical damage)



Annex 5: Product Definitions (2/3)

Forest Industry By-Products

- **Wood chips:** Includes wood chips that are resulted as by products of industrial processing such as sawmilling industry. Not altered by any chemical process.
- **Sawdust:** Includes sawdust and shavings that has much smaller particle size than chips is resulted as by product of sawing of logs and planing. Not altered by any chemical process.
- **Bark:** Outer layer of roundwood which is removed in debarker before industrial processing. Bark is usually consumed for energy along the forest industry processing and district heating plants. Not altered by any chemical process.

Black Liquor:

- **Black liquor** is the spent cooking liquor produced from the kraft process when digesting pulpwood into paper pulp. Lignin, hemicelluloses and other substances are removed from the wood to free the cellulose fibres. The pulp industry derives a significant share its bio-energy in the form of black liquor. This by-product is almost entirely used in energy production within the pulp and paper industry.



Annex 5: Product Definitions (3/3)

Wood Pellets:

- **Wood pellets** are made by compressing clean by-products of the mechanical wood industry, mainly chips, sawdust and shavings. Wood pellets are small cylindrical columns, made from various types of compressed, dry, renewable biomass, most typically wood. This class includes also wood briquettes that are compressed larger cylindrical objects.

Waste Wood:

- **Waste wood** includes all kinds of wooden materials that are available at the end of their use as a wooden products (also called “recovered” or “post-consumer”).



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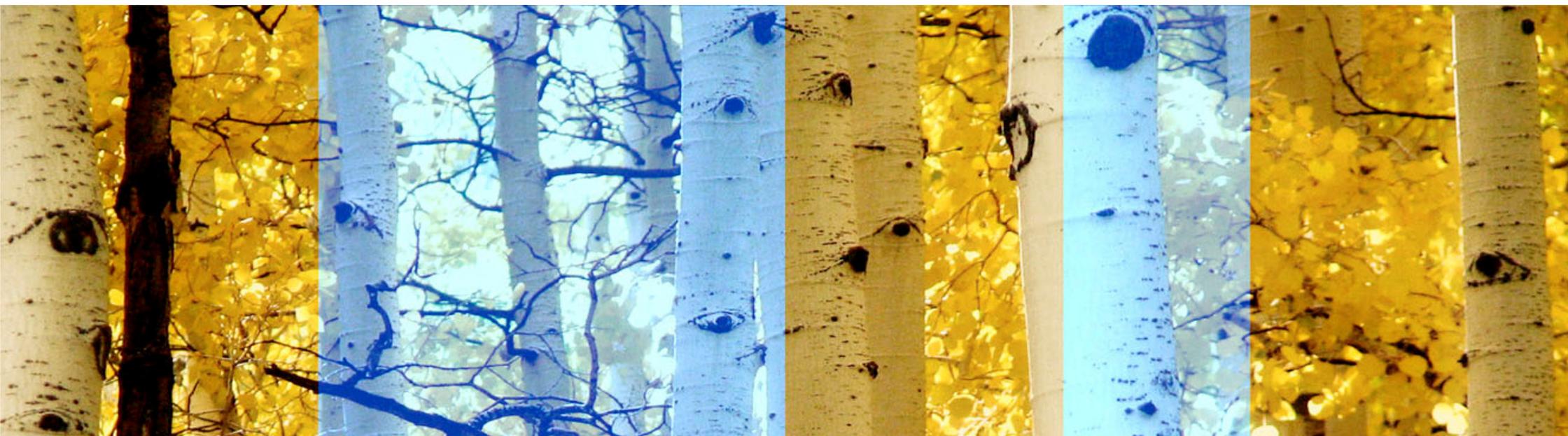
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