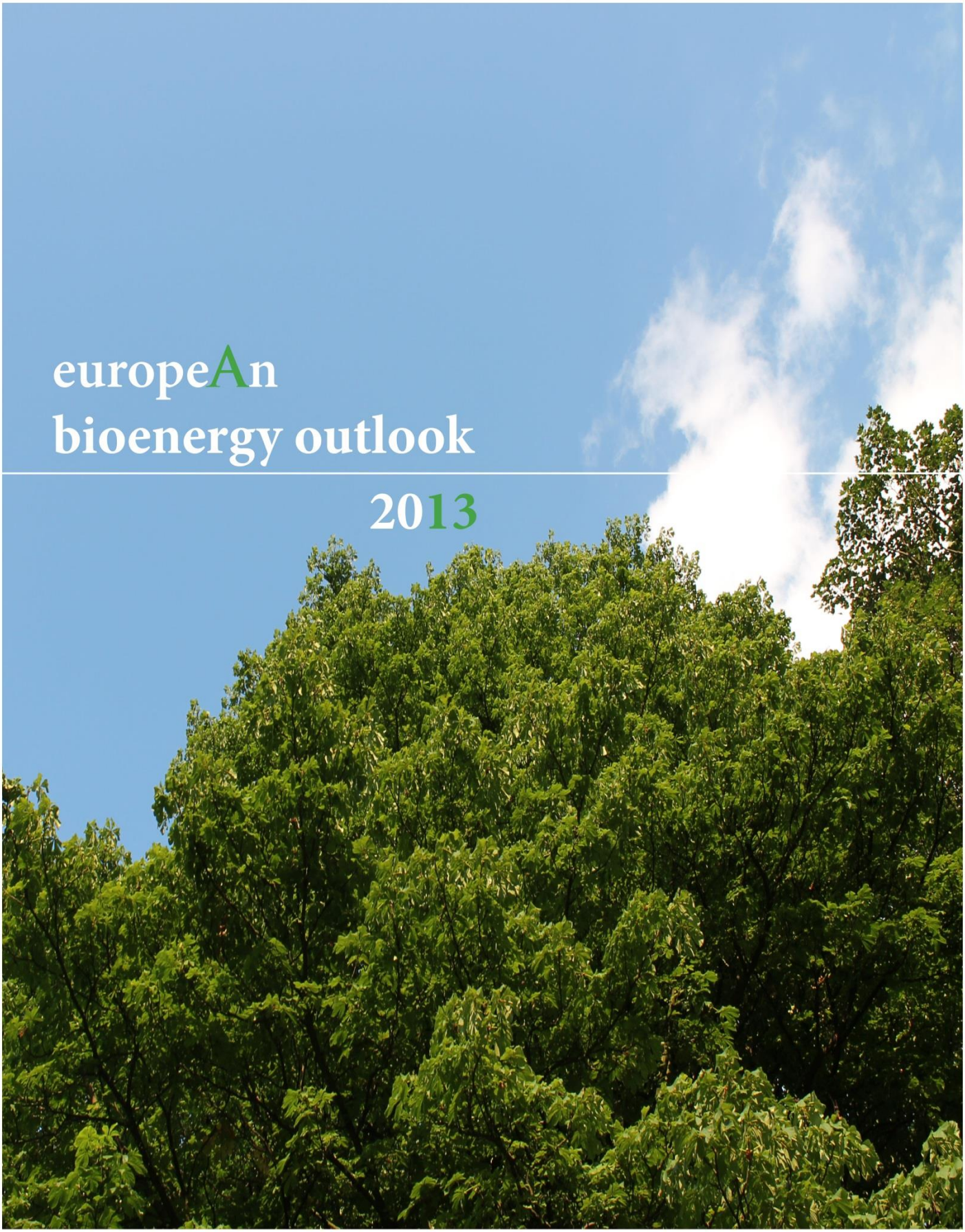

europeAn bioenergy outlook 2013

statistical report

AEBIOM
EUROPEAN BIOMASS ASSOCIATION

europeAn bioenergy outlook 2013

The preparation of the **European Bioenergy Outlook 2013** was coordinated by Cristina Calderón, with the assistance of Jean-Marc Jossart, Secretary General of AEBIOM and Niall Goodwin.

Chapter 9 on pellets has been entirely done by Gilles Gauthier, EPC manager, with the support of Christian Rakos, EPC President. Special thanks are given to EPC and EIPS members who provided national statistics and make it possible to have trustworthy figures.

Brussels, December 2013

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About AEBIOM

Founded in 1990, the European Biomass Association (AEBIOM) is a nonprofit, Brussels-based international organization active at EU level. AEBIOM's primary mission is to develop the market for sustainable bioenergy, and ensure favorable business conditions for its members.

AEBIOM holds a strong position in the bioenergy sector (bio-heat, electricity and biofuels) and brings together approximately 30 national bioenergy associations and 80 private-sector companies from all over Europe and beyond.

AEBIOM Networks

AEBIOM members are active in the Working Groups organized by AEBIOM. The overview below of the existing AEBIOM Working Groups should help you to better identify the groups in which your company can engage at the European level.

European Pellet Council (EPC)

The European Pellet Council (EPC) is an umbrella organisation representing the interests of the European wood pellet sector. Its members are national pellet associations or related organisations from 17 countries. The European Pellet Council is a platform for the pellet sector to discuss the issues that need to be managed in the transition from a niche product to a major energy commodity. These issues include standardisation and certification of pellet quality (ENplus), communication, statistics, safety, security of supply, education and training, and the quality of pellet using devices.

European Industry of Pellet Suppliers (EIPS)

EIPS was created by the joint forces of the pellet producers, traders and other supporting companies to strengthen their representation in Brussels. Current focus: sustainability, carbon accounting, safety, technical specifications, statistics.

The group is discussing and formulating the position of pellet suppliers regarding specifications and sustainability requirements for industrial pellets. Other issues include best practices regarding safety and security, as well as public relations and lobbying issues of the sector.

International Biomass Torrefaction Council (IBTC)

The International Biomass Torrefaction Council (IBTC) is a platform to promote the use of torrefied biomass as a viable energy carrier, undertake studies or projects, and to commonly voice their concerns to the outside world.

Members of IBTC are European and International companies developing biomass torrefaction technology, pellet /briquette machine manufacturers, the technical division of the utilities and national or sectorial associations as well as other bodies or groups dedicated to the promotion of the use of torrefied biomass.

AEBIOM

EUROPEAN BIOMASS ASSOCIATION

YOUR PARTNER IN EU AFFAIRS & NETWORKING

FOREWORD

Dear friends,

Statistics are essential to follow market trends, build up strategies and support policy making. AEBIOM fully understands this concern and publishes now its fifth annual statistical bioenergy outlook, still free of charge for anybody.

Data collection is still challenging. Rules followed by Eurostat are not obvious to understand for non initiated people and same questions are coming up all the time: How much and what kind of biomass is used in the heat sector? What is the percentage of electricity used for heating purposes?

The 2012 version was downloaded by more than 3000 interested persons. What a success! Such achievement is due to the commitment of the AEBIOM team and particularly Cristina Calderón. She didn't count her hours, sometimes until late evenings, for data collection, enquiries and preparing an attractive statistical outlook for you. Thank you Cristina.

Have a useful statistical analysis!

Jean-Marc Jossart
AEBIOM Secretary General

BRUSSELS, December 2013

Dear readers,

The figures in this report have been compiled for data published in many different sources and information provided by AEBIOM´s members and other bioenergy experts. This report consists of two main parts. The first part (chapters 3) provides basic information about the biomass resources originated from forest, agricultural and waste streams. The second part (chapters 4-6) is structured according to its end use: electricity, heat and transport. Finally one chapter on biogas and an extensive chapter dedicated to the pellet sector prepared by EPC (the European Pellet Council). At the end of the document the reader can find the Annex that includes explanation of terms, conversion units and abbreviations.

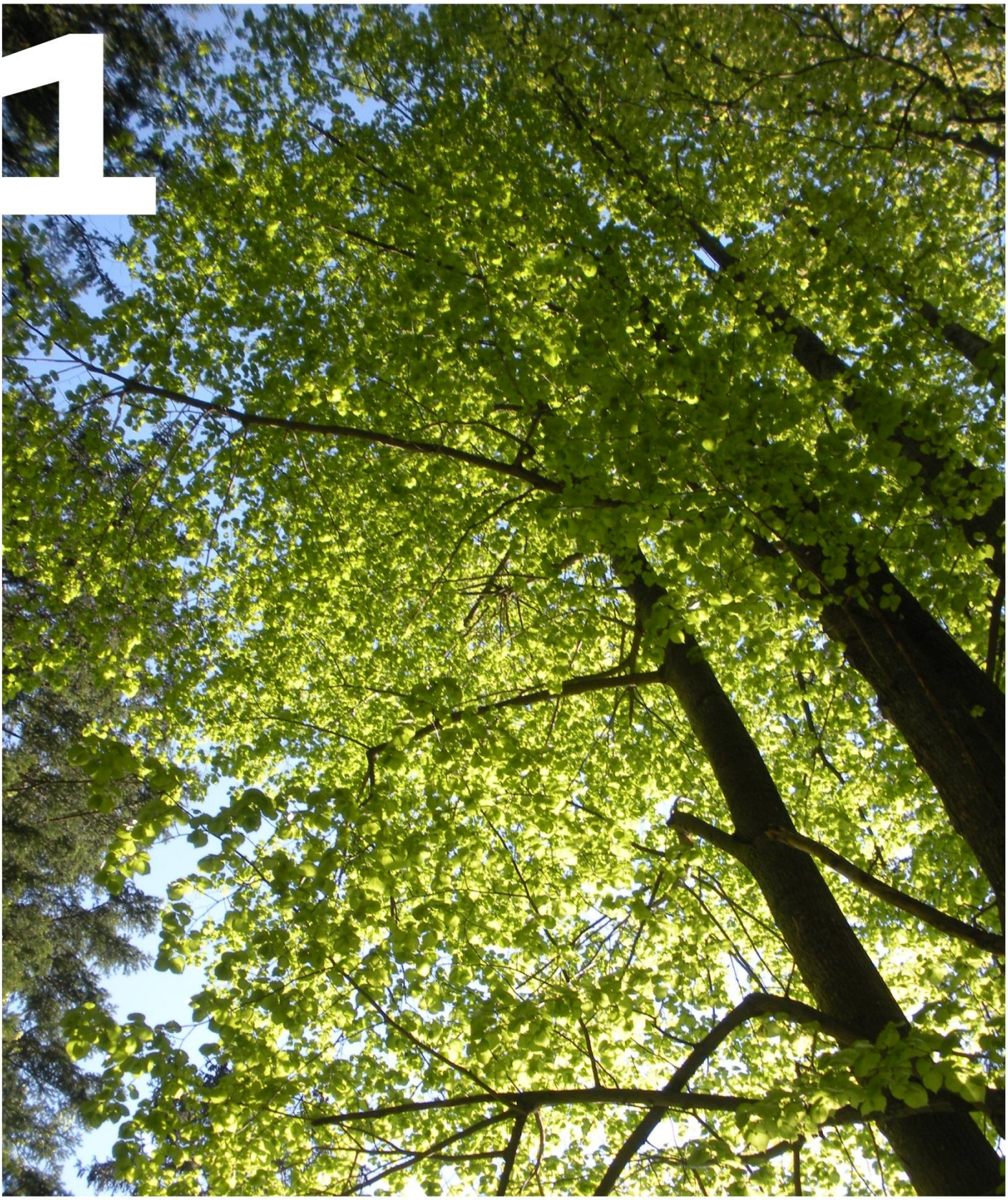
The AEBIOM team, and especially my colleagues Gilles Gauthier and Niall Goodwin, have worked hard preparing this report that we hope serves you in your best interest and contributes to the successful development of bioenergy in Europe.

Thank you for your interest and confidence in our work.

Cristina Calderón
AEBIOM Bioenergy Expert
IBTC General Manager

BRUSSELS, December 2013

introduction



1.1 Biomass for energy

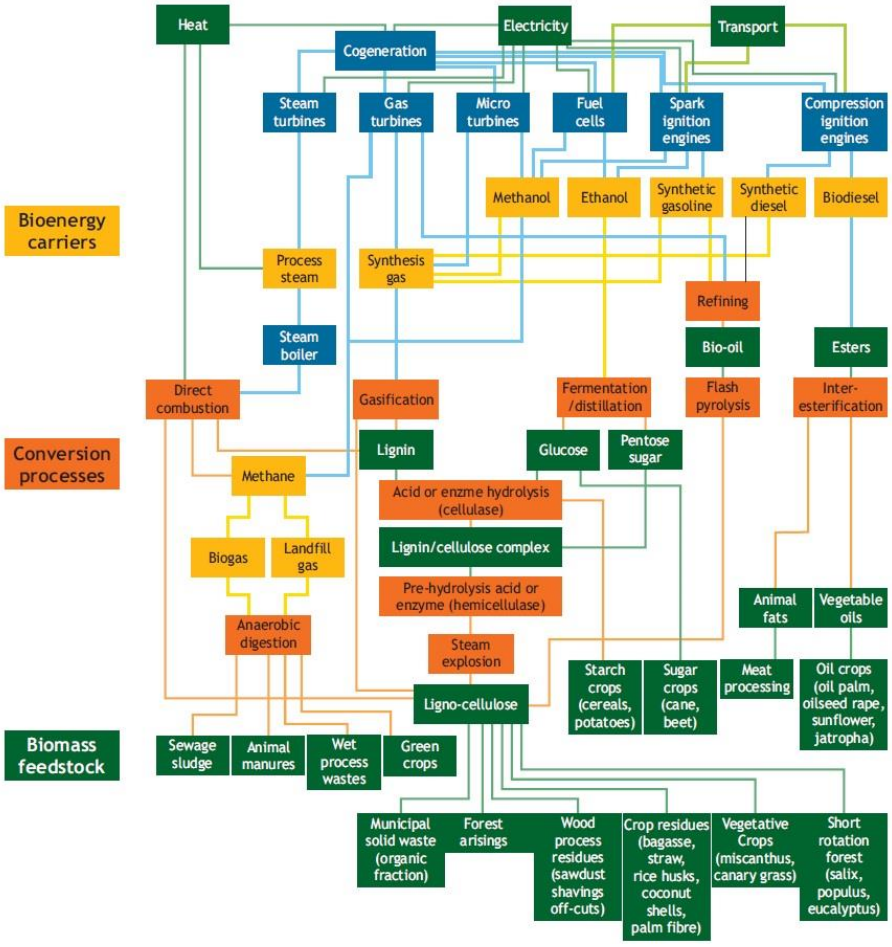
Bioenergy refers to renewable energy coming from biological material using various transformation processes such as combustion, gasification, pyrolysis or fermentation.

Biomass originates from forest, agricultural and waste streams.

- Forest and wood-based industries produce wood which is the largest resource of solid biomass. Biomass procurement logistics from forest to bioenergy plants are subject to major improvements. The sector covers a wide range of different bio with different characteristics - wood logs, bark, wood chips, sawdust and more recently pellets. Pellets, due to their high energy density and standardised characteristics, offer great opportunities for developing the bioenergy market worldwide.
- Agriculture can provide dedicated energy crops as well as by-products in the form of animal manure and straw. Available land can be used for growing conventional crops such as rape, wheat, maize etc. for energy purposes or for cultivating new types of crops such as poplar, willow, miscanthus and others.
- Biogenic waste is the biomass that can cover several forms of waste such as organic fraction of municipal solid waste, wood waste, refuse-derived fuels, sewage sludge, etc.

Each biomass resource has different characteristics in terms of calorific value, moisture and ash content, etc. that requires appropriate conversion technologies for bioenergy production. These conversion routes use chemical, thermal and/or biological processes.

Figure 1.1 Biomass feedstock converted to bioenergy carriers



Source: International Energy Agency (IEA)

1.2 Biomass in Europe:

The most important facts at a glance

- **Bioenergy represented 68% of the total gross inland consumption of renewables in 2011.**

Total gross inland consumption of renewables in the EU was 169 Mtoe in 2011, from which 115 Mtoe was biomass and renewable waste.

- **Biomass accounted for 8.4 % of the total final energy consumption in Europe in 2011.**

In some countries such as Estonia, Latvia, Finland and Sweden this is above 25%.

- **95,5% of the final heat consumption from renewables is biomass for heat.**

More than 50% of biomass for heat is consumed by households.

- **The EU pellet consumption for heating has grown by more than one million tons per year since 2010, amounting to 8 million tons in 2012.**

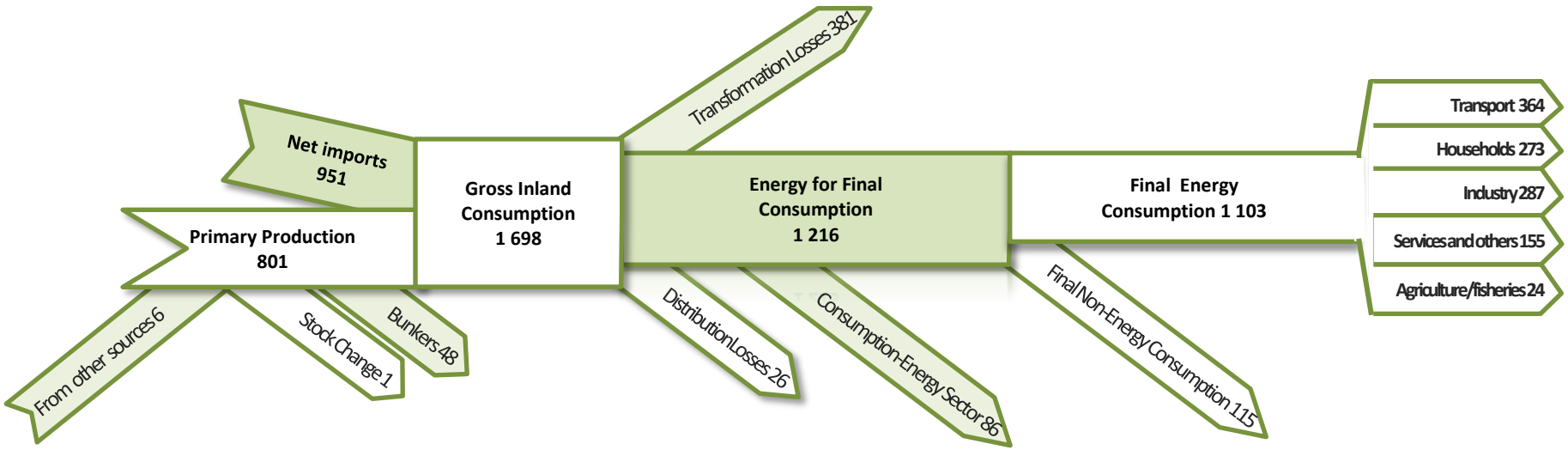
Around 50% of these pellets are ENplus certified.

overview about the EU energy system

2.1 Generalities

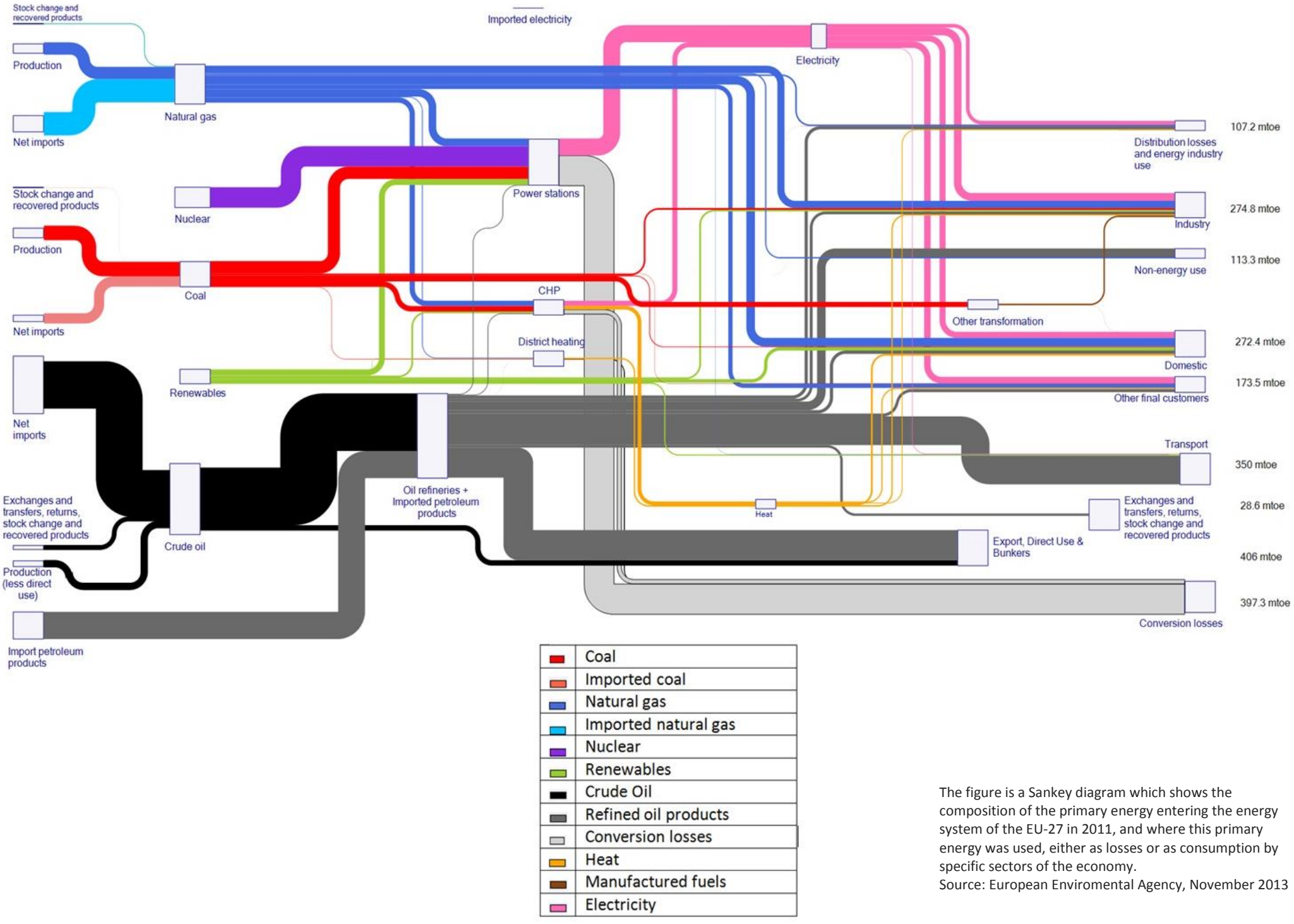
2.1.1 ENERGY BREAKDOWN

Figure 2.1 EU Energy flow in 2011 (Mtoe)



*Net imports: correspond to the total imports minus the total exports.
Source: Eurostat, "EU Energy in figures" Statistical pocketbook 2013

Figure 2.2 Overall picture of the energy system in the EU (Mtoe)



The figure is a Sankey diagram which shows the composition of the primary energy entering the energy system of the EU-27 in 2011, and where this primary energy was used, either as losses or as consumption by specific sectors of the economy.
Source: European Enviromental Agency, November 2013

Table 2.1 Net imports* by fuel in the EU 27 in 2011 (Mtoe)

	Net imports	Petroleum and Products	Gases	Solid Fuels	Renewables	Electricity
EU-27	939.70	548.50	266.30	118.10	6.70	0.00
Share (%)	100.00	58.00	28.00	13.00	1.00	0.00
BE	48.43	29.67	15.21	2.95	0.39	0.22
BG	7.09	3.84	2.26	1.98	-0.08	-0.92
CZ	12.07	8.64	7.51	-2.57	-0.04	-1.47
DK	-1.67	-3.95	-2.47	3.59	1.04	0.11
DE	194.86	106.85	56.70	31.71	-0.07	-0.32
EE	0.74	0.70	0.50	-0.02	-0.14	-0.31
IE	12.40	7.04	3.83	1.40	0.08	0.04
EL	20.00	15.36	3.97	0.23	0.16	0.28
ES	104.77	66.28	29.40	8.74	0.87	-0.52
FR	127.91	83.93	38.27	10.18	0.37	-4.85
IT	142.61	63.79	57.53	15.29	2.07	3.93
CY	2.65	2.62		0.00	0.03	
LV	2.63	1.51	1.41	0.12	-0.56	0.11
LT	5.90	2.39	2.73	0.26	-0.06	0.58
LU	4.46	2.94	1.03	0.06	0.04	0.39
HU	13.13	5.35	6.13	1.04	0.03	0.57
MT	2.50	2.50				
NL	29.18	44.18	-23.54	7.53	0.21	0.78
AT	23.53	11.23	8.00	3.05	0.54	0.70
PL	34.53	25.46	9.64	-0.62	0.51	-0.45
PT	18.94	12.24	4.53	2.15	-0.22	0.24
RO	7.76	4.26	2.46	1.13	0.08	-0.16
SI	3.53	2.61	0.74	0.26	0.03	-0.11
SK	11.18	3.24	4.86	3.02	-0.01	0.06
FI	19.32	10.21	3.36	4.60	-0.04	1.19
SE	18.77	15.89	1.15	2.35		-0.62
UK	72.44	19.73	31.01	19.66	1.51	0.53

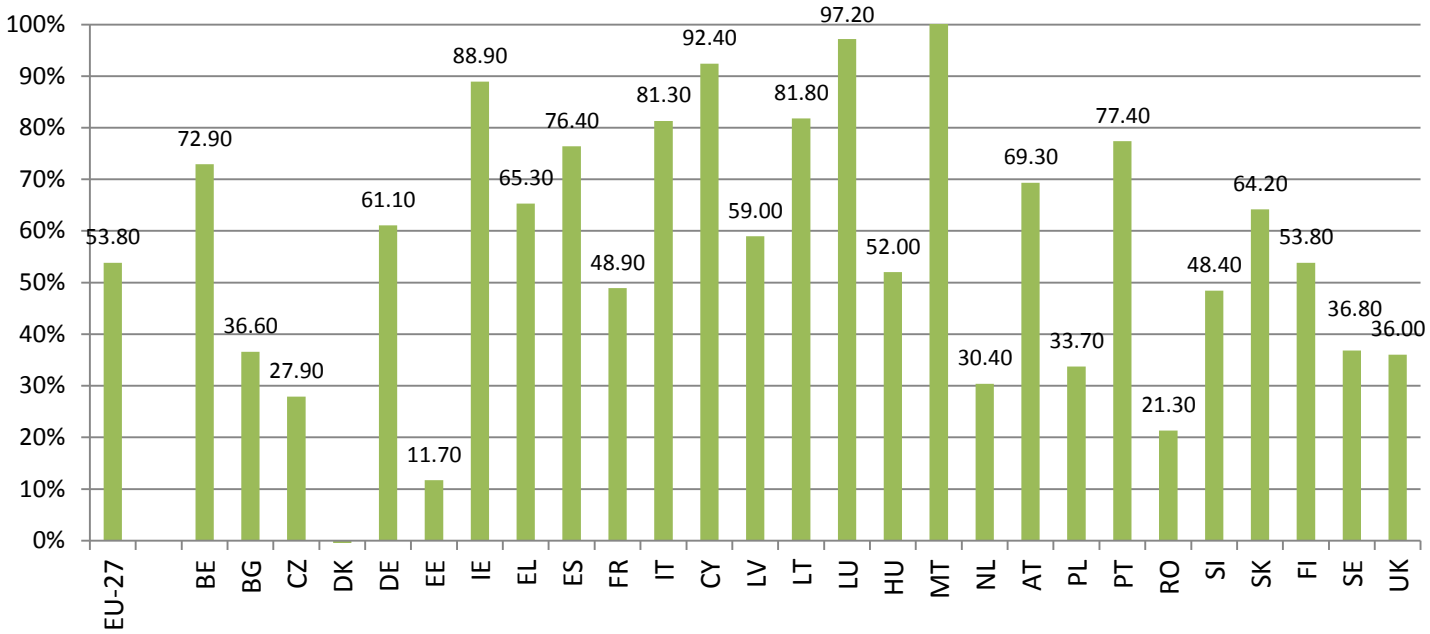
* Net imports correspond to the total imports minus total exports.

* Negative rate indicates a net exporter.

Values over 100% indicate stocks build up

Source: Eurostat, April 2013

Figure 2.3 Energy Imports dependency in Europe in 2011 (%) – All fuels



Source: Eurostat, April 2013

Before going into data, it may be useful for the reader of this report to clarify some terms used in Eurostat:

- **Gross inland consumption**: Gross inland consumption is the quantity of energy necessary to satisfy inland consumption of the geographical entity under consideration. It is calculated using the following formula: primary production + recovered products + imports +stock changes – exports – bunkers (i.e. quantities supplied to sea-going ships)
- **Final energy consumption:** Final energy consumption is the energy finally consumed in the transport, industrial, commercial, agricultural, public and household sectors. It excludes deliveries to the energy transformation sector and to the energy industries themselves.

- **Gross final energy consumption** is defined in Directive 2009/28/EC as the sum of:

  - final energy consumption, i.e. energy delivered to industry for manufacturing processes, to the transport sector, including international aviation, and to other sectors (households, services, agriculture, etc)
  - consumption of electricity and heat by the energy branch for electricity and heat generation (own use by plant),
  - losses of electricity and heat in transmission and distribution.

Table 2.2 Gross inland consumption by fuel in 2011 (Mtoe)

	Total	Petroleum and Products	Gases	Solid Fuels	Nuclear	Renewables	Waste, Non-Renewable	Electricity
EU-27	1697.70	597.90	397.60	285.50	234.00	169.00	13.70	0.00
Share (%)	100.00	35.20	23.40	16.80	13.80	10.00	0.80	0.00
BE	59.68	23.32	15.19	2.91	12.44	2.86	2.74	0.22
BG	19.28	3.86	2.63	8.11	4.23	1.35	0.02	-0.92
CZ	43.31	9.10	6.77	18.38	7.32	2.99	0.22	-1.47
DK	18.98	7.42	3.73	3.23		4.08	0.41	0.11
DE	316.32	110.76	65.83	77.11	27.85	31.22	3.87	-0.32
EE	6.16	1.08	0.50	4.06		0.83		-0.31
IE	13.85	6.83	4.12	2.03		0.82	0.01	0.04
EL	27.92	13.52	3.97	7.89		2.23	0.03	0.28
ES	128.53	57.90	28.99	12.46	14.89	14.64	0.17	-0.52
FR	259.32	83.22	37.04	10.29	114.11	18.27	1.24	-4.85
IT	172.93	68.21	63.81	15.91		19.94	1.13	3.93
CY	2.67	2.54		0.01		0.12	0.00	
LV	4.25	1.25	1.29	0.12		1.44	0.04	0.11
LT	7.08	2.47	2.72	0.25		1.06		0.58
LU	4.59	2.96	1.03	0.06		0.12	0.03	0.39
HU	24.23	6.50	9.35	2.76	4.06	0.89	0.10	0.57
MT	1.13	1.13				0.00		
NL	81.32	33.62	34.32	7.47	1.07	3.30	0.76	0.78
AT	33.94	12.43	7.75	3.45		8.77	0.84	0.70
PL	102.18	26.48	12.84	54.60		7.95	0.76	-0.45
PT	23.89	11.70	4.46	2.21		5.14	0.14	0.24
RO	36.36	9.12	11.11	8.16	3.03	5.07	0.03	-0.16
SI	7.27	2.59	0.74	1.47	1.60	0.95	0.03	-0.11
SK	17.43	3.59	4.64	3.70	4.03	1.37	0.04	0.06
FI	35.74	10.31	3.36	5.69	5.98	9.07	0.14	1.19
SE	49.51	14.62	1.16	2.49	15.60	15.75	0.51	-0.62
UK	198.77	71.37	70.20	30.65	17.79	7.80	0.43	0.53

Source: Eurostat, April 2013

Table 2.3 Final energy consumption by fuel in 2011 (Mtoe)

	Total	Petroleum and Products	Gases	Electricity	Out of which electricity from RES	Derived Heat	Out of which derived heat from RES	Renewables*	Solid Fuels	Waste,No-Renewable
EU-27	1103.40	444.60	241.10	238.00	62.77	48.90	10.21	76.80	48.80	5.20
Share - %	100.00	40.30	21.90	21.60		4.40		7.00	4.40	0.50
BE	38.89	14.51	12.28	6.89	1.03	0.74	0.05	1.23	1.14	2.10
BG	9.29	3.05	1.28	2.44	0.47	1.04	0.01	1.00	0.46	0.02
CZ	24.63	6.55	5.98	4.87	0.74	2.10	0.12	1.91	3.07	0.15
DK	14.67	6.45	1.59	2.70	1.22	2.50	1.20	1.27	0.14	0.02
DE	213.10	79.70	47.70	44.84	11.66	10.04	1.09	19.87	10.04	0.91
EE	2.83	0.97	0.20	0.57	0.10	0.47	0.17	0.50	0.12	
IE	10.80	6.31	1.48	2.14	0.46		0.00	0.30	0.56	0.01
EL	18.83	11.65	1.08	4.45	0.74	0.05	0.00	1.38	0.22	
ES	86.54	44.05	14.42	20.63	7.81		0.00	5.80	1.64	
FR	148.06	65.30	26.95	36.09	6.44	3.66	0.28	11.51	4.26	0.29
IT	122.31	48.49	35.53	25.95	7.46	3.19	0.69	5.49	3.41	0.25
CY	1.90	1.38		0.41	0.01	0.00	0.00	0.10	0.01	0
LV	3.98	1.40	0.40	0.53	0.26	0.50	0.09	1.00	0.11	0.04
LT	4.70	1.59	0.53	0.74	0.19	0.87	0.19	0.73	0.24	
LU	4.29	2.93	0.61	0.56	0.20	0.03	0.00	0.09	0.06	0.01
HU	16.27	4.55	5.97	2.97	0.23	1.01	0.08	1.21	0.52	0.04
MT	0.45	0.29		0.16	0		0.00	0		
NL	50.66	18.27	18.79	9.24	1.06	2.07	0.21	0.86	1.43	
AT	27.34	10.22	4.89	5.29	4.11	1.75	0.88	3.65	1.06	0.48
PL	64.68	20.54	9.10	10.48	1.20	6.42	0.39	5.46	12.07	0.61
PT	17.34	8.62	1.64	4.16	2.17	0.33	0.00	2.53	0.02	0.04
RO	22.57	6.48	6.24	3.67	1.44	1.66	0.05	3.65	0.84	0.03
SI	4.94	2.47	0.58	1.08	0.36	0.19	0.03	0.55	0.05	0.02
SK	10.79	2.19	3.53	2.13	0.52	0.77	0.11	0.62	1.53	0.02
FI	25.17	7.58	0.98	6.90	2.07	4.08	1.56	4.71	0.89	0.03
SE	32.17	10.21	0.72	10.72	7.24	4.13	3.02	5.19	1.20	
UK	132.02	58.85	38.58	27.34	3.48	1.27	0.00	2.17	3.73	0.08

*It doesn´t include electricity from RES and Derived Heat from RES.

Source: Eurostat, April 2013

2.1.2 RENEWABLES IN EUROPE

Table 2.4 Gross inland consumption renewables in 2011(Mtoe)

	Renewables	Biomass and Renewable Wastes	Hydro	Wind	Geothermal	Solar	Tide, Wave and Ocean
EU-27	169.00	114.90	26.40	15.40	6.20	6.10	0.00
Share (%)	10.00	6.80	1.60	0.90	0.40	0.40	0.00
BE	2.86	2.52	0.02	0.20	0.00	0.11	
BG	1.35	0.97	0.25	0.07	0.03	0.02	
CZ	2.99	2.59	0.17	0.03		0.20	
DK	4.08	3.21	0.00	0.84	0.01	0.02	
DE	31.22	22.73	1.48	4.20	0.58	2.22	
EE	0.83	0.80	0.00	0.03			
IE	0.82	0.37	0.06	0.38		0.01	
EL	2.23	1.34	0.34	0.29	0.03	0.24	
ES	14.64	7.00	2.63	3.65	0.02	1.35	
FR	18.27	13.00	3.85	1.05	0.08	0.24	0.05
IT	19.94	9.07	3.94	0.85	5.02	1.07	
CY	0.12	0.05		0.01	0.00	0.06	
LV	1.44	1.18	0.25	0.01			
LT	1.06	0.97	0.04	0.04	0.00		
LU	0.12	0.11	0.00	0.01		0.00	
HU	1.89	1.70	0.02	0.05	0.10	0.01	
MT	0.00	0.00					
NL	3.30	2.81	0.00	0.44	0.01	0.03	
AT	8.77	5.45	2.94	0.17	0.03	0.18	
PL	7.95	7.45	0.20	0.28	0.01	0.01	
PT	5.14	3.07	0.99	0.79	0.20	0.09	
RO	5.07	3.66	1.27	0.12	0.02	0.00	
SI	0.95	0.59	0.31		0.04	0.01	
SK	1.37	1.00	0.32	0.00	0.01	0.04	
FI	9.07	7.96	1.07	0.04		0.00	
SE	15.75	9.50	5.71	0.52		0.01	
UK	7.80	5.85	0.49	1.33	0.00	0.13	

Source: Eurostat, April 2013

Table 2.5 RES share* in 2011 (%)

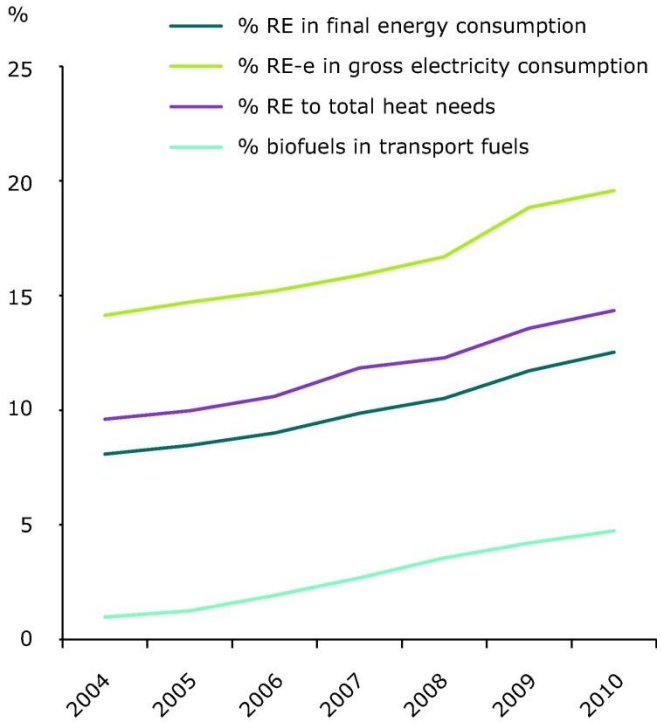
	Overall RES **	RES-Heating and Cooling	RES-Electricity Generation	RES - Transport	2020 RES Target
EU-27	13.00	15.10	21.70	3.80	20.00
BE	4.10	4.30	8.80	0.30	13
BG	13.80	23.80	12.90	0.40	16.00
CZ	9.40	12.80	10.60	0.60	13.00
DK	23.10	33.60	35.90	0.20	30.00
DE	12.30	12.00	21.30	6.10	18.00
EE	25.90	46.00	12.30	0.20	25.00
IE	6.70	5.00	17.60	2.80	16.00
EL	11.60	20.10	14.60	1.80	18.00
ES	15.10	13.50	31.50	5.90	20.00
FR	11.50	16.70	16.50	0.50	23.00
IT	11.50	11.00	23.50	4.70	19.00
CY	5.40	18.10	3.40		13.00
LV	33.10	44.70	44.70	4.80	40.00
LT	20.30	33.80	9.00	3.70	23.00
LU	2.90	5.00	4.10	2.00	11.00
HU	8.10	12.30	6.40	0.50	13.00
MT	0.40	5.60	0.10		10.00
NL	4.30	3.30	9.80	4.60	14.00
AT	30.90	31.10	66.10	7.60	34.00
PL	10.40	13.30	8.20	6.50	15.00
PT	24.90	35.50	46.50	0.40	31.00
RO	21.40	24.30	31.10	2.10	24.00
SI	18.80	27.30	30.80	2.10	25.00
SK	9.70	9.60	19.80	0.40	14.00
FI	31.70	44.30	29.20	0.40	38.00
SE	46.80	64.50	59.60	8.80	49.00
UK	3.80	2.20	8.70	2.90	15.00

* For the purpose of calculating the overall renewable share the relevant parameter is the gross final energy consumption in a reference scenario and after aviation reduction.

** In calculating a Member State's gross final energy consumption for the purpose of measuring its compliance with the targets and indicative trajectory laid down in this Directive, the amount of energy consumed in aviation shall, as a proportion of that Mem-ber State's gross final consumption of energy, be considered to be no more than 6,18 %. For Cyprus and Malta the amount of energy consumed in aviation shall, as a proportion of those Member States' gross final consumption of energy, be considered to be no more than 4,12 %.

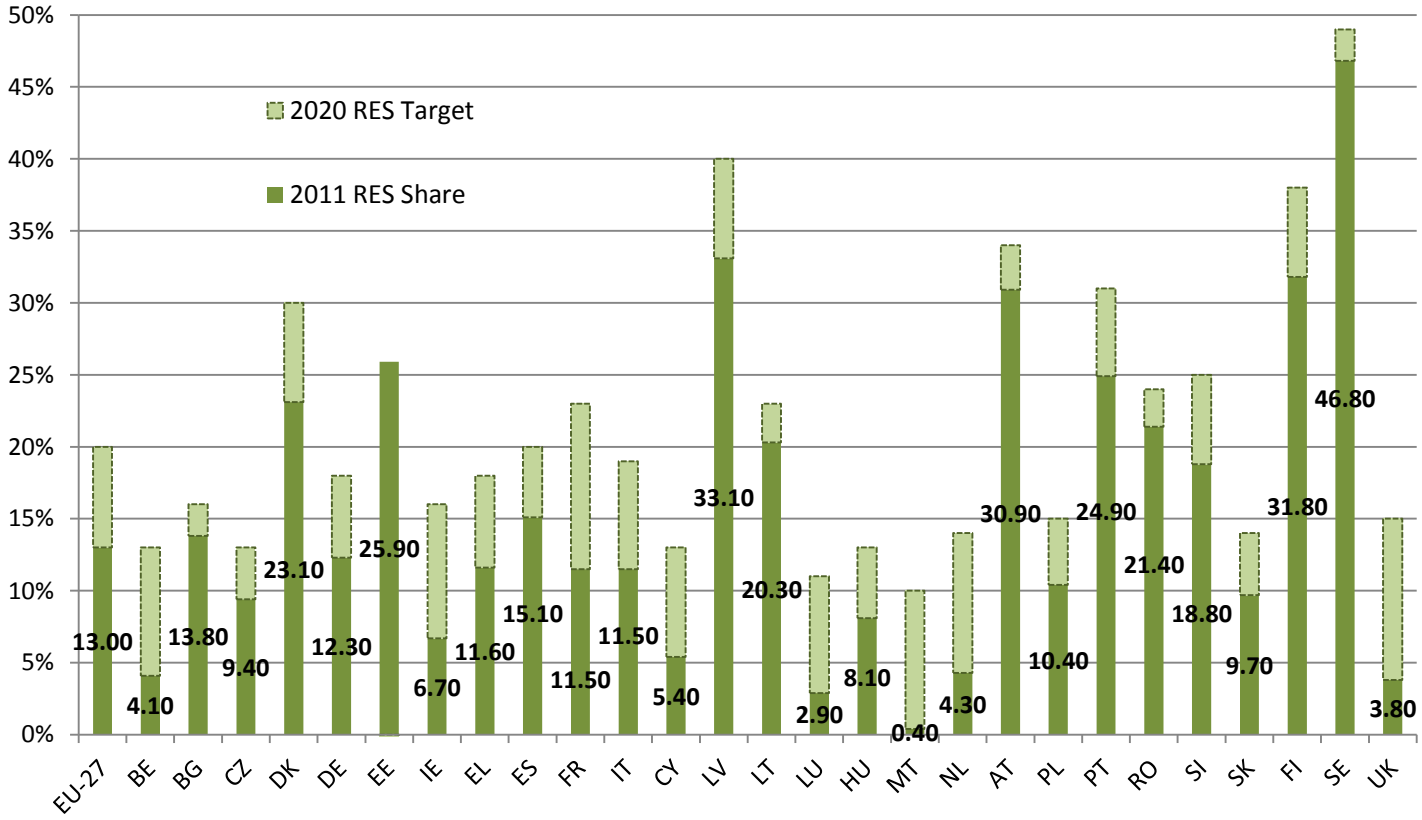
Source: Eurostat, April 2013

Figure 2.4 Share of renewable energy in final energy consumption in the EU27



Source: European Environment Agency, Mar 2013. Official data from Eurostat.

Figure 2.5 RES Share in 2011 compared with the 2020 RES target (%)



Source: Eurostat, April 2013

Table 2.6 Feed-in tariffs for renewables (€/kWh) in 2010

Country	Windpower 'On-shore'	Wind power 'Off-shore'	Solar PV	Biomass	Hydro
EU27					
BE	n/a	n/a	n/a	n/a	n/a
BG	0.07 - 0.09	0.07 - 0.09	0.34 - 0.38	0.08 - 0.10	0.045
CZ	0.108	0.108	0.455	0.077 - 0.103	0.081
DK	0.035	n/a	n/a	0.039	n/a
DE	0.05 - 0.09	0.13 - 0.15	0.29 - 0.55	0.08 - 0.12	0.04 - 0.13
EE	0.051	0.051	0.051	0.051	0.051
IE	0.059	0.059	n/a	0.072	0.072
EL	0.07 - 0.09	0.07 - 0.09	0.55	0.07 - 0.08	0.07 - 0.08
ES	0.073	0.073	0.32 - 0.34	0.107 - 0.158	0.077
FR	0.082	0.31 - 0.58	n/a	0.125	0.06
HR					
IT	0.3	0.3	0.36 - 0.44	0.2 - 0.3	0.22
CY	0.166	0.166	0.34	0.135	n/a
LV	0.11	0.11	n/a	n/a	n/a
LT	0.10	0.10	n/a	0.08	0.07
LU	0.08 - 0.10	0.08 - 0.10	0.28 - 0.56	0.103 - 0.128	0.079 - 0.103
HU	n/a	n/a	0.097	n/a	0.029 - 0.052
MT	n/a	n/a	n/a	n/a	n/a
NL	0.118	0.186	0.459 - 0.583	0.115 - 0.177	0.073 - 0.125
AT	0.073	0.073	0.29 - 0.46	0.06 -0.16	n/a
PL	n/a	n/a	n/a	0.038	n/a
PT	0.074	0.074	0.31 - 0.45	0.1 - 0.11	0.075
RO	n/a	n/a	n/a	n/a	n/a
SI	0.087 - 0.094	0.087 - 0.095	0.267 - 0.414	0.074 - 0.224	0.077 - 0.105
SK	0.05- 0.09	0.05- 0.09	0.27	0.072 - 0.10	0.066 - 0.10
FI	n/a	n/a	n/a	n/a	n/a
SE	n/a	n/a	n/a	n/a	n/a
UK	0.31	n/a	0.42	0.12	0.23

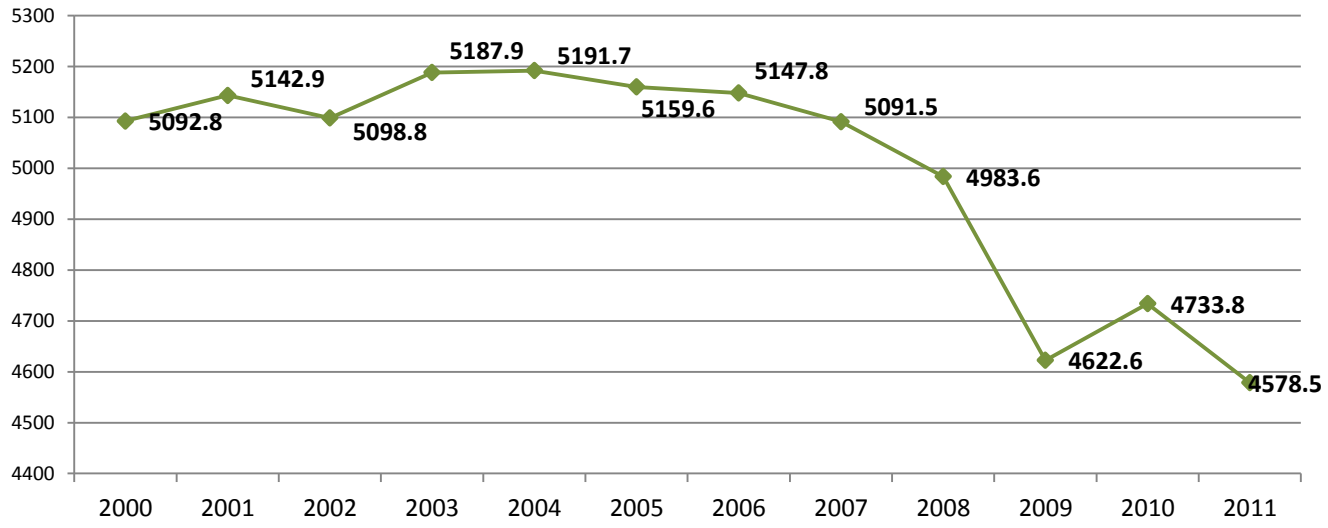
Source: Europe´s Energy Portal. Prices valid for April 1st, 2010.

2.1.3 GHG EMISSIONS

Greenhouse gas emissions in the EU-27 have fallen 8.11% during the last decade — a net reduction of 406 million tons of CO_2 eq.

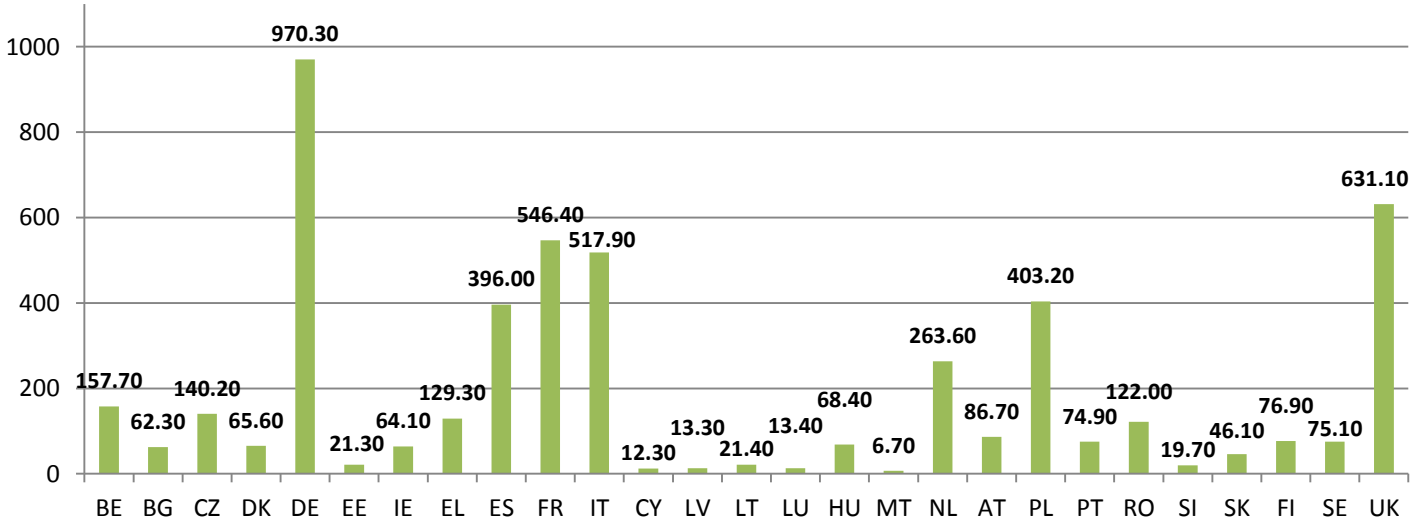
At Member State level, all countries reduced greenhouse gas emissions during the last decade but there is a large variation in GHG emission trends between countries. The overall EU GHG emission trend is dominated by the two largest emitters, Germany and the United Kingdom, together accounting for about one third of total EU-27 GHG emissions.

Figure 2.6 GHGs Emissions (million tons CO_2 equiv.) in EU28



Source: European Environment Agency (EEA)

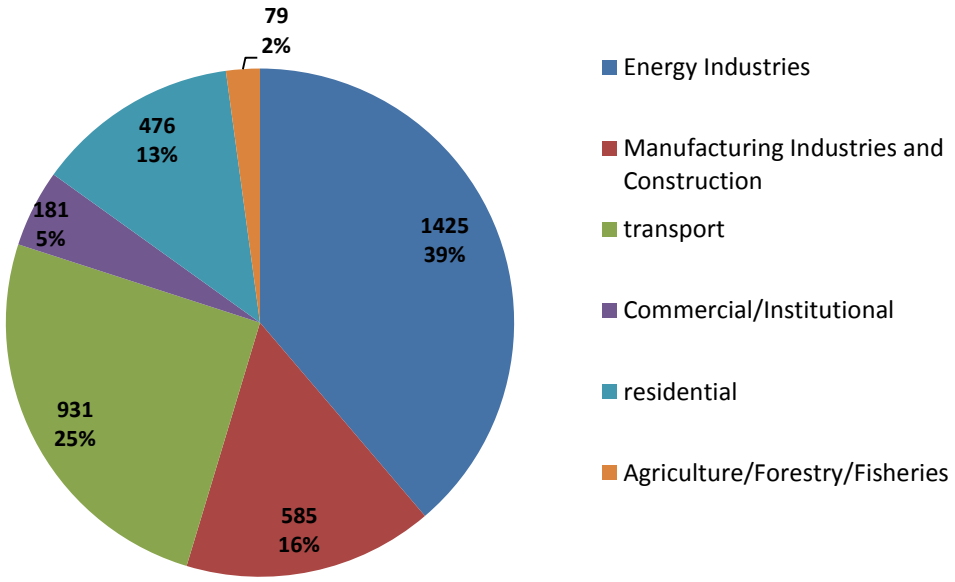
Figure 2.7 GHGs Emissions in 2010 (million tons CO_2 equiv.)



Source: Eurostat, April 2013

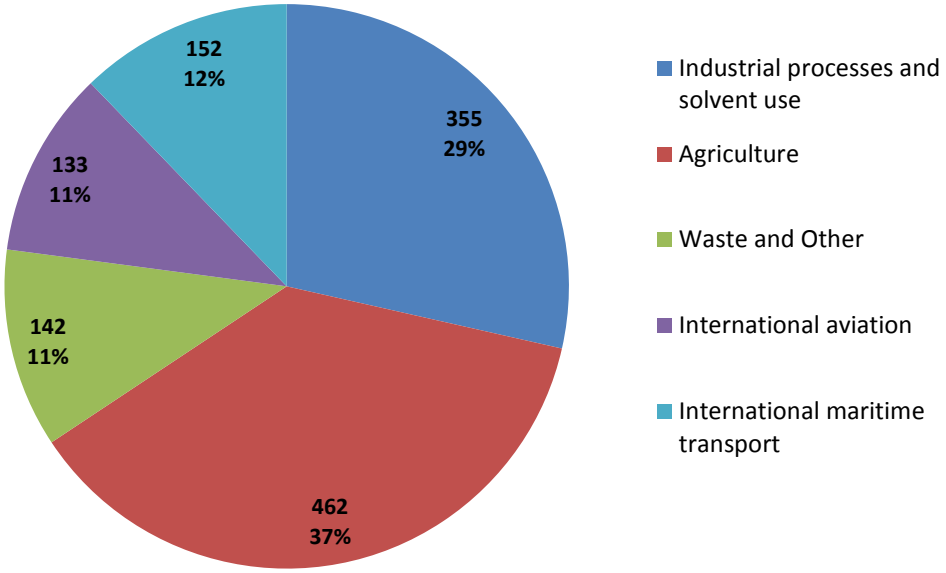
Fuel combustion activities represent 75.2% of the total GHGs emissions in Europe (3763 million ton CO_2 or equiv.)

Figure 2.8 GHGs Emissions in 2010 for fuel combustion activities (million tons CO2 equiv.)



Source: Eurostat, April 2013

Figure 2.9 GHGs Emissions in 2010, other than fuel combustion (million tons CO2 equiv.)



Source: Eurostat, April 2013

2.2 Bioenergy in Europe

2.2.1 CURRENT BIOENERGY BALANCE

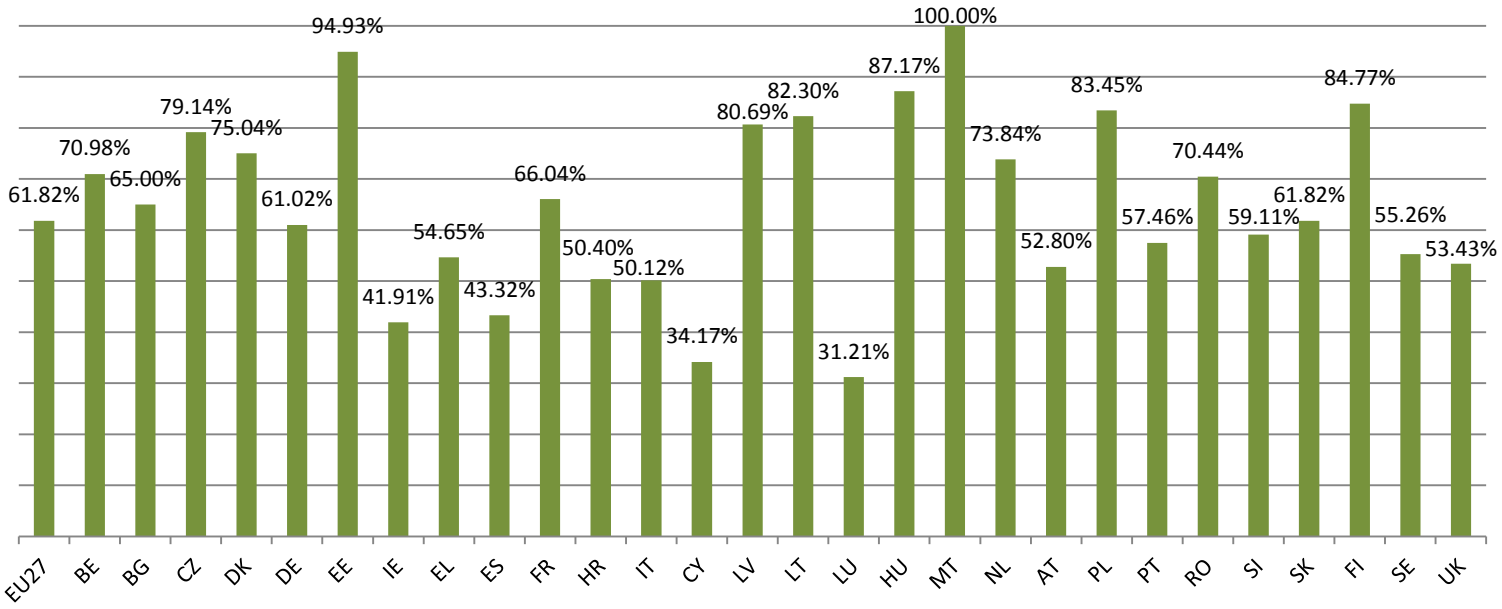
According to the last statistics, bioenergy remains the major source among renewables in Europe, accounting for almost 62% of European renewables and showing steady growth patterns across the different market segments.

Table 2.7 Final energy consumption, overall RES and biomass in 2011 (ktoe)

	Total	RES	%RES/Total Final Energy	Biomass	%biomass/Total Final Energy
EU27	1103260	149785	13.58%	92599	8.39%
BE	38886	2309	5.94%	1639	4.21%
BG	9287	1480	15.94%	962	10.36%
CZ	24634	2771	11.25%	2193	8.90%
DK	14679	3690	25.14%	2769	18.86%
DE	207093	26616	12.85%	16240	7.84%
EE	2843	769	27.05%	730	25.68%
IE	10800	766	7.09%	321	2.97%
EL	18835	2128	11.30%	1163	6.17%
ES	86532	13614	15.73%	5898	6.82%
FR	148065	18236	12.32%	12043	8.13%
HR	6181	883	14.29%	445	7.20%
IT	122312	13644	11.16%	6838	5.59%
CY	1896	120	6.33%	41	2.16%
LV	3982	1362	34.20%	1099	27.60%
LT	4696	1113	23.70%	916	19.51%
LU	4276	298	6.97%	93	2.17%
HU	16276	1528	9.39%	1332	8.18%
MT	446	1	0.22%	1	0.22%
NL	50663	2141	4.23%	1581	3.12%
AT	27328	8648	31.65%	4566	16.71%
PL	64689	7050	10.90%	5883	9.09%
PT	17350	4709	27.14%	2706	15.60%
RO	22576	5139	22.76%	3620	16.03%
SI	4951	944	19.07%	558	11.27%
SK	10795	1252	11.60%	774	7.17%
FI	25179	8347	33.15%	7076	28.10%
SE	32168	15452	48.04%	8539	26.55%
UK	132023	5654	4.28%	3021	2.29%

Source: Eurostat, AEBIOM calculations

Figure 2.10 Share of bioenergy in the RES (final energy consumption) in 2011



Source: Eurostat, AEBIOM calculations

Figure 2.11 Bioenergy balance in 2011 (ktoe)

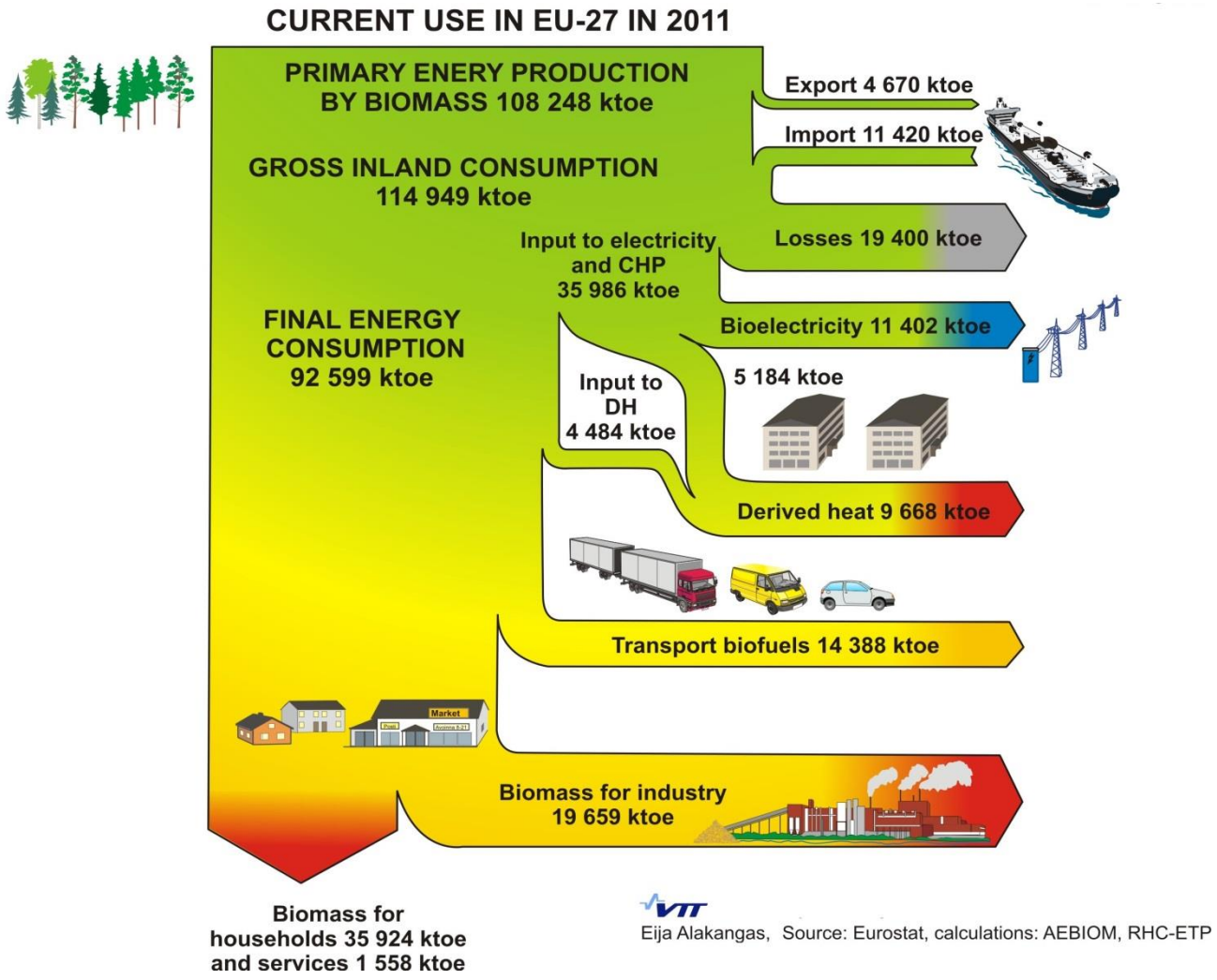
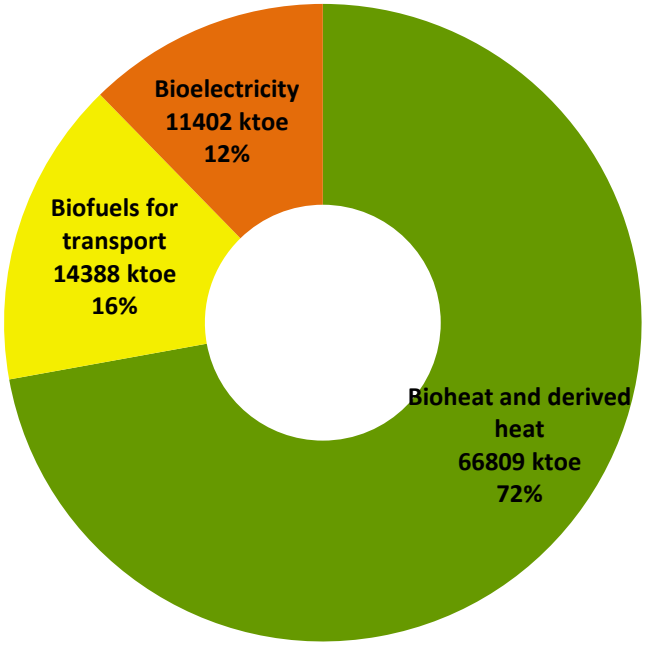


Table 2.8 Bioenergy balance in Europe in 2011 (ktoe)

	Primary energy Production	Import	Export	Gross inland consumption	7. Input to Power and CHP plants	8. Input to heating plants	1. Final use industry	2. Final use residential	3 Final use services	4. Final use transport	5. Bio-electricity	6. Derived heat	(1 + 2 + 3 + 4 + 5 +6) Final energy consumption	(5/7) Efficiency for electricity	(5+6)/(7+8) Efficiency for electricity and heat
EU27	108248	11420	4670	114949	35986	4484	19659	35924	1558	14388	11402	9668	92599	31.68%	52.06%
BE	2131	507	119	2525	1311	0	580	239	11	353	406	50	1639	30.97%	34.78%
BG	1048	13	91	972	10	2	176	747	12	17	5	5	962	50.00%	83.33%
CZ	2629	193	229	2589	652	35	390	1106	53	300	231	113	2193	35.43%	50.07%
DK	2162	1145	100	3207	1413	435	172	857	40	133	376	1191	2769	26.61%	84.79%
DE	22800	489	561	22728	9222	727	2834	5809	0	3278	3235	1084	16240	35.08%	43.41%
EE	942	0	140	797	179	119	109	365	20	0	67	169	730	37.43%	79.19%
IE	285	84	1	374	81	0	150	23	20	99	29	0	321	35.80%	35.80%
EL	1085	165	9	1339	57	0	261	764	14	106	18		1163	31.58%	31.58%
ES	6118	1368	500	6995	1150	0	1253	2472	64	1721	388	0	5898	33.74%	33.74%
FR	12624	530	157	12997	1498	144	1961	6413	510	2437	442	280	12043	29.51%	43.97%
HR	652	6	189	470	26	0	44	387	4	4	4	2	445	15.38%	23.08%
IT	6997	2230	163	9071	3789	82	207	3545	24	1455	931	676	6838	24.57%	41.51%
CY	21	25	0	47	6	0	7	7	5	16	5	1	41	83.33%	100.00%
LV	1817	44	600	1181	39	130	259	624	70	42	10	94	1099	25.64%	61.54%
LT	1077	147	203	971	64	179	77	558	34	45	14	188	916	21.88%	83.13%
LU	71	46	7	109	18	2	25	14	1	42	8	3	93	44.44%	55.00%
HU	1674	137	109	1703	572	12	82	724	125	166	159	76	1332	27.80%	40.24%
MT	1	0	0	1	0	0	0	1	0	0	0	0	1		
NL	2656	757	544	2815	1851	127	89	305	49	322	607	209	1581	32.79%	41.25%
AT	5045	945	405	5453	1406	567	1207	1516	72	516	389	866	4566	27.67%	63.61%
PL	6949	540	34	7453	1972	43	970	2747	212	934	654	366	5883	33.16%	50.62%
PT	3088	23	246	3068	612	0	1437	712	0	307	250	0	2706	40.85%	40.85%
RO	3618	115	37	3658	35	69	211	3147	0	195	17	50	3620	48.57%	64.42%
SI	554	38	4	589	71	8	58	415	2	35	23	25	558	32.39%	60.76%
SK	1016	38	44	996	310	67	368	44	14	172	71	105	774	22.90%	46.68%
FI	8000	175	215	7960	2744	553	3047	1224	76	234	966	1529	7076	35.20%	75.67%
SE	9503	0	0	9503	3136	1182	3322	1183	41	418	992	2583	8539	31.63%	82.79%
UK	4336	1667	154	5847	3787	0	407	363	90	1045	1116	0	3021	29.47%	29.47%

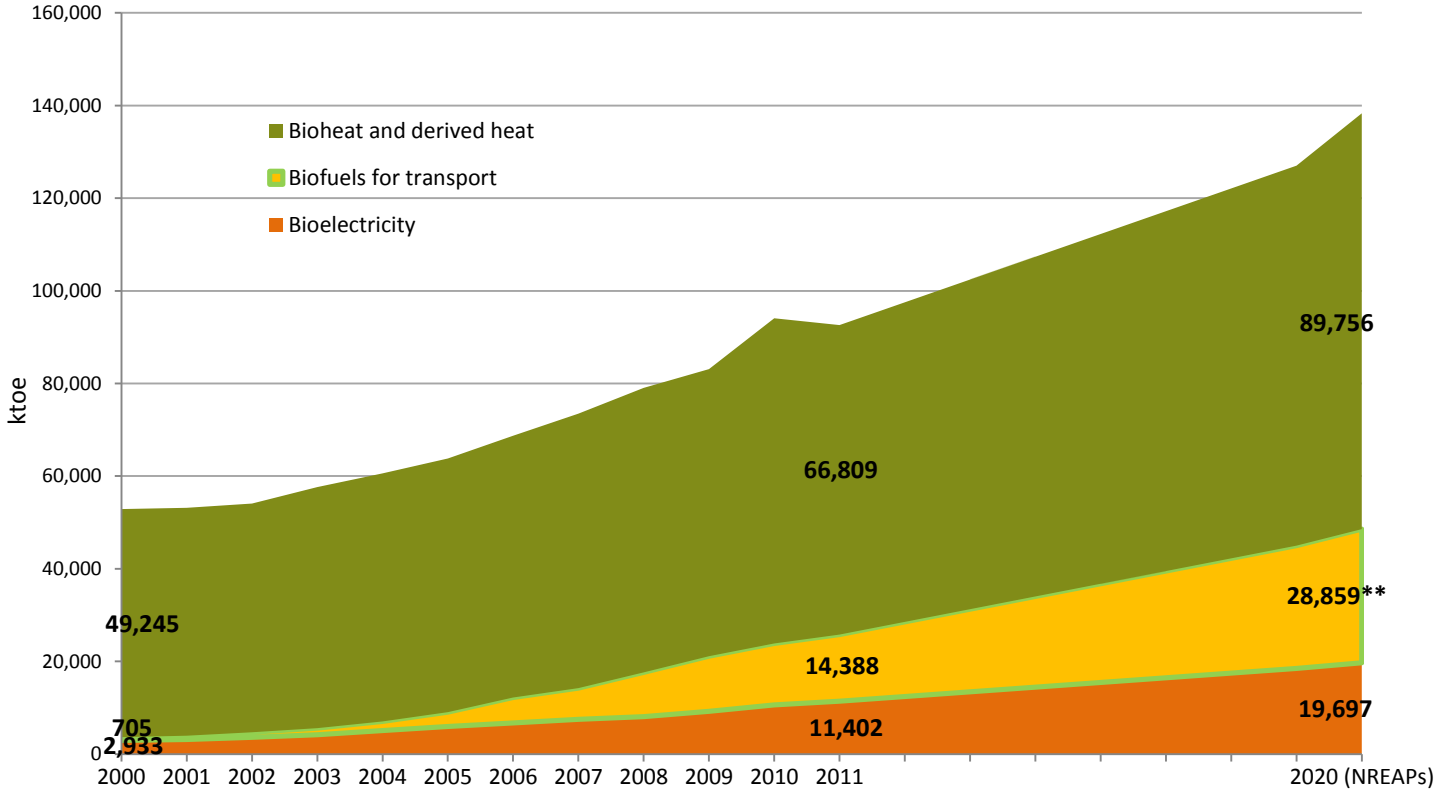
Source: Eurostat, AEBIOM calculations

Figure 2.12 Final energy consumption of biomass in heat, electricity and transport in 2011 (ktoe)



Source:Eurostat, AEBIOM calculation

Figure 2.13 Final energy consumption of bioenergy 2000-2020 in Europe*



* The figures between 2011 and 2020 are only estimations considering a stable growth between2011-2020.
** The rules to calculate the biofuels contribution to the 10% RES target in transport are under revision to take ILUC impact into account. Therefore this biofuels target is very unlikely to be achieved.
Source: Eurostat and NREAPs. AEBIOM calculation

2.2.2 OVERVIEW ABOUT THE NATIONAL RENEWABLE ENERGY ACTION PLANS

On 27 March 2013, the Commission published its **renewable energy progress report** (requirement of the RES Directive – article 22 – report every 2 years). The purpose of this progress report is to assess Member States' progress in the promotion and use of renewable energy towards the 2020 targets. In addition, it contains sections on the sustainability scheme for biofuels and bioliquids consumed in the EU and on the economic, social, and environmental impacts of this consumption.

The original documents are available in: http://ec.europa.eu/energy/renewables/reports/doc/com_2013_0175_res_en.pdf

Table 2.9 Overview of Member States' progress in renewables

	2010 RES Share*	1st interim target**	2020 RES target
EU27	12.7%	10.7%	20%
AT	30.10%	25.40%	34.00%
BE	5.40%	4.40%	13.00%
BU	13.80%	10.70%	16.00%
CY	5.70%	4.90%	13.00%
CZ	9.40%	7.50%	13.00%
DK	22.20%	19.60%	30.00%
EE	24.30%	19.40%	25.00%
FI	33.00%	30.40%	38.00%
FR	13.50%	12.80%	23.00%
DE	11.00%	8.20%	18.00%
EL	9.70%	9.10%	18.00%
HU	8.80%	6.00%	13.00%
IE	5.80%	5.70%	16.00%
IT	10.40%	7.60%	17.00%
LV	32.60%	34.00%	40.00%
LT	19.70%	16.60%	23.00%
LU	3.00%	2.90%	11.00%
MT	0.40%	2.00%	10.00%
NL	3.80%	4.70%	14.00%
PL	9.50%	8.80%	15.00%
PT	24.60%	22.60%	31.00%
RO	23.60%	19.00%	24.00%
SK	9.80%	8.20%	14.00%
SL	19.90%	17.80%	25.00%
ES	13.80%	10.90%	20.00%
SE	49.10%	41.60%	49.00%
UK	3.30%	4.00%	15.00%

* RES share reported in the Interim Reports for 2010 compared with ** the interim target for 2010 that MS fixed in the NREAPs.

Source: Report from the Commission Renewable Energy Progress Report (COM(2013)175)

AEBIOM has compiled data from the progress reports, focusing in bioenergy sector, in order to contribute to a better understanding of the bioenergy development in all EU countries, allowing easy comparison for further analysis.

For the purpose of calculating the overall renewable and bioenergy share the relevant parameter is the gross final energy consumption in a reference scenario and after aviation reduction. In 2020 the overall share of renewable, under these specifications, will reach 20.7% in Europe. Biomass will be by far the most important source of RES energy in Europe, covering 56,5% of all renewables.

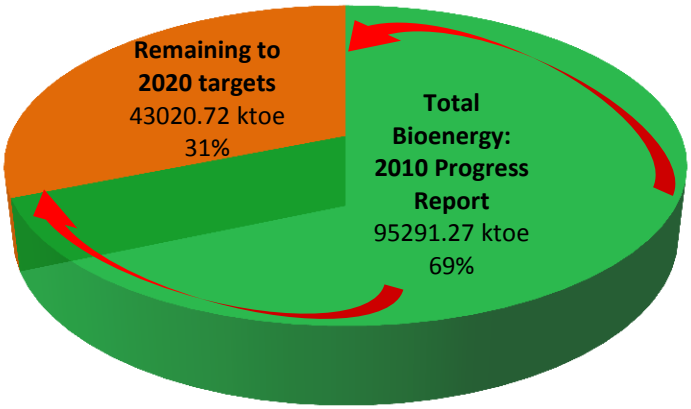
According to the NREAPs the total contribution of bioenergy in 2020 will be 138.3 Mtoe and heating will continue being by far the most important sector for bioenergy in 2020 counting 65% of the total and follow by transport with 21% and electricity 14%.

Table 2.10 Estimation of total contribution expected from bioenergy in 2020 (ktoe)

	Total	Bioelectricity	Biomass for heat and bioheat*	Biofuels
EU27	138312	19697	89756	28859
AT	4540	443	3607	490
BE	3772	949	2034	789
BU	1344	75	1073	196
CY	80	12	30	38
CZ	3671	531	2517	623
DK	3665	761	2643	261
EE	726	30	607	89
FI	8280	1110	6610	560
FR	21431	1476	16455	3500
DE	20908	4253	11355	5300
EL	1947	108	1222	617
HU	2069	286	1277	506
IE	1054	87	486	481
IT	9765	1615	5670	2480
LV	1543	105	1392	46
LT	1295	105	1023	167
LU	328	29	83	216
MT	14	12	2	0
NL	3143	1431	878	834
PL	8214	1223	5089	1902
PT	3101	302	2322	477
RO	4365	0	3876	489
SK	1022	147	690	185
SL	776	58	526	192
ES	9311	861	4950	3500
SE	11583	1441	9426	716
UK	10368	2249	3914	4205

* Biomass for heat means the energy content of biomass before conversion (considered as final energy when used in households, services and industry), while bioheat is the energy content of heat after conversion (considered as final energy in DH and CHP plants).

Figure 2.14 Bioenergy in 2010 according to the progress reports and remaining to achieve the 2020 targets



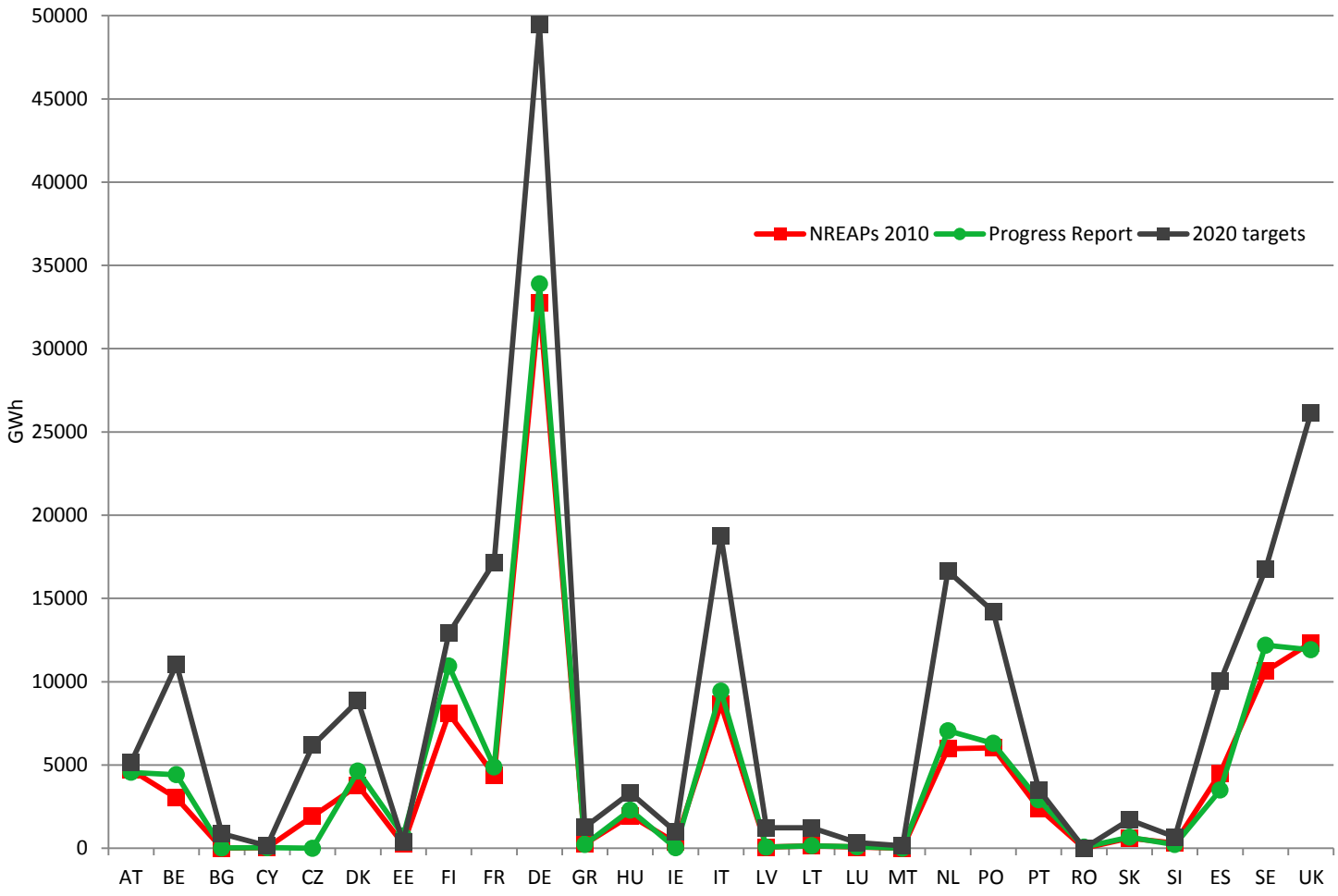
The following graphs show the contribution of biomass to the different sectors in 2020 according to the NREAPs.

- **Bioelectricity**

Table 2.11 State of play: Bioenergy consumption in electricity (GWh)

	Total Biomass			Solid			Biogas			Bioliquids		
	2010 Production (GWh)		2020 TARGETS Production (GWh)	2010 Production (GWh)		2020 TARGETS Production (GWh)	2010 Production (GWh)		2020 TARGETS Production (GWh)	2010 Production (GWh)		2020 TARGETS Production (GWh)
	NREAPs	PR		NREAPs	PR		NREAPs	PR		NREAPs	PR	
TOTAL EU27	113249	121204	229077	76705	91281	159556	28719	23817	63028	8632	6350	12752
AT	4720	4554	5147	4131	2674	4530	553	649	581	36	1232	36
BE	3006,9	4413,8	11038,5	2579,9	3575,9	9574,6	393,3	568,2	1439,1	33,7	269,6	24,8
BG	2	16	871	0	0	514	2	16	357	0	0	0
CY	30	35,13	143	0	0	0	30	35,13	143	0	0	0
CZ	1930	0	6171	1306	0	3294	624	0	2871	0	0	6
DK	3772	4632	8846	3578	4299	6345	194	333	2493	0	0	8
EE	241	740	346	0	730	0	0	10	0	0	0	0
FI	8090	10948	12910	3930	10859	7860	40	89	270	4120	0	4780
FR	4391	4876	17171	4506	3863	13470	935	1013	3701	0	0	0
DE	32778	33900	49457	17498	16000	24569	13829	16200	23438	1450	1700	1450
GR	254	216	1259	73	0	364	181	216	895	0	0	0
HU	1955	2291	3324	1870	2179	2688	85	112	636	0	0	0
IE	347	27	1006	28	9	687	320	18	319	0	0	0
IT	8645	9440	18780	4758	4308	7900	2129	2054	6020	1758	3078	4860
LV	72	66	1226	8	9	642	64	57	584	0	0	0
LT	147	147	1223	98	116	810	50	31	413	0	0	0
LU	70	84	334	25	28	190	44	56	144	0	0	0
MT	8,68	0	135,48	0	0	85,5	8,68	0	49,98	0	0	0
NL	5975	7059	16639	5103	5961	11975	872	1044	4664	0	54	0
PO	6028	6303,59	14218	5700	5905,21	10200	328	398,38	4018	0	0	0
PT	2400	2904	3516	1092	2804	8074	138	100	525	1170	0	1523
RO	0	69,472	0	0	69,227	0	0	0,245	0	0	0	0
SK	610	668	1710	540	636	850	70	32	860	0	0	0
SI	298	222	676	150	125	309	148	97	367	0	0	
ES	4517	3488	10017	3719	3241	7400	799	653	2617	0	0	0
SE	10632	12191	16754	10513	11976	16635	53	36	53	65	17	65
UK	12330	11914	26160	5500	11914	20590	6830	0	5570	0	0	0

Figure 2.15 Gross electricity generation from biomass

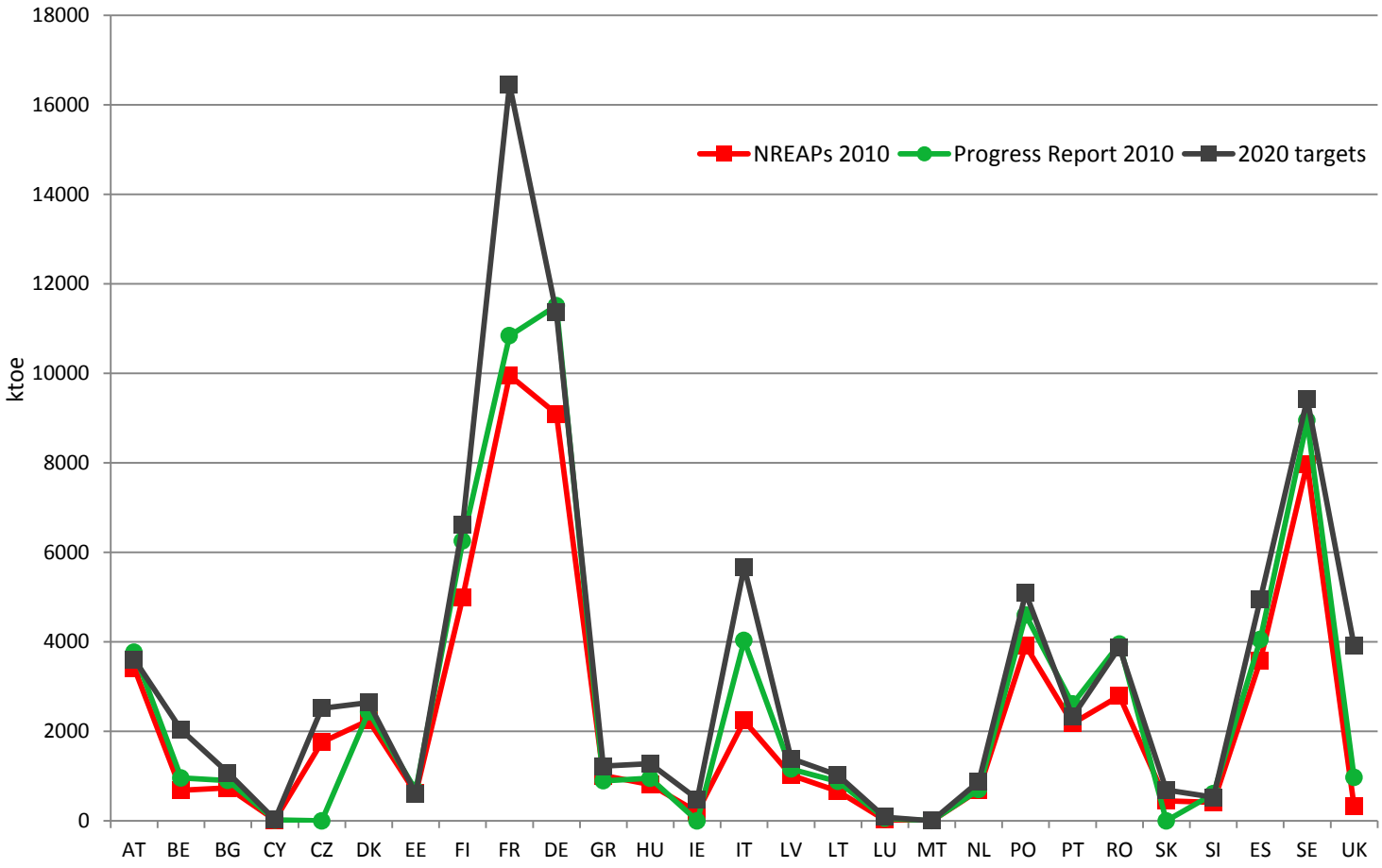


- **Biomass for heat**

Table 2.12 State of play: Bioenergy consumption in heating and cooling (ktoe)

	Biomass			Solid			Biogas			Bioliquids		
	2010		2020 TARGETS	2010		2020 TARGETS	2010		2020 TARGETS	2010		2020 TARGETS
	NREAPs	PR		NREAPs	PR		NREAPs	PR		NREAPs	PR	
Total EU27	61782,81	71758,41	89756,78	56718,1	67449,032	80992,66	1476,41	1928,999	4416,12	3643,2	2153,68	4416
AT	3415	3767	3607	3400	3734	3591	15	28	16	0	4	0
BE	682,1	957,5	2034	669	890,4	1947	8,9	26,2	55	4,2	41,6	32
BG	734	899	1073	734	883	1053	0	3	20	0	13	0
CY	18,3	19,43	30,16	16,3	17,04	24,16	2	2,39	6	0	0	0
CZ	1759	0	2517	1706	0	2350	53	0	167	0	0	0
DK	2245	2436	2643	2178	2387	2470	59	49	165	8	0	8
EE	612	682	607	612	680	607	0	2	0	0	0	0
FI	4990	6251	6610	2710	6203	3940	30	8	60	2240	40	2610
FR	9953	10840	16455	9870	10711	15900	83	129	555	0	0	0
DE	9092	11513	11355	7516	9537	8952	912	1293	1692	664	683	711
GR	1012	892	1222	1012	890	1222	0	2	0	0	0	0
HU	812	951	1277	812	942	1225	0	9	56	0	0	0
IE	198	0	486	188	193	453	10	7,6	33	0	0	0
IT	2239	4028	5670	2206	3721	5254	26	26	266	7	281	150
LV	1020	1158	1392	1013	1153	1343	7	4	49	0	0	0
LT	663	879	1023	657	874	973	6	5	50	0	0	0
LU	23,4	54,4	82,9	18,8	47,9	69,5	4,6	6,5	13,4	0	0	0
MT	1,01	0,56	1,72	0	0,33	0	1,01	0,15	1,72	0	0,08	0
NL	684	698	878	573	569	650	111	116	228	0	14	0
PO	3911	4599,5	5089	3846	4554,2	4636	65	45,3	453	0	0	0
PT	2179	2609	2322	1514	1699	1484	10	32	37	655	878	801
RO	2794	3951,021	3876	2793	3950,162	3845	1	0,859	20	0	0	11
SK	447	0	690	443	533	630	4	7	60	0	0	0
SI	415	603	526	415	552	497	0	5	0	0	46	28
ES	3583	4054	4950	3550	4015	4850	33	39	100	0	0	0
SE	7978	8949	9426	7961	8713	9415	16,9	83	11	65	153	65
UK	323	967	3914	305	0	3612	18	0	302	0	0	0

Figure 2.16 Final energy consumption in heating and cooling from biomass (ktoe)

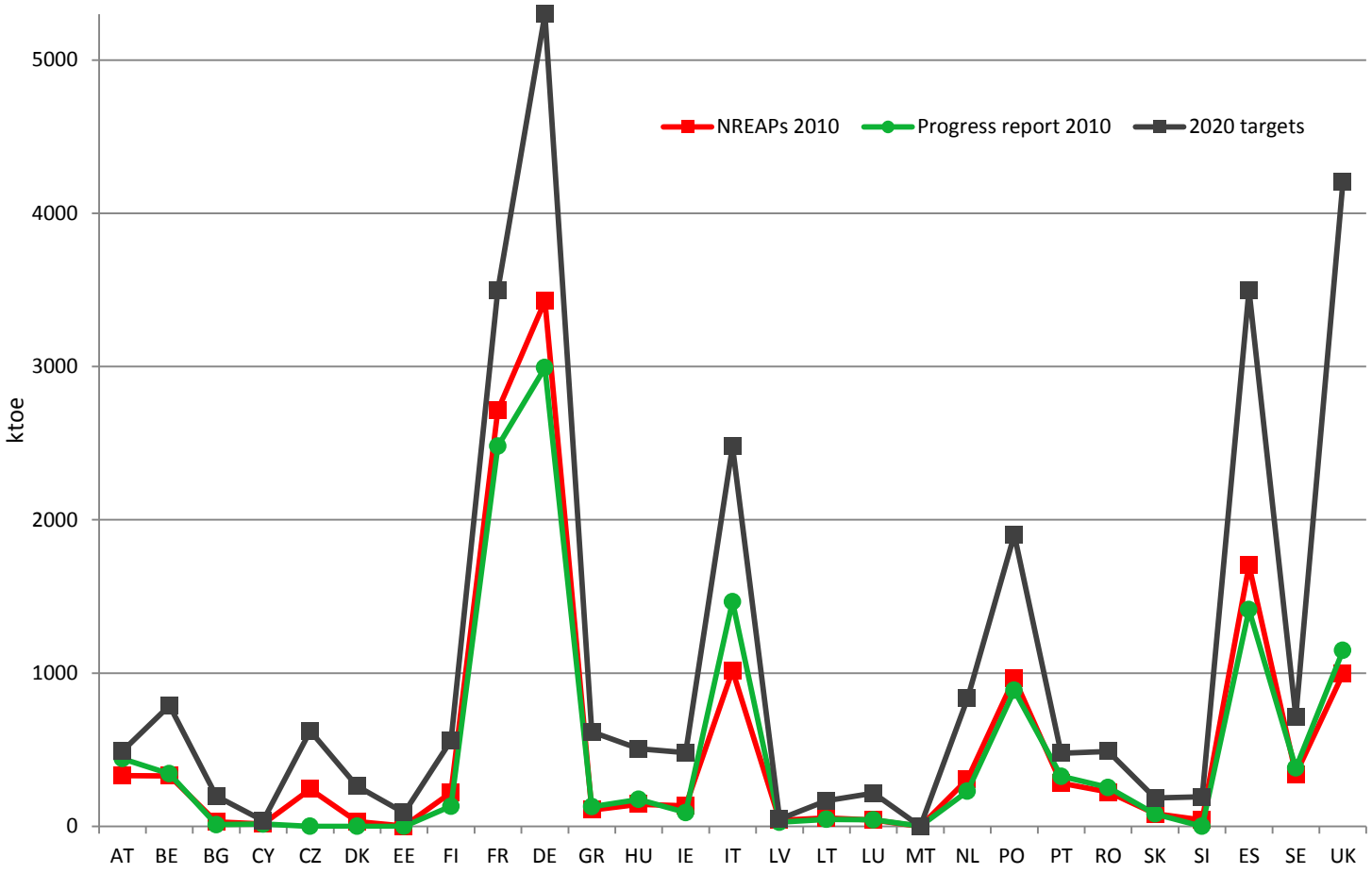


- **Biofuels**

Table 2.13 State of play: Bioenergy consumption in transport (ktoe)

	Bioethanol (ktoe)						Biodiesel (ktoe)					
	2010				2020 TARGETS	of which Art 21.2	2010				2020 TARGETS	of which Art 21.2
	NREAPs	of which Art 21.2	PR	of which Art 21.2			NREAPs	of which Art 21.2	PR	of which Art 21.2		
Total EU27	2868,78	37,75	2785,7	36	7283,53	950,49	10950,87	417,53	10323,54	264,936	21575,61	1672,02
AT	54	0	68	0	80	0	276	0	374	0	410	0
BE	37,18	0	38,2	0	91,23	0	291,87	0	304,6	0	697,91	126,89
BG	0	0	0	0	42	32	30	30	11	0	154	130
CY	0	0	0	0	14,7	14,7	15,7	0,3	14,96	0,09	23,2	23,1
CZ	50	0	0	0	128	29	193	0	0	0	495	215
DK	13	0	0	0	94	47	18	0	0	0	167	84
EE	0	0	0	0	38	0	0,9	0	0	0	51,1	0
FI	70	0	71,5	0	130	40	150	0	60	0	430	140
FR	550	0	394	0	650	0	2165	0	2086	63	2850	0
DE	639	0	749	0	857	474	2790	98	2244	0	4443	98
GR	43	0	0	0	414	0	64	0	128	12	203	0
HU	34	0	57	0	304	0	110	18	119	0	202	22
IE	40	0	30	30	139	0	94	0	60	60	342	0
IT	148	19	155	0	600	100	868	72	1311	38	1880	250
LV	14	0	8	0	18	18	25	0	19	0	28	15
LT	13	0	10	0	36	0	42	0	35	0	131	0
LU	4,7	0	1	0	23,1	0	36,8	0	41	0	192,7	0
MT	0	1,75	0	0	0	5,79	0	1,23	0,546	0,546	0	7,03
NL	168	17	134	4	282	34	139	139	95	82	552	121
PO	279	0	189	0	451	44	687	0	698	0	1451	132
PT	0	0	0	0	27	0	281	4	326	0,3	450	8
RO	75	0	110,9	0	163	35	149	0	142,43	0	326	70
SK	15	0	15,1	0	75	25	67	0	66	0	110	30
SI	3,9	0	0	0	18,5	0	36,6	0	0	0	173,7	0
ES	232	0	231	0	400	52	1471	55	1183	5	3100	200
SE	251	0	203	2	465	0	89	0	178	4	251	0
UK	135	0	321	0	1743	0	861	0	827	0	2462	0

Figure 2.17 Total contribution of biofuels in the transport sector



2.2.3 SOCIO-ECONOMIC INDICATORS

Table 2.14 Turnover in 2011 (MEUR)

	Biogas	Biofuels	Solid biomass
Total EU	5175	14685	27498
BE	60	305	290
BG	0	5	290
CZ	90	285	600
DK	35	130	430
DE	2280	3670	7100
EE	<5	5	250
IE	20	90	55
EL	25	100	270
ES	90	1600	1400
FR	190	2450	1730
HR	-	-	-
IT	1500	1350	1030
CY	0	15	<5
LV	10	40	510
LT	<5	40	285
LU	<5	40	10
HU	10	150	443
MT	0	0	0
NL	100	300	310
AT	60	410	2430
PL	40	1400	600
PT	20	290	760
RO	<5	190	1135
SI	10	35	150
SK	15	155	230
FI	15	160	2175
SE	10	470	4500
UK	575	1000	510

Note: Turnover figures, expressed in current euros, focus on the main economic investment activity of the supply chain (manufacturing, distribution and installation of equipment, plant operation and maintenance). Turnover arising from electricity or heat sale, financial and training activities, or publicly funded research etc. are excluded

Source: The State of renewables energies in Europe – 12th EurObserv´ER Report

Table 2.15 Jobs in bioenergy sector 2011

	Biofuels	Solid biomass	Renewable municipal waste	Biogas
Total EU	109150	274150	26000	70950
BE	2000	3000	430	350
BG	100	3000	n/a	0
CZ	2500	6200	50	500
DK	1500	4500	2500	200
DE	23200	48300	6800	52900
EE	50	2600	n/a	<50
IE	700	600	<50	100
EL	550	2750	n/a	100
ES	10200	14400	1300	2000
FR	29900	45500	3800	2350
HR				
IT	8400	10600	950	4000
CY	50	50	n/a	0
LV	300	5200	<50	200
LT	300	2950	n/a	<50
LU	150	50*	<50	<50
HU	1200	4600	50	100
MT	0	0	n/a	0
NL	2500	3150	4500	1900
AT	2700	18850	150	1500
PL	6450	21800	<50	500
PT	1600	7800	300	<50
RO	1400	11700	n/a	300
SI	150	1550	<50	350
SK	1100	2350	<50	<50
FI	1400	22450	250	<50
SE	3800	25000	2900	<50
UK	7500	5200	1720	3200

Note: Employment covers both direct and indirect jobs (in full-time equivalent) and relate to gross employment, i.e. not taking into account job losses in other industrial sectors or due to expenditure and investment shifted away from other sectors.

Direct jobs are those directly derived from RES manufacturing, equipment and component supply, or onsite installation and O&M.

Indirect jobs are those that result from activity in sectors that supply the materials or components used, but not exclusively so, by the renewables sectors (such as jobs in copper smelting plants part whose production may be used for manufacturing solar thermal equipment, but may also be destined for appliances in totally unconnected fields

Source: The State of Renewable Energies in Europe, 10th EurObserv'ER Report, 2010

biomass supply

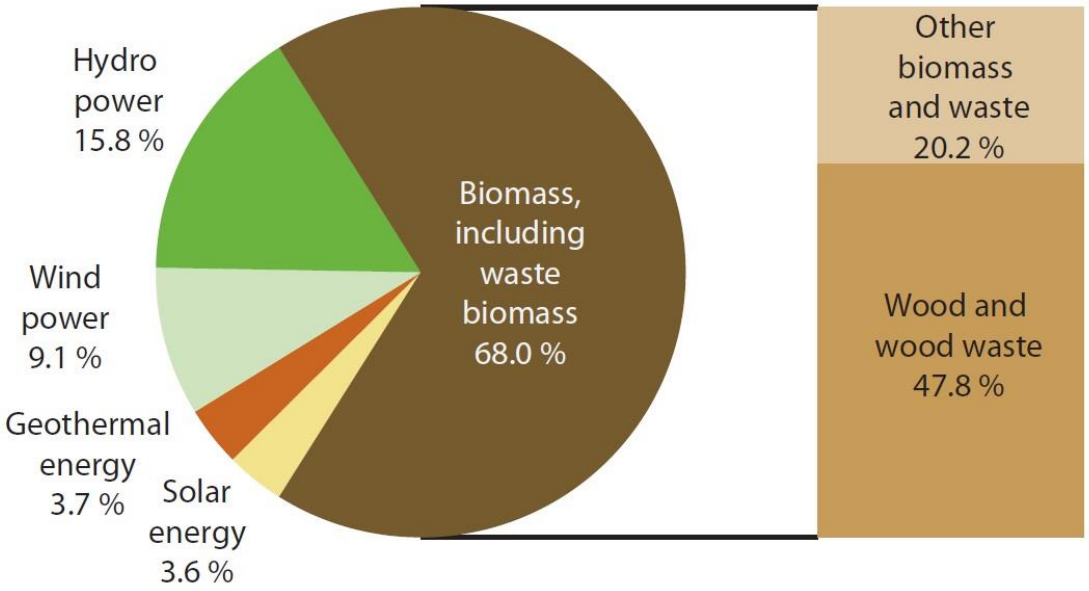
3.1 General overview

Bioenergy is the largest source of renewable energy today providing heat, electricity, as well as transport fuels and a significant increase in bioenergy demand is expecting in the coming years. Since bioenergy can be generated from wood, energy crops and biomass residues, as well as organic wastes, there is a considerable potential that can contribute to the rural development, and create new opportunities for farmers and forest owners. International trade in biomass and biomass intermediates (pellets for instance) will be also vital to match supply and demand in different regions in Europe.

Obtaining accurate data on the biomass resource available can be challenging specially for some biomass feedstock as energy crops. AEBIOM has compiled data from different sources in order to have a clear picture of the biomass resources available in Europe. The following tables deliver data for the three main relevant biomass sector: agriculture, forestry and waste.

As can be seen in the graph below, within the total biomass, wood and wood waste provided the highest share of energy from organic, non-fossil materials of biological origin, accounting for almost half (47.8 %) of the EU-28's gross inland energy consumption of renewables in 2011.

Figure 3.1 Consumption of renewable energy, EU-28, 2011



Source: Eurostat 2013

3.2 Biomass for agricultural land and by-products

3.2.1 AGRICULTURE IN EU

Table 3.1 Agricultural land use in 2012 (1000 ha)

	Utilised agricultural area (UAA)	Arable land	Permanent grassland	Permanent crops
EU-27	177647	98664	59114	11606
BE	1358	834	500	22
BG	5123	3295	1647	159
CZ	3526	2519	968	37
DK	2664	2435	216	6
DE	16667	11834	4631	200
EE	956	621	192	3
IE	4533	1169	3362	1
EL	4151	1559	1221	1214
ES	23463	12522	6291	4630
FR	29001	18358	9478	1020
IT	1331	904	346	79
CY	13134	:	4184	2371
LV	115	86	2	29
LT	1841	1178	656	6
LU	2842	2261	550	32
HU	131	63	67	2
MT	5338	4315	759	174
NL	11	9	0	1
AT	1842	1001	795	36
PL	2864	1355	1441	65
PT	14529	10871	3207	398
RO	3598	1070	1795	714
SI	13733	8798	4489	320
SK	480	172	281	27
FI	1927	1360	515	19
SE	2285	2248	32	4
UK	3032	2594	435	3

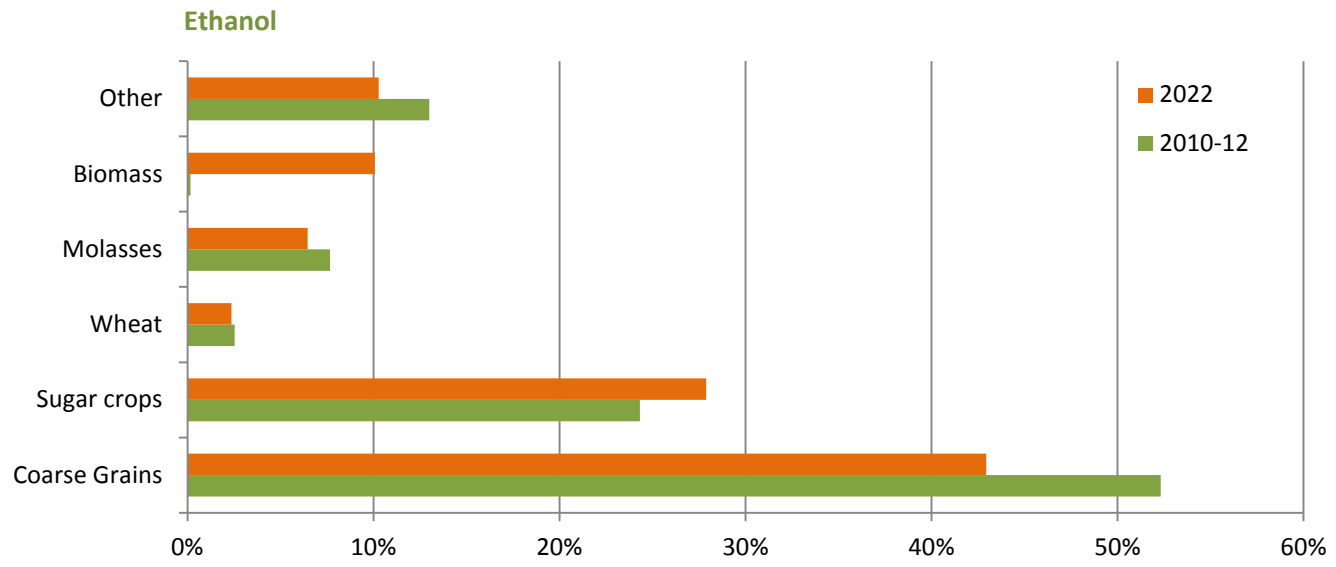
Source: Eurostat

Table 3.2 Harvested production of some of the main crops 2012 (1000 tons)

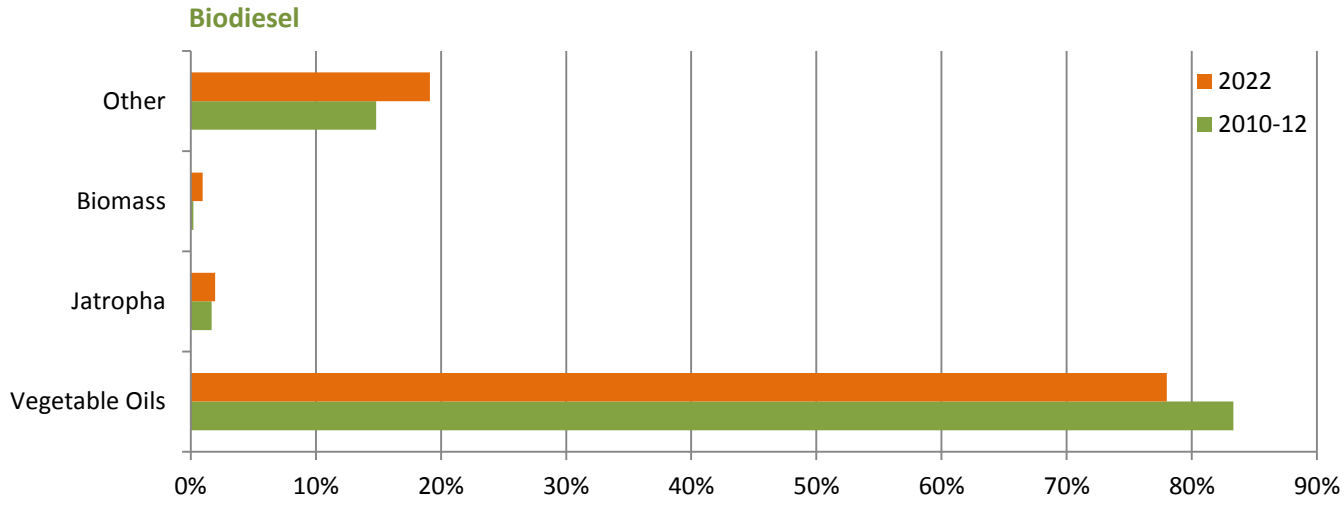
	Cereals for the production of grain (including rice and seed)	Cereals (excluding rice)	Sugar beet	Rape	Sunflower	Wheat (including spelt)	Barley
EU 27	282315	279191	115000	:	:	133476	54792
BE	3012	3012	4830	:	:	1835	364
BG	6988	6933	0	271	1388	4455	662
CZ	6596	6596	3869	1109	57	3519	1617
DK	9460	9460	2649	481	:	4525	4059
DE	45397	45397	27687	:	63	22409	10391
EE	991	991	0	55	:	485	341
IE	2125	2125	:	:	:	708	1261
EL	4284	4069	435	1	160	1569	326
ES	17543	16644	3460	43	642	5190	5956
FR	68458	68335	33739	5483	1575	37921	11348
IT	2687	2687	919	26	90	1000	236
CY	18959	17377	2501	25	186	7767	960
LV	91	91	:	:	:	23	67
LT	2125	2125	:	205	:	1540	249
LU	4657	4657	1003	265	0	2999	742
HU	153	153	:	15	0	79	38
MT	10373	10362	882	413	1317	4011	996
NL	:	:	0	:	0	:	:
AT	1826	1826	5735	7	0	1302	206
PL	4876	4876	3114	149	53	1276	663
PT	28544	28544	12350	1690	6	8608	4180
RO	1178	991	19	:	10	59	21
SI	12824	12773	720	146	1398	5298	986
SK	576	576	0	17	0	188	85
FI	3036	3036	895	202	197	1275	471
SE	3659	3659	399	:	0	887	1581
UK	5071	5071	2314	229	0	2289	1702

Source: Eurostat

Figure 3.2 Share of feedstock used for biofuels production (% of biofuels produced per feedstock). Worldwide figures.



Coarse grains generally refers to cereal grains other than wheat and rice



Source: OECD/Food and Agriculture Organization of the United Nations (2013), OECD-FAO Agricultural Outlook 2013, OECD Publishing. http://dx.doi.org/10.1787/agr_outlook-2013-en

Table 3.3 Cellulosic energy crops in 2011 (ha)

	Hemp	Switchgrass	Reed Canary grass	Willow	Poplar	Miscanthus
AT				220-1 100	880-1 100	800
BE*				60		100
BU						
CY						
CZ						
DK	55 (some for fibre production)		19	5.697	2.807	64 (some for thatcher)
EE						
FI			18 700			
FR					2300	2 000-3 000
DE				4 000	5 000	2 000
EL						
HU						
IE				930		2 200
IT				670	5.490	50-100
LV						
LT				550		
LU						
MT						
NL						90
PL				5 000 – 9 000	300	
PT						
RO		50.000				
SK						
SL						
ES						
SE	390		780	11 000	550	450
UK				1 500-2 300		10 000-11 000

* Willow data only for Walloon region

Source:

Denmark: 2013 data – Thomas Holst, Ministry of Food, Agriculture and Fisheries of Denmark

Ireland: 2013 data - Barry Caslin – Teagasc

Romania: Estimation, Tuzetka 2013

Data 2011→Ministry for food and agricultural-FNR (Germany); Swedish Agricultural board; Crops for Energy (UK); NFU (UK); Miscanthus Growers Ltd. (UK), Cradle Crops (The Netherlands); Association d´initiatives locales pour l´energie et l´environnement, AILE (France) ; NovaBiom (France); VALBIOM, DGARNE -Département des Aides- Direction des Surfaces agricoles (Belgium).

3.3 BIOMASS FROM FORESTRY

3.3.1 FORESTRY IN EUROPE

Table 3.4 Forest area in the EU

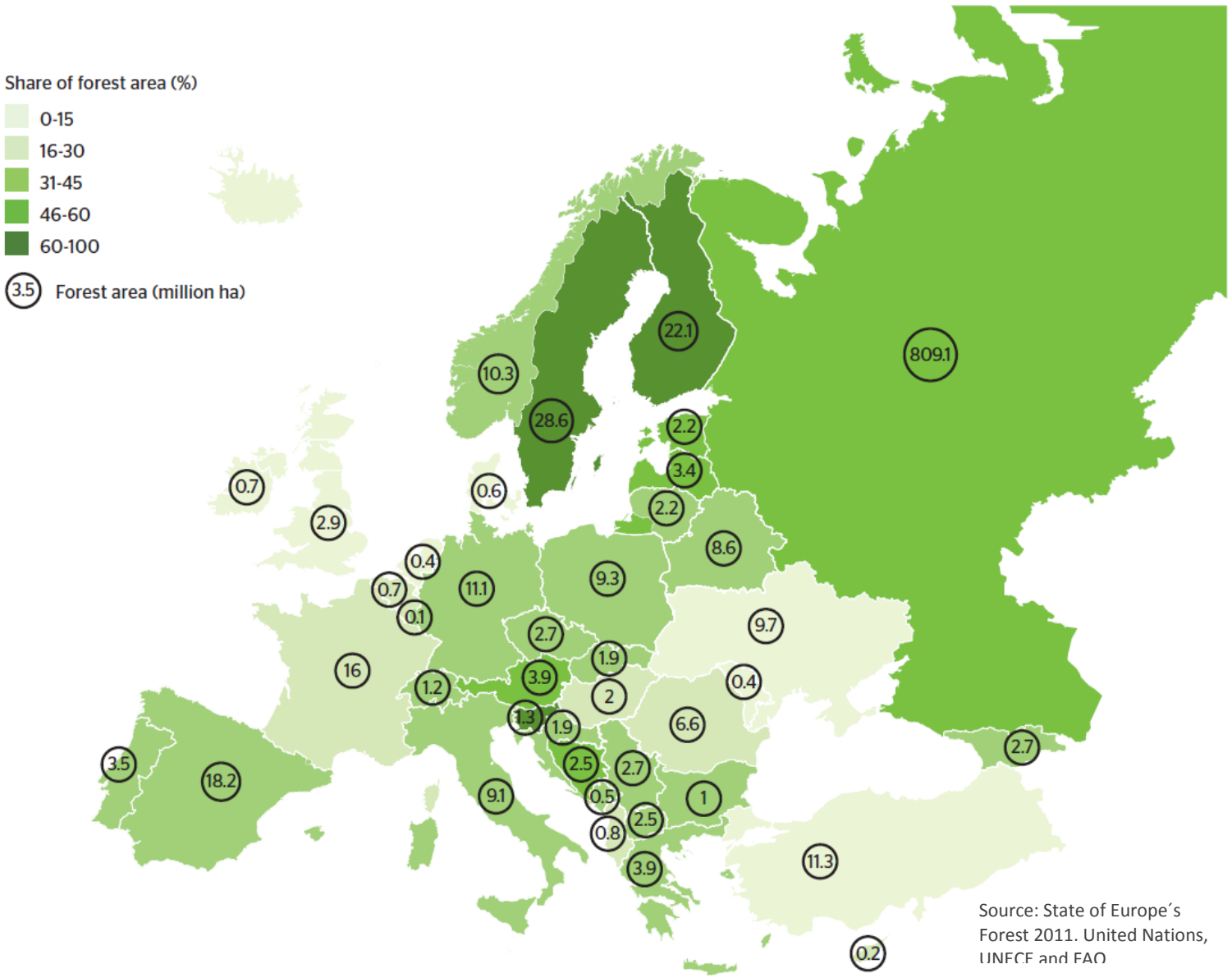
	Forest and other wooden land		Forest available for wood supply		Forest and other wooden land	
	2000	2010	2000	2010 [1]	2000	2010
	(1000 ha)				(ha/capita)	
EU 27	174 235	177 757	128 125	132 605	0,36	0,35
BE	694	706	663	672	0,07	0,07
BG	3 480	3 927	2 258	2 864	0,42	0,52
CZ	1 637	2 657	2 561	2 330	0,26	0,25
DK	622	591	371	581	0,12	0,11
DE	11 076	11 076	10 985	10 568	0,13	0,14
EE	2 337	2 350	2 103	2 013	1,70	1,75
IE	650	789	597	:	0,17	0,18
EL	6 525	6 539	3 317	3 595	0,60	0,58
ES	27 452	27 747	10 480	14 915	0,69	0,60
FR	17 165	17 572	14 645	15 147	0,28	0,27
IT	10 439	10 916	8 446	8 086	0,18	0,18
CY	387	387	43	41	0,56	0,48
LV	3 097	3 467	2 777	3 138	1,30	1,54
LT	2 103	2 240	1 756	1 875	0,60	0,67
LU	88	88	87	86	0,20	0,18
HU	1 866	2 029	1 622	1 726	0,18	0,20
MT	0	0	0	:	0,00	0,00
NL	360	365	290	295	0,02	0,02
AT	3 955	4 006	3 341	3 343	0,49	0,48
PL	9 059	9 337	8 342	8 532	0,23	0,24
PT	3 667	3 611	2 009	1 822	0,36	0,34
RO	6 600	6 733	4 628	5 193	0,29	0,31
SI	1 283	1 274	1 130	1 175	0,65	0,62
SK	1 921	1 933	1 767	1 775	0,36	0,36
FI	23 305	23 269	20 508	19 869	4,51	4,35
SE	30 653	31 247	21 076	20 554	3,46	3,35
UK	2 813	2 901	2 323	2 411	0,05	0,05

[1] EU27, excluding Ireland and Malta

Source: Eurostat "Forestry in the EU and the world", 2011

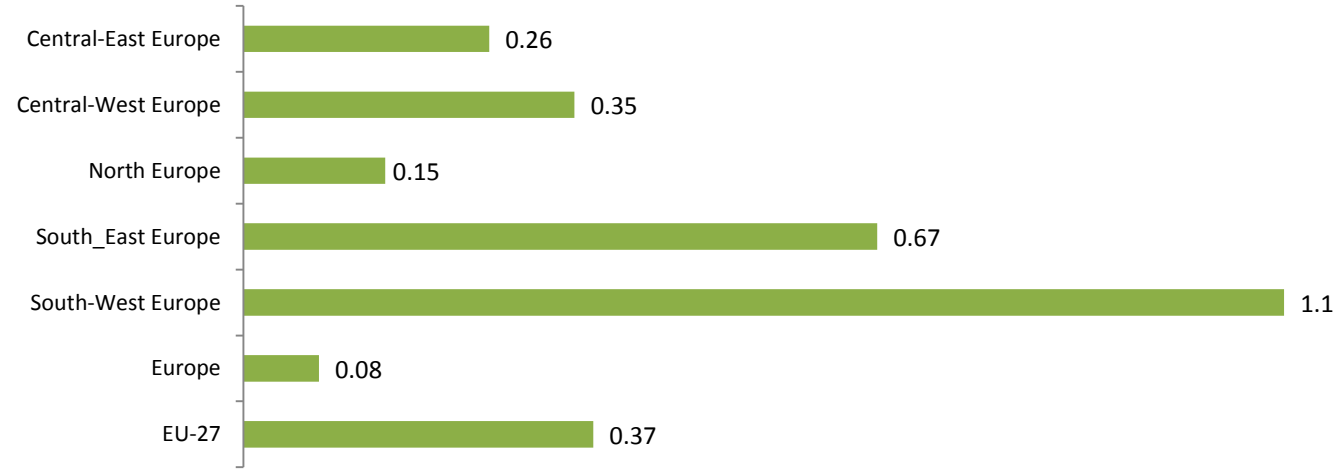
In Europe, the forest area designated primarily for conservation of biological diversity doubled in the last 20 years.

Figure 3.3 Forest area (million ha) and share (%) of land area by country, 2010



Forest area in Europe has expanded by 17 million ha during the past 20 years. On average, Europe's forest area has risen by 834 499 ha (0.08%) per year (State of Europe´s Forest 2011. United Nations, UNECE and FAO).

Figure 3.4 Annual rate of change in forest area by region, 1990-2010 (% of forest area/year)



North Europe: Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden. Central-West Europe: Austria, Belgium, France, Germany, Ireland, Liechtenstein, Luxembourg, Netherlands, Switzerland, United Kingdom. Central-East Europe: Belarus, Czech Republic, Georgia, Hungary, Poland, Republic of Moldova, Romania, Slovakia, Ukranie. South-West Europe: Andorra, Italy, Malta, Monaco, Portugal, Spain. South-East Europe: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Montenegro, Serbia, Slovenia, the former Yugoslav Republic of Macedonia, Turkey.

Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO

Table 3.5 Age-class distribution – total of all even-aged forest stands, 2010 (1000ha)

	total	Age Class									
		<10 yrs	10-20	21-40	41-60	61-80	81-100	101-120	121-140	>140	unspec.
BE	511.7	43.9	55.5	128	83.9	34.9	13	2.4	0.7	0	149.3
BG	3927	0	526	909	1268	548	260	187	129	100	0
CZ	2657	214.7	230.9	385.1	366.9	477.6	417.7	305.3	118.6	57.7	82.5
DK	470.4	47.8	74.3	120.9	109.5	37	17	10.9	5.1	5.7	42.2
DE	11076	643	643	1778	2160	1541	1391	981	597	587	755
EE	1716.8	258.2	119.3	327.8	508.1	325.9	123.8	34.3	13.1	6.2	0
IE	573.3	169.7	207.6	165.3	21.8	4.9	2.2	1.2	0.2	0.4	0
EL											
ES											
FR	10128.6	87.5	570.7	1650.2	1865.7	1632.1	1158.5	923.8	623	775.5	841.6
HR	1556	68	157	346	312	363	159	114	31	6	0
IT	5435.7		227.1	2088.5	1151.3	729.4	177	148.1	76.5		725
CY											
LV	3162.4	369.5	251.5	712	782.8	560.1	274.5	125.7	86.4		
LT	2165	206	146	338	583	452	233	74	17	11	105
LU											
HU	1616.3	163.7	285.6	492.5	274.9	216.3	121.1	42.1	7.4	3.9	8.7
MT											
NL	305										0
AT											
PL	9116	803	632	1523	2565	1705	1153	524	139	71	0
PT											
RO											
SI											
SK	1938	142.9	148.4	294.9	295.7	393.7	345.8	183.7	65.4	56.5	10.7
FI	22084	2087	1701	3887	3948	3739	2706.4	1249.7	714.9	2049.6	0
SE	22839	2863	2272	4911	3929	2590	2110	1482	1226	1456	0
UK	2881	251	282	733	546	331	170	102	82	91	293

Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO

Table 3.6 Forest ownership in the EU

	Public owned		Private and other		Change 2000-2010			
	2000	2010	2000	2010	Pub. owned	Priv. & other	Pub. owned	Priv. & other
	(1000ha)				(1000 ha/year)		(% annual average)	
BE	290	301	377	377	1,1	0,0	0,4	0,0
BG	3 041	3 408	334	519	36,8	18,4	1,1	4,5
CZ	2 023	2 041	614	616	1,8	0,2	0,1	0,0
DK	138	139	348	448	0,1	10,0	0,1	2,6
DE	5 846	5 708	5 230	5 368	-13,8	13,8	-0,2	0,3
EE	899	858	1 344	1 345	-4,1	0,1	-0,5	0,0
IE	399	400	236	337	0,1	10,1	0,0	3,6
EL (1)	2 790	2 907	811	845	23,4	6,8	0,8	0,8
ES	4 988	5 336	1 200	12 838	34,8	83,7	0,7	0,7
FR	3 984	4 113	11 369	1 141	12,9	47,2	0,3	0,4
IT	2 811	3 073	5 558	6 076	26,2	51,8	0,9	0,9
CY	118	119	54	54	0,1	0,0	0,1	0,0
LV	1 749	1 655	1 493	1 696	-9,4	20,3	-0,6	1,3
LT	1 562	1 366	458	784	-19,6	32,6	-1,3	5,5
LU	41	41	46	46	0,0	0,0	0,0	0,0
HU	1 155	1 178	753	861	2,4	10,9	0,2	1,4
MT	0	0	0	0	-	-	-	-
NL	184	184	176	181	0,0	0,5	0,0	0,3
AT	928	858	2 332	2 482	-7,0	15,0	-0,8	0,6
PL	7 535	7 661	1 524	1 658	12,6	13,4	0.2	0,8
PT (1)	54	54	3 366	3 382	0,1	3,2	0,1	0,1
RO (2)	6 010	4 398	356	2 097	-161,2	174,1	-3,1	19,4
SI	365	291	868	962	-7,4	9,4	-2,2	1,0
SK	1 006	980	915	958	-2,6	4,3	-0,3	0,5
FI	7 213	6 699	15 245	15 389	-51,4	14,4	-0,7	0,1
SE (3)	7 522	7 664	20 990	20 941	28,4	-9,8	0,4	0,0
UK	1 011	959	1 782	1 922	-5,2	14,0	-0,5	0,8

(1) 2005 instead of 2010, change from 2000 to 2005 instead of from 2000 to 2010.
(2) Excluding other ownership.
(3) 2005 instead of 2000, change from 2005 to 2010 instead of from 2000 to 2010.
Source: SoEF 2011

Table 3.7 Ownership, number of holdings of forest in size classes, 2010

	Number of forest holdings in size classes									
	Public					Private				
	<10 ha	11-100 ha	101-500 ha	501-10000 ha	>10000 ha	<10 ha	11-100 ha	101-500 ha	501-10000 ha	>10000 ha
AT	619	1015	236	105	3	104634	36027	2420	434	4
BE	-	-	-	-	-	-	-	-	-	-
BG	36279	6850	1246	144	134	545692	2979	75	10	0
HR	6	43	88	542	2	599953	30	10	6	1
CY	0	0	0	1	3	-	-	-	-	-
CZ	74	876	848	222	78	-	-	441	312	1
DK	96	150	52	33	0	21496	4245	382	94	0
EE	-	-	-	-	-	-	-	-	-	-
FI	-	-	-	-	-	205620	223280	14578	-	-
FR	1547	7117	5954	2032	17	-	-	-	-	-
DE	0	-	-	1480	-	157530	-	-	657	-
GR	-	-	-	-	-	-	-	-	-	-
HU	622	374	88	144	30	22559	9925	1127	101	0
IE	0	10	60	242	5	14190	6142	218	20	0
IT	-	-	-	-	-	-	-	-	-	-
LV	-	-	-	-	-	-	-	-	-	-
LT	0	0	0	5	42	222573	13225	201	21	0
LU	118	33	77	14	1	12230	840	8	2	0
MT	-	-	-	0	0	0	0	0	0	0
NL	1920	108	102	25	4	27694	905	103	22	0
PO	980	716	115	98	396	-	-	-	-	-
PT	-	-	-	-	-	-	-	-	-	-
RO	-	-	-	-	-	-	-	-	-	-
SK	53	65	31	58	6	2813	2042	1221	268	2
SI	4467	583	113	26	4	295925	17194	274	20	0
ES	-	-	-	-	-	-	-	-	-	-
SE	94	199	257	328	65	82882	126377	27023	2032	126
UK	0	380	101	128	37	80900	20500	3200	500	0

Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO.

Table 3.8 Natura 2000 forest area (1000 ha)

	Total Natura 2000 forest area (1000 ha)
EU 27	37462
AT	479
BE	213
BG	2222
CY	88
CZ	751
DK	76
EE	467
FI	2891
FR	3009
DE	2655
GR	1550
HU	808
IE	41
IT	2930
LV	403
LT	491
LU	28
MT	2
NL	121
PO	3347
PT	746
RO	2239
SK	946
SI	499
ES	7978
SE	2353
UK	129

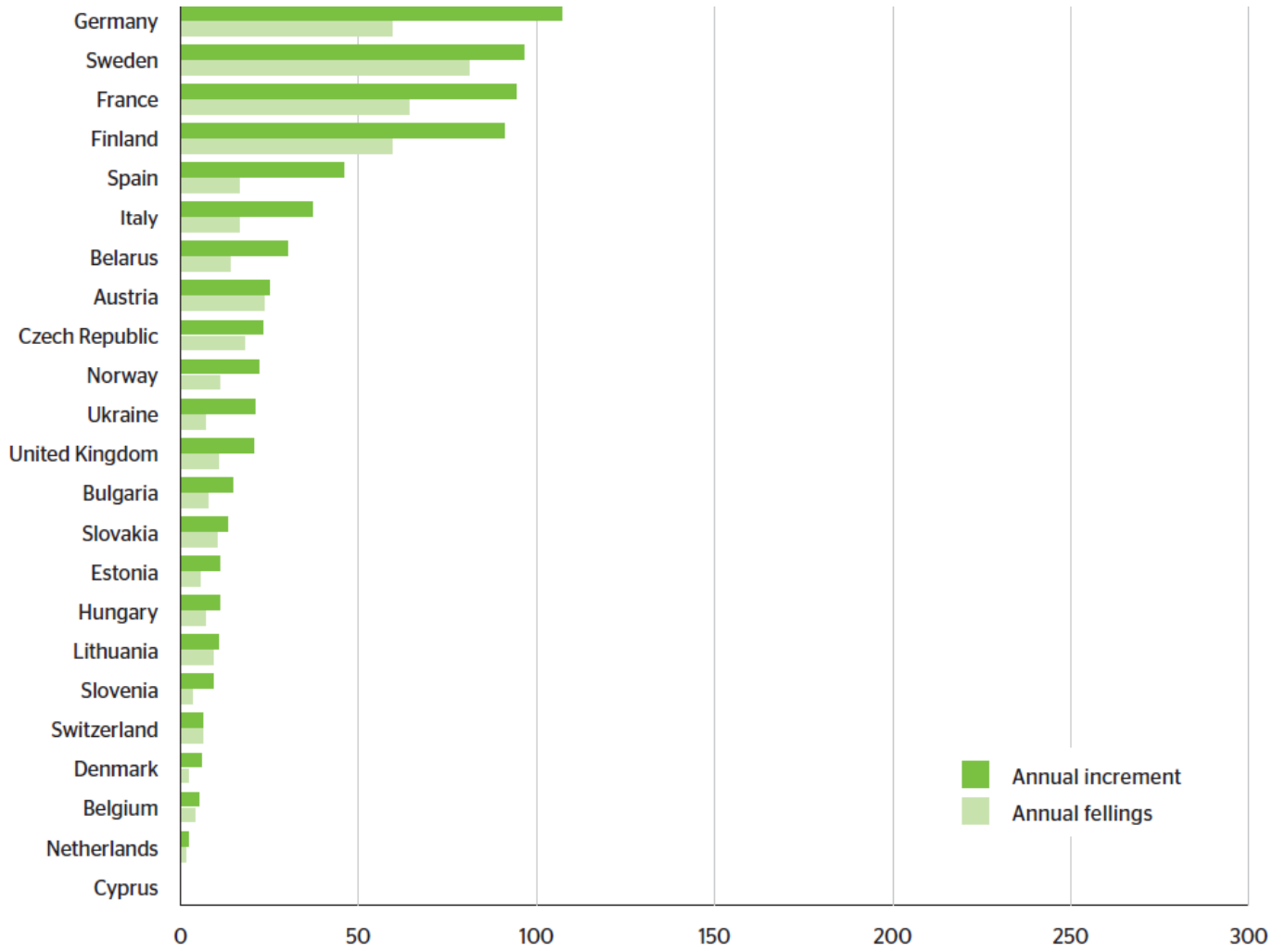
Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO. Data provided by EU-27 DG Environment

Table 3.9 Proportion of forest under a management plan or equivalent, 1990-2010

	Forest (% of forest area)											
	Total				Management plans				Equivalents			
	1990	2000	2005	2010	1990	2000	2005	2010	1990	2000	2005	2010
AT	100	100	100	100	50	50	50	51	100	100	100	100
BE	-	-	74	74	-	48	48	50	-	-	26	24
BG	100	100	100	100	100	100	100	100	0	0	0	0
HR	100	100	100	100	68	73	75	78	32	27	25	22
CY	66	62	62	62	0	0	0	0	66	62	62	62
CZ	100	100	100	100	100	100	100	100	0	0	0	0
DK	-	69	-	-	-	52	-	-	-	17	-	-
EE	100	55	69	69	100	55	69	69	0	0	0	0
FI	100	100	100	100	71	65	64	68	29	35	36	32
FR	64	67	64	61	64	67	64	61	0	0	0	0
DE	68	68	68	68	68	68	68	68	0	0	0	0
GR	-	-	-	-	-	-	-	-	-	-	-	-
HU	100	100	100	100	98	98	98	98	3	3	3	3
IE	-	-	-	-	88	81	79	77	-	-	-	-
IT	95	-	94	-	12	-	18	-	83	-	76	-
LV	-	-	92	92	-	-	92	92	-	-	0	0
LT	100	100	100	100	100	100	57	59	0	0	43	41
LU	-	-	-	-	-	-	-	-	-	-	-	-
MT	-	-	-	-	100	100	100	100	-	-	-	-
NL	100	100	100	100	56	62	62	62	44	38	38	37
PO	-	-	92	91	-	-	81	81	-	-	11	10
PT	-	-	35	-	-	-	35	-	-	-	0	-
RO	100	94	94	95	97	90	90	95	3	4	4	0
SK	100	100	100	100	100	100	100	100	-	-	-	-
SI	100	100	100	100	100	100	100	100	-	-	-	-
ES	-	-	-	-	19	19	20	19	-	-	-	-
SE	-	-	100	100	-	-	68	67	-	-	32	33
UK	45	56	50	58	6	45	40	44	38	11	10	14

Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO

Figure 3.5 Annual feelings and annual increment for European reporting countries (million m3), 2010



Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO

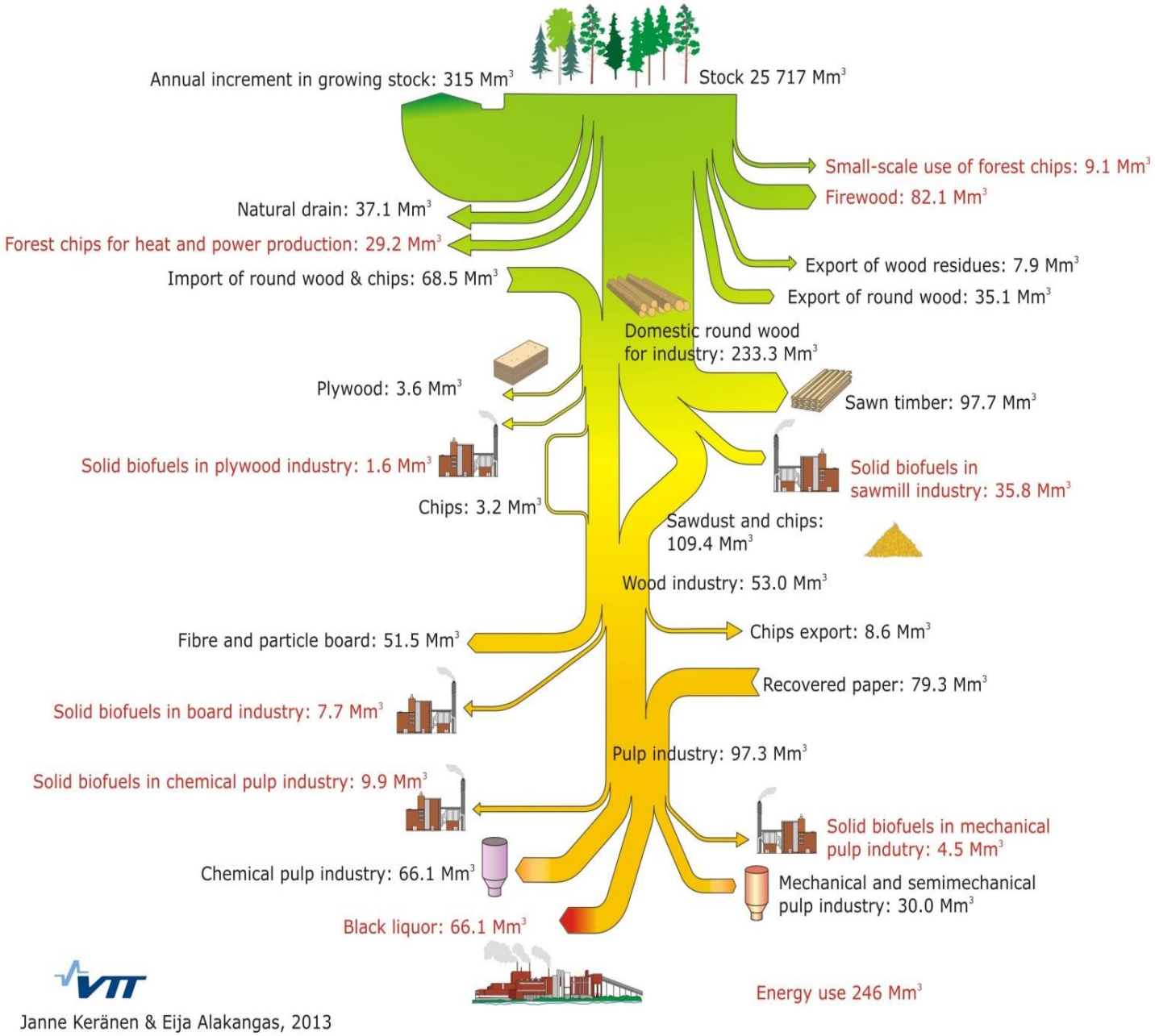
Table 3.10 Commercial wood volume (forest available for wood supply) in the EU.

	Growing stock		Increment		Fellings		Grow. stock	Increment	Fellings
	2000	2010	2000	2010	2000	2010	2010		
			(million m^3 over bark)				(m^3/ha)		
EU 27	19 394	21 750	752	768,3	463	484,1	163,3	5,8	3,6
BE	142	164	5	5	4	4	244,4	7,9	5,7
BG	321	435	14	15	4	8	151,9	5,1	2,7
CZ	678	738	20	23	16	18	316,6	9,9	7,7
DK	56	112	5	6	2	2	192,7	10,0	4,1
DE	3 356	3 466	122	107	49	60	328,0	10,1	5,6
EE	427	398	11	11	13	6	197,8	5,6	2,8
IE	58	74	3	4	2	3	119,4	5,8	4,5
EL (1)	157	170	4	5	2	2	47,4	1,3	0,5
ES	617	784	29	46	18	17	52,6	3,1	1,1
FR	2 119	2 453	98	94	63	64	162,0	6,2	4,2
IT	1 153	1 285	32	33	11	13	159,0	4,0	1,6
CY	3	3	0	0	0	0	79,0	0,9	0,2
LV	515	584	17	18	12	12	186,1	5,8	4,0
LT (2)	320	408	9	11	6	9	217,6	5,7	4,6
LU (3)	13	0	1	1	0	0	299,1	7,5	2,9
HU	291	259	12	11	7	7	150,1	6,4	4,0
MT	0	0	0	0	0	0	0,0	0,0	0,0
NL	49	56	2	2	1	2	189,8	7,6	5,3
AT	1 060	1 107	31	25	19	24	331,1	7,5	7,0
PL (3)	1 584	2 092	38	68	33	41	245,2	8,0	4,8
PT (4)	210	154	13	19	11	14	84,5	10,5	7,9
RO	697	1	35	34	14	17	211,5	6,5	3,3
SI	305	390	7	9	3	3	331,9	7,8	2,9
SK	437	478	12	13	7	10	269,1	7,4	5,9
FI	1 916	2 024	79	91	67	59	101,9	4,6	3,0
SE	2 643	2 651	91	96	74	81	129,0	4,7	3,9
UK	267	340	21	21	9	11	141,0	8,6	4,4

(1) Fellings, 2005 instead of 2010. (2) Increment and fellings, 2005 instead of 2000. (3) Increment, 2005 instead of 2010.
(4) Increment and fellings, 2005 instead of 2010.
Source: Eurostat, SoEF 2011

The most common primary designated function of forests within the EU is production essentially of wood but also of non-wood forest products. Futher downstream, arrange of manufacturing processes take these basic and primary wood products and transform them into a range of wood and paper products or as a source of energy. The following figure gives a clear overview of the wood flow in Europe.

Figure 3.6 Wood flow in Europe 2012 (million m^3)



Source: Janne Keränen and Eija Alakangas, VTT 2013

A common measure of the magnitude of the extraction of wood from forests is roundwood removals: this comprises all quantities of roundwood removed from the forest or other felling sites and stripped of the bark (under bark).

The total level of removals in the EU in 2010 was 420 million m^3 under bark. The largest volumes of wood removals were recorded in Sweden, Germany, France, Finland and Poland, which together accounted for close to two thirds of the EU total. The production of roundwood in the EU in 2009 was, in the main, composed of industrial roundwood (accounting for 79% of the total), while the production of fuelwood covered the remaining 20.1 %.

Table 3.11 Roundwood removals under bark and proportion of fuelwood in EU

	Total roundwood			Fuelwood, including wood for charcoal					
	1000 m^3			1000 m^3			% of total roundwood		
	2000	2005	2010	2000	2005	2010	2000	2005	2010
EU27	408 094	443 484	420 794	68 935	75 127	84 892	16,89%	16,94%	20,17%
BE	4 510	4 950	4 827	550	650	713	12,20%	13,13%	14,78%
BG	4 783	5 861	5 668	2 107	2 678	2 657	44,04%	45,69%	46,88%
CZ	14 441	15 510	17 022	940	1 225	2 114	6,51%	7,90%	12,42%
DK	2 952	2 962	2 669	461	1 280	1 079	15,62%	43,23%	40,44%
DE	53 710	56 946	54 418	2 622	6 041	9 030	4,88%	10,61%	16,59%
EE	8 910	5 500	7 560	1 640	1 050	1 701	18,41%	19,09%	22,50%
IE	2 673	2 648	2 789	73	19	31	2,73%	0,72%	1,14%
EL	2 244	1 522	1 251	1 601	1 004	804	71,33%	65,95%	64,32%
ES	14 321	15 531	15 648	1 600	2 180	2 480	11,17%	14,04%	15,85%
FR	65 864	52 498	55 477	26 388	24 555	26 173	40,07%	46,77%	47,18%
IT	9 329	8 690	7 254	5 680	5 673	4 839	60,89%	65,28%	66,71%
CY	20	9	8	5	3	3	26,38%	39,96%	40,51%
LV	14 304	12 842	12 533	1 680	950	2 312	11,74%	7,40%	18,45%
LT	5 500	6 045	7 096	1 450	1 130	1 943	26,36%	18,69%	27,38%
LU	259	248	274	18	12	16	6,93%	4,87%	6,11%
HU	5 902	5 940	5 740	2 596	3 136	2 993	44,00%	52,79%	52,16%
MT	0	0	0	0	0	0	-	-	-
NL	1 039	1 110	1 080	160	290	290	15,40%	26,13%	26,84%
AT	13 276	16 471	17 830	2 860	3 685	4 549	21,54%	22,37%	25,51%
PL	26 025	31 944	35 467	1 536	3 413	4 124	5,90%	10,68%	11,63%
PT	10 831	10 746	9 648	600	600	600	5,54%	5,58%	6,22%
RO	13 148	14 501	13 111	3 032	2 959	2 563	23,06%	20,41%	19,55%
SI	2 253	2 732	2 945	532	943	1 104	23,61%	34,52%	37,48%
SK	6 163	9 302	9 599	277	297	509	4,49%	3,19%	5,31%
FI	54 542	52 250	50 951	4 395	5 134	4 974	8,06%	9,83%	9,76%
SE	63 300	98 200	70 200	5 900	5 900	5 900	9,32%	6,01%	8,40%
UK	7 791	8 519	9 718	229	317	1 381	2,94%	3,72%	14,21%

* Fuelwood is wood of generally lower quality (from trunks and branches of trees), to be used as fuel for cooking, heating and energy production and includes wood used to produce charcoal.
Source: Eurostat, AEBIOM calculations

Table 3.12 Quantity and value of total roundwood removals, 1990-2010.

	Total roundwood															
	Volume (1000m3)				Volume (m3/ha FAWS)				Value (million €)				Value (€/ha FAWS)			
	1990	2000	2005	2010	1990	2000	2005	2010	1990	2000	2005	2010	1990	2000	2005	2010
AT	13215	13941	18092	19261	4	4.2	5.4	5.8	891	871	1125	1173	269.2	260.7	336.6	350.8
BE	3899	3098	4010	3451	5.8	4.7	6	5.1	137	105	136	-	204.2	158.3	203.3	-
BG	3785	4238	5674	6071	1.6	1.9	2.2	2.1	-	36	170	201	-	15.8	66.6	70
HR	1989	3532	4074	4306	1.1	2	2.3	2.5	-	274	315	343	-	156.6	180.8	196.9
CY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CZ	11737	14310	16487	16187	4.6	5.6	6.5	6.9	173	601	701	682	67.2	234.8	278.3	292.8
DK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EE	-	9797	5399	4348	-	4.7	2.6	2.2	-	287	194	196	-	136.4	93.5	97.3
FI	41727	53432	53663	46512	2	2.6	2.7	2.3	1380	1839	1923	1858	67.5	90.5	95.9	93.5
FR	66948	63637	57498	61677	4.8	4.3	3.9	4.1	2832	2587	2601	2980	203.6	176.7	176.4	196.7
DE	35744	47810	60268	47688	3.6	4.5	5.7	4.5	1719	1894	2422	3003	172.5	179.2	229.2	284.2
GR	2562	1932	1639	1743	0.8	0.6	0.5	0.5	-	-	-	-	-	-	-	-
HU	6744	6183	6415	6496	4.4	3.8	3.8	3.8	198	192	244	266	129.4	118.4	145.1	154.1
IE	1626	2525	2655	2591	-	-	-	-	40	82	120	-	-	-	-	-
IT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LV	4416	12930	14606	11091	1.6	4.3	4.7	3.5	-	-	-	-	-	-	-	-
LT	-	5424	6101	5515	-	3.1	3.3	2.9	-	137	179	181	-	77.8	97.6	96.3
LU	-	261	268	353	-	3	3.1	4.1	-	6	7	-	-	64.2	83.4	-
MT	0	0	0	0	-	-	-	-	0	0	0	0	-	-	-	-
NL	1286	962	1064	1118	4.6	3.3	3.6	3.8	30	22	25	29	105.3	75.7	83.3	98.8
PO	22601	27483	33506	35281	2.7	3.3	4	4.1	448	833	1046	1291	53.9	99.8	124.3	151.3
PT	10367	9209	10583	10866	6	5.2	5.9	6	-	-	-	-	-	-	-	-
RO	14221	13016	15012	13667	2.5	2.6	3	2.6	-	-	-	-	-	-	-	-
SK	4972	5810	7780	9027	2.8	3.3	4.4	5.1	113	258	350	356	64	145.9	199.9	200.7
SI	2582	2199	2787	3236	2.3	1.9	2.4	2.8	105	81	104	145	94.5	69.8	89.5	123.8
ES	15471	14995	15641	13980	1.2	1.1	1.1	0.9	539	689	757	703	43.1	49.4	53.4	47.1
SE	55809	65929	79179	74285	2.5	3.1	3.8	3.6	2243	2379	2518	2656	100.2	113.6	122.1	129.2
UK	6374	7766	8476	8432	3	3.3	3.6	3.5	277	318	304	269	129.2	136.8	127.9	111.4

Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO

3.3.2 THE ROLE OF FOREST IN THE CARBON CYCLE

Forests have an important role in the carbon cycle as carbon sinks. However forests can also release carbon naturally through decomposition and forest fires; carbon dioxide is also released when wood that has been harvested is broken down, for example through combustion. Whether forests are overall carbon sources, neutral or sinks can be seen from the development of the carbon stock. An analysis from 1990 to 2010 shows an increase in carbon stock of approximately 26.0 %.

Table 3.13 Carbon stock in forest 1990-2010

	Forest (million tons)											
	Biomass				Deadwood				Soil and litter			
	1990	2000	2005	2010	1990	2000	2005	2010	1990	2000	2005	2010
AT	339	375	399	393	3	4	5	5	-	-	-	-
BE	50.4	60.8	63.1	64.4	1.4	1.4	1.5	1.6	61.8	61.1	61.7	62.2
BG	126.6	161.2	181.9	202.1	-	-	-	-	322.5	327.4	353.9	380.3
HR	189.7	221.4	237.2	253.1	-	-	-	-	-	-	-	-
CY	2.6	2.7	2.9	3	-	-	-	-	-	-	-	-
CZ	287.3	322.3	339.2	355.5	16.6	16.6	16.7	16.8	181.9	184	185.4	186.8
DK	22	25.5	37.1	38.5	0.4	0.4	0.6	0.6	-	-	-	79.2
EE	137.6	168.3	167.3	162.5	6.8	8.3	10.4	11.8	-	-	-	-
FI	720.8	802.4	832.4	832.4	15.1	15.1	15.9	15.9	3844	4200	4099	4111
FR	965	1049	1165	1208	-	-	-	-	1148	1212	1242	1258
DE	981	1193	1283	1405	-	27	27	35	-	-	-	-
GR	67	73	76	79	-	-	-	-	-	-	-	-
HU	95	107	110	117	-	-	-	-	-	-	-	-
IE	15.8	18.2	19.9	22.6	1.4	1.4	1.4	1.4	284.2	282.7	281.8	280.6
IT	375.3	466.6	512.3	557.9	11.7	14.5	15.9	17.3	703	775.2	811.2	847.4
LV	193.5	234.2	244.1	271.6	5.1	5.4	16.1	16.8	297.4	304	309.4	317.8
LT	134.1	145.6	150.8	155.6	9.8	10.2	10.6	10.8	186.7	193.9	203.6	207.8
LU	7.4	9.4	9.4	9.4	-	-	-	-	9	9.1	9.1	9.1
MT	0.1	0.1	0.1	0.1	-	-	-	-	-	-	-	-
NL	20.5	24	25.6	27.7	0.5	0.6	1.2	1.5	46	48	49	49
PO	691	807	887	1073	8	5	6	26	-	-	-	-
PT	-	-	101.8	102.4	-	-	-	-	-	-	-	-
RO	599.7	599.3	601.1	618.1	-	-	-	-	722.6	721.9	724.7	745.5
SK	162.7	189.8	202.4	211.2	12.5	14.5	15.3	15.3	287.2	290	290.9	292.9
SI	116	140.6	159.3	178.3	3.6	4.4	5.1	5.8	123.7	128.4	129.4	130.4
ES	289.2	396.1	399.6	421.8	-	-	-	-	-	-	-	-
SE	1178.1	1182.7	1219	1255.3	27.4	27.5	28.3	29.2	3044.7	3033.7	3034.5	3029.9
UK	120	119	128	136	2	2	2	2	681	727	743	755

Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO. FOREST EUROPE/UNECE/FAO enquiry on Pan-European Quantitative Indicators.

The forest functions in the carbon balance are addressed by three Kyoto Protocol activities: afforestation/reforestation; deforestation; and forest management. In the following table it can be seen the data that countries report on the changes to carbon stocks in managed forests that result from these three types of activities.

Table 3.14 Data on afforestation and reforestation (A/R), deforestation (D) and forest management (FM) activities reported by Annex B Parties under the Kyoto Protocol for the year 2008 (in Gt CO_2 equivalent)

	A/R	D	FM	CO_2 balance
AT	-2 531	1 224		-1 307
BE	-399	468		69
BG	1 353*	275		1 628
CZ	-272	160	-6 145	-6 257
DK	-70	35	281	247
DE	-2 615	16 393	-20 441	-6 663
EE	-534	6 600		6 066
IE	2 763*	11		2 774
EL	-351	4	-2 052	-2 399
ES	-10 276	188	-39 120	-52 279
FR	-13 591	11 926	-84 620	-86 285
IT	-1 736	386	-50 773	-52 122
CY	-	-	-	-
LV	-440	1 674	-23 595	-22 361
LT	-	-	-	-
LU	-	-	-	-
HU	-1183	44	-3 885	-5 025
MT	-	-	-	-
NL	-574	780		233
PL	-3 916	263	-46 865	-50 519
PT	-4 134	6 877	2 563	-180
RO	-	-	-	-
SI	-2 456	2 385	-10 307	-7 851
SK		2 426	-10 324	-7 897
FI	-1 077	2 886	-39 935	-38 126
SE	-1 576	2 385	-18 606	-17 797
UK	-2 696	452	-10 873	-13 116

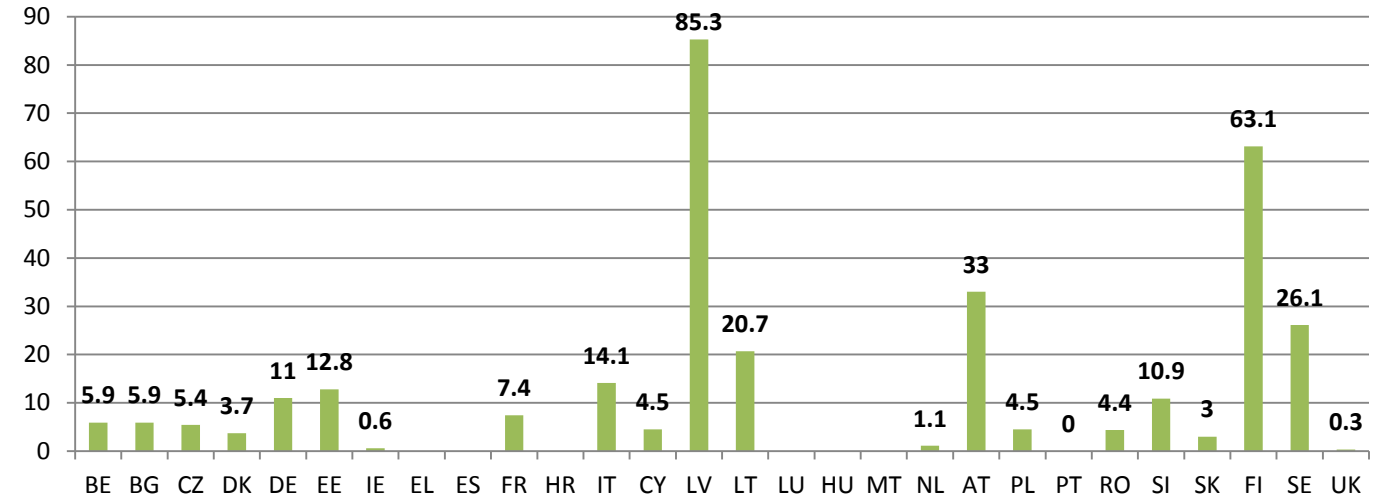
* AEBIOM considers this could be an error in the publicationas afforestation should always be a negative number (sequestration of carbon)
Source: FAO (State of World Forest 2011)
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5270.php

The use of wood as a fuel is largely carbon neutral if wood resources are cultivated in a sustainable way. Although carbon dioxide is released into the atmosphere when wood is burnt, this is converted into carbon and oxygen as trees grow, and hence the cycle of tree growth and wood burning is often referred to as being carbon neutral.

3.3.3 WOOD AS A SOURCE OF ENERGY

Wood for use as an energy source comes not only from tree felling, but also from selective thinning of managed forests and other forestry practices (direct sources). Wood for energy use may also be derived as a by-product from downstream processing in wood-based manufacturing, for example, as off-cuts, trimmings, sawdust, shavings, wood chips or black liquor (indirect sources). End-of-life wood and paper products may also be used as a source of energy (recovered wood). The scheme in page 49 (figure 3.6) can help to understand the global picture.

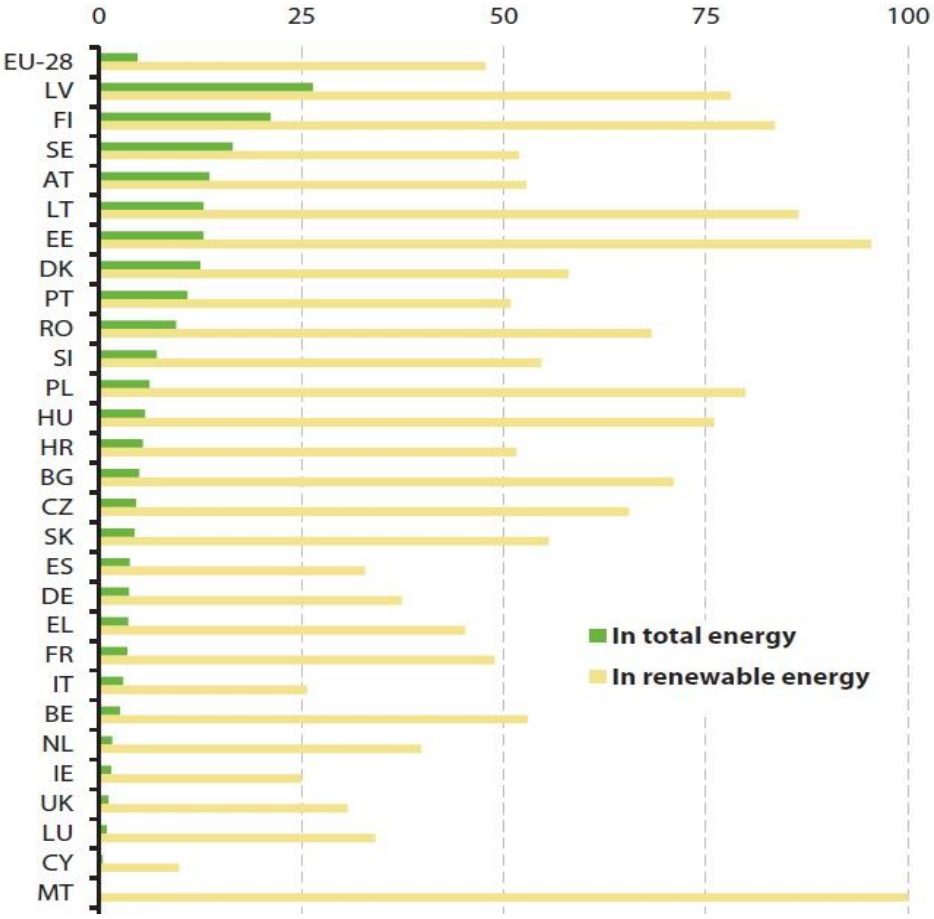
Figure 3.7 Share of energy from wood in national energy production (%)



*Data for total energy production seem very low, so share of wood comes out very high

Source: State of Europe´s Forest 2011. United Nations, UNECE and FAO

Figure 3.8 Wood as a source of energy, 2011 (% share of wood and wood waste in gross inland energy consumption)



Source: Eurostat 2013

Households account for the largest share (62.65%) of the EU´s final energy consumption of wood and wood wastes, some 35.7 million tons of oil equivalents. The other main use of energy derived from wood and wood waste was within industrial activities, in particular, in paper manufacturing and printing.

Table 3.15 Final energy consumption (only heat) from wood and wood waste by sector in 2011 (ktoe)

	Total	Industry	Other sectors		
			Residential	Agriculture and Forestry	Services
EU27	57066	18620	35755	1472	888
BE	807	556	238	9	4
BG	936	176	747	4	9
CZ	1511	389	1106	7	9
DK	1078	147	857	50	23
DE	8294	2217	5809	0	0
EE	497	109	365	4	19
IE	172	134	23	0	16
EL	1007	260	719	28	0
ES	3775	1203	2446	62	64
FR	8511	1935	6413	40	122
HR	431	44	384	0	3
IT	3707	189	3495	2	21
CY	11	7	3	0	0
LV	957	259	623	8	67
LT	678	76	558	12	31
LU	39	25	14	0	0
HU	940	82	724	10	123
MT	1	0	1	0	0
NL	402	68	299	24	12
AT	2942	1177	1509	189	67
PL	4438	933	2747	572	187
PT	2149	1437	712	0	0
RO	3422	208	3147	5	0
SI	472	57	415	0	0
SK	424	368	44	10	2
FI	4420	3002	1214	133	72
SE	4669	3310	1170	148	41
UK	810	296	357	157	0

Source: Eurostat

It is important to mention that many wood-based manufacturing activities increasingly recover energy from their waste streams and that their energy cost may be reduce by switching to renewable biomass sources that are by-products of their own production processes.

3.4 BIOMASS FROM WASTE

3.4.1 WASTE PRODUCTION IN EU

In 2010 (last available data), some 2505 million tons of waste was generated in the EU-27, of which around 17.2% was biodegradable waste.

Table 3.16 Waste generated in Europe for all NACE activities include households in 2010 (thousands of tons)

	Total waste	Biodegradable waste*				
		Paper and cardboard wastes	Wood wastes	Animal and vegetal wastes	Household and similar wastes**	Common sludges
EU28	2505400	56740	60950	108570	186240	19160
BE	62537	4214	2779	4588	2570	2421
BG	167203	142	115	731	3107	33
CZ	23758	690	303	450	3309	760
DK	20965	1366	483	886	3140	79
DE	363545	8062	10812	12933	21376	1253
EE	19000	80	871	280	305	32
IE	19808	746	508	2079	3265	312
EL	70433	652	350	445	4771	118
ES	137519	3843	1624	9763	21120	1468
FR	355081	7005	8945	9406	22179	1456
HR	3158	144	174	120	1337	150
IT	158628	5352	3760	9490	21378	1642
CY	2373	146	24	201	173	11
LV	1498	45	87	166	563	46
LT	5583	105	300	536	1065	62
LU	10440	125	111	98	210	11
HU	15735	585	287	808	3195	237
MT	1288	12	8	16	216	2
NL	119255	2652	2569	13558	7432	658
AT	34883	1937	1295	1661	3664	439
PL	159458	1009	3508	6356	8638	487
PT	38347	2677	2079	1143	8768	908
RO	219310	585	2340	18895	4464	324
SI	5159	134	334	264	777	84
SK	9384	192	239	904	1458	288
FI	104337	767	12281	900	2031	463
SE	117645	1280	1863	1684	2511	483
UK	259068	12194	2906	10211	33219	4937

* Not all the biodegradable waste can be considered as biowaste. According to the Waste Framework Directive (2008/98/CE) biowaste includes organic waste from gardens and parks, food and kitchen waste from households, restaurants, caterers and distribution networks, and comparable waste from food-processing plants. Biodegradable waste covers other biodegradables such as wood, paper, paperboard, wastewater and sludge.

** Total household wastes, not all it is biodegradable.

Source: Eurostat

Municipal waste (biodegradable garden, kitchen and food waste) represents more than half of all the biowaste generated in Europe. In the EU27, 503 kg of municipal waste was generated per person in 2011, while 486 kg of municipal waste was treated per person. This municipal waste was treated in different ways3 : 37% was landfilled, 23% incinerated, 25% recycled and 15% composted, compared with 56% landfilled, 17% incinerated, 17% recycled and 10% composted in 2001 (Eurostat newsrelease 33/2013, 4 March 2013)

Table 3.17 Municipal waste* generated in Europe in 2011

	Municipal waste (thousand of tons)		MSW renewable (1000toe)	
	Waste generated	Energy recovery	Primary production	Final energy consumption
EU28	253249	44966	8456**	747**
BE	5125	2075	482	9
BG	2753	0	0	0
CZ	3358	607	80	21
DK	4001	2154	506	30
DE	48805	7846	2404	179
EE	399	0	0	0
IE	2850	124	11	11
EL	5607	0	0	0
ES	22997	1906	175	0
FR	34336	11627	1243	291
HR	1645	0	0	0
IT	32500	5340	843	0
CY	560	0	0	0
LV	721	0	0	0
LT	1339	6	0	0
LU	356	137	11	0
HU	3809	408	42	0
MT	243	0	0	0
NL	9947	3229	875	0
AT	4650	1540	138	0
PL	12129	0	32	32
PT	5139	1091	98	0
RO	7800	0	0	0
SI	844	11	0	0
SK	1767	182	18	3
FI	2719	678	140	36
SE	4350	2236	713	0
UK	32500	3769	645	135

* Municipal waste is defined as waste collected by or on behalf of municipalities and includes waste produced by households; it may also include similar waste from offices, small businesses and so on, depending on the arrangements in the municipality.

** Calculated by AEBIOM as a sum of the value of all countries.

Source: Eurostat

Table 3.18 Composition of waste treatment type, EU-27,2011

	Municipal waste generated, Kg per person	Total municipal waste treated, kg per person	Municipal waste treated, %			
			Landfilled	Incinerated	Recycled	Composted
EU27	503	486	37	23	25	15
BE	465	460	1	42	36	20
BG	375	371	94	0	3	3
CZ	320	319	65	18	15	2
DK	718	718	3	54	31	12
DE	597	597	1	37	45	17
EE	298	257	70	0	20	10
IE	623	560	55	5	37	4
EL	496	496	82	0	15	3
ES	531	531	58	9	15	18
FR	526	526	28	35	19	18
IT	535	505	49	17	21	13
CY	658	658	80	0	11	9
LV	350	292	88	0	10	1
LT	442	432	79	1	19	2
LU	687	687	15	38	27	20
HU	382	382	67	11	17	5
MT	584	536	92	1	7	0
NL	596	502	1	38	32	28
AT	552	528	3	35	28	34
PL	315	255	71	1	11	17
PT	487	487	59	21	12	8
RO	365	293	99	0	1	0
SI	411	351	58	2	34	6
SK	327	312	78	11	5	6
FI	505	505	40	25	22	13
SE	460	460	1	51	33	15
UK	518	514	49	12	25	14

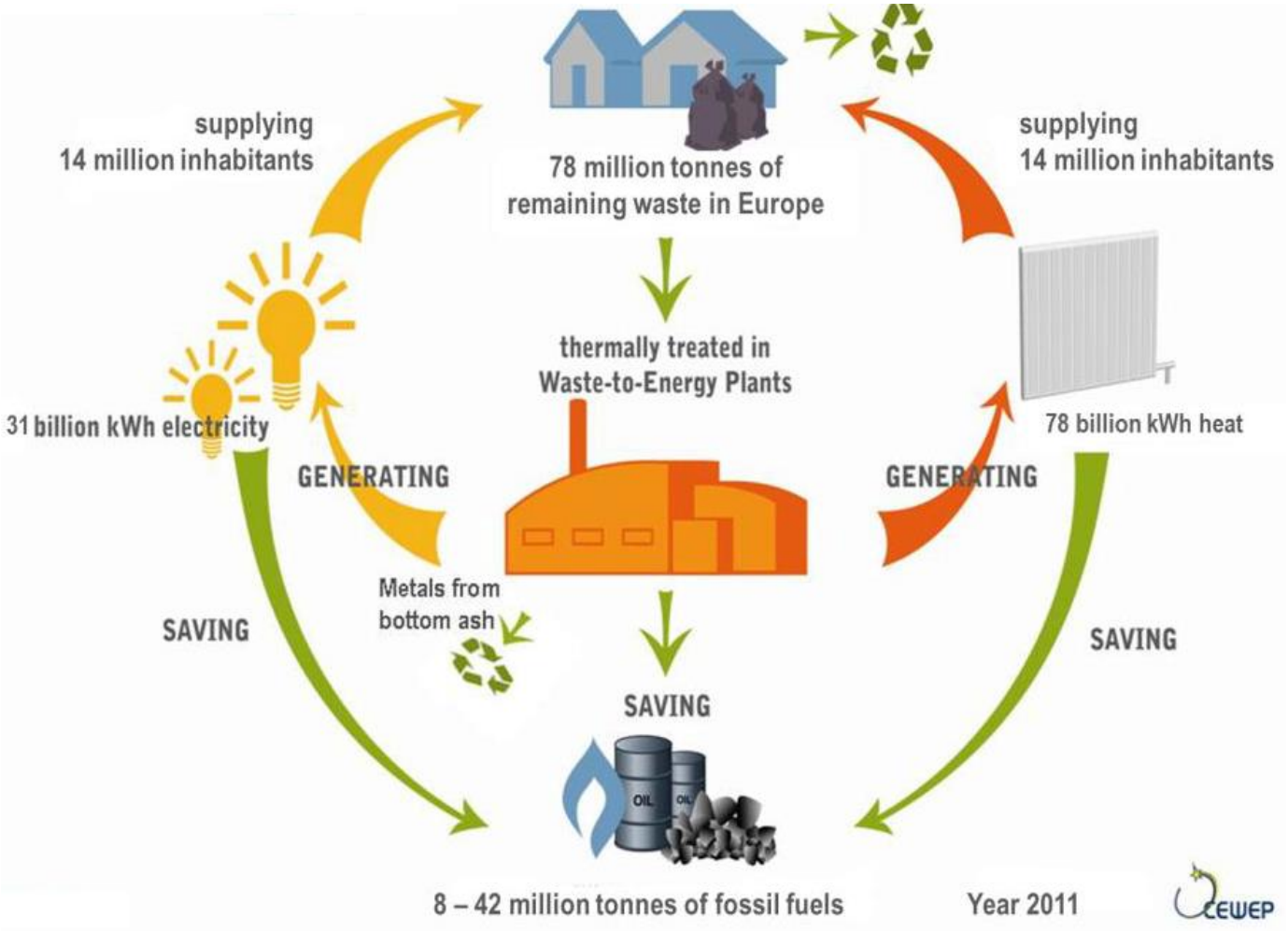
Waste treatment refers to the following methods:
Landfill means the depositing of waste into or onto land, including specially engineered landfill and temporary storage of over one year.
Incineration means thermal treatment of waste in an incineration plant.
Recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes, except use as fuel.
Composting means the biological treatment (anaerobic or aerobic) of biodegradable matter resulting in a recoverable product.
In principle, data on treated municipal waste only refer to waste treated within the Member State, and does not take into account waste exported for treatment. However, recycling capacities may be limited in small countries. Luxembourg is a case where recycled amounts include exports.

Source: Eurostat newsrelease 33/2013, 4 March 2013

3.4.2 WASTE AS A SOURCE OF ENERGY

Currently, Waste-to-Energy Plants in Europe can supply 14 million inhabitants with electricity and 14 million inhabitants with heat. This is based on 78 million tons of remaining household and similar waste that was treated in 2011 in Europe. Then between 8 - 42 million tons of fossil fuels (gas, oil, hard coal and lignite) can be substituted annually, which would emit 21 - 42 million tons of CO_2 (Source: CEWEP, Energising waste a win-win situation, October 2013)

Figure 3.9 Waste to energy cycle, 2011



Source: CEWEP (Confederation of European Waste-to-Energy Plants)

Waste-to-Energy plants put the energy content of remaining waste, not suitable for sustainable recycling, to good use: producing electricity and heat from a locally available energy source.

Figure 3.10 Waste to energy in Europe in 2011

- Waste-to-Energy plants operating in Europe (not including hazardous waste incineration plants)
- Waste thermally treated in Waste-to-Energy plants in million tons

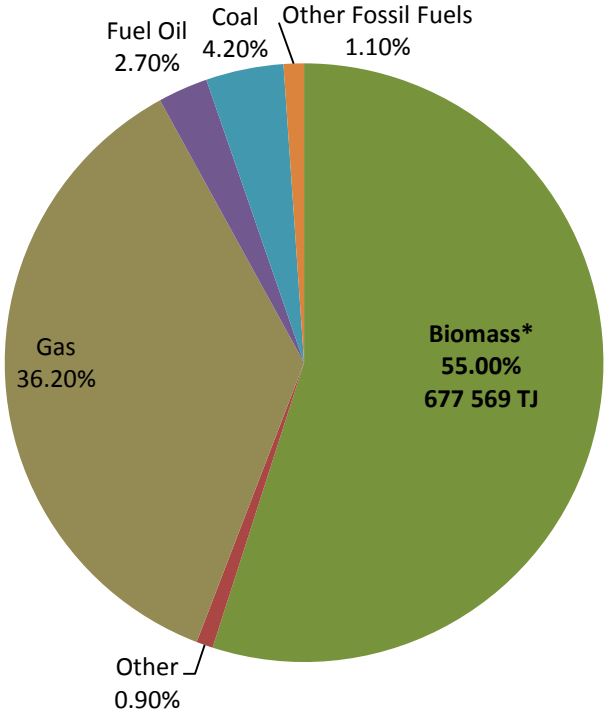
*From Eurostat; ** Includes plant in Andorra

Source: CEWEP (Confederation of European Waste-to-Energy Plants). Data supplied by CEWEP members unless specified otherwise.

3.5 Other

3.5.1 BLACK LIQUOR

Figure 3.11 CEPI primary energy 2011



* AEBIOM assumes that this biomass corresponds mainly to black liquor.
Source: CEPI (Confederation of European Paper Industries)

3.5.2 PEAT

Peat is an intermediate fuel, part way between the biomass of which it was originally composed and the fossil fuel (coal) that it would eventually become, given appropriate geological conditions.
Peat is not recognized as biomass by the European Commission and therefore is also not considered a renewable source of energy. However, peat is an important source of energy for many northern European countries and is often co-fired with biomass, providing as a way technical advantages.

Table 3.19 Primary production, imports, exports and final energy consumption of peat for energy in 2011 (ktoe)

	Primary production	Imports	Exports	Final Energy consumption
EU27	2759	145	12	475
EE	79	0	6	0
IE	760	0	0	163
LV	0	0	1	1
LT	12	0	3	6
RO	1	8	0	8
FI	1688	26	1	288
SE	220	111	0	8

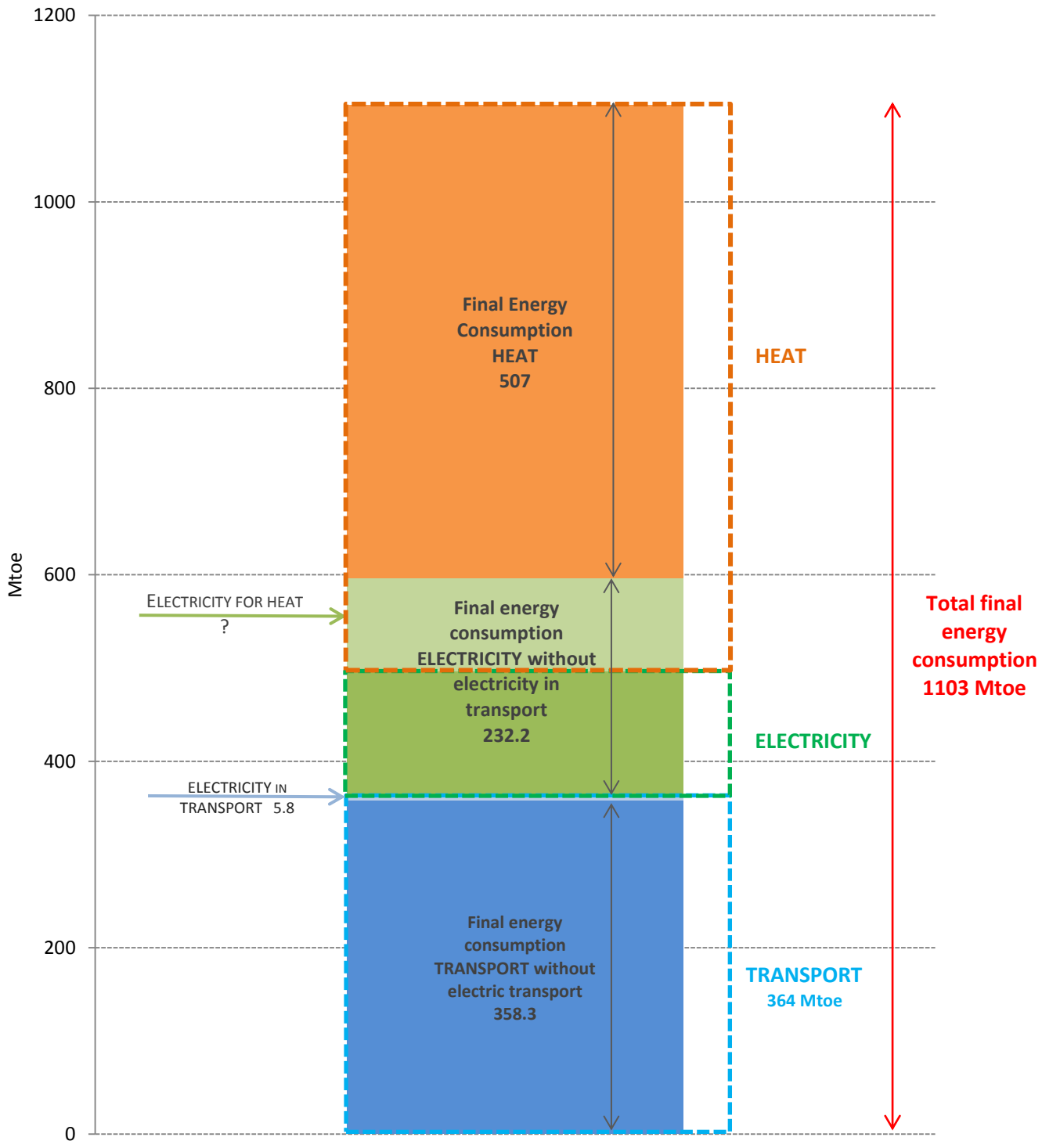
For the others EU27 countries, all the numbers are 0.
Source: Eurostat

biomass for heat

4.1 Heat demand in Europe

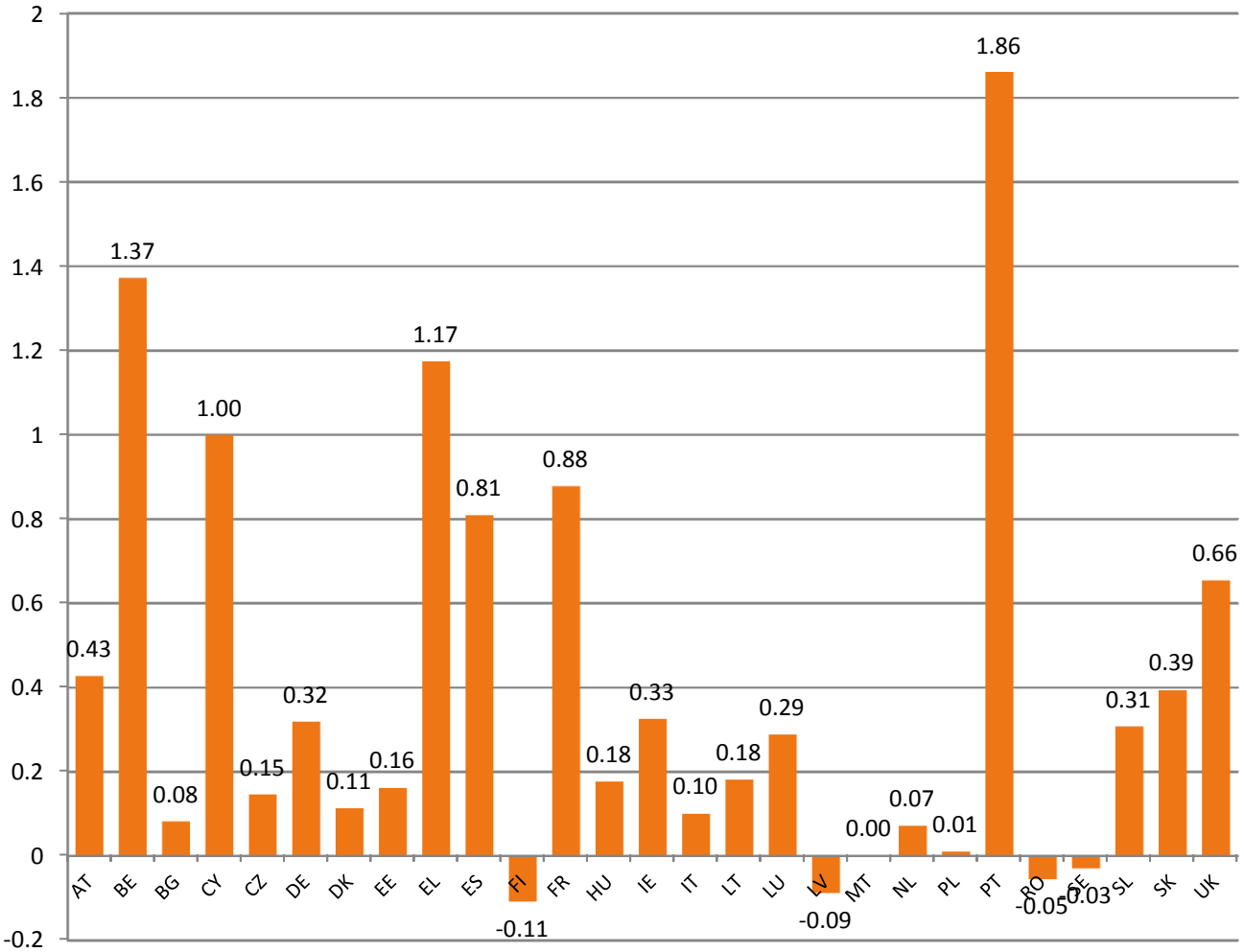
At present, more than 50% of the total energy consumed in Europe is used for the generation of heat for either domestic or industrial purposes.

Figure 4.1 Final energy consumption in EU in 2011 (Mtoe)



Source: Eurostat, AEBIOM calculations

Figure 4.2 Expected additional heat demand* until 2020 (%expected growth rate 2010-2020)

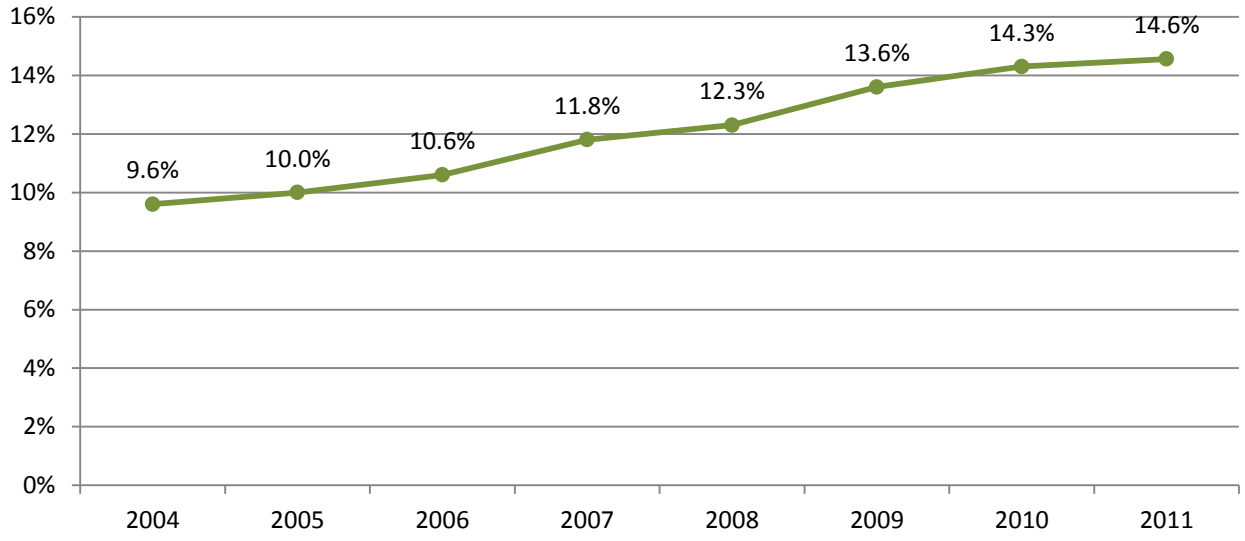


Note: 2010 was taken as a base year

*Only heat for DH and CHP

Source: European Commission "EU energy trends to 2030", Cross Border Bioenergy calculations.

Figure 4.3 Share of renewable energy sources in heating and cooling



Source: Eurostat, AEBIOM calculations

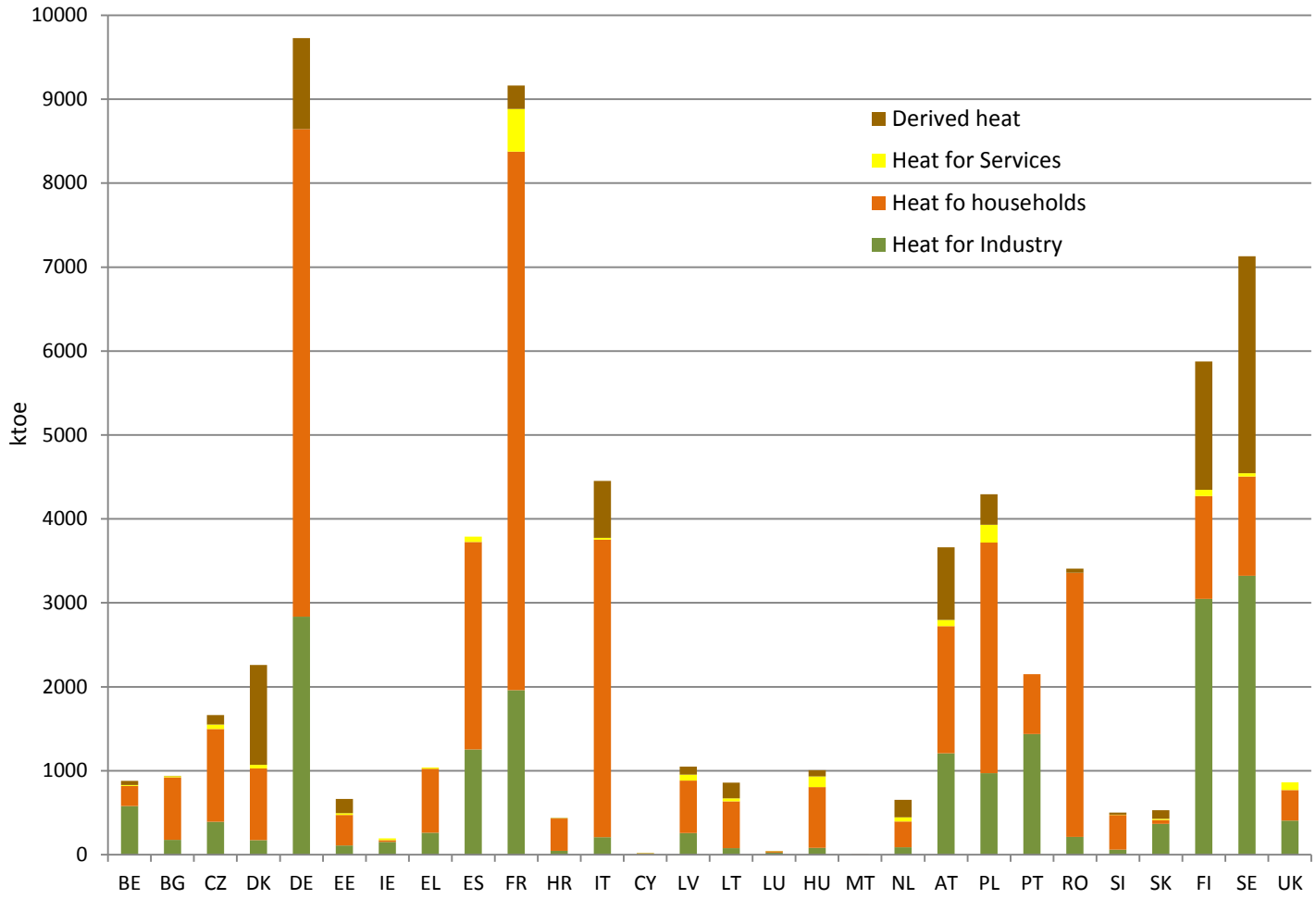
4.2 Biomass for heat and bioheat

Table 4.1 Final heat consumption of biomass for heat in comparison with the total heat consumption in Europe in 2010

	Total heat consumption (all fuels)*	Final energy consumption of heat from RES	Share of RES in the total EU heating	Biomass for heat	
				ktoe	% of RES (heat)
EU27	507013	72992	14.40%	69719	95.52%
BE	21435	928	4.33%	912	98.28%
BG	3933	991	25.20%	944	95.26%
CZ	13629	1729	12.69%	1715	99.19%
DK	6876	2338	34.00%	2314	98.97%
DE	101350	12011	11.85%	10890	90.67%
EE	1493	667	44.68%	667	100.00%
IE	4351	200	4.60%	192	96.00%
EL	6734	1276	18.95%	1067	83.62%
ES	30133	4079	13.54%	3857	94.56%
FR	62979	9356	14.86%	9209	98.43%
HR	2834	450	15.88%	437	97.11%
IT	55245	4733	8.57%	4454	94.11%
CY	447	88	19.69%	24	27.27%
LV	2271	1057	46.54%	1057	100.00%
LT	2438	872	35.77%	870	99.77%
LU	993	49	4.93%	48	97.96%
HU	9128	1130	12.38%	1021	90.35%
MT	22	1	4.55%	1	100.00%
NL	26264	753	2.87%	720	95.62%
AT	13572	4051	29.85%	3865	95.41%
PL	36720	4912	13.38%	4866	99.06%
PT	6282	2231	35.51%	2153	96.50%
RO	13870	3504	25.26%	3482	99.37%
SI	1954	545	27.89%	499	91.56%
SK	6047	559	9.24%	551	98.57%
FI	13296	6072	45.67%	6041	99.49%
SE	12581	7723	61.39%	7277	94.23%
UK	52970	1127	2.13%	1017	90.24%

*¨This figure doesn´t include the electricity for heat (space heating, domestic water, some industrial processes).
Source: Eurostat, AEBIOM calculations

Figure 4.4 Final energy consumption of biomass for heat in Europe in 2011 in the different sectors



Source: Eurostat, AEBIOM calculations.

4.3 District heating and cooling

Table 4.2 District heating statistics in some EU member states

	Energy supply composition for DH generated			Total DH sales 2011 (TJ)	% of citizens served by DH	Number of DH utilities	Total installed DH capacity (MWth)	Total share of CHP in national electricity production
	Recycled heat	Direct renewables	Others					
AT	64%	23%	13%	73176	21%	885	9500	16%
BG	67%	0.2%	33%	20664	17%	14	6300	7%
HR	72%		28%	9980	10%	12		28.9%
CZ	68%	2%	30%	88240	38%			14%
DK	69.77%	19.33%	10.89%	101940	61.07%			63.2%
EE	38.38%	23.02%	38.71%	22885	54%	ca.200	5604	12.7%
FI	76.76%	6.29%	16.95%	112290	50%	ca.150	22940	36%
FR	47.33%	10.45%	42.22%	78502	7.4%	548 (systems)	16293	3.3%
DE	90.25%	0.08%	9.67%	279938 (fed to grid)	12%		49931 (connected load)	13.2%
HU				31647		142	7638	
EL								
IT	68.5%	7.1%	24.4%	26360	5%	63	2556 (only CHP)	32.6%
LV	43%	42%	15%	24984	64%	71	3210	43%
LT	55.06%	17.06	27.88%	26243	67%	31	8719	69%
NL				26800	5%		5600	
PL	69.95%	0.7%	29.4%	235000	41%	480	58300	17.1%
RO	91.39%	0.31%	8.30%	49095	19%	89	13619	10.9%
SL	79%	2%	19%	8066	15%	65	2501	6.9%
SK	54%	2%	45%	83630	36%	344	15800	19.2%
SE	70%	23%	7%	182727	48%	440 (systems)	17500	

Source: Euroheat and Power. 2013 Survey

Table 4.3 Heat consumption* from solid biomass in the countries of the European Union in 2010 and 2011** (in ktoe)

	2010	of which district heating	2011	of which district heating
EU27	67394	7523	64947	6956
BE	853	7	853	7
BG	880	1	880	1
CZ	1639	58	1686	62
DK	2050	886	1922	844
DE	8667	379	8738	444
EE	686	141	604	126
IE	180	0	172	0
EL	847	0	1007	0
ES	3653	0	3776	0
FR	9965	0	8717	0
IT	3602	147	3660	178
CY	11	0	11	0
LV	1153	101	1049	91
LT	872	186	865	188
LU	40	2	35	2
HU	929	56	849	56
MT	0	0	0	0
NL	450	49	454	46
AT	4069	934	3818	890
PL	4551	274	5253	332
PT	2151	0	2149	0
RO	3942	35	3942	35
SI	526	18	491	19
SK	525	101	511	88
FI	6099	1532	5978	1500
SE	8238	2615	6716	2047
UK	806	0	810	0

*Consumption of the end user (either as heat sold by the distric heating or self-consumed, either as fuels for the production of heat and cold)
**estimate
***Unpublished data
Source: EurObserv'ER 2012

Table 4.4 Heat production from solid biomass in the European Union in 2010 and 2011* (in Ktoe) in the transformation sector **

	2010			2011		
	Heat-only plants	CHP plants	Total heat	Heat-only plants	CHP plants	Total heat
EU	2889	4634	7523	2730	4226	6956
SE	836	1779	2615	760	1287	2047
FI	492	1041	1532	500	1000	1500
DK	395	491	886	363	481	844
AT	514	420	934	459	431	890
DE	148	231	379	149	296	444
PL	38	236	274	40	292	332
LT	149	36	186	152	36	188
EE	65	76	141	58	68	126
LV	92	10	101	81	10	91
IT	53	94	147	64	114	178
SK	44	57	101	38	50	88
CZ	22	37	59	24	38	62
NL	0	49	49	0	46	46
HU	4	52	56	4	52	56
RO	30	5	35	30	5	35
SL	5	13	18	6	13	19
BE	0	7	7	0	7	7
LU	2	0	2	2	0	2
BU	1	0	1	1	0	1

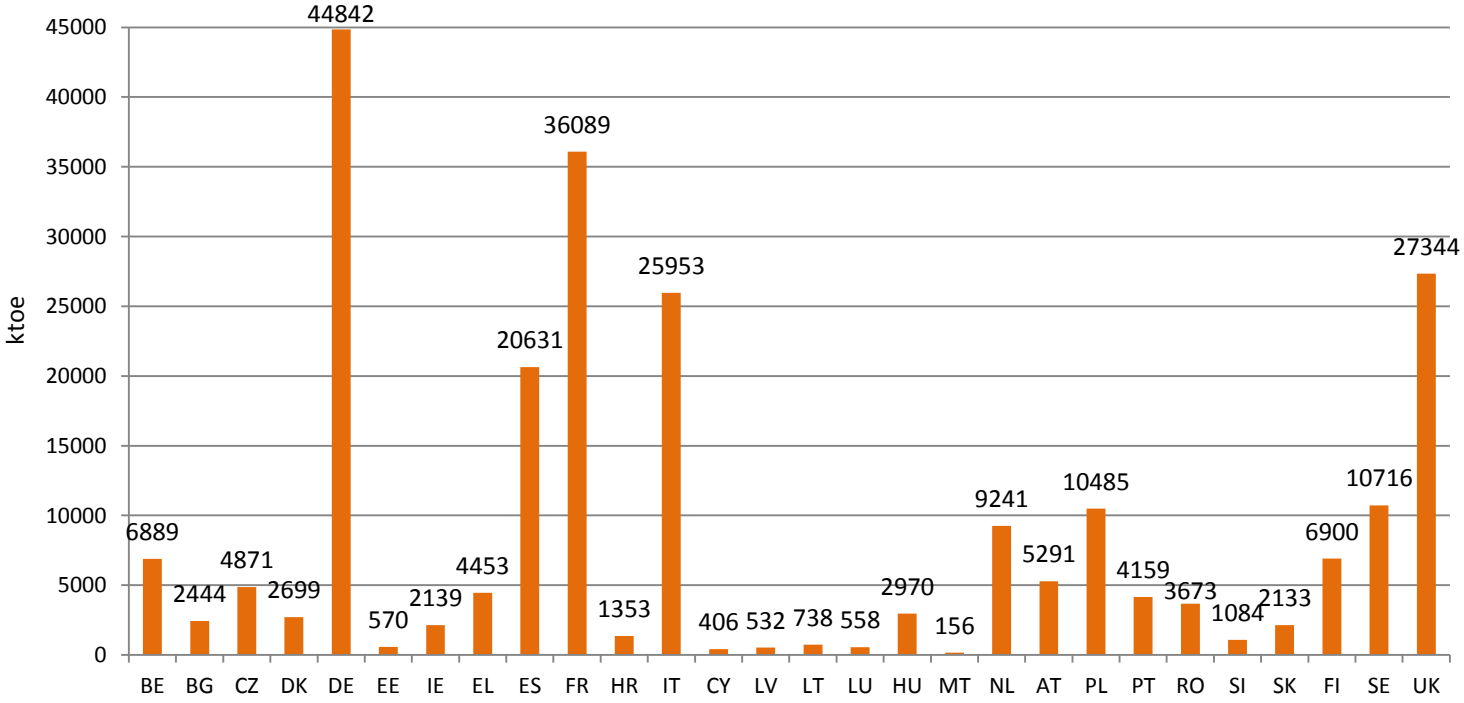
* Estimation
** Heat sold in district heating.
Source: EurObserv´ER 2012

electricity from biomass

5 ELECTRICITY FROM BIOMASS

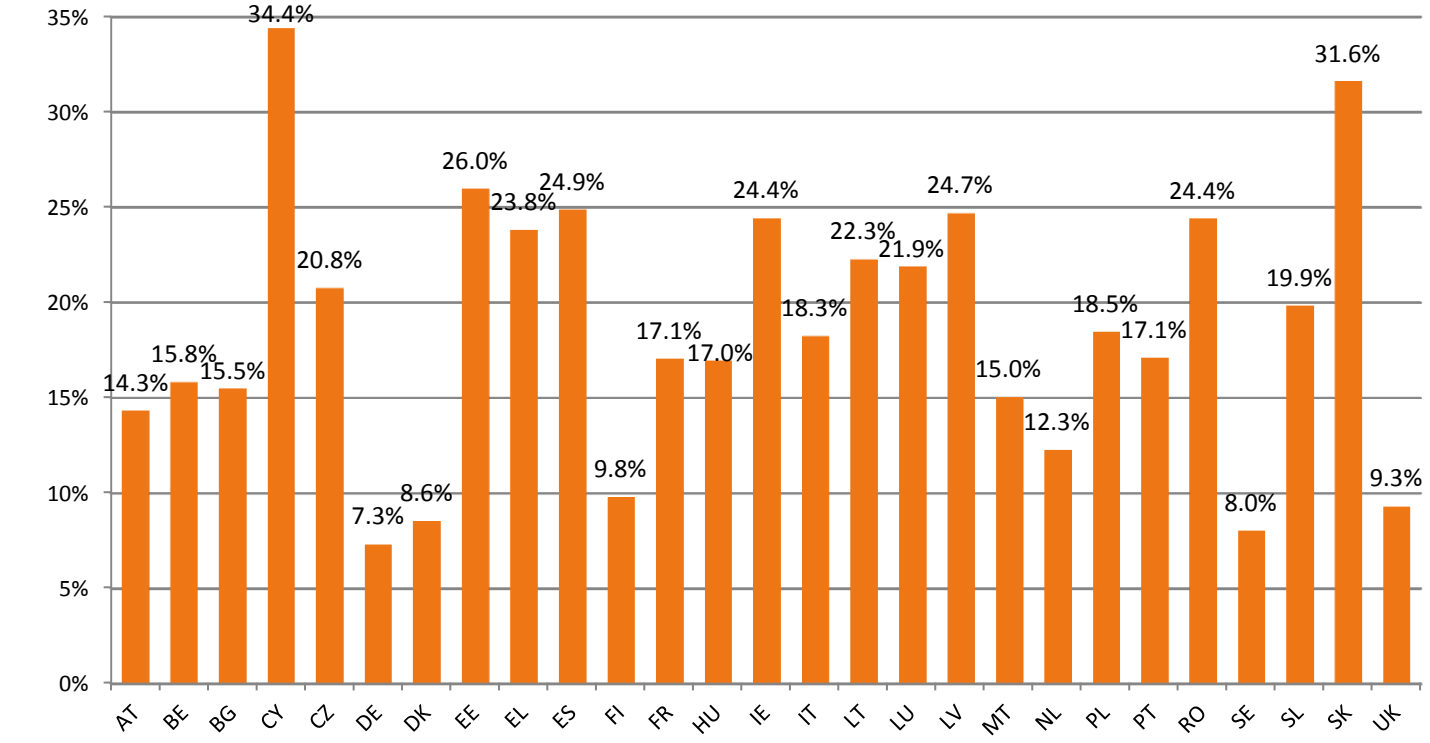
5.1 Electricity in Europe

Figure 5.1 Final electricity consumption in EU countries in 2010 (ktoe)



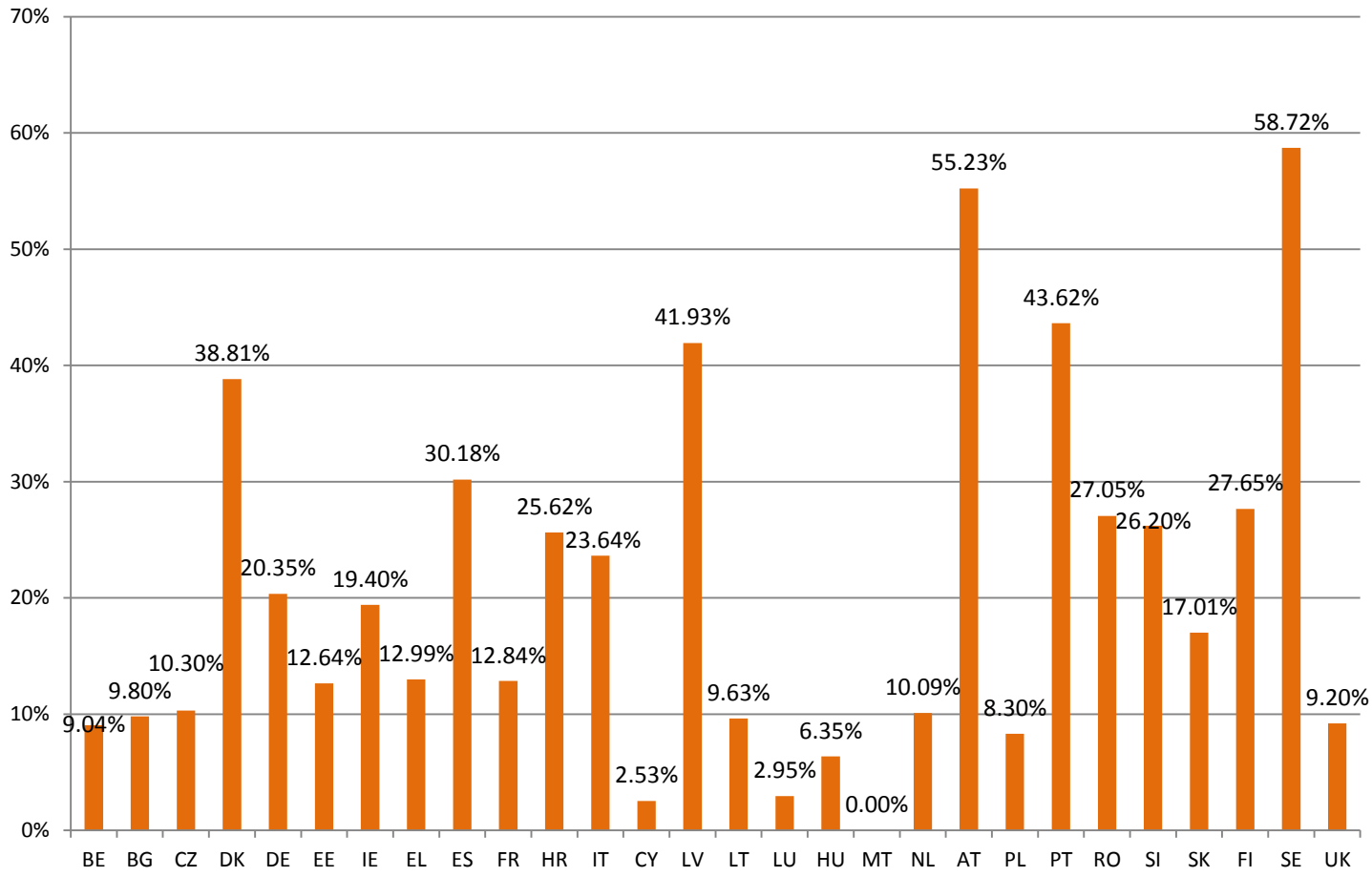
Source: Eurostat

Figure 5.2 Expected additional electricity demand between 2010 and 2020



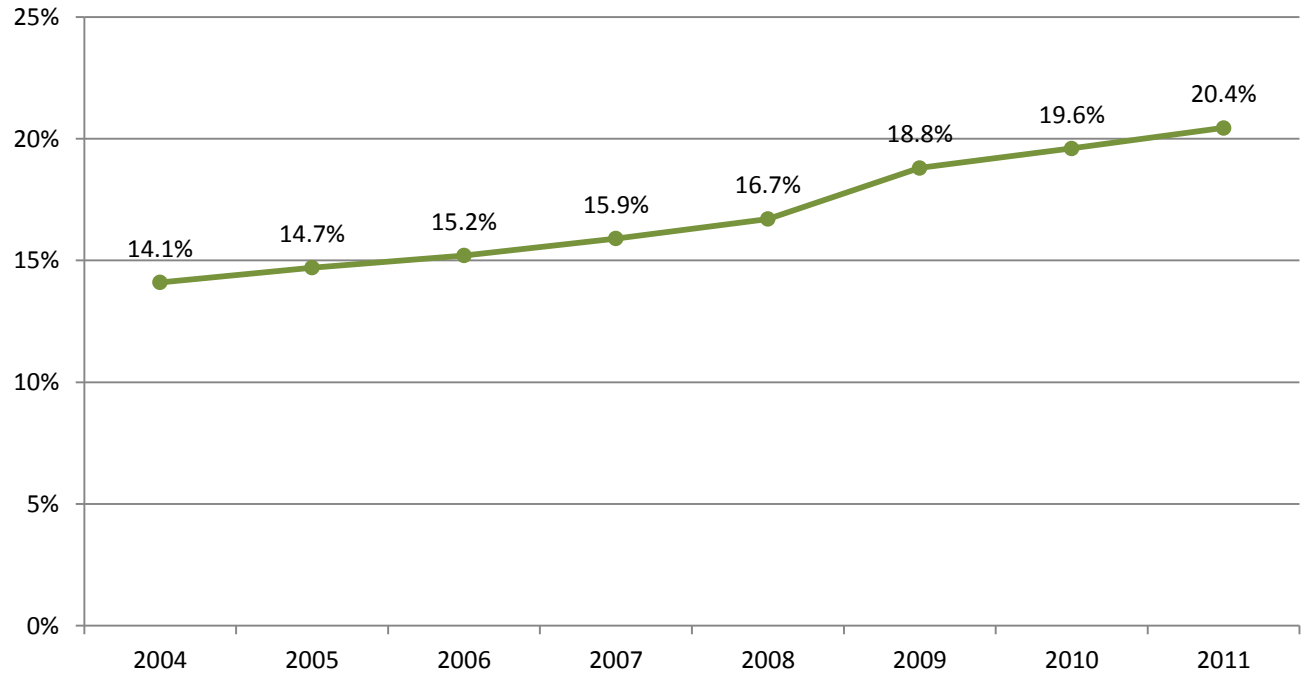
Source: European Commission “EU energy trends to 2030”, Cross Border Bioenergy project

Figure 5.3 Percentage of electricity generated from renewable sources in 2011.



Source: Eurostat

Figure 5.4 Share of electricity from renewable sources in gross electricity generation in EU27



Source: Eurostat

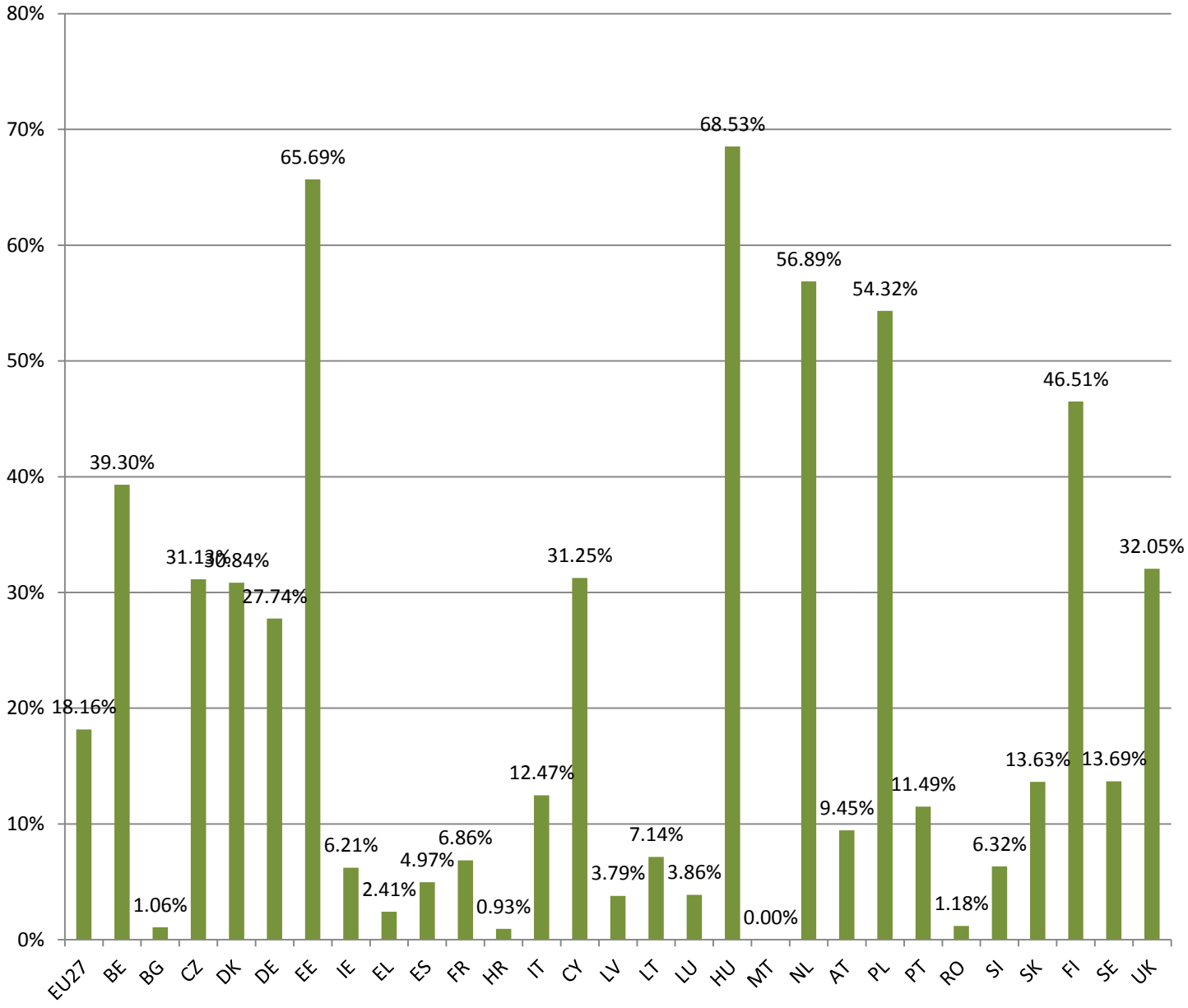
5.2 Bioelectricity

Table 5.1 Gross electricity generation (ktoe) in 2011

	Total	Gross electricity generation from RES	Gross electricity generation from biomass
EU27	281992	62772	11402
BE	7753	1033	406
BG	4368	472	5
CZ	7520	742	231
DK	3024	1219	376
DE	52353	11662	3235
EE	1109	102	67
IE	2363	467	29
EL	5111	746	18
ES	25087	7814	388
FR	48322	6443	442
HR	931	429	4
IT	26016	7466	931
CY	424	16	5
LV	524	264	10
LT	415	196	14
LU	320	207	8
HU	3094	232	159
MT	188	0	0
NL	9713	1067	607
AT	5649	4117	389
PL	14063	1204	654
PT	4511	2175	250
RO	5350	1440	17
SI	1381	364	23
SK	2464	521	71
FI	6318	2077	966
SE	12930	7248	992
UK	31625	3482	1116

Source: Eurostat, AEBIOM calculation.

Figure 5.5 Share of electricity produce from biomass in the overall RES electricity production



Source: Eurostat, AEBIOM calculations.

Table 5.2 Gross electricity production from solid biomass in the European Union in 2010 and 2011* (in GWh)

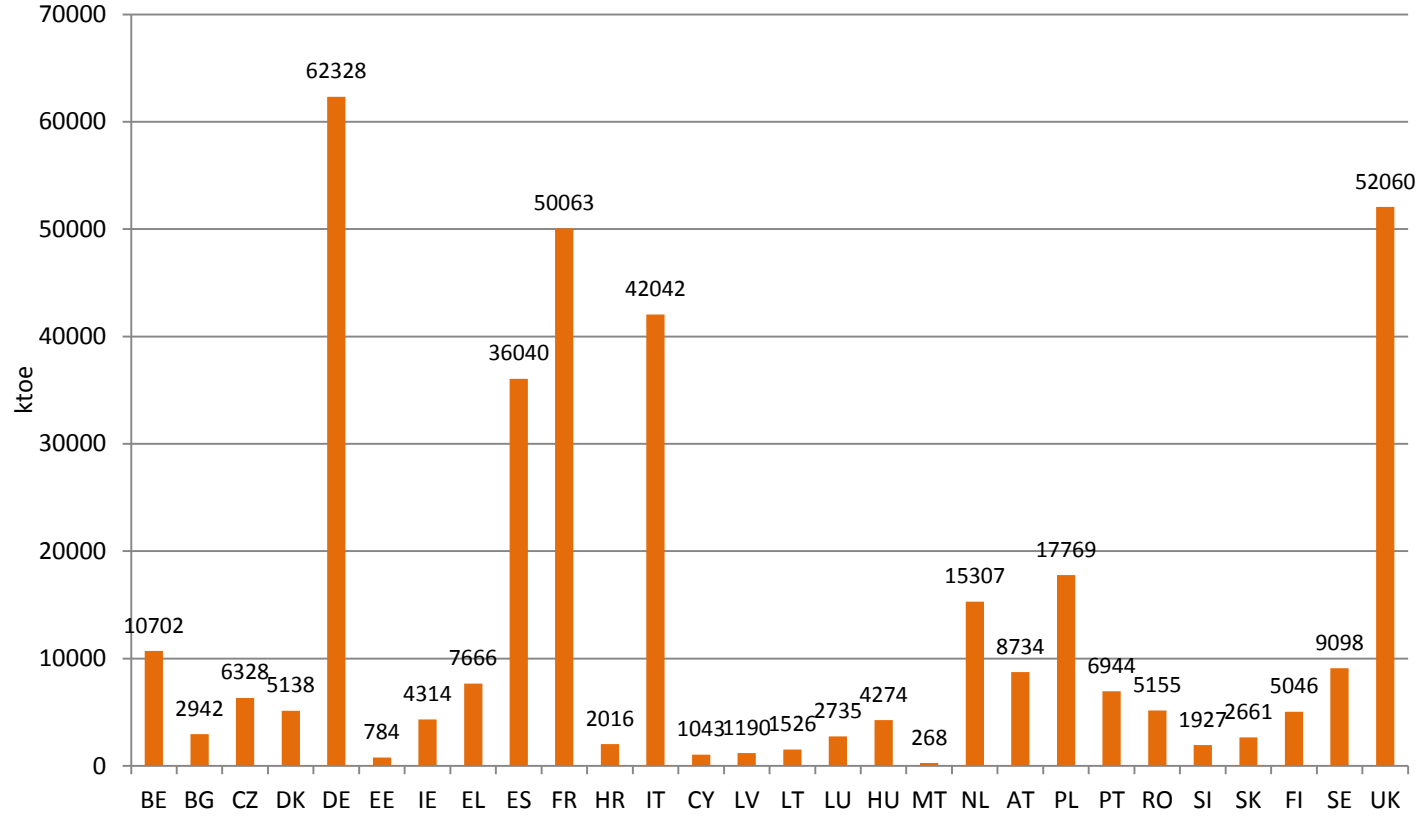
	2010			2011		
	Electricity only plants	CHP plants	Total electricity	Electricity only plants	CHP plants	Total Electricity
EU	26320	70972	70972	30649	42151	72800
BE	1900	1004	2904	1900	1004	2904
BG	0	19	19	0	19	19
CZ	595	898	1493	650	1036	1686
DK	0	3314	3314	0	3064	3064
DE	7521	3209	10730	6814	4725	11539
EE	255	475	730	255	475	730
IE	92	19	111	120	16	137
EL						
ES	1342	1166	2508	1572	1365	2937
FR	314	1216	1530	320	1218	1538
HR						
IT	1543	717	2260	1678	845	2522
CY						
LV	2	7	9	3	10	19
LT	0	116	116	0	121	121
LU						
HU	1900	134	2034	1446	76	1522
MT						
NL	2447	1750	4197	2328	1649	3977
AT	1467	2426	3893	1279	2649	3928
PL	0	5906	5906	4496	2605	7101
PT	665	1560	2225	745	1722	2467
RO	48	62	110	48	62	110
SI	0	120	120	0	125	125
SK	0	682	682	0	614	614
FI	1552	9018	10570	1495	8473	9968
SE	0	10260	10260	0	9641	9641
UK	4677	575	5252	5500	637	6137

Source: EurObserv'ER 2012

biofuels for transport

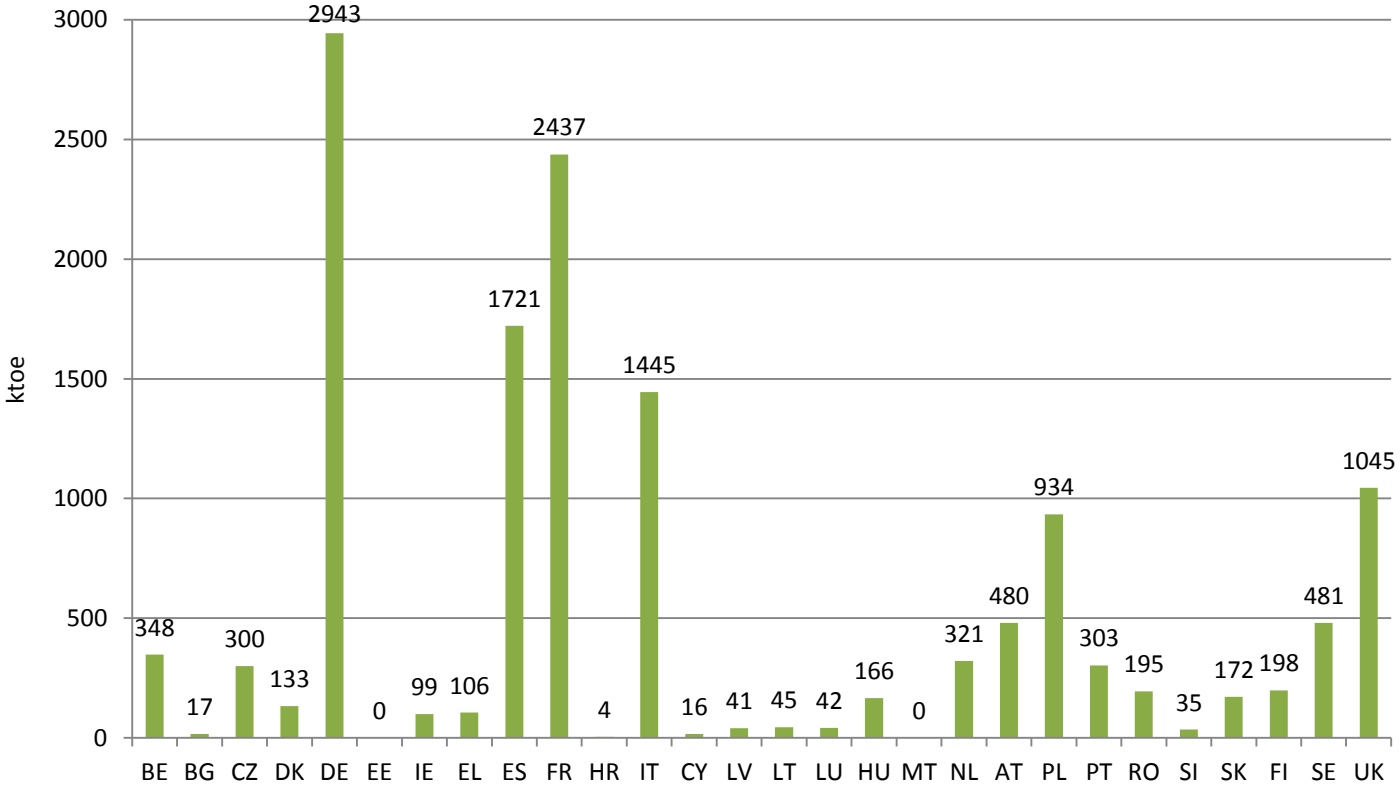
6.1Generalities

Figure 6.1 Final energy consumption in the transport sector in EU countries in 2011 (ktoe)



Source: Eurostat, AEBIOM calculation.

Figure 6.2 Final energy consumption of RES in the transport sector in EU countries in 2011 (ktoe)



Source: Eurostat, AEBIOM calculation.

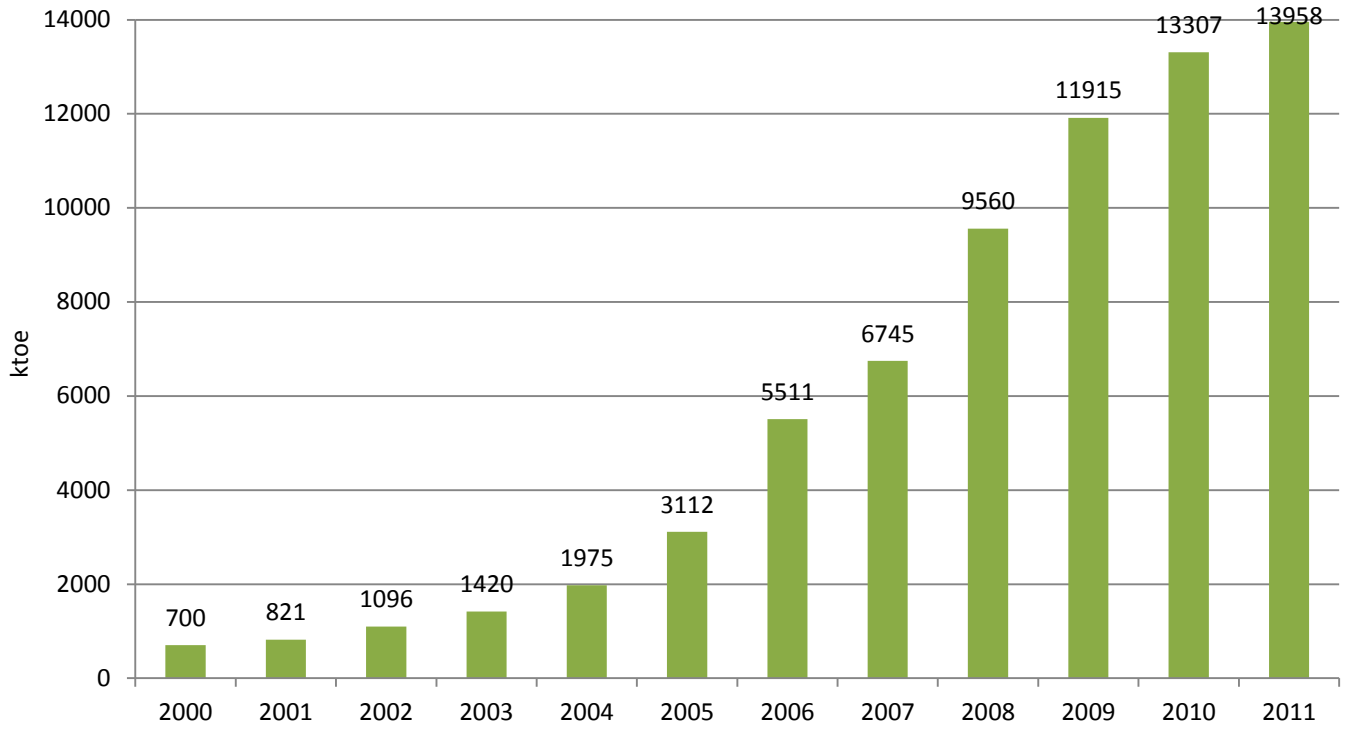
Table 6.1 Final energy consumption of RES in the road transport (ktoe)

	Total final energy consumption in road transport	RES in road transport	% of RES in final energy consumption in road transport*
EU27	297576	14013	4.71%
BE	8859	348	3.93%
BG	2498	17	0.68%
CZ	5622	300	5.34%
DK	3935	133	3.38%
DE	51767	2943	5.69%
EE	705	0	0.00%
IE	3565	99	2.78%
EL	5953	106	1.78%
ES	28616	1721	6.01%
FR	41635	2437	5.85%
HR	1814	4	0.22%
IT	35893	1445	4.03%
CY	741	16	2.16%
LV	979	40	4.09%
LT	1375	45	3.27%
LU	2315	42	1.81%
HU	3898	166	4.26%
MT	173	0	0.00%
NL	11350	321	2.83%
AT	7496	475	6.34%
PL	16674	934	5.60%
PT	5716	303	5.30%
RO	4548	195	4.29%
SI	1875	35	1.87%
SK	2102	172	8.18%
FI	4005	196	4.89%
SE	7841	481	6.13%
UK	37438	1045	2.79%

* This simple calculation is different from the methodology used to calculate the RES percentage in transport as stated in the RES directive.

Source: Eurostat, AEBIOM calculations.

Figure 6.3 Trend of the EU biofuel consumption for transport (ktoe)



Source: Eurostat, AEBIOM calculation.

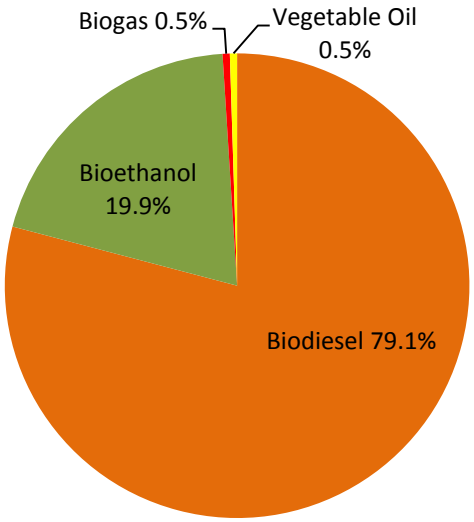
6.2 Biodiesel and bioethanol

Table 6.2 Biofuel consumption for transport in the European Union in 2012* (toe)

	Bioethanol	Biodiesel	Other Biofuels	Total Consumption	Certified as Sustainable
EU27	2868669	11409473	140462	14418603	57%
BE	48366	281026	0	329393	n.a.
BG	0	9809	0	9809	n.a.
CZ	59965	221169	0	281134	100%
DK	70528	159006	0	229534	100%
DE	805460	2190767	22093	3018321	100%
EE	0	0	0	0	0%
IE	28710	54665	62	83436	n.a.
EL	0	124606	0	124606	0%
ES	208675	1718649	0	1927325	0%
FR	417600	2299800	0	2717400	100%
HR	905	31458	0	32363	100%
IT	98667	1263734	0	1362401	n.a.
CY	0	16136	0	16136	0%
LV	6703	12514	0	19217	0%
LT	8707	51810	0	60517	100%
LU	1286	45582	119	46987	100%
HU	27236	30835	23429	81500	n.a.
MT	0	0	0	0	0%
NL	123818	202374	0	326192	n.a.
AT	57124	449024	13141	519289	83%
PL	144635	755006	0	899641	n.a.
PT	2833	284209	0	287042	4%
RO	47721	138746	9721	196188	n.a.
SI	5290	46337	0	51627	100%
SK	23789	76566	502	100856	94%
FI	85268	169461	0	254729	n.a.
SE	207564	307929	71394	586887	91%
UK	388722	499713	0	888435	83%

* Estimate
** Vegetable oils used in the pure state for Germany, Austria, Ireland, Luxembourg, Romania. Biogas fuel for Sweden
***As 2012 data for Romania was unavailable at the time of publication, 2011 data was used by default.
Source: EurObserv´Er 2013

Figure 6.4 Share of each type of biofuel as energy content of EU biofuel consumption for in 2012*



* Estimate
Source: EurObserv´Er 2013

Table 6.3 Bioethanol fuel output across the European countries in 2011 and 2012* (millions of liters)

	2011	2012*
BE	400	450
BG	10	40
CZ	110	130
DK	5	5
DE	770	773
EE	0	0
IE	10	10
EL	0	0
ES	463	381
FR	1007	1200
IT	60	150
CY	0	0
LV	5	15
LT	18	27
LU	0	0
HU	173	220
MT	0	0
NL	275	450
AT	195	216
PL	167	212
PT	0	0
RO	65	20
SI	0	0
SK	130	130
FI	10	10
SE	200	230
UK	320	167

* Estimate
Source: EurObserv´Er 2013

biogas sector in EU

7.1 Generalities

Table 7.1 Primary energy production of biogas in the EU 27 in 2010 and 2011* (ktoe)

	2010				2011*			
	Landfill Gas	Sewage sludge gas[1]	Other biogas[2]	Total	Landfill Gas	Sewage sludge gas[1]	Other biogas[2]	Total
EU27	2801.7	1065	10875.4	10875.4	3157.9	1208	5719.3	10085.8
BE	41.9	14.6	70.9	127.4	41.9	14.6	70.9	127.4
BG	-	-	-	-	-	-	-	-
CZ	29.5	35.9	111.3	176.7	31.8	38.8	179.9	249.6
DK	8.1	20.1	74	102.2	5.2	19.6	73.2	98.1
DE	232.5	402.6	6034.5	6669.6	149	504.2	4414.2	5067.6
EE	2.7	1.1	0	3.7	2.2	1.1	0	3.3
IE	44.2	9.6	4.6	58.4	43.8	8.2	5.6	57.6
EL	51.7	15	1	67.7	55.4	16.1	1.4	72.8
ES	119.6	12.4	66.7	198.7	148.1	15.3	82.6	246
FR	236.7	44.1	53.2	334	249.7	41.9	58	349.6
IT	349.6	8.1	149.8	507.5	755.6	16.2	323.9	1095.7
CY	0	0	1	1	0	0	1	1
LV	7.9	3.3	2.2	13.3	7.8	2.4	11.8	22
LT	2	3	5	10	5.9	3.1	2.1	11.1
LU	0.1	1.2	11.7	13	0.1	1.4	11.3	12.8
HU	2.6	12.3	19.3	34.2	7.3	6.4	15.5	29.1
MT	-	-	-	-	-	-	-	-
NL	36.7	50.2	206.5	293.4	31.5	51.5	208.3	291.3
AT	5.1	22.3	144.2	171.6	4.3	16.4	138.8	159.5
PL	43.3	63.3	8	114.6	47.5	67.8	20.1	135.4
PT	28.2	1.7	0.8	30.7	42.3	1.8	0.9	45
RO	0	0	3	3	0	0	3	3
SE	35.7	60.7	14.8	111.2	12.4	68.9	37.9	119.3
SI	7.7	2.8	19.9	30.4	7.1	2.7	26.2	36
SK	0.8	9.5	1.8	12.2	3	13.6	29.3	45.8
FI	22.7	13.2	4.5	40.4	23.9	13.4	4.8	42
UK	1492.6	258	0	1750.6	1482.4	282.4	0	1764.8

* Estimation
** Overseas department not included
[1] Urban and industrial
[2] Decentralised agricultural plants, municipal solid waste, mechanisation plants, centralized co-digestion plants.
Source: Eurobserver 2012

Table 7.2 Gross electricity production from biogas in the European Union in 2010 and 2011* (GWh)

	2010			2011*		
	Electricity-only plants	CHP	Total electricity	Electricity-only plants	CHP	Total electricity
EU27	24528.2	5803	30331.2	21302.4	14554.1	35856.4
BE	149	417	566	158	442	600
BG	-	-	-	-	-	-
CZ	361	275	636	535	394	929
DK	1	352	353	1	342	343
DE	14847	1358	16205	10935	8491	19426
EE	0	10.2	10.2	0	17	17
IE	184	22	206	181	22	203
EL	190.5	31.4	221.9	37.6	161.7	199.3
ES	536	117	653	709	166	875
FR	756	297	1053	780	337	1117
IT	1451.2	602.9	2054.1	1868.5	1536.2	3404.7
CY	-	-	-	-	-	-
LV	5.9	50.8	56.7	0	105.3	105.3
LT	0	31	31	0	37	37
LU	0	55.9	55.9	0	55.3	55.3
HU	75	21	96	128	55	183
MT	-	-	-	-	-	-
NL	82	946	1028	69	958	1027
AT	603	45	648	555	70	625
PL	0	398.4	398.4	0	430	430
PT	90	11	101	149	11	160
RO	0	1	1	0	19.1	19.1
SE	0	36.4	36.4	0	33	33
SI	7.2	90.2	97.4	5.7	121	126.7
SK	1	21	22	39	74	113
FI	51.5	37.8	89.2	53.6	39.4	93
UK	5137	575	5712	5098	637	5735

*Estimation
Source: Eurobserver 2012

Table 7.3 Gross heat production from biogas in the European Union in 2010 and 2011* (in ktoe) in the transformation sector**

	2010			2011*		
	Heat-only plants	CHP	Total	Heat-only plants	CHP	Total
EU27	44.1	129.8	173.8	55.1	146.4	201.6
BE	0	6.5	6.5	0	6.9	6.9
BG	-	-	-	-	-	-
CZ	1.2	4.9	6.1	1.7	5.5	7.2
DK	3.5	24.1	27.6	3.9	25	28.9
DE	13.6	22.4	36	28.8	29.2	58
EE	0.1	1.5	1.5	0.1	1.3	1.4
IE	-	-	-	-	-	-
EL	-	-	-	-	-	-
ES	-	-	-	-	-	-
FR	-	-	-	-	-	-
IT	0.2	24.3	24.6	0	29.7	29.7
CY	-	-	-	-	-	-
LV	0	1.2	1.2	0	4	4
LT	0	0.4	0.4	0	0.6	0.6
LU	0	0.8	0.8	0	0.9	0.9
HU	-	-	-	-	-	-
MT	-	-	-	-	-	-
NL	0	6.7	6.7	0	6	6
AT	7.5	4.8	12.2	5.1	5.3	10.4
PL	0.3	17.6	18	0	14.9	14.9
PT	-	-	-	-	-	-
RO	-	-	-	-	-	-
SE	9.5	8	17.5	7.5	7.3	14.8
SI	0	4.6	4.6	0	5.5	5.5
SK	0.7	1	1.7	0.4	3.3	3.7
FI	7.4	0.9	8.4	7.6	1	8.6
UK	-	-	-	-	-	-

*Estimation
** Heat sold to the district heating network or to the industrial units
Source: Eurobserver 2012

Table 7.4 Biogas plants in Europe in 2010 and 2011

Country	Total number of Biogas Plants 2010	Total number of biogas plants 2011	Agriculture	Landfill	Sewage	Other
BE	nd	118	29	25	21	43
BG	nd	0	0	0	0	0
CZ	235	327	212	61	54	0
DK	nd	196	87	32	68	9
DE	7090	8400	7215	nd	980	205
EE	3	3	1	1	1	0
IE	nd	5	5	0	0	0
EL	17	20	0	3	11	6
ES	12	30	22	0	0	0
FR	498	498	48	301	60	89
HR	nd	6	4	1	1	0
IT	510	521	324	197	0	0
CY						
LV	15	27	21	3	1	2
LT	16	13	1	7	3	2
LU	30	33	26	0	4	3
HU	43	43	21	8	13	1
MT						
NL	209	235	98	41	75	21
AT	425	433	200	15	94	124
PL	160	178	21	89	67	1
PT	nd	26	2	17	7	0
RO	6	7	0	0	7	0
SI	22	30	22	4	4	0
SK	56	56	34	9	9	4
FI	74	75	10	39	18	8
SE	228	229	32	57	135	5
UK	275	299	29	75	146	49

* Other-biowaste and industrial biogas plants.
n.d.- no data
Source: European Biogas Association 2012

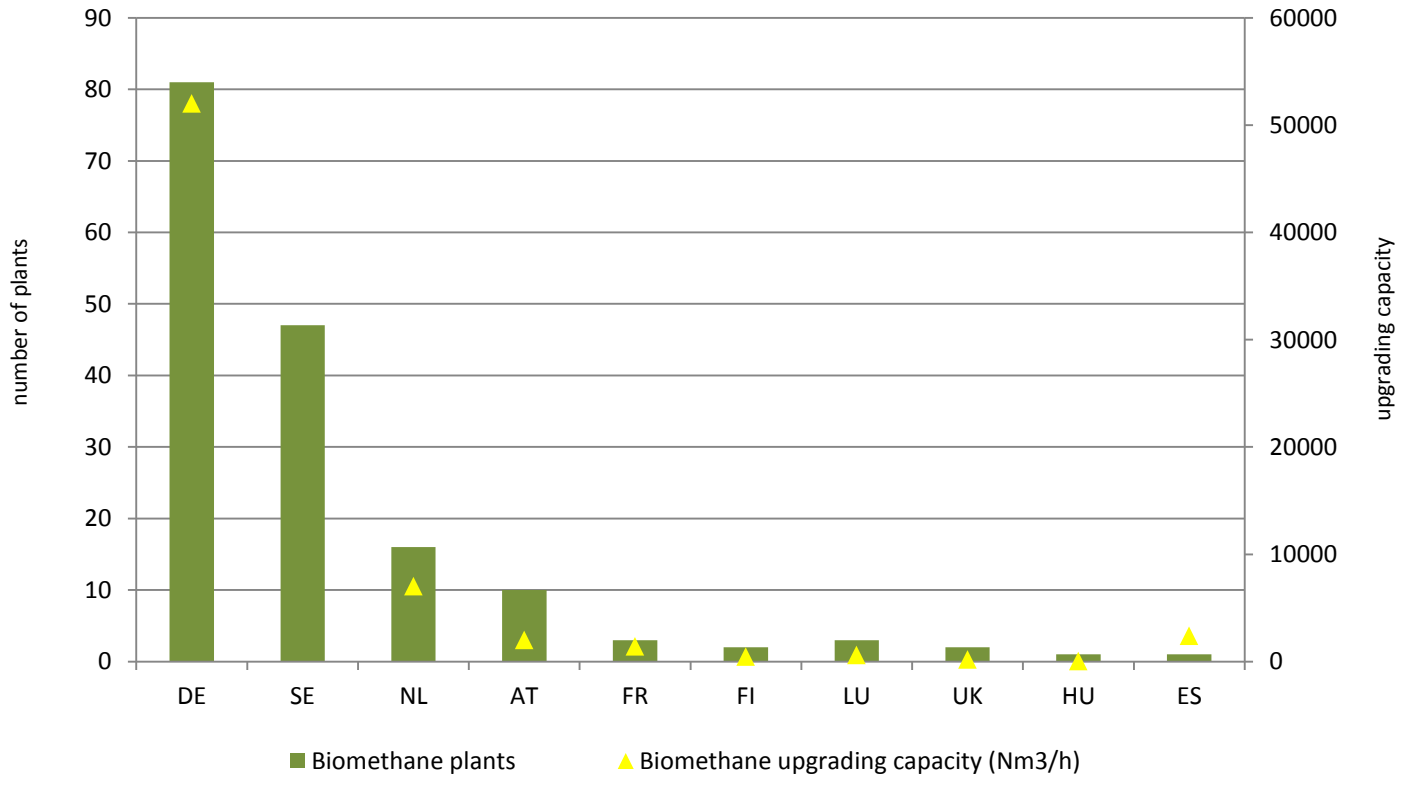
7.2 Biomethane

Table 7.5 Status quo of biomethane plants 2011 in 12 European Countries.

	Biomethane plants	Biomethane plants feeding the grid	Biogas plants total (approx..)	Agricultural	Biowaste (incl. organic MSW)	Sewage	LFG
DE	84	82	8792	approx. 7000	92	1700	
FR	3	1	283	40	98	74	71
HR	-	-	4	2	-	1	1
IT	-	-	667	approx. 300	32	135	200
HU	1	-	58	36	-	14	8
MT							
NL	13	13	130				
AT	10	7	503	approx. 300	55	134	14
PL	-	-	219	17	2	approx. 200	
PT							
RO							
SE	47	8	229	14	23	135	57
SK	-	-	24	12	-	12	-
FI							
UK	2	2	360	60		100	>200
Total*							

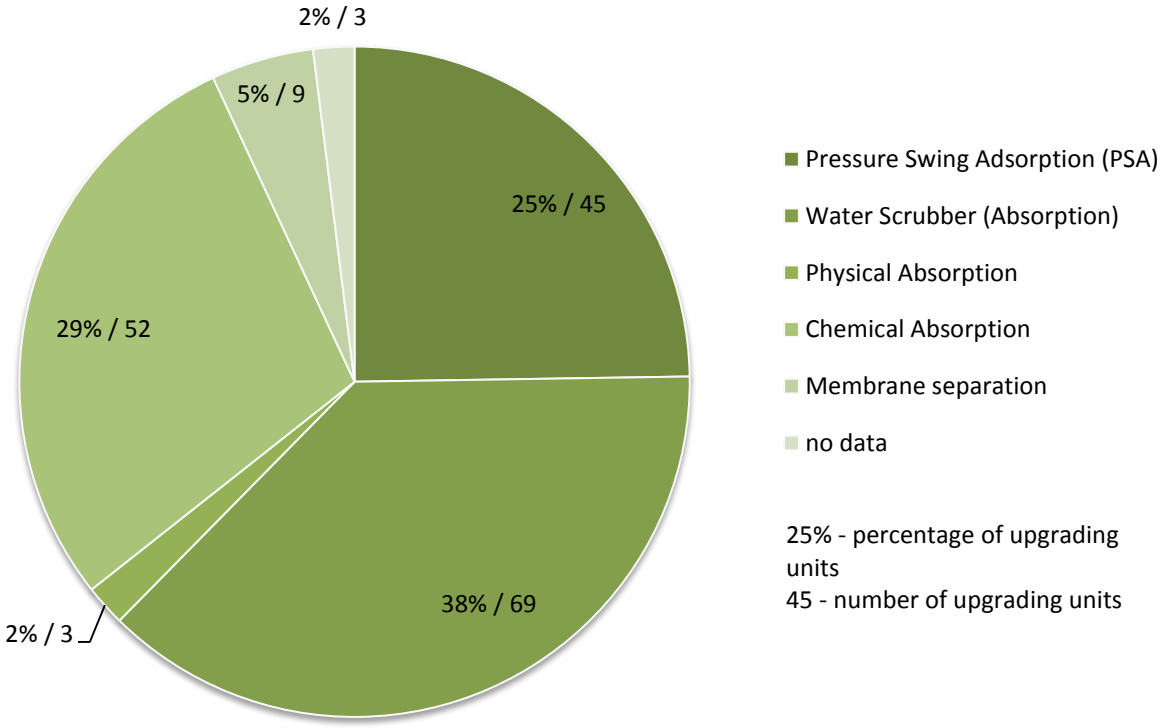
* Including Switzerland
Source : Fraunhofer Umsicht

Figure 7.1 Biomethane plants and upgrading capacity in Europe in 2011



Source: European Biogas Association 2012

Figure 7.2 Split of biomethane upgrading units in Europe in 2011



Source: European Biogas Association 2012

Table 7.6 Biomethane production and support in Europe 2011

Country	Biomethane Plants	Biomethane plants feeding into grid	Biomethane up-grading capacity (Nm3/h)	Biomethane Production (GWh/year)
EU27	172	119	70041	3856.7
BE	0	0	0	0
BG	0	0	0	0
CZ	0	0	0	0
DK	0	0	0	0
DE	87	87	55930	3400
EE	0	0	0	0
IE	0	0	0	0
EL	0	0	0	0
ES	1	1	2400	nd
FR	3	2	1400	nd
HR	0	0	0	0
IT	0	0	0	0
CY	0	0	0	0
LV	0	0	0	0
LT	0	0	0	0
LU	3	2	610	26.4
HU	1	0	25	nd
MT				
NL	16	16	7031	208.3
AT	10	0	2000	50
PL	0	0	0	0
PT	0	0	0	0
RO	0	0	0	0
SI	0	0	0	0
SK	0	0	0	0
FI	2	1	445	2
SE	47	8	nd	170
UK	2	2	200	nd

Source: European Biogas Association 2012

pellet sector in EU

The European Pellet Council (EPC) is an umbrella organisation representing the interests of the European wood pellet sector. Its members are national pellet associations or related organisations from 17 countries. The European Pellet Council is a platform for the pellet sector to discuss the issues that need to be managed in the transition from a niche product to a major energy commodity. These issues include standardisation and certification of pellet quality (ENplus), communication, statistics, safety, security of supply, education and training, and the quality of pellet using devices.

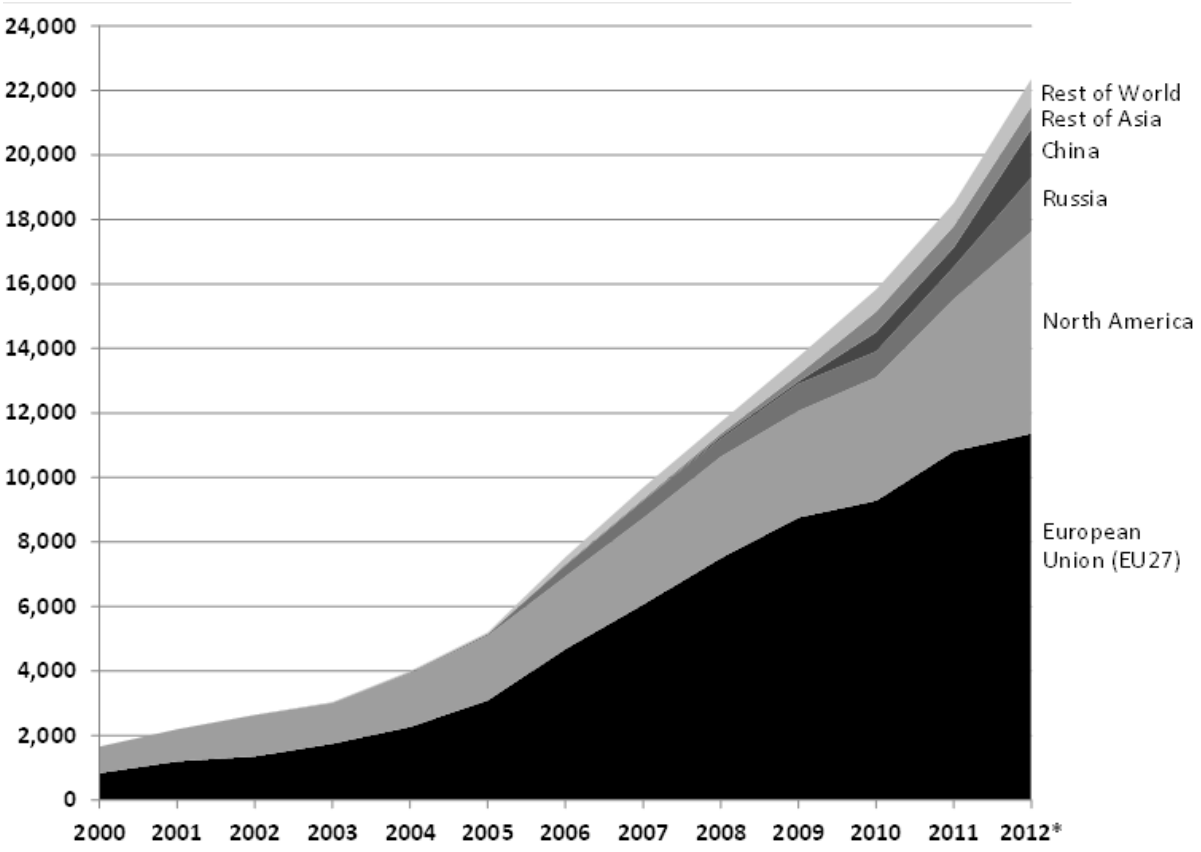
This part, dedicated to pellets, has been edited by Gilles Gauthier, the general manager of EPC. Special thanks to EPC member associations which have provided a large part of the data, EIPS Members and other partners from consulting companies, research centres and universities. Data on industrial pellet use have been supplied by Hawkins Wright.

8.1 Generalities of the pellet sector

8.1.1 WORLD WOOD PELLET PRODUCTION

Wood pellet production started in Europe and North America during the oil crisis of the 1970's. From 2000, the wood pellet market grew very rapidly with more than a tenfold increase in 12 years. In 2000, the annual production was around 1,8 million tons with a 50%/50% share between the EU 27 and North America. By the end of 2012, there were 760 pellet production plants amounting to a global production capacity of 42 million tons with actual production ranging from 22,4 million to 24,5 million.
During this period (2000-2012), some new production countries emerged: some EU countries, Russia, China, Brazil, etc.

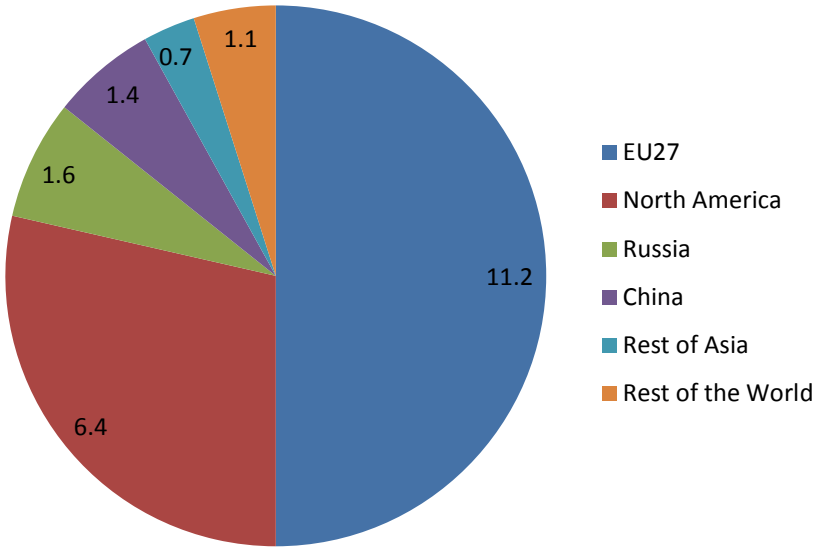
Figure 8.1 Estimated global wood pellet production [in thousands of tons]



Source: IEA Bioenergy Task 40

The EU remains by far the biggest world pellet producer with actual production ranging from 10,5 million tons to 11,2 million tons in 2012.

Figure 8.2 World wood pellet production share in 2012



Source: IEA Bioenergy Task 40, EPC

The EU pellet sector is comprised of a number of medium and small scale pellet producers. The largest pellet producers are mainly located in North America and Russia.

Table 8.1 World pellet production plants with a production capacity above 200.000 t/a (January 2013)

Country	Company name	City	Production capacity (t/a)	Status
RU	Vyborskay Cellose	Leningrad Region	900.000	Operating
US	Georgia Biomass	Waycross	800.000	Operating
US	German Pellet Texas	Woodville	578.000	Project
US	Green Circle	Cottondale	550.000	Operating
US	Enviva	Courtland	550.000	Project
CA	Protocol Biomass	Prescott	500.000	Project
US	Enviva	Northapton	500.000	Operating
CA	Pinnacle Pellet	Burns Lake	400.000	Operating
US	Point Bio Energy	Greater Baton Rouge	400.000	Project
US	Enviva	Hertford	380.000	Operating
CA	Pacific BioEnergy	Prince George	360.000	Operating
CA	Atlantic Fiber Resources	Chandler	260.000	Project
DE	German Pellets	Herbrechtingen	256.000	Operating
DE	German Pellets	Wismar	256.000	Operating
FR	Erscia France	Sardy-Les-Epiry	250.000	Operating
RU	SP Akraim	Khabarovsk	250.000	Operating
US	FRAM	Appling County	220.000	Operating
CA	Pinnacle Pellet Meadowbank	Strathnaver	200.000	Operating
IN	Ankit	Bengaluru	200.000	Operating
CN	Hongyi Biofuels	Linyi, Shandong	200.000	Operating
CN	Wanyou Bioenergy	Yiyang, Hunan	200.000	Operating

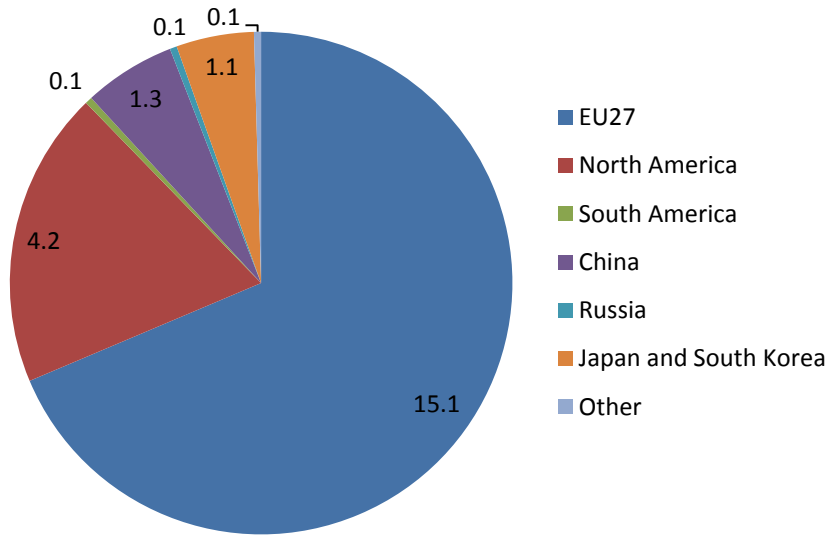
Source: Bioenergy International, pellet map, January 2013

8.1.2 WORLD WOOD PELLET CONSUMPTION

World pellet consumption ranges from 22,4 million to 24,5 million tons. The EU is by far the biggest pellet consumer worldwide with an average consumption of 15,1 million tons in 2012.

Current projections show that EU consumption will continue to expand. Some non-European countries, such as Japan and South Korea, are foreseen as potential big pellet consumers.

Figure 8.3 World wood pellets consumption share in 2012 (million tons)

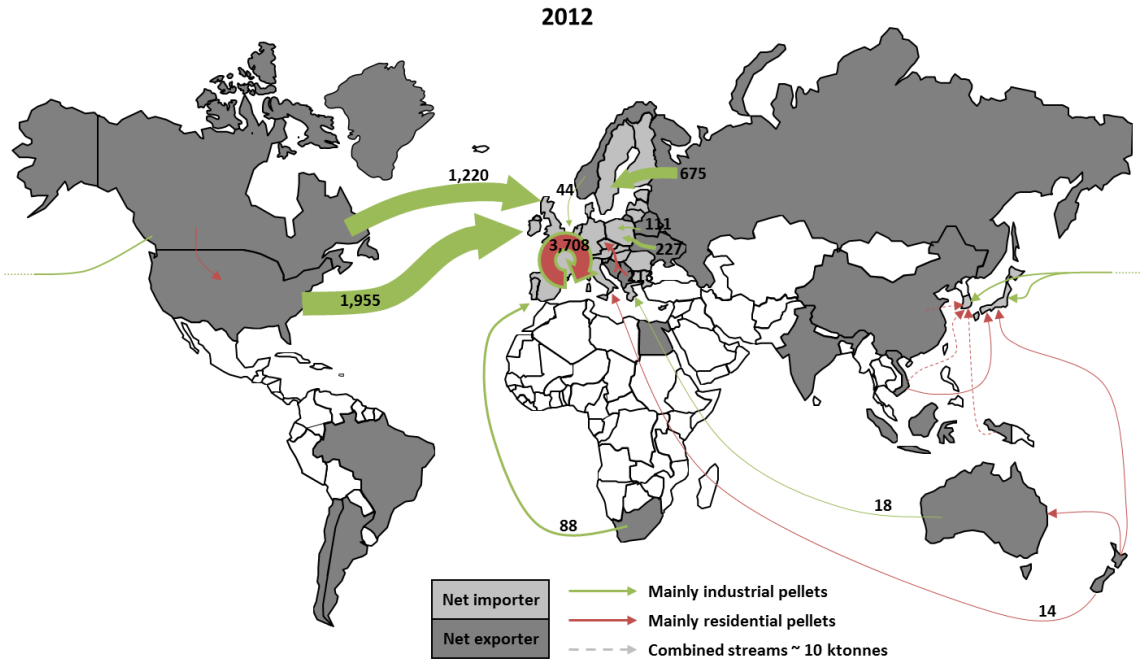


Source: POYRY

8.1.3 WORLD WOOD PELLET TRADE

More and more the pellet market is becoming increasingly globalized. The main exporter to EU is North America followed by Russia. Countries such as Australia, New Zealand and South Africa are also exporting a minor quantity of pellets to EU.

Figure 8.4: World wood pellets trade map in 2012



Source: IEA Bioenergy Task 40

8.2 Situation in Europe

8.2.1 EUROPEAN WOOD PELLET PRODUCTION

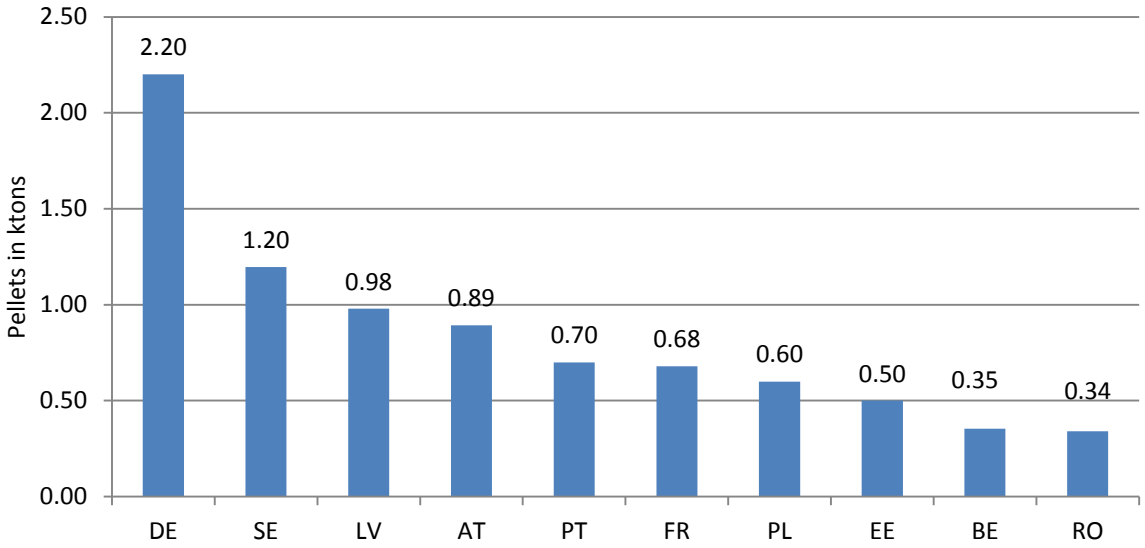
Globally, European pellet production had a growth of more than 30% from 2009 to 2012. Some countries are reaching their pellets production limits or even decreasing their production (DK, FI, IT, SE). This situation is due to different reasons: lack of (affordable) raw materials, high production costs, competition with importing countries. Other countries (AT, BE, DE, ES, FR, LT, LV, PL, PT) show a slight or even strong growth of pellet production.

Table 8.2 European wood pellets production (2009-2012)

Country	2009	2010	2011	2012		
	Actual production (tons)	Actual production (tons)	Actual production (tons)	Number of operating production plants	Production capacity (tons)	Actual production (tons)
EU	7.939.602	9.185.667	9.469.127	497	15.979.700	10.651.512
AT	695.000	850.000	940.000	30	1.230.000	893.000
BE	222.779	285.180	261.817	10	535.000	353.765
BG				40	350.000	120.000
CZ	158.000	145.000	148.000	12	200.000	160.000
DE	1.600.000	1.750.000	1.880.000	55	3.100.000	2.200.000
DK	134.280	137.622	120.000	9	200.000	99.930
EE	380.850*	422.880*	363.220*			500.000
ES	169.110*	184.090*	240.000*	40	950.000	250.000
FI	299.000	290.000	308.000	30	510.000	252.000
FR	345.000	465.000	530.000	45	1.000.000	680.000
GR					140.000	35.000
HR	92.000	110.000	138.000	10	276.800	150.000
HU	29.200	32.000	30.000	13	123.000	27.000
LT	170.000	190.000	205.000	10	300.000	275.000
LV	525.260*	615.140*	713.399	17	1.112.000	979.000
IT	550.000	500.000	470.000	24	450.000	300.000
NL	129.230*	119.830*	120.000*	4	379.000	100.000
PL	410.000	510.000	600.000	30	900.000	600.000
PT	286.710*	627.028	675.300	23	904.000	700.000
RO	139.860*	174.830*	245.000*	6	385.000	340.000
SE	1.475.823	1.649.567	1.343.891	67	2.294.000	1.195.787
SI	57.500	57.500	57.500	9	90.900	83.000
SK	70.000	70.000	80.000	10	200.000	80.000
UK				3	350.000	278.030
Other European countries						
BA				16	188.900	92.000
CH	120.000	140.000	140.000	23	280.000	150.000
CS	4.200	41.240	77.747	30	282.860	108.030
RU						1.455.000
UA	45.000	100.000	155.000			210.000
Outside Europe						
CA				25	1.800.000	1.356.500
US				125	5.800.000	4.100.000

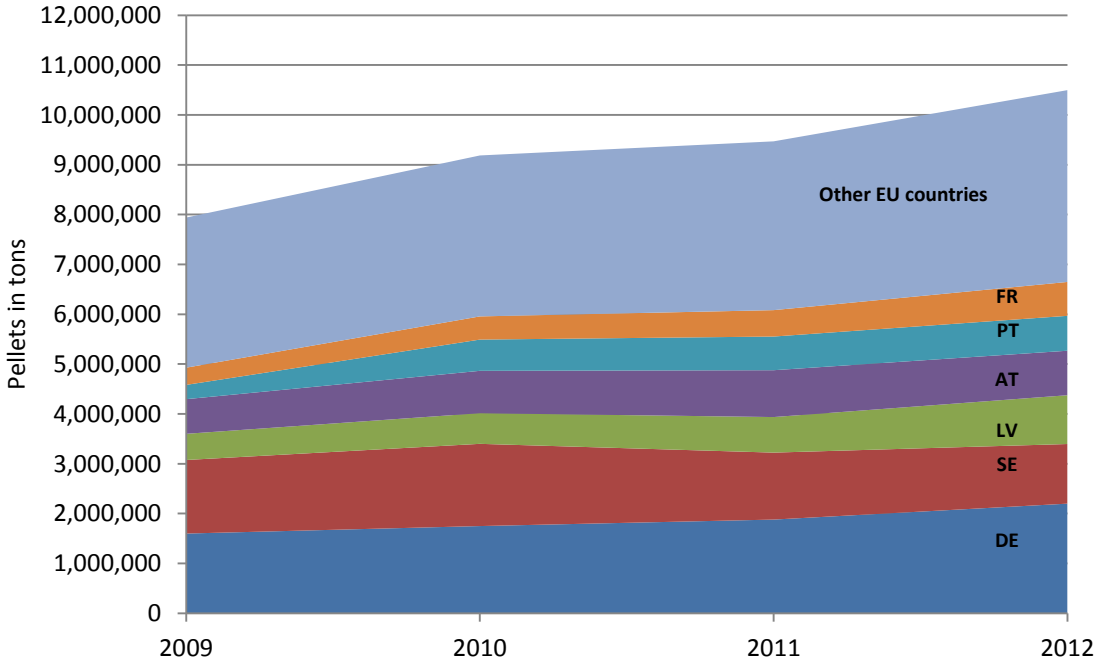
Source: EPC 2013, Eurostat*

Figure 8.5 Main European pellet producers in 2012 (Thousands of tons)



Source: EPC 2013

Figure 8.6 Evolution of the actual pellet production of the biggest EU pellets producers (2009-2012)



Source: EPC 2013

8.2.2 EUROPEAN WOOD PELLETS CONSUMPTION

8.2.2.1 PELLETS CONSUMPTION FOR HEATING

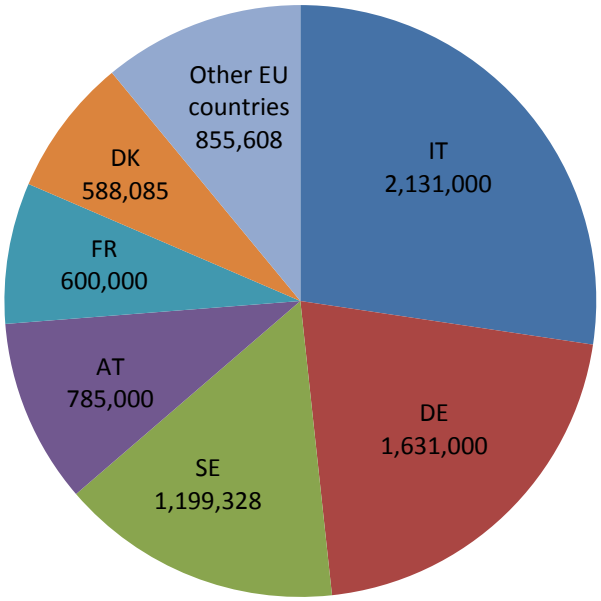
With a consumption of nearly 8 million tons, the heating sector is a big player in EU pellet consumption with a share of more than 50 % of the total EU pellet consumption.
This sector is more predicable than the power sector and its growth of more than 1 million tons a year (5,6 million tons in 2010) is significant.

Table 8.3 European pellets consumption for heating (2012-2013)

Country	2012			2013		
	Residential heating < 50 kW (tons)	Commercial heating >50 kW (tons)	Total demand for heating (tons)	Residential heating < 50 kW (tons)	Commercial heating >50 kW (tons)	Total demand for heating (tons)
EU	5.853.554	1.733.467	7.790.021			
AT	700.000	85.000	785.000	800.000	100.000	900.000
BG	24.000		24.000	28.000		28.000
CZ	30.000	30.000	60.000			
DE	1.082.800	548.200	1.631.000	1.246.900	610.900	1.857.800
DK	499.872	88.213	588.085			
ES	125.000	50.000	175.000	137.500	62.500	200.000
FI	69.000	127.000	196.000	75.000	185.000	260.000
FR	540.000	60.000	600.000	680.000	70.000	750.000
HR	2.500	1.500	4.000	3.000	2.000	5.000
HU	8.028	480	8.508	8.948	624	9.572
IT	2.119.000	12.000	2.131.000	2.500.000	13.000	2.513.000
LT	13.500	3.600	17.100	23.500	5.000	28.500
LU			10.000			
LV			120.000			
PL	140.000	10.000	150.000			
PT			73.000			150.000
SE	491.854	707.474	1.199.328			1.438.388*
SK	8.000	10.000	18.000	10.000	15.000	25.000
Other European countries						
BA	14.100	2.300	16.400			
CH	133.000	47.000	180.000	148.000	52.000	200.000
CS	48.500	14.800	63.300			
UA		243.000	243.000		570.000	570.000
Outside Europe						
CA	176.500					
US	2.100.000	100.000	2.200.000	2.200.000	100.000	2.300.000

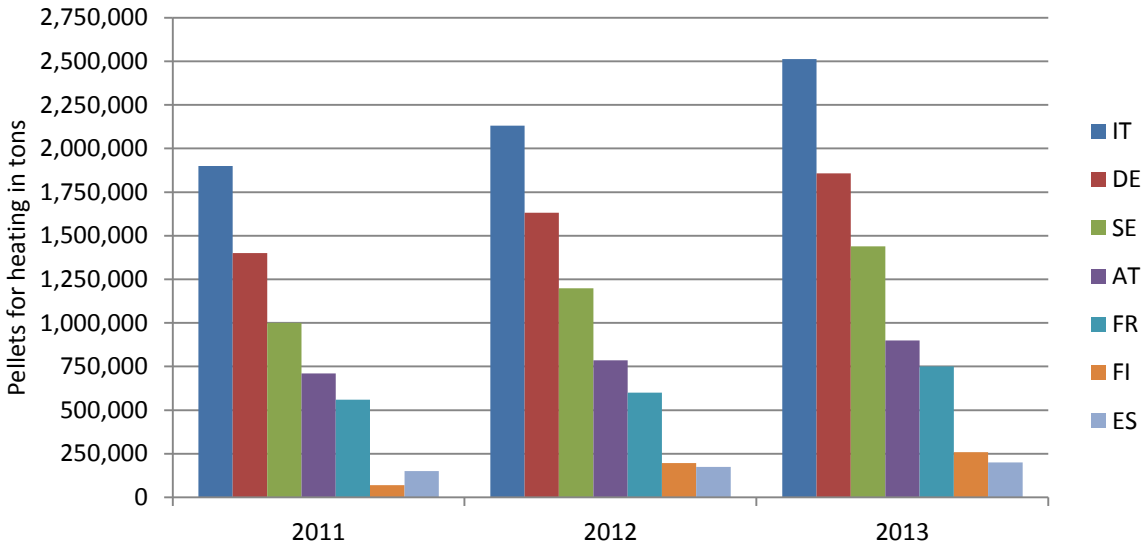
Source: EPC 2013 , *EPC estimation

Figure 8.7 Main EU pellet consumers for heating in 2012 (in tons)



Source: EPC 2013

Figure 8.8 Evolution of pellet consumption for heating in the highest consuming countries (2011-2013)



Source: EPC 2013

Table 8.4 Installed pellet boilers (< 50 kW, projections to 2020)

Country	2012		2013		2015	2020
	Pellet boilers <50 kW (Residential)		Pellet boilers <50 kW (Residential)		Pellet boilers <50 kW (Residential)	Pellet boilers <50 kW (Residential)
	Number of new installed boilers in 2012	Total number of installed boilers until end of 2012	Number of new installed boilers in 2013	Total number of installed boilers until end of 2013	Total number of installed boilers until end of 2015	Total number of installed boilers until end of 2020
AT	10.000	91.000	9.000	100.000	120.000	180.000
DE	25.820	185.460	27.890	213.350	275.980	482.070
ES	1.278	8.760	1.565	10.325		
FI	100	25.500	150	25.650	30.000	75.000
FR	6.600	30.400	9.000			
HU	90	157	80	237	320	450
IT	9.425	39.553	12.268	52.533	79.930	204.000
SK	100	750	70	830	55	1.600
UK						65.000
Other European countries						
CH	600	12.200	700	13.600	16.500	26.600

Source: EPC 2013

Table 8.5 Installed pellet boilers (> 50 kW, projections to 2020)

Country	2012		2013		2015	2020
	Pellet Boilers >50 kW (commercial)		Pellet Boilers >50 kW (commercial)		Pellet Boilers >50 kW (commercial)	Pellet Boilers >50 kW (commercial)
	Number of new installed boilers in 2012	Total number of installed boilers until end of 2012	Number of new installed boilers in 2013	Total number of installed boilers until end of 2013	Total number of installed boilers until end of 2015	Total number of installed boilers until end of 2020
AT	2.000	10.000	1.000	11.000	13.000	20.000
DE	830	7.820	890	8.710	10.720	17.320
ES	1.176	4.670	1.069	5.739		
FI	150	2.000	175	2.175	4.000	20.000
HU	25	60	18	78	90	130
IT	112	217	122	339	692	2.100
LT	50	150	50	200	340	690
SK	20	150	10	160	200	250
UK		683	1.818	2.501		
Other European countries						
CH	80	600	90	700	800	1.150
UA	120	800	200	1.000		

Source: EPC 2013

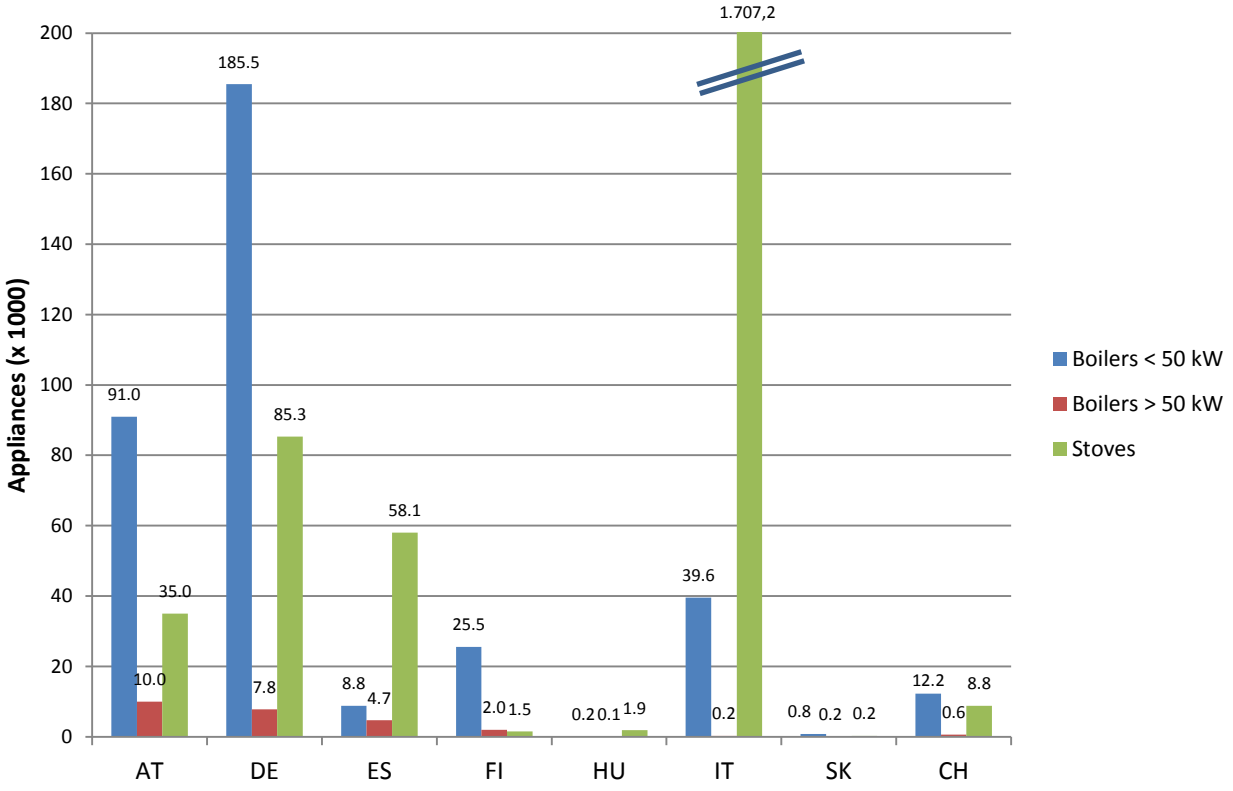
Table 8.6 Annually installed pellet stoves (projections to 2020)

Country	2012		2013		2015	2020
	Pellet Stoves		Pellet Stoves		Pellet Stoves	Pellet Stoves
	Number of new stoves installed in 2012	Total number of stoves installed until end of 2012	New stoves installed capacity in 2013	Total number of stoves installed until end of 2013	Total number of stoves installed until end of 2015	Total number of stoves installed until end of 2020
AT	5.000	35.000	5.000	40.000	45.000	80.000
DE	14.830	85.330	15.570	100.900	134.410	219.100
ES	13.800	58.053	15.538	73.591		
FI	60	1.500	100	1.600	2.500	6.000
FR	58.000	195.785	85.000			
HU	1.010	1.850	150	2.000	2.500	3.500
IT	192.000	1.707.240	230.000	1.900.000	2.350.000	3.680.000
SK	65	200	63	263	300	500
Other European countries						
CH	800	8.800	900	9.800	10.800	13.800
Outside Europe						
CA	5.811	45.000				
US	48.000		50.000			

Source: EPC 2013

When comparing the sales of boilers and stoves in different countries, one can observe clear trends. AT, DE, FI markets are clearly driven by boilers. In contrast, IT and ES are driven by stoves.

Figure 8.9 Total number of installed pellets heating appliances in 2012 (in thousands heating appliances)



Source: EPC 2013

8.2.2.2 PELLETS CONSUMPTION FOR POWER PLANTS

The projections for the use of pellets for electricity production (including CHP) are stable in most EU countries except the UK which is foreseen to become a big industrial pellet consumer.

Table 8.7 Main EU pellet consuming countries for power plants (2012-2013)

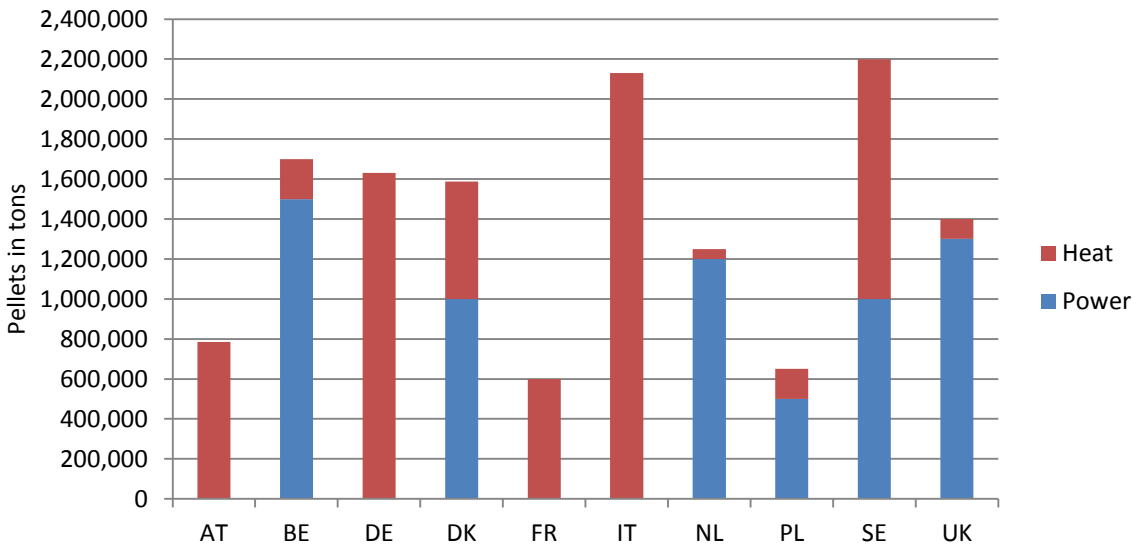
Country	2012	2013
BE	1.500.000	1.500.000
DK	1.000.000	1.000.000
NL	1.200.000	1.000.000
PL	500.000	400.000
SE	1.000.000	1.000.000
UK	1.300.000	4.570.000

Source: Hawkins Wright

8.2.2.3 SHARE OF HEAT/POWER PELLETS CONSUMPTION

One can observe very different trends depending on the country. Some countries (BE, NL and UK) are driven by the pellet power market. In contrast, other countries (AT, DE, FR, IT) are almost exclusively driven by the pellet heat market.

Figure 8.10 Share of heat/power pellet consumption in the highest consuming EU countries (2012)



Source: EPC 2013, Hawkins Wright

8.2.3 EUROPEAN WOOD PELLETS TRADE

Table 8.8 10 EU main pellets importing countries (2012)

Country	Import from	Quantity (tons)
DK	LV	586.254
	RU	347.962
	EE	292.422
	Other countries	749.868
	Total import	1.976.506
UK	CA	854.602
	US	475.337
	LV	101.783
	Other countries	21.439
	Total import	1.453.161
IT	AT	313.933
	DE	137.445
	HR	114.267
	Other countries	524.409
	Total import	1.090.054
BE	US	571.933
	CA	205.469
	UK	81.360
	Other countries	111.192
	Total import	969.954
NL	US	602.328
	CA	180.572
	PT	107.368
	Other countries	74.946
	Total import	965.213
SE	RU	208.091
	EE	101.314
	DE	40.756
	Other countries	113.167
	Total import	463.328
DE	DE	86.966
	AT	40.164
	FR	32.569
	Other countries	144.701
	Total import	304.400
AT	RO	103.724
	DE	86.619
	CZ	57.721
	Other countries	19.564
	Total import	267.628
SI	HR	21.808
	RO	3.354
	IT	1.272
	Other countries	3.417
	Total import	29.852
FI	RU	17.937
	LV	9.722
	SE	282
	Other countries	330
	Total import	28.270

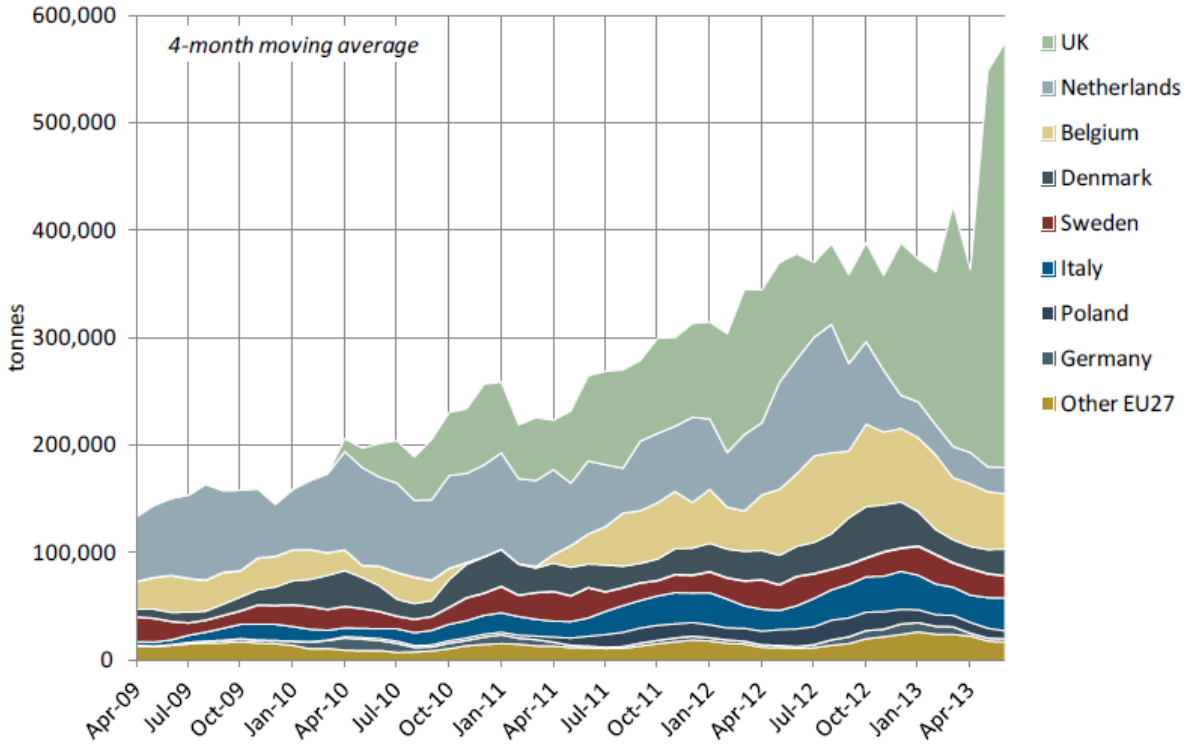
Source: Eurostat

Table 8.9 10 EU main pellets exporting countries

Country	Export to	Quantity (tons)
LV	DK	436.993
	EE	131.659
	SE	103.899
	Other countries	237.134
	Total export	909.684
DE	DK	178.196
	AT	166.986
	IT	160.224
	Other countries	309.784
	Total export	815.189
PT	DK	212.313
	NL	137.701
	UK	107.067
	Other countries	123.979
	Total export	581.061
AT	IT	404.455
	DE	53.102
	CZ	5.701
	Other countries	9.691
	Total export	472.949
EE	DK	264.729
	SE	122.465
	UK	20.011
	Other countries	18.200
	Total export	425.403
RO	IT	117.267
	AT	94.362
	GR	18.327
	Other countries	46.541
	Total export	276.497
LT	IT	130.070
	DK	94.581
	DE	18.286
	Other countries	21.895
	Total export	264.831
SE	DK	151.099
	DE	11.712
	FI	1.336
	Other countries	143
	Total export	164.289
NL	BE	96.828
	UK	24.073
	DK	22.161
	Other countries	15.841
	Total export	158.902
CZ	AT	49.604
	IT	48.971
	DE	28.081
	Other countries	20.721
	Total export	147.377

Source: Eurostat

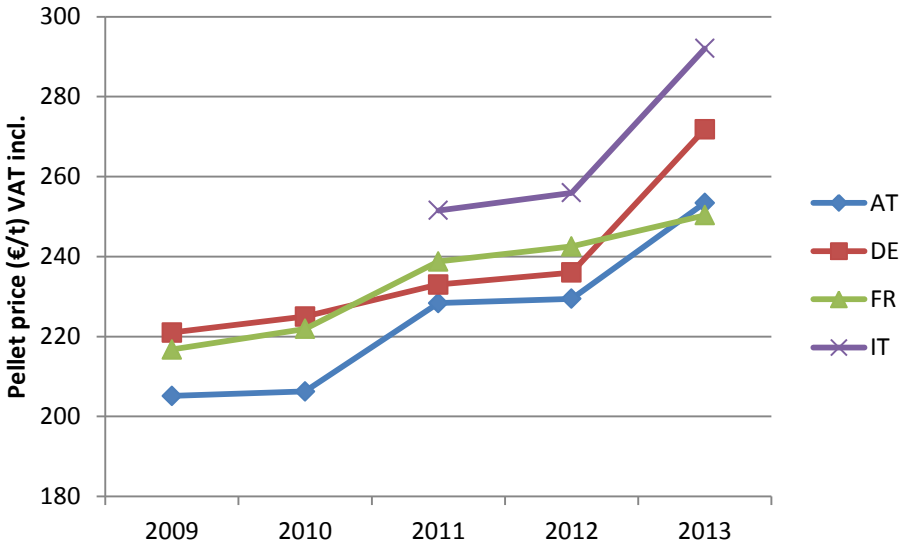
Figure 8.11 EU imports of wood pellets from non-EU countries (2009-2013)



Source: Hawkins Wright

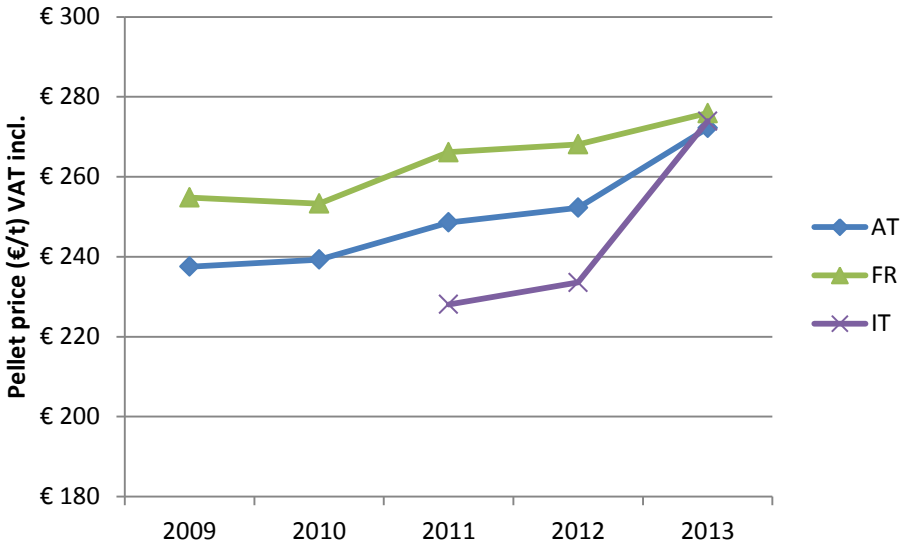
8.2.4 EUROPEAN WOOD PELLET PRICE

Figure 8.12 Domestic bulk pellet price (€/t, delivered, VAT incl., 2009-2013)



Source: EPC 2013
Because this year is not over yet, 2013 figures are based on partial data.

Figure 8.13 Bagged pellet price (€/t, retailer price, palette, VAT incl., 2009-2013)

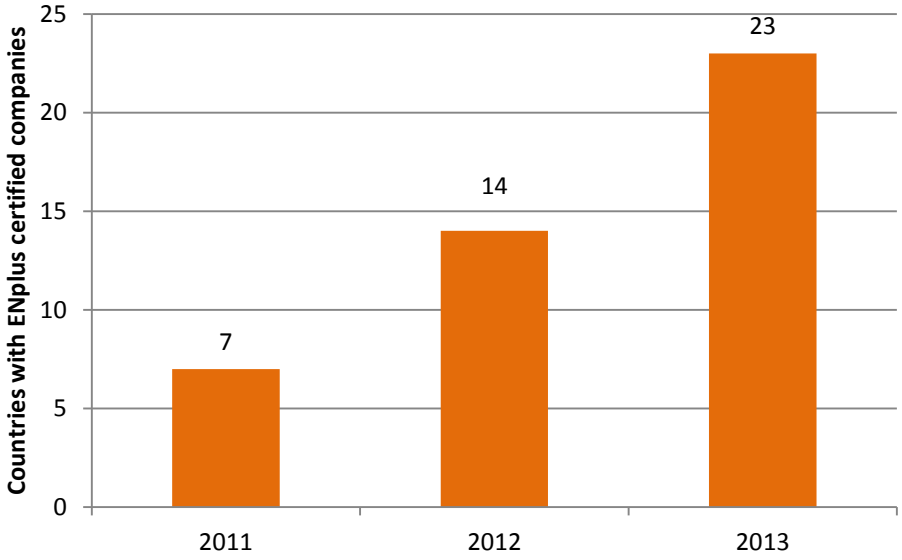


Source: EPC 2013

8.3ENplus certification statistics

The ENplus quality certification is a major step towards establishing pellets as a widely used energy commodity. This system, based on the EN 14961-2 standard, is managed by the European Pellet Council (EPC) from January 2011. Today, EPC enjoys the support of large parts of the European and even World pellet sector. 103 producers and 134 traders are ENplus certified amounting to a total of more than 4 million tons of ENplus certified pellets.

Figure 8.14 Countries with ENplus certified companies



2013: AT, BE, CA, CH, CS, CZ, DE, DK, EE, ES, FR, HU, IT, LT, PT, LV, NL, PL, RO, SI, SK, UK, US

Source: EPC 2013

annexes

Country abbreviations and key general statistics

		Total Area (km^2)	Population (1000 inhabitants)	GDP in current prices (EUR/inhabitant) ([1])
EU28	EU 28	4 281 550	507227	25500
AT	Austria	83870	8452	34000
BE	Belgium	30528	11162	5400
BG	Bulgaria	111002	7285	14600
HR	Croatia	56594	4262	43900
CY	Cyprus	9251	866	32600
CZ	Czech Republic	78865	10516	13000
DE	Germany	357104	82021	35700
DK	Denmark	43098	5603	17200
EE	Estonia	45227	1325	22300
EL	Greece	131982	11063	31100
ES	Spain	505365	46704	10300
FI	Finland	338420	5427	25700
FR	France	505365	65633	20500
HU	Hungary	93034	9909	10900
IE	Ireland	70285	4591	11000
IT	Italy	301323	59685	80700
LT	Lithuania	65300	2972	9800
LU	Luxembourg	2586	537	16300
LV	Latvia	64589	2024	35800
MT	Malta	316	421	36400
NL	Netherlands	37355	16780	9900
PL	Poland	312679	38533	15600
PT	Portugal	91909	10487	6200
RO	Romania	238391	20057	17200
SE	Sweden	450295	9556	13200
SI	Slovenia	20273	2059	35600
SK	Slovak Republic	49037	5411	42800
UK	United Kingdom	244101	63888	30500

(1) Data for 2012

Source: Eurostat

Symbols and abbreviations

Symbol	Meaning	Symbol	Meaning
,	Decimal separator	HFO	Heavy Fuel Oil
- / n.a.	Data not available	HVO	Hydrotreated Vegetable Oil
BTL	Biomass to Liquid	IEA	International Energy Agency
ca.	Circa = approximately	IRENA	International Renewable Energy Agency
CEPI	Confederation of European Paper Industries	J	Joule
CHP	Combined Heat and Power	Kg oe	Kilogram oil equivalent
CO2	Carbon Dioxide	m^3	Cubic meter
DH	District Heating	m.c./MC	Moisture content
EE	Energy efficiency	MSW	Municipal solid waste
EEA	European Environmental Agency	NCV	Net Calorific Value
EREC	European Renewable Energy Council	Nm^3	Normal m^3
ETBE	Ethyl Tertiary Butyl Ether	ODS	Organic dry substance
EPC	European Pellet Council	ORC	Organic rankine cycle
EC	European Commission	PVO	Pure Vegetable Oil
FAME	Fatty Acid Methyl Ester	RES	Renewable Energy Sources
FAO	Food and Agriculture Organisation	RME	Rape Methyl Ester
FAWS	Forest Available for Wood Supply	solid m^3	Solid cubic meter
GCV	Gross Calorific Value	toe	Ton of oil equivalent
GDP	Gross Domestic Product	UAA	Utilized agricultural areas
GIC	Gross Inland Consumption	VAT	Value Added Tax
h	Hour	W	Watt

Table decimal prefixes

10^1	**Deca (da)**	10^{-1}	**Deci (d)**
10^2	**Hecto (h)**	10^{-2}	**Centi (c)**
10^3	**Kilo (k)**	10^{-3}	**Milli (m)**
10^6	**Mega (M)**	10^{-6}	**Micro (µ)**
10^9	**Giga (G)**	10^{-9}	**Nano (n)**
10^{12}	**Tera (T)**	10^{-12}	**Pico (p)**
10^{15}	**Peta (P)**	10^{-15}	**Femto (f)**
10^{18}	**Exa (E)**	10^{-18}	**Atto (a)**

Table general conversion factor for energy

from \ to	1 MJ	1kWh	1 kg oe	Mcal
1 MJ	1	0.278	0.024	0.239
1 kWh	3.6	1	0.086	0.86
1 kg oe	41.868	11.63	1	10
1 Mcal	4.187	1.163	0.1	1

LIQUIDS

Average net calorific value, energy content

	NCV (GJ/m³)	Density (t/m³)	NCV (GJ/t)	1 m³ = x toe	1 t = x toe
toe			41,868		
Diesel	35,4	0,83	42,7	0,85	1,02
Biodiesel*	32,8	0,88	37,3	0,78	0,89
Rape oil	34,3	0,915	37,5	0,82	0,9
Gasoline	31,9	0,748	42,7	0,76	1,02
Ethanol	21,2	0,794	26,7	0,51	0,64

*also called RME for rapeseed methyl ester or FAME for fatty acid methyl ester. Calorific value can change according to raw material used for biodiesel production

Source: M. Kaltschmitt,H. Hartmann, Energie aus Biomasse, Springer 2001

SOLID FUELS

Net calorific value, moisture content and energy density for different biomass fuels

Fuel	Net calorific value, dry content kWh/kg (moisture content 0%) ($q_{p,net,d}$)	Moisture content w-% (Mar)	Net calorific value, as received=actual value kWh/kg ($q_{p,net,ar}$)	Bulk density kg/loose m^3	Energy density (MWh/loose m^3)	Ash content, dry, %
Sawdust	5,28-5,33	45-60	0,60-2,77	250-350	0,45-0,70	0,4-0,5
Bark, birch	5,83-6,39	45-55	2,22-3,06	300-400	0,60-0,90	1-3
Bark, coniferous	5,14-5,56	50-65	1,38-2,50	250-350	0,50-0,70	1-3
Plywood chips	5,28-5,33	5-15	4,44-5,00	200-300	0,9-1,1	0,4-0,8
Wood pellets	5,26-5,42	7-8	4,60-4,90	550-650	2,6-3,3	0,2-0,5
Steam wood chips	5,14-5,56	40-55	1,94-3,06	250-350	0,7-0,9	0,5-2,0
Lof wood (oven-ready)	5,14-5,28	20-25	3,72-4,03	240-320	1,35-1,95	
Logging residue chips	5,14-5,56	50-60	1,67-2,50	250-400	0,7-0,9	1,0-3,0
Whole tree chips	5,14-5,56	45-55	1,94-2,78	250-350	0,7-0,9	1,0-2,0

Reed canary grass (spring harvested)	4,78-5,17	8-20	3,70-4,70	70	0,3-0,4	1,0-10,0
Reed canary grass (autumn harvested)	4,64-4,92	20-30	3,06-3,81	80	0,2-0,3	5,1-7,1
Grain	4,8	11	4,30	600	2,6	2
Straw, chopped	4,83	12-20	3,80-4,20	80	0,3-0,4	5
Miscanthus, chopped	5,0	8-20	3,86-4,06	110-140	1,72-2,19	2,0-3,5
Straw pellets	4,83	8-10	4,30-4,40	550-650	2,4-2,8	5
Olive cake (olive pomace)	4,9-5,3	55-70	1,00-3,10	800-900	1,46-1,64	2-7
Olive cake (olive marc)	4,9-5,3	<10	4,30-4,70	600-650	2,6-2,9	2-7

1kWh/kg = 1 MWh/ton = 3.6 GJ/ton

Source: EUBIONET "Biomass fuel supply chains for solid biofuels"

Calculation of net calorific value as received (CEN/TS 15234)

The net calorific value (at constant pressure) as received (net calorific value of the moist biomass fuel) is calculated according to equation:

$$q_{p,net,ar} = q_{p,net,d} \times [(100 - M_{ar})/100] - 0{,}02443 \times M_{ar}$$

$q_{p,net,ar}$ is the net calorific value (at constant pressure) as received [MJ/kg]
$q_{p,net,d}$ is the ner calorific value (at constant pressure) in dry matter [MJ/kg] (net calorific value of dry fuel)
M_{ar} is the moisture content as received [w-%, wet basis]
0,02443 is the correction factor of the enthalpy of vaporization (constant pressure) for water (moisture) at 25°C [MJ/kg per 1 w-% of moisture)

Typical moisture content of biomass fuels and corresponding calorific values as received

		GCV			NCV		
	Moisture content (%)	kWh/kg	GJ/t	toe/t	kWh/kg	GJ/t	toe/t
Green wood direct from the forest, freshly harvested	60%	2	7,2	0,17	1,6	5,76	0,14
Chips from short rotation coppices after harvest	50-55%	2,5	9	0,21	2,1	7,56	0,18
Recently harvested wood	50%	2,6	9,36	0,22	2,2	7,92	0,19
Saw mill residues, chips etc	40%	3,1	11,16	0,27	2,9	10,44	0,25
Wood, dried one summer in open air, demolition timber	30%				3,4	12,24	0,29
Wood, dried several years in open air	20%				4	14,4	0,34
Pellets	8-9%				4,7	16,92	0,4
Wood, dry matter	0%				5,2	18,72	0,45
Cereals as stored after harvest, straw, hay, miscanthus after harvest	13-15%				4	14,4	0,34
Silomaize	30%						
Rape seed	9%				7,1	25,6	0,61
Chicken litter as received	68%				2,6	9,6	0,22
To compare with:							
Hard coal					8,06	29	0,69
Brown coal					4,17	15	0,36
Peat					2,8	10	0,24

Source: M. Kaltschmitt,H. Hartmann, Energie aus Biomasse, Springer 2001; AEBIOM

The energy content of one ton of wood depends primarily upon the moisture content and not on the wood species. This is not true on volume basis. The energy content of 1 m³ wood depends upon the species, the water content and the form of the wood (logs, fire wood pieces, chips etc.).

In the practical use the NCV is of greater importance than the GCV, because normally the energy needed to evaporate the water is not used. This energy needed to evaporate 1 kg of moisture is around 2,44 MJ (0,68 kWh). The GCV is only of importance in combustion plants, where the vapour is condensed and therefore this energy can be used. The NCV of a given biomass fuel depends mainly on the mass, measured in units such as tons or kg and the moisture content.
The moisture content is defined as follows:

m: total weight of a given biomass

d: weight of the dry matter of this biomass (after completely drying)

Moisture content, m.c. in % = (100 – d/m) x 100

Examples for weight and energy content (NCV) for 1 m³ wood at different water contents, species and shape of the wood

Species	Shape	m.c. in %	t/m³	GJ/m³	kWh/m³
Spruce	**Solid wood**	0	0,41	7,7	2.130
Spruce	**Solid wood**	40	0,64	6,6	1.828
Spruce	**Stapled wood**	25	0,33	4,5	1.245
Spruce	**Chips**	40	0,22	2,3	640
Beech	**Solid wood**	0	0,68	12,6	3.500
	Solid wood	40	0,96	9,2	2.547
Beech	**Stapled wood**	25	0,5	6,3	1.739
Beech	**Chips**	40	0,34	3,2	892
	Pellets	9	0,69	10,8	3.300
Average figures					
Average figures for different species	**Solid wood**	35	0,75	7,2	2.000
Average figures for different species	**Chips**	35	0,3	2,9	800

Source: M. Kaltschmitt,H. Hartmann, Energie aus Biomasse, Springer 2001

GASEOUS FUELS

Net Calorific value and density of gaseus fuels

	NCV kWh/Nm³	NCV MJ/m³	NVC toe/1000m³	Density kg/Nm³	NCV kWh/kg
Natural gas	9,9	36	0,86	0,73	13,6
Biogas (60% methane)	6	21,6	0,52		
Biomethane (upgraded biogas)	9,5	36	0,86	0,73	13

Transformation coefficients from biomass to final energy
The following coefficients describe the quantity of final energy in terms of toe that can be produced on the basis of one ton of different forms of biomass and different conversion technologies.

Biodiesel:
conversion technology: transesterification
1 t rape seed → 0,4 t rape seed oil → 0,4 t biodiesel→ 0,45 m³ RME = 0,35 toe
These figures are valid for big installations.

Ethanol :
conversion technology: alcoholic fermentation
1 t corn (14% m.c.) → 0,382 m³ ethanol = 0,194 toe
1 t wheat (14% m.c.) → 0,378 m³ ethanol = 0,192 toe
1 t sugar beet (16% sugar content) → 0,107 m³ ethanol = 0,054 toe
1 t sugar cane (14% sugar content) → 0,085 m³ ethanol = 0,043 toe

Biogas:
conversion technology: anaerobic fermentation
1 t silo maize (30% dry matter) → 180 m³ biogas → 110 m³ biomethane = 0,088 toe
25% of this biogas is needed as energy source for the fermentation
1 t sugar beet (23% organic dry matter) → 170 m³ biogas→ 100 m³ biomethane = 0,08 toe
1 t cattle manure (8-11% org. dry matter) 25 m³ biogas→ 15 m³ biomethane = 0,012 toe
1 t pig manure (7% organic dry matter) → 20 m³ biogas → 12 m³ biomethane = 0,01 toe
1 t poultry manure. (32 % organ. dry matter) → 80 m³ biogas → 48 m³ biomethane = 0,04 toe
1 t organic waste from households → 90m³ biogas → 55 m³ biomethane = 0,05 toe
1 t glycerine (100% organic dry matter) → 840 m³ biogas → 500 m³ biomethane = 0,4 toe

Advanced biofuels:
1 t wood (dry matter) = 0,2 t BTL = 0.2 toe
1 t wood (dry matter) = 0,2 t ethanol

1 Global Warming potentials

CO_2	1	g $CO_{2,eq}$ / g CO_2
CH_4	23	g $CO_{2,eq}$ / g CH_4
N_2O	296	g $CO_{2,eq}$ / g N_2O

2 GHG emission coefficients

N-fertiliser	5880,6	g $CO_{2,eq}$/kg N
P_2O_5-fertiliser	1010,7	g $CO_{2,eq}$/kg P_2O_5
K_2O-fertiliser	576,1	g $CO_{2,eq}$/kg K_2O
CaO-fertiliser	129,5	g $CO_{2,eq}$/kg CaO
Pesticides	10971,3	g $CO_{2,eq}$/kg
Seeds- rapeseed	729,9	g $CO_{2,eq}$/kg
Seeds- sugarbeet	3540,3	g $CO_{2,eq}$/kg

Seeds- sugarcane	1,6	g $CO_{2,eq}$/kg
Seeds- sunflower	729,9	g $CO_{2,eq}$/kg
Seeds- wheat	275,9	g $CO_{2,eq}$/kg
Natural gas (4000 km, Russian NG quality)	66,20	g $CO_{2,eq}$/MJ
Natural gas (4000 km, EU Mix quality)	67,59	g $CO_{2,eq}$/MJ
Diesel	87,64	g $CO_{2,eq}$/MJ
HFO for marine transport	87,20	g $CO_{2,eq}$/MJ
Methanol	99,57	g $CO_{2,eq}$/MJ
Hard coal	111,28	g $CO_{2,eq}$/MJ
Lignite	116,98	g $CO_{2,eq}$/MJ
Electricity EU mix MV	127,65	g $CO_{2,eq}$/MJ
Electricity EU mix LV	129,19	g $CO_{2,eq}$/MJ
Electricity (NG CCGT)	124,42	g $CO_{2,eq}$/MJ
Electricity (Lignite ST)	287,67	g $CO_{2,eq}$/MJ
Electricity (Straw CHP)	5,71	g $CO_{2,eq}$/MJ
CH_4 and N_2O emissions, steam from NG boiler	0,39	g $CO_{2,eq}$/MJ
CH_4 and N_2O emissions, steam from Lignite CHP	3,79	g $CO_{2,eq}$/MJ

3 Lower heating values (LHV's)

Diesel	43,1	MJ/kg (0% water)
Gasoline	43,2	MJ/kg (0% water)
HFO for marine transport	40,5	MJ/kg (0% water)
Ethanol	26,81	MJ/kg (0% water)
Methanol	19,9	MJ/kg (0% water)
FAME	37,2	MJ/kg (0% water)
Syn diesel (BtL)	44,0	MJ/kg (0% water)
HVO	44,0	MJ/kg (0% water)
PVO	36,0	MJ/kg (0% water)
n-Hexane	45,1	MJ/kg (0% water)
Hard coal	26,5	MJ/kg (0% water)
Lignite	9,2	MJ/kg (0% water)
Corn	18,5	MJ/kg (0% water)
FFB	24,0	MJ/kg (0% water)
Rapeseed	26,4	MJ/kg (0% water)
Soybeans	23,5	MJ/kg (0% water)
Sugar beet	16,3	MJ/kg (0% water)
Sugar cane	19,6	MJ/kg (0% water)
Sunflowerseed	26,4	MJ/kg (0% water)
Wheat	17,0	MJ/kg (0% water)
Animal fat	37,1	MJ/kg (0% water)
BioOil (byproduct FAME from waste oil)	21,8	MJ/kg (0% water)
Crude vegetable oil	36,0	MJ/kg (0% water)
DDGS (10 wt% moisture)	16,0	MJ/kg (10% water)
Glycerol	16,0	MJ/kg (0% water)
Palm kernel meal	17,0	MJ/kg (0% water)
Palm oil	37,0	MJ/kg (0% water)
Rapeseed meal	18,7	MJ/kg (0% water)
Soybean oil	36,6	MJ/kg (0% water)
Sugar beet pulp	15,6	MJ/kg (0% water)

Sugar beet slops	15,6	MJ/kg (0% water)

4 Transport efficiencies

Truck for dry product (Diesel)	0,94	MJ/ton,km
Truck for liquids (Diesel)	1,01	MJ/ton,km
Truck for FFB transport (Diesel)	2,01	MJ/ton,km
Tanker truck MB2218 for vinasse (Diesel)	2,16	MJ/ton,km
Tanker truck with water cannons for vinasse (Diesel)	0,94	MJ/ton,km
Dumpster truck MB2213 for filter mud (Diesel)	3,60	MJ/ton,km
Ocean bulk carrier (Fuel oil)	0,20	MJ/ton,km
Ship /product tanker 50kt (Fuel oil)	0,12	MJ/ton,km
Rail (Electric, MV)	0,21	MJ/ton,km

Source: BioGrace project

Biodiesel
Biodiesel is a methylester derived from vegetable oils or animal fats by the process of trans-esterification. Biodiesel has similar properties as fossil diesel and can be blended with fossil diesel or used as pure biofuel.

Bioethanol
Bioethanol is an alcohol – C2H5OH – derived from sugar by fermentation. The crops used for the production of ethanol for energy purposes contain sugar (like sugar beets or sugar cane) or starch like cereals or corn. In the latter case starch is hydrolyzed to sugar and then fermented to alcohol. . The conversion of lignin or cellulose to sugar is a more complicated process and subject to research in pilot plants. These technologies are summarized under the term advanced biofuels.

Biomass
The biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste. (Renewable Energy Directive)

Biofuels
'Biofuels' means liquid or gaseous fuel for transport produced from biomass

Bioliquids
'Bioliquids' means liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass

Biogas
Biogas is a gas containing 50-70% biomethane. It is produced by micro-organisms under anaerobic conditions from different sources of wet biomass such as manure, fresh crops, and organic waste. The process of biogas production takes place in landfill sites and also in swamps and other places in the nature, where organic matter is stored under anaerobic conditions.

Black liquor
Wood consists of cellulose, hemicellulose and to 30-35% of lignin, which cannot be used to produce pulp and paper. Black liquor is a recycled by-product formed during the process of chemical pulping of wood in the papermaking industry. In this process, lignin is separated from cellulose, with the latter forming the paper fibres. Black liquor is the combination of the lignin residue with water and the chemicals used for the extraction. It plays an important role as bioenergy carrier in the paper and pulp industry. An example: A pulp mill consuming 1 million m^3 wood per year can use 0.03-0.04 Mtoe primary energy in the form of black liquor.

By-products and waste of the forest- and wood industry
Further wood based fuels are by-products of the forest- and wood industry such as: Bark, saw dust, demolition wood, branches, tops and other wood waste.

CO2eq (Carbon Dioxide Equivalent)
Carbon dioxide equivalent is the standard unit for comparing the global warming potential of any greenhouse gas over a specified period of time. In this way, the relative severity of all greenhouse gas emissions can be evaluated in terms of one agreed reference point.
CHP (Combined Heat and Power)
Combined heat and power (CHP) or cogeneration is a technology used to improve energy efficiency through the generation of heat and power in the same plant, generally using a gas turbine with heat recovery. Heat delivered from CHP plants may be used for process or space-heating purposes in any sector of economic activity including the residential sector. CHP thus reduces the need for additional fuel combustion for the generation of heat and avoids the associated environmental impacts, such as CO2 emissions.

Derived heat
According to Eurostat, derived heat covers the total heat production in heating plants and in combined heat and power plants. It includes the heat used by the auxiliaries of the installation which use hot fluid and losses in the installation/network heat exchanges. For autoproducing entities (= entities generating electricity and/or heat wholly or partially for their own use as an activity which supports their primary activity) the heat used by the undertaking for its own processes is not included.

Energy crops
Energy crops are those annual or perennial plants that are specifically cultivated to produce solid, liquid or gaseous forms of energy, including transportation biofuels. These can be traditional crops such as oilseeds, (rape, soybean, sunflower) cereals (wheat, barley, maize) sugar beet and new dedicated perennial energy crops – only planted for energy purposes – such as short rotation coppices (willows, poplars) miscanthus, reed canary grass and others.

Economic Size Unit
For each activity ('enterprise') on a holding, or farm (e.g. wheat, dairy cows or vineyard), a standard gross margin (SGM) is estimated, based on the area (or the number of heads) and a regional coefficient. The sum of all margins, for all activities of a given farm, is referred to as the economic size of that farm. The economic size is expressed in European Size Units (ESU), 1 ESU being equal to 1 200 euros of SGM.

Final Energy Consumption
'Gross final consumption of energy' means the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission.
Note: According to the understanding of AEBIOM (taking into account the phrasing in the template of the RES Directive) the share of RES electricity will be calculated in the following way:

Fire wood
Fire wood is the oldest form of woody biomass, yet in many European countries it is still the most used biomass. The production and the use of firewood is labour intensive, explaining why firewood has lost market shares in the past. New firewood boilers complying with high environmental standards, new technical development of producing firewood and the increasing price of fossil fuels lead to a renaissance of firewood as heating fuel in some regions

Gross Calorific Value (GCV)
The gross calorific value is the total amount of heat released by a unit quantity of fuel when it is burned completely with oxygen and when the vapor produced during combustion is condensed to liquid water. GCV includes the heat of condensation and is therefore independent upon the moisture content

Gross Inland Consumption (GIC)
Gross inland consumption is the quantity of energy consumed within the borders of a country. It is calculated using the following formula: Primary production + recovered products + imports + stock changes – exports – bunker (i.e. quantities supplied to sea going ships)

Net Calorific Value (NCV)
The net calorific value (or lower heating value – LHV) is the amount of heat released by a unit quantity of fuel, when it is burned completely with oxygen, and when the water contained in the fuel is transformed to vapor and not condensed to water again. This quantity therefore does not include the heat of condensation of any water vapor. The net calorific value of a given biomass depends on the content of dry matter (excluding minerals) and moisture. The higher the moisture content and minerals content (giving ashes) the lower the net calorific value.

Organic Waste (renewable)
Renewable organic waste is the term used to describe those wastes that are readily biodegradable, or easily broken-down with the assistance of micro-organisms. Organic wastes consist of materials that contain molecules based on carbon, the carbon coming from the atmosphere via the green plants. This includes food waste and green waste.

Pellets
Wood pellets are a clean, CO2 neutral and convenient fuel, mostly produced from sawdust and wood shavings compressed under high pressure using no glue or other additives. They are cylindrical in shape and usually 6-10 mm in diameter. The average length is about 10-30 mm. Furthermore, due to their high energy content the convenient delivery and storage features, pellets are the ideal fuel for fully automatic small scale heating systems. With a rapidly growing share in the market, they are a key technology for increasing biomass utilisation in Europe. In the last few years pellets are increasingly used in power plants for co-firing. Pellets are also an excellent way of using local resources thus making a concrete contribution to environmental protection and climate change prevention.

Refuse-derived fuel (RDF)
(Also solid recovered fuel or specified recovered fuel) RDF is produced by shredding and dehydrating municipal solid waste (MSW). It consists largely of organic components of municipal waste such as plastics and biodegradable waste.

RES = Renewable Energy Sources
'energy from renewable sources' means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases

Round wood
Wood in its natural state as felled, with or without bark. It may be round, split, roughly squared or in other forms. Normally measured in m^3.

Ton of oil equivalent (toe)
The ton of oil equivalent is a conventional standardized unit for measuring energy, defined on the basis for a ton of oil with a net calorific value of 41 868 kJ/kg.

Utilised agricultural area (UAA)
Total arable land,permanent grassland, land used for permanent crops and kitchen gardens. The UAA excludes unutilised agricultural land, woodland and land occupied by buildings, farmyards, tracks, ponds, etc.

Wood chips
The importance of wood chips as heating fuel is increasing rapidly due to competitive prices and automatic heating systems based on wood chips. Wood chips are either produced as by-products from saw mills and other wood industries or from logs coming directly from the forests; in the latter case their price is higher. High quality wood chips can only be produced from optimal raw material with a minimum diameter of five centimetres. Smaller diameters cause more ash, which means less convenience for the customer operating the wood chip heating system. Rotten and musty wood, dirty wood, demolition wood, shrubs with small branches and whole trees are not suitable to produce high quality wood chips for small wood chip heating systems. Such raw materials can, however, be used to produce lower quality wood chips for larger biomass district heating plants.

Wood briquettes
Briquettes are similar to wood pellets, but physically larger. Sizes vary but briquettes can vary in diameter from around 50 mm to 100 mm +. Briquettes are usually between 60 mm and 150 mm in length. They can offer a cleaner, more consistent alternative to firewood logs, offering higher energy density and steady combustion.

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