BIOENERGY EUROPE

STATISTICAL REPORT 2019

REPORT BIOMASS FOR HEAT

Bioenergy EUROPE

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CONTENTS

Index

List of Figures

List of Tables

STATISTICAL REPORT

TIMELINE

Every year since its debut release in 2007, Bioenergy Europe's Statistical Report has provided an in-depth overview of the bioenergy sector in the EU-28 Member States.

Bioenergy Europe's Statistical Report has been enriched each year with new figures and information, collecting unique data on the developments of the European bioenergy market from a growing number of international contributors.

Bioenergy Europe is therefore able to develop a detailed report that helps industry leaders, decision makers, investors and all bioenergy professionals to understand the situation of bioenergy in Europe.

With more than 150 graphs and figures, readers of Bioenergy Europe´s Statistical Report can get accurate and up-to-date information on the EU-28 energy system such as the final energy consumption of biomass for heat and electricity, the number of biogas plants in Europe, the consumption and trade of pellets, the production capacity of biofuels and other key information to help break down and clarify the complexity of a sector in constant evolution.

In 2017, the Report was rewarded by the European Association Awards for being the "best Provision of Industry Information and Intelligence", a recognition after a decade of collective work.

THE EUROPEAN ASSOCIATION AWARDS 2017

2007
FIRST STATISTICAL REPORT

2009
+ ANALYSIS ON THE NATIONAL RENEWABLE ENERGY ACTION PLANS
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89 PAGES

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+ PELLET CHAPTER
108 PAGES

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REPORT AVAILABLE TO THE PUBLIC, FREE OF CHARGE. EMPHASIS ON PROVIDING TRANSPARENT DATA AND SHARING KNOWLEDGE TO SUPPORT ANY PRIVATE AND PUBLIC INITIATIVE PROMOTING BIOENERGY.
300 PAGES

2019

ABOUT

OUR ACTIVITIES

Bioenergy Europe carries a wide range of activities aimed at supporting its members by informing them about latest EU and national policy developments, and by voicing their concerns to EU and other authorities. These include advocacy activities in key policy areas as well as the organisation of dedicated working groups acting as platforms where members can discuss common issues and exchange information on the state of play of bioenergy.

There are currently 7 active working groups:

- Agrobiomass & Energy Crops
- Biopower & CHP
- Competitiveness
- Domestic Heating
- Sustainability
- Pellets
- Wood Chips

In addition, Bioenergy Europe conceives and deploys targeted publications and communication campaigns to inform and educate about the potential of bioenergy for a decarbonised Europe.

Most notably, the association has several years of experience in data collection on the evolution of the bioenergy market and produce unique and tailored analyses along the year.

Thanks to the experience and authority acquired over the last 19 years, Bioenergy Europe successfully established two international certification schemes to guarantee high quality standard for fuels.

Bioenergy Europe is also the umbrella organisation of the European Pellet Council (EPC) and the International Biomass Torrefaction Council (IBTC). These networks have been created thanks to the dynamics of Bioenergy Europe members. Today, these networks bring together bioenergy experts and company representatives from all over Europe.

EUROPEAN PELLET COUNCIL
A NETWORK OF BIOENERGY EUROPE

The European Pellet Council (EPC) is an umbrella organisation of Bioenergy Europe founded in 2010, representing the interests of the European wood pellet sector. Its members are national pellet associations or related organisations from 18 countries.

The EPC is a platform for the pellet sector to discuss the issues related to the transition from a niche product to a major energy commodity. These issues include the standardisation and certification of pellet quality, safety, security of supply, education and training, and the quality of pellet-using devices.

EPC is managing the EN*plus*® quality certification.

www.pelletcouncil.eu
www.enplus-pellets.eu

INTERNATIONAL BIOMASS TORREFACTION COUNCIL
A NETWORK OF BIOENERGY EUROPE

The International Biomass Torrefaction Council (IBTC) is an umbrella organisation of Bioenergy Europe launched in 2012 and aims to building the first platform for companies having common interests in the development of torrefied Biomass markets. Currently, the IBTC initiative is supported by more than 23 companies active worldwide.

IBTC's objective is to promote the use of torrefied biomass as an energy carrier and to assist the development of the torrefaction industry. In this respect, IBTC's key activities are to undertake studies or projects, and to commonly voice its members' concerns to third parties to help to overcome barriers of market deployment.

www.ibtc.bioenergyeurope.org

ABOUT

BIOENERGY EUROPE

BIOENERGY EUROPE is the common voice of the bioenergy sector with the aim to develop a sustainable bioenergy market based on fair business conditions.

BIOENERGY EUROPE is a non-profit Brussels-based international organisation founded in 1990 which brings together national associations and companies from all over Europe – thus representing more than 4000 indirect members, including mainly companies and research centers.

www.bioenergyeurope.org

ASSOCIATIONS

ACADEMIA

ABOUT

BIOENERGY EUROPE

Companies

Members as of September 2019.

1. Heat and Renewable Heat Demand in Europe

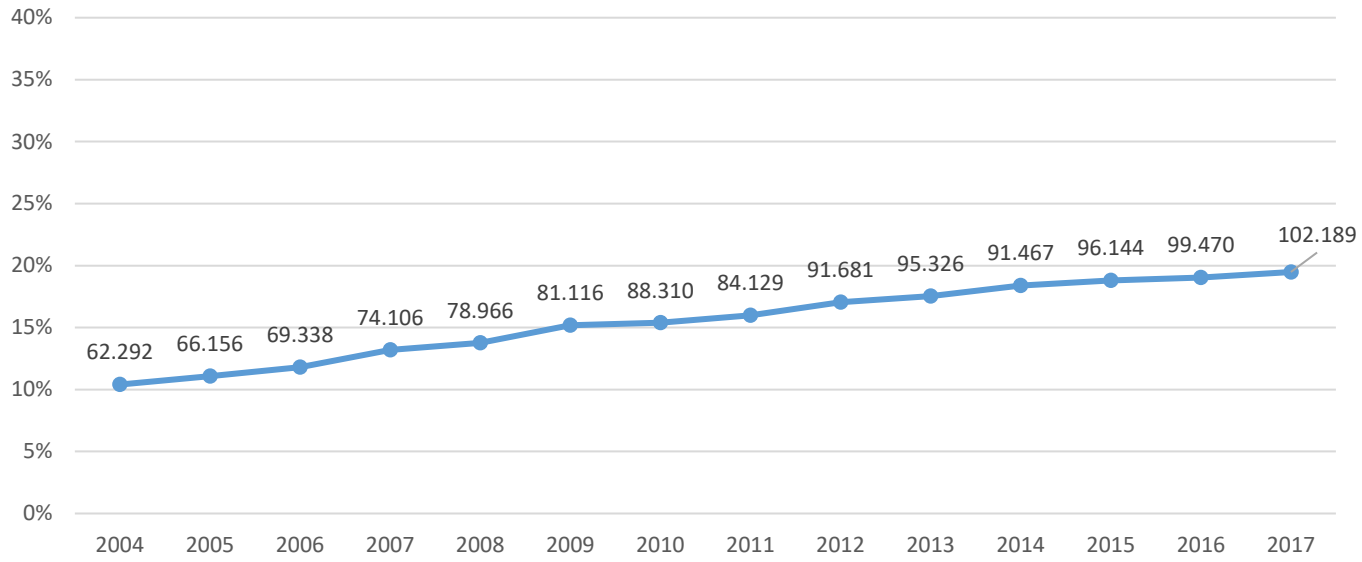
Heating and cooling (H&C) (the major part being heating) represented nearly half of the final energy consumption in the EU in 2017. Therefore, it should be one of the main targets for the decarbonisation efforts. Countries such as, Cyprus, Greece, Malta, Spain, and Portugal where heating & cooling accounted for less than 37% of the total final energy consumption are countries with warmer climate conditions. Additionally, those figures do not include the electricity used for H&C. Hence, in total the H&C represents for more than 50% of the final energy consumed in the EU.

Table 1 H&C Consumption Compared with Total Final Energy Consumption in EU28 and its Member States in 2017* (ktoe)

	H&C Energy Consumption	Total Final Energy Consumption	% of the H&C Sector in the Final Energy Consumption
EU28	524.486	1.060.037	49,5%
Growth Rate (2016-2017)	0,4%	1%	-0,9%
AT	14.005	26.213	53,4%
BE	18.577	32.888	56,5%
BG	4.111	9.738	42,2%
CY	469	1.536	30,5%
CZ	14.392	24.406	59,0%
DE	110.670	204.604	54,1%
DK	7.654	13.862	55,2%
EE	1.539	2.806	54,9%
EL	5.615	16.054	35,0%
ES	28.905	79.397	36,4%
FI	14.142	24.640	57,4%
FR	62.740	141.003	44,5%
HR	3.316	6.776	48,9%
HU	10.777	17.975	60,0%
IE	4.520	10.741	42,1%
IT	55.823	113.611	49,1%
LT	2.550	5.241	48,6%
LU	1.115	3.615	30,8%
LV	2.357	3.875	60,8%
MT	85	495	17,1%
NL	27.014	44.953	60,1%
PL	38.177	69.139	55,2%
PT	5.514	15.275	36,1%
RO	13.383	22.860	58,5%
SE	14.163	32.370	43,8%
SI	1.888	4.837	39,0%
SK	6.094	9.903	61,5%
UK	54.891	121.221	45,3%

* Calculated in accordance to the methodology established in Directive 2009/28/EC and Regulation (EC) No 1099/2008. Total heat includes all elements of *'gross final consumption of energy'* for other purposes than electricity and transport.
Source: Eurostat, SHARE 2017

Figure 1 Evolution of Renewables in Heating and Cooling* (ktoe, %)



* Calculated in accordance to the methodology established in Directive 2009/28/EC and Regulation (EC) No 1099/2008.
Source: Eurostat, SHARES 2017

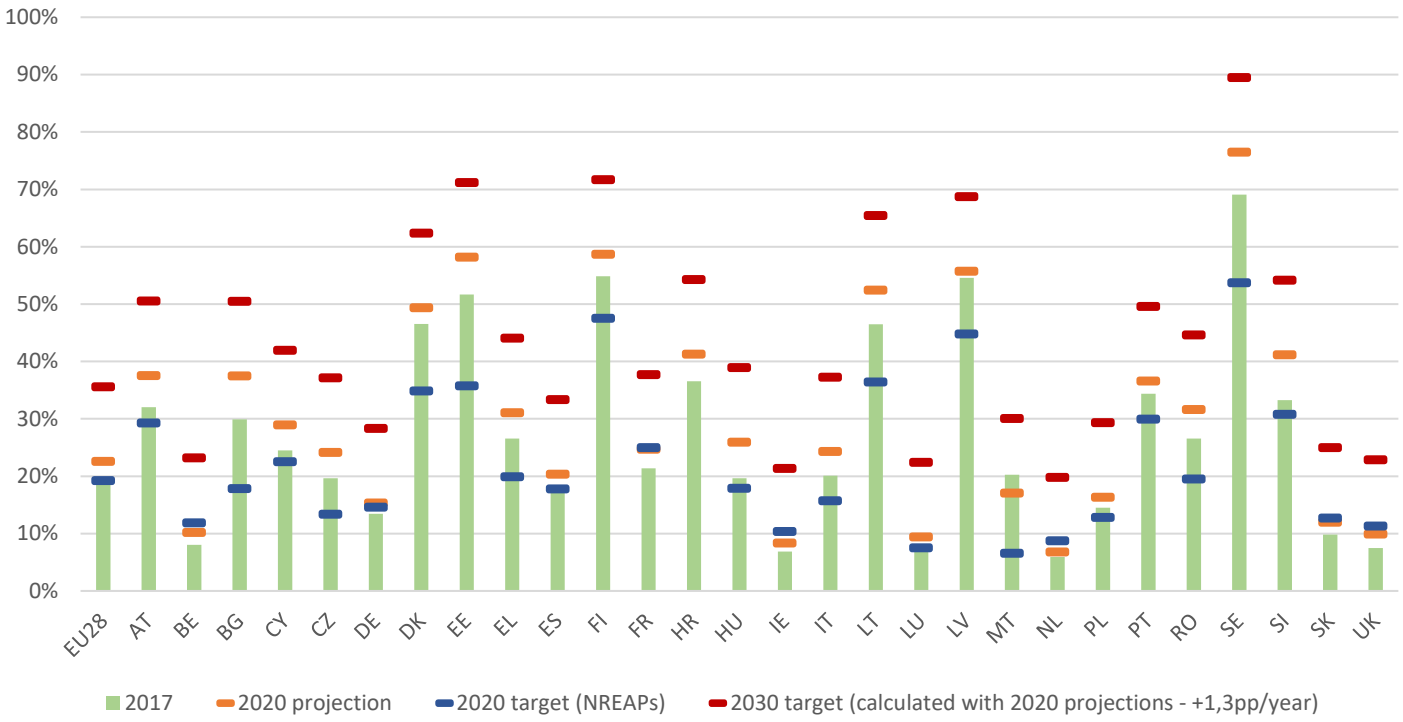
Deployment of renewables is much slower in the heat sector than with that of the electricity sector. On average, the increase has been 0,70 percentage point (pp) each year between 2004 and 2017 compared to 1,27pp in the electricity sector. Even though the relative increase is higher in the electricity sector; in absolute terms the increase might be higher in the H&C sector (depending on the year). In 2017, in absolute terms, the renewable heat was more important (102.189 ktoe) than that of renewable electricity in terms of energy (86.682 ktoe). With the recast of the Renewable Energy Directive, which sets the legislative framework for renewables for the period 2021-2030, an indicative target has been set at an annual increase of 1,3 percentage points of renewables in the final heat consumption, with the possibility to include a maximum of 40% waste heat. When deducting the share of waste heat, the renewable heating target decreases to 0,78 percentage points almost equal to the business as usual scenario.

Despite this low ambition agreed by the three EU institutions (European Commission, European Parliament, and European Council), the attempt to address the heating and cooling sector is a step in the right direction.

However, to reach the EU's long-term decarbonisation objectives, it is essential to accelerate the efforts within this sector. Long-term strategies to decarbonize the building sector and investments in research and innovation (R&I) for high temperature needs in the industrial sector or for biomass fuel diversification will be needed.

If we want to reach our long-term energy and climate objectives, it is essential to act now and put the H&C sector at the centre of EU's decarbonisation strategy.

Figure 2 Renewable Energy Share in the Heating and Cooling (H&C) Sector in 2017 (with absolute number shown in ktoe) – 2020 (projections and NREAP) and 2030 target (%)

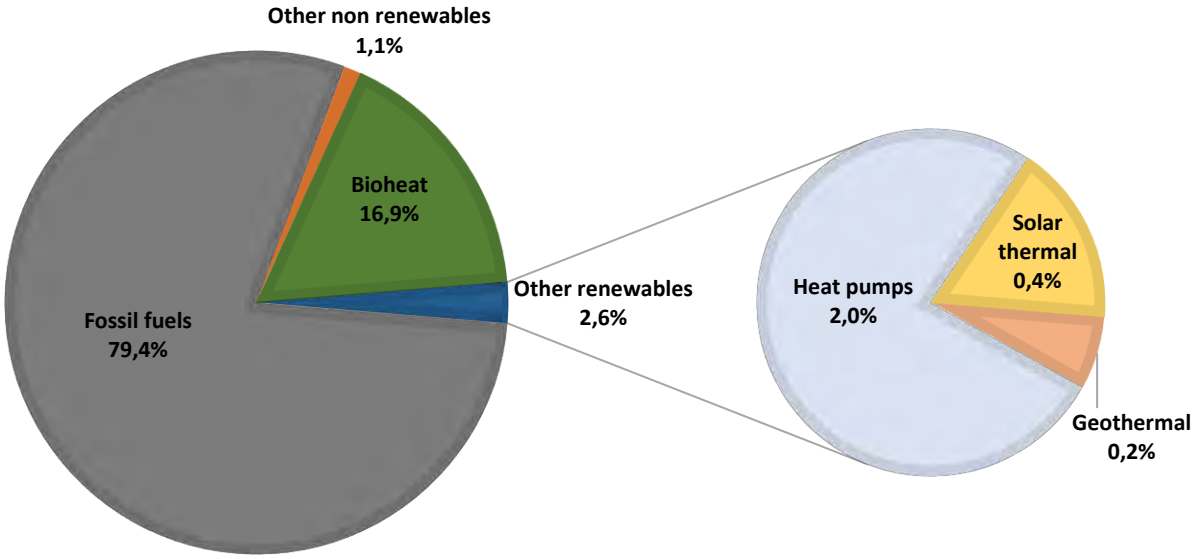


Note: 2030 objectives according to RED II art 23 (+1,3 pp): from the % of RE in H&C projected for 2020: + 1,3 percentage point per year from 2020-2030 (+13%).
Sources: EUROSTAT, NREAPs, and Bioenergy Europe calculations.

As per Bioenergy Europe's projections (based on current growth trends), in 2020, the EU will over-achieve the overall Member States National Renewable Energy Action Plans (NREAPs) objectives for H&C by 3,4% (Cf. figure 2). Most Member States will reach or even over-achieve their 2020 objectives for H&C. This is not due to a fast growth of renewables in H&C but rather due to an initial low ambition in the national NREAPs. However, some countries are not expected to reach their 2020 objectives for H&C namely; The United Kingdom, Ireland, The Netherlands, and Belgium.

At a time when Member States are developing their 2030 National Energy and Climate Plans (NECPs), more ambition is needed from member states to reach the 2030 common targets and effectively move towards a 100% renewable heating and cooling. Indeed, the current renewable H&C objectives proposed by Member States in their draft NECPs are lower than the target calculated with the +1,3 percentage point per year for the majority of the Member States. Without making considerable efforts to increase the share of renewable heat, Member States will fail to meet their climate commitments in the long term.

Figure 3 Contribution of the different Energy Sources in Heating and Cooling in EU28 in 2017 (%)



Note: Other non-renewables are mainly non-renewable waste.
Article 5 of Directive 2009/28/EC establishes the guidelines for Member States on calculating renewable energy from heat pumps from different heat pump technologies. Only renewable energy from heat pumps with a Seasonal Performance Factor (SPF) greater than 2.5 should be considered towards the target.
Source: Eurostat, SHARES 2017, Bioenergy Europe's calculation

With a share of only 19,5 % renewables in the heating sector, the vast majority of heat is still being produced by fossil fuels. To fill this renewable heat gap, all renewable solutions must experience a strong increase in the coming years. The EU and Member States should now focus on this sector and put in place the right framework to accelerate the deployment of renewable heat solutions.

86,6% of the renewable heat, used within the EU in 2017 was that of bioheat. With this vital share, bioenergy and especially that of solid biomass is a key driver towards meeting the renewable energy targets in the heating sector. Heat pumps are the second source of renewable heat and they showed the largest increase in time. In just ten years their contribution for renewable heat has multiplied by a factor of 3.

Bioheat reached 88.481 ktoe in 2017 and the related greenhouse gas (GHG) savings were estimated to be around 296 $MtCO_{2eq}$ representing more than the current annual emission of Czech Republic, Hungary, and Austria put together.

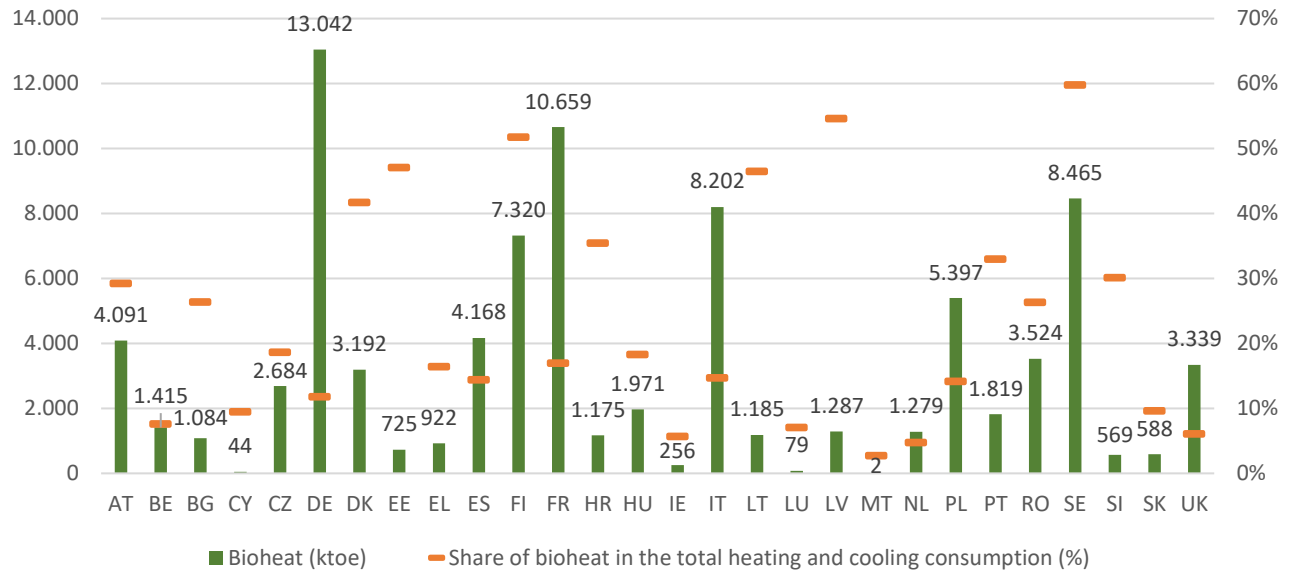
Table 2 Total H&C Consumption and Contribution of Renewables in EU28 Member States in 2017* (ktoe)

	Total	Renewables	Share of Renewables	Bioheat	% of Bioheat in the Renewables
EU28	524.486	102.189	19,5%	88.481	86,6%
Growth Rate (2016-2017)	0,4%	3%	2%	2%	-0,3%
AT	14.005	4.488	32,0%	4.091	91,2%
BE	18.577	1.492	8,0%	1.415	94,8%
BG	4.111	1.229	29,9%	1.084	88,2%
CY	469	115	24,5%	44	38,7%
CZ	14.392	2.829	19,7%	2.684	94,9%
DE	110.670	14.855	13,4%	13.042	87,8%
DK	7.654	3.563	46,5%	3.192	89,6%
EE	1.539	795	51,6%	725	91,1%
EL	5.615	1.492	26,6%	922	61,8%
ES	28.905	5.065	17,5%	4.168	82,3%
FI	14.142	7.757	54,8%	7.320	94,4%
FR	62.740	13.395	21,3%	10.659	79,6%
HR	3.316	1.212	36,5%	1.175	96,9%
HU	10.777	2.117	19,6%	1.971	93,1%
IE	4.520	310	6,9%	256	82,6%
IT	55.823	11.211	20,1%	8.202	73,2%
LT	2.550	1.186	46,5%	1.185	100,0%
LU	1.115	90	8,1%	79	87,0%
LV	2.357	1.287	54,6%	1.287	100,0%
MT	85	17	19,8%	2	13,9%
NL	27.014	1.601	5,9%	1.279	79,9%
PL	38.177	5.530	14,5%	5.397	97,6%
PT	5.514	1.896	34,4%	1.819	95,9%
RO	13.383	3.557	26,6%	3.524	99,1%
SE	14.163	9.782	69,1%	8.465	86,5%
SI	1.888	628	33,2%	569	90,6%
SK	6.094	599	9,8%	588	98,1%
UK	54.891	4.091	7,5%	3.339	81,6%

***** Calculated in accordance to the methodology established in Directive 2009/28/EC and Regulation (EC) No 1099/2008. Total includes all elements of *'gross final consumption of energy'* for other purposes than electricity and transport.
Source: Eurostat, SHARE 2017

The overall EU share of renewable heat hides strong disparities between Member States. Forest-rich countries such as Lithuania, Estonia, Finland, Latvia and, Sweden have already achieved very high shares of renewable heat (close or over 50%) thanks to bioenergy. Other countries are lagging far behind. With shares of renewable heat below 10% in six Member States and below 20% in almost half of the EU, political incentives for all renewable heating solutions need to be implemented.

Figure 4 Final Energy Consumption of Bioheat (ktoe) and share of Bioheat in the total Heating and Cooling Consumption in 2017 in the EU28 Member States (%)

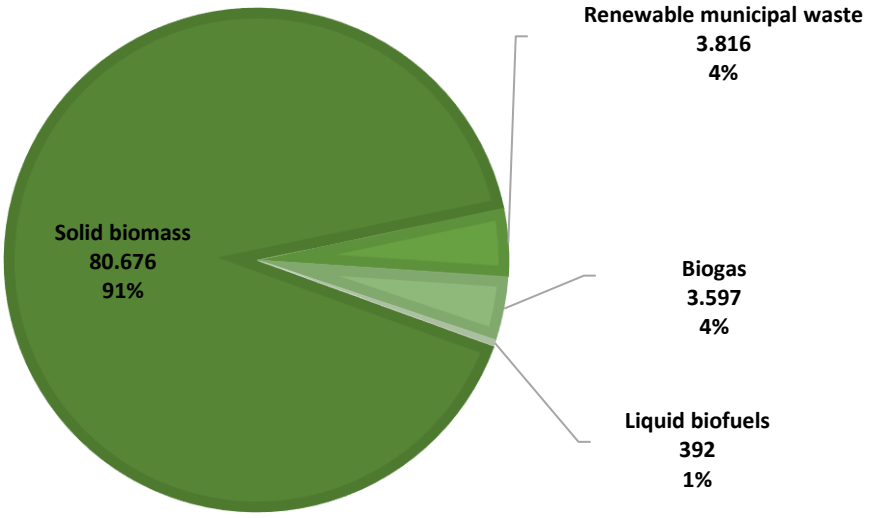


Source: Eurostat

In most Member States, there is no price on carbon emitted in the H&C sector because the EU ETS system covers only installations above 20 MW. Most of the heat consumption happens in installations below 20 MW, except in countries where district heating exists. The graph above clearly highlights those Member States with a high share of bioheat are either countries with district heating traditions (installations above 20 MW falling under ETS) or countries that have introduced carbon taxes (Sweden, Finland).

Fostering the decarbonisation of the H&C sector, by ways of introducing a price on carbon has been proven to be an effective tool. In addition, the direct and indirect subsidies on fossil fuels (gas, heating oil or electricity) are creating unfair competition to renewable solutions and hampering their uptake. To reach a carbon neutral 2050 economy, a strategy to phase out fossil fuels must be urgently put in place.

Figure 5 Type of Biomass Used for Bioheat in EU28 in 2017 (ktoe, %)



Source: Eurostat

Solid biomass is by far the main feedstock (91%) for bioheat production and inversely bioheat is the main final usage of solid biomass, 85% of the solid biomass is used for bioheat production (the rest being mainly used for bioelectricity - Cf. Bioelectricity report). Both for environmental and economic reasons, this is mostly sourced from by-products of forest management operations and the wood industry, such as sawmills (Cf. biomass supply report).

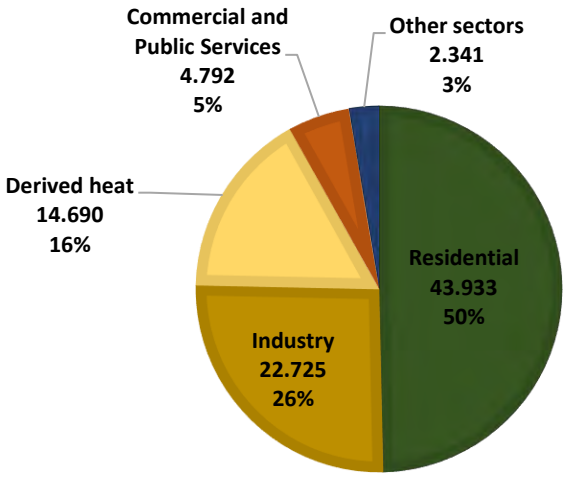
Table 3 Biomass Used for Heat by Fuels and Sectors in EU28 in 2017 (ktoe)

	Solid Biomass	Renewable Municipal Waste	Biogas	Liquid Biofuels	Total
Industrial Sector	21.456	688	499	83	22.725
Residential Sector	43.531	7	391	4	43.933
Derived Heat Sector	10.952	2.905	734	100	14.690
Commercial & Services Sectors	2.972	217	1.434	168	4.792
Other Sectors	1.766	0	539	36	2.341
Total	80.676	3.816	3.597	392	88.481

Source: Eurostat

Other sectors include agriculture, fishing and industries not elsewhere specified, the biogas for this category is mainly used (as well as produced) in the agricultural sector (537 ktoe). The derived heat sector (district heating and CHP) is the one using most of the renewable municipal waste for heat.

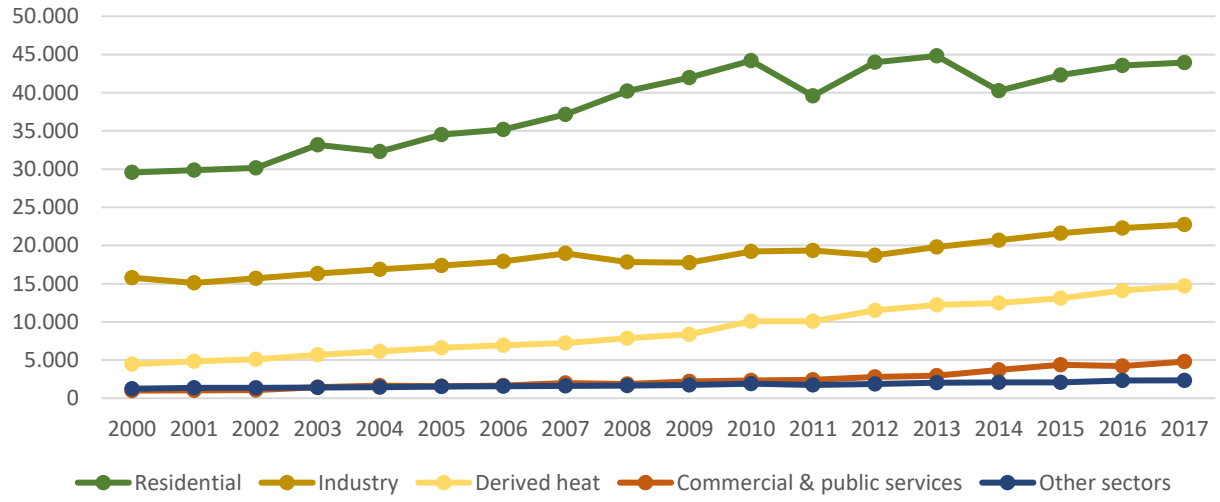
Figure 6 Final Energy Consumption of Bioheat in the Different Sectors in EU28 in 2017 (ktoe, %)



Note: Other sectors include agriculture, fishing and not elsewhere specified
Source: Eurostat

At EU level, half of the heat produced from biomass is consumed by that of the residential sector (43.933 ktoe). This is only counting the biomass that is directly consumed for the production of heat within households, excluding heat supplied through district heating. The residential sector is followed by 22.725 ktoe of biomass for heat in industry and 14.690 ktoe of derived heat (mostly being district heating). This important share of bioheat going to the residential and service sector (schools, hospitals, hotels) shows that there is a great number of small and medium installations producing bioheat.

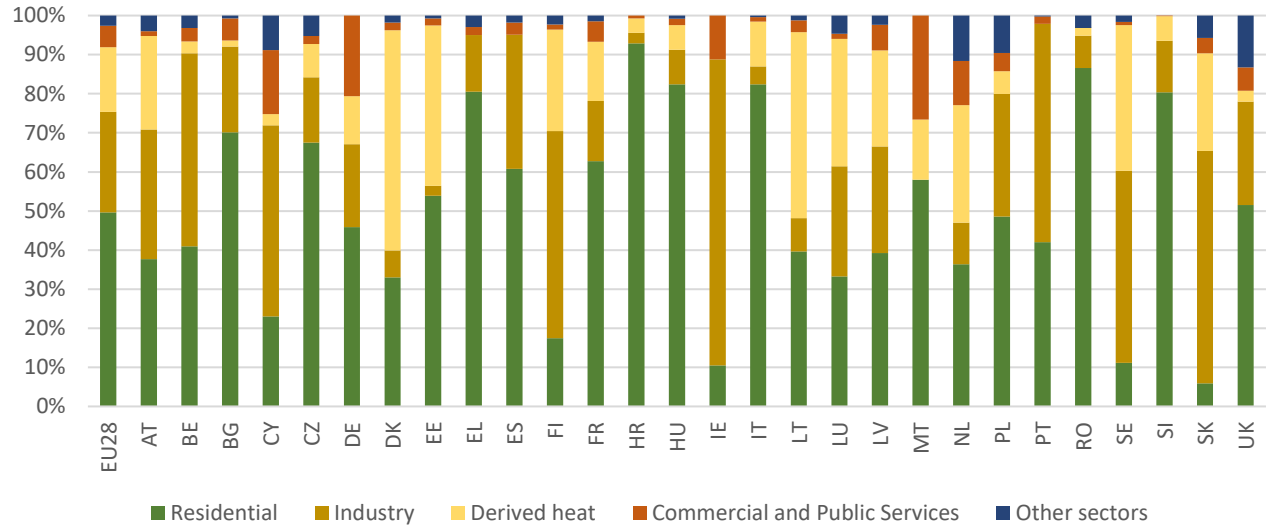
Figure 7 Evolution of the Final Consumption of Bioheat by Sector in EU28 (ktoe)



Note: Other sectors includes agriculture, fishing and not elsewhere specified
Source: Eurostat

The consumption of bioheat is steadily growing in all sectors, especially in the industrial and derived heat segment. The fluctuation in the residential sector can be explained by the mildness of winters and the fluctuation of fuel prices. The total bioheat has increased by 70% since 2000 to 2017, +49% for the bioheat in the residential sector, +44% in the industry, +229% in the derived heat, +378% in the commercial & public services sector. This shows that households, industries, district heating etc. are increasingly relying on biomass which is dissimilar to traditional fuels in way of showing a very dynamic market, growing on average by 3,2% every year since 2000.

Figure 8 Importance of the Different Sectors in the Final Energy Consumption of Bioheat in EU28 Member States in 2017 (%)



Source: Eurostat

Bioheat deployment strongly differs between Member States. The residential sector remains the predominant sector for bioheat consumption in the majority of Member States even though the industrial and derived heat sector is increasing. The consumption of bioheat in the industry sector has a high importance in countries such as Belgium, Finland, Ireland, Portugal, Sweden, and Slovakia. The countries with the biggest share of bioheat consumption through district heating are Denmark, Estonia, Lithuania, and Sweden with shares higher than 37%. In contrast, bioheat district heating are fewer in Mediterranean countries such as Greece and Portugal. The use of bioheat in the service sector (schools, hospitals, hotels) is rather limited in most countries but on an increasing trend (see table 4). Only Germany, Cyprus, and Malta present more than 15% shares.

Table 4 Final Energy Consumption of Bioheat in EU28 Member States in 2017 by Sector (ktoe)

	Total	Household	Industry	Derived Heat	Commercial and Public Services	Other Sectors
EU28	88.481	43.933	22.725	14.690	4.792	2.341
Growth Rate (2016-2017)	2,4%	1%	2%	4%	14%	1%
AT	4.091	1.543	1.357	977	52	162
BE	1.415	580	699	42	48	46
BG	1.084	760	238	17	61	8
CY	44	10	22	1	7	4
CZ	2.684	1.811	450	229	54	140
DE	13.042	5.985	2.763	1.600	2.693	0
DK	3.192	1.054	220	1.797	63	57
EE	725	390	19	297	13	5
EL	922	742	134	0	19	27
ES	4.168	2.534	1.430	n.a.	128	75
FI	7.320	1.276	3.881	1.897	96	170
FR	10.659	6.690	1.638	1.621	557	154
HR	1.175	1.091	32	44	8	0
HU	1.971	1.624	175	125	32	16
IE	256	27	201	n.a.	29	0
IT	8.202	6.757	380	941	88	35
LT	1.185	470	101	564	36	15
LU	79	26	22	26	1	4
LV	1.287	505	351	316	85	30
MT	2	1	0	0	1	0
NL	1.279	465	136	385	144	149
PL	5.397	2.621	1.695	312	252	517
PT	1.819	765	1.016	0	34	4
RO	3.524	3.051	291	70	1	112
SE	8.465	943	4.163	3.154	65	138
SI	569	457	75	36	1	0
SK	588	35	350	147	23	34
UK	3.339	1.720	885	93	200	441

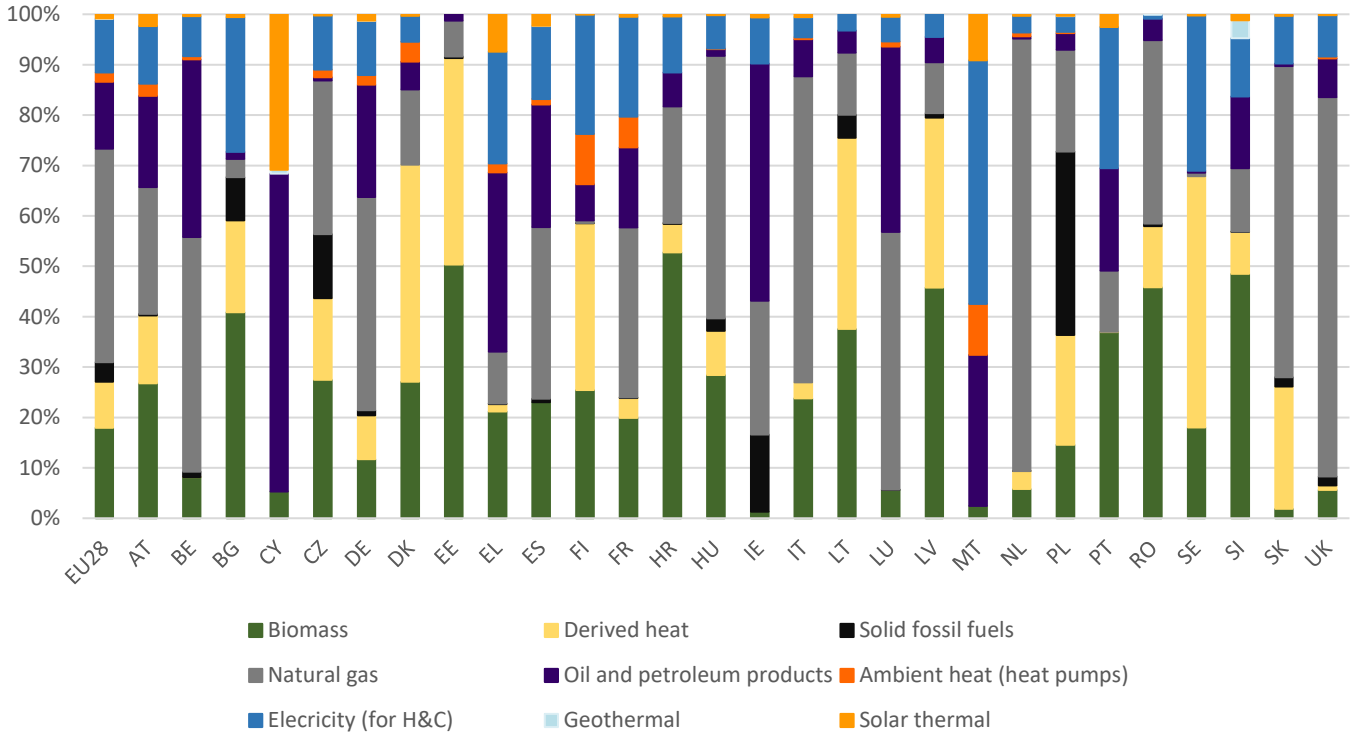
Source: Eurostat

2. The Residential Sector

In 2017, the residential sector (excluding electricity consumption), represented 21% of the final energy consumption in the EU (23% considering the electricity used for heating & cooling - H&C - and 27% considering all electricity used in the residential sector), and only 23% of these household energy consumptions (excluding electricity) were from renewables, mainly bioenergy (87%). These statistics highlight that there is around 168.000 ktoe from non-renewable sources to be replaced (mainly gas) (plus the non-renewable part of the electricity used). Therefore, there is an urgent need to decarbonise the residential sector in order to keep the temperature rise levels under 1.5°C. Individual biomass heating systems can be an important part of the solution (alongside with energy efficiency method and raising awareness on energy sobriety), offering cheap and renewable solutions, especially in rural and remote areas. Long-term strategies to decarbonise the building sector are needed, to not only foster a switch from fossil to renewable solutions but to also promote the replacement of old biomass appliances with modern ones which will use less wood in exchange for the same useful heat production as their older counterparts whilst simultaneously reducing air emissions.

Bioenergy used in the residential sector was 99% based on solid biomass, the remaining is mainly biogas (renewable municipal waste and liquid biofuels together accounted for 0,025%) in 2017 in the EU28.

Figure 9 Shares of Energy Used for Heating (and Cooling) in the Residential Sector by Member States in 2017 (%)



Note: Ambient heat is the energy in form of heat captured by heat pumps, the electricity used to fuel the heat pumps is included under "Electricity (for H&C)".
Source: Eurostat

In the EU28 in 2017, cooling in the residential sector was performed only with electricity and it represented around 3,4% of the electricity used for H&C, thus accounting for 0,4% of the total residential H&C energy consumption. Please note, when talking about the electricity used in final energy consumption, we should consider that a primary energy source (most likely non-renewable) was required for its production and that it represents a greater amount of energy that the one finally presented (e.g. table 5).

Space heating represented the largest part of the residential H&C consumption in EU28 in 2017 accounting for 76% (equivalent to 64% of the total residential energy consumption) followed by water heating that accounted for 17% (15% when considering the total residential energy consumption).

Despite the important share of bioheat used in the residential sector, this sector is still dominated by fossil fuels producing more than 60% of the heat for the households in the EU28 in 2017. Additionally, to the promotion of bioheat for decarbonising the sector, it is also important to replace the existing stock of old and inefficient biomass installations with highly efficient nearly-zero emissions modern biomass installations. This will not only increase the resource efficiency but also improve the air quality. For example, the number of fine particles emitted by an old open fire is equivalent to the emissions of approximately 278 modern appliances such as pellet stoves (Cf. our factsheet '*Slashing emissions from Residential Wood Heating*'). Therefore, to accelerate the deployment of modern biomass heating installations, increasing awareness at local level and establishing financial support for renewable solutions is essential.

Additionally, the biomass directly used within the residential sector for heating, a part of the derived heat, is produced from biomass. At the EU scale, biomass in the residential sector (directly used at the residential scale) accounted for 18% of the energy consumption for H&C in 2017. In addition, one quarter (Cf. Section 4) of the 9% of derived heat, gives a total of 20,3% of biomass used for heat in the residential sector.

By summing the contribution of biomass directly in the residential sector and for the derived heat for Denmark, Estonia, Croatia, Lithuania, Latvia, and Sweden, the total biomass in the residential sector in 2017 accounted for more than 50% of the energy for residential heating.

Table 5 Residential Heat Production by Fuel in 2017 in EU28 (ktoe)

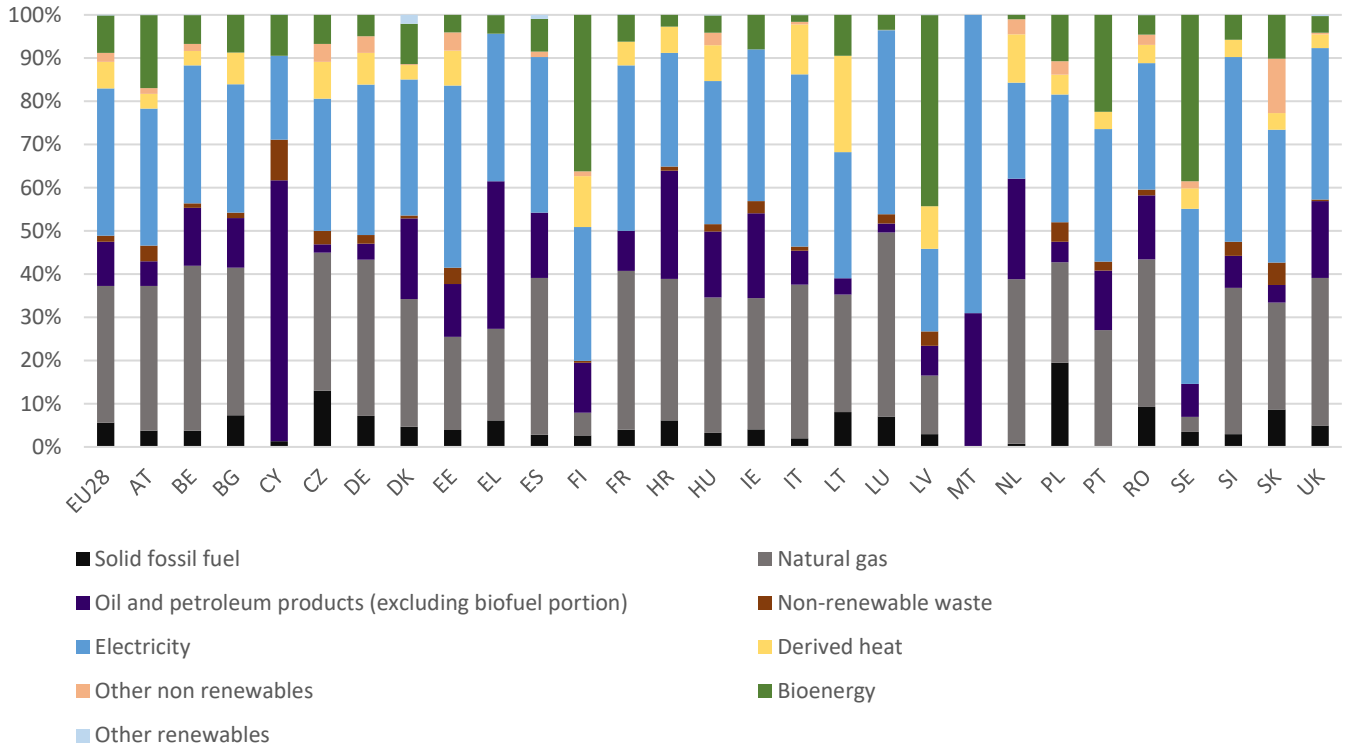
	Total	Solid Fossil Fuels	Natural Gas	Oil and Petroleum Products	Derived Heat	Electricity (for H&C)	Biomass	Geothermal	Solar Thermal	Ambient Heat (Heat Pumps)	Others
EU28	244.788	9.409	103.789	32.371	22.443	26.259	43.933	95	1.966	4.505	17
AT	5.766	18	1.449	1.045	778	658	1.543	0	136	139	0
BE	7.117	79	3.310	2.513	1	565	580	0	25	45	0
BG	1.859	159	68	25	340	498	760	0	10	0	0
CY	194	0	0	122	0	n.a.	10	2	60	0	0
CZ	6.586	838	2.004	45	1.066	706	1.811	0	15	100	0
DE	50.984	500	21.598	11.348	4.431	5.456	5.984	28	645	993	0
DK	3.896	0	582	216	1.673	199	1.054	0	12	152	8
EE	776	2	55	10	318	n.a.	390	0	0	0	0
EL	3.503	4	361	1.246	51	777	742	0	260	62	0
ES	11.008	79	3.747	2.674	n.a.	1.593	2.534	11	247	123	0
FI	5.017	4	26	359	1.660	1.190	1.276	0	2	500	0
FR	33.622	35	11.340	5.342	1.332	6.662	6.690	0	157	2.064	0
HR	2.068	4	479	138	117	230	1.091	0	9	0	0
HU	5.706	142	2.972	75	499	375	1.624	0	12	9	0
IE	2.086	319	554	982	n.a.	191	27	0	12	0	0
IT	28.414	0	17.261	2.087	905	1.146	6.757	1	154	102	0
LT	1.252	57	154	55	475	40	470	0	0	0	0
LU	466	0	238	171	0	23	26	0	2	5	0
LV	1.104	10	111	55	372	50	505	0	0	0	0
MT	55	0	0	16	0	26	1	0	5	6	0
NL	8.025	1	6.886	37	285	268	465	0	22	61	0
PL	17.992	6.554	3.630	599	3.917	565	2.621	17	49	40	0
PT	2.069	0	251	421	1	579	765	0	53	0	0
RO	6.651	34	2.421	282	805	55	3.051	3	0	0	0
SE	5.242	0	36	20	2.614	1.615	943	0	11	0	2
SI	943	0	119	134	79	109	457	34	11	0	0
SK	1.862	35	1.150	9	452	176	35	0	6	0	0
UK	30.526	534	22.986	2.343	272	2.506	1.720	0	52	106	7

Note: 'others' includes non-renewable waste and manufactured gas. Source: Eurostat

3. The Industrial Sector

Industries represented in 2017 (excluding electricity consumption) 16% of the final energy consumption in the EU (25% considering the electricity), and only 13% of this industrial energy consumption (excluding electricity) was from renewables, almost entirely bioenergy (99%). Meaning that there is around 149.000 ktoe from non-renewable sources to be replaced (plus the non-renewable part of the electricity used). Therefore, it is substantial to put some efforts to decarbonise this energy and hence to promote bioenergy as it is one of the best solutions regarding industrial requirements.

Figure 10 Division by Fuel of the Final Energy Consumption in Industry in EU28 in 2017 (%)



Source: Eurostat

Figure 10 and Table 6 are not just focusing on heat but on the total energy consumption within industries in 2017. However, heating and cooling production is the major part of the final energy consumption. Indeed, in 2015 in EU28, according to HeatRoadmap, around 80% of the final energy consumption in industry was dedicated to H&C (mainly heat for process – 81% of the H&C energy consumption). Figure 10 and Table 6 illustrate the significant share of fossil fuels compared with renewables in all countries, with that of Latvia, Finland, and Sweden as exceptions. Bioenergy is clearly the main renewable energy source used in industries in 2017, even when considering the renewable electricity with the EU average share – 30,5% (Cf. our bioelectricity report). Bioenergy (including bioelectricity with the EU average share – 5,6%) accounted for 11% of the final energy consumption in industry in 2017 in the EU28 while the second renewable energy is the electricity from wind that reached 4%. Biomass is key to decarbonise the industry due to its technical characteristics, its competitiveness and reliability.

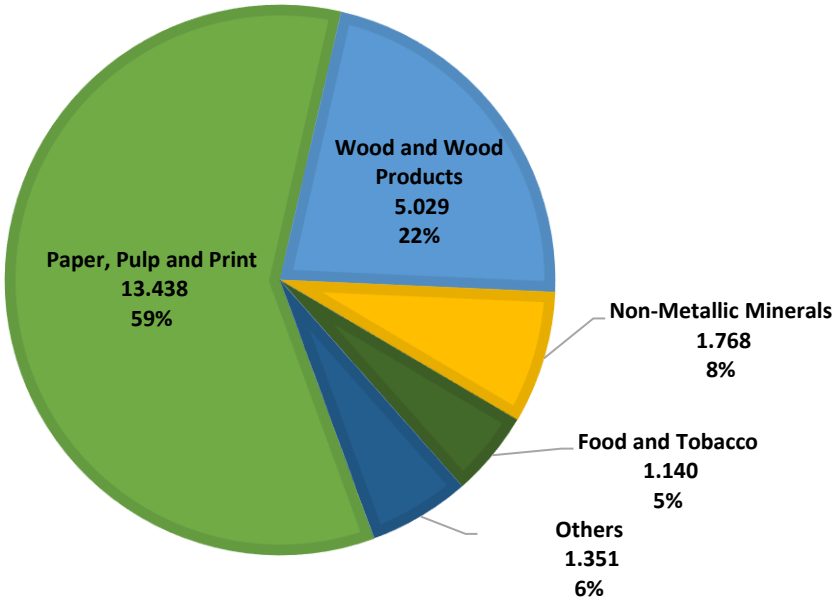
The biomass in industry is mainly based on solid biomass (94,4%) followed by renewable municipal waste (3%) and biogas 2,2%, liquid biofuels account for less than 0,4%.

Table 6 Final Energy Consumption in Industry by Fuel in 2017 in EU28 (ktoe)

	Total	Solid Fossil Fuel	Natural Gas	Oil and Petroleum Products	Non-Renewable Waste	Electricity	Derived Heat	Other Non-Renewables	Biomass	Other Renewables
EU28	261.037	14.597	82.617	26.833	3.538	89.035	16.122	5.252	22.725	317
Growth Rate (2016-2017)	1,50%	1%	4%	-5%	2%	2%	1%	-1%	2%	-2%
AT	8.052	302	2.699	457	296	2.549	279	107	1.357	5
BE	10.495	397	3.999	1.412	108	3.353	350	172	699	3
BG	2.721	200	929	313	35	809	198	0	238	0
CY	230	3	0	139	22	45	0	0	22	0
CZ	6.701	873	2.141	128	212	2.047	572	279	450	0
DE	56.273	4.029	20.361	2.075	1.127	19.612	4.110	2.195	2.763	0
DK	2.344	110	693	438	16	737	78	5	220	47
EE	456	18	98	56	17	192	37	19	19	0
EL	3.096	190	656	1.059	0	1.056	0	0	134	2
ES	18.974	532	6.885	2.878	0	6.831	n.a.	237	1.430	181
FI	10.719	283	568	1.234	54	3.315	1.261	122	3.881	0
FR	26.539	1.065	9.745	2.464	4	10.150	1.472	0	1.638	1
HR	1.180	72	386	295	12	310	72	0	32	0
HU	4.347	140	1.363	665	76	1.439	360	127	175	4
IE	2.510	103	762	492	70	882	n.a.	0	201	0
IT	24.926	489	8.871	1.954	245	9.941	2.874	159	380	13
LT	1.071	86	292	40	0	313	239	0	101	0
LU	642	45	274	13	14	274	1	0	22	0
LV	793	23	108	55	26	152	79	0	351	0
MT	57	0	0	18	0	39	0	0	0	0
NL	13.845	100	5.273	3.222	0	3.079	1.545	491	136	0
PL	15.841	3.084	3.685	749	717	4.690	722	500	1.695	0
PT	4.526	11	1.214	621	96	1.388	179	0	1.016	0
RO	6.390	593	2.181	945	89	1.868	271	150	291	1
SE	10.817	378	376	827	0	4.380	516	177	4.163	0
SI	1.296	38	439	96	42	554	51	0	75	0
SK	3.452	299	855	141	177	1.062	134	434	350	0
UK	22.745	1.133	7.767	4.047	84	7.967	723	79	885	60

Note: 'other renewables' includes solar thermal, geothermal, and ambient heat. Source: Eurostat

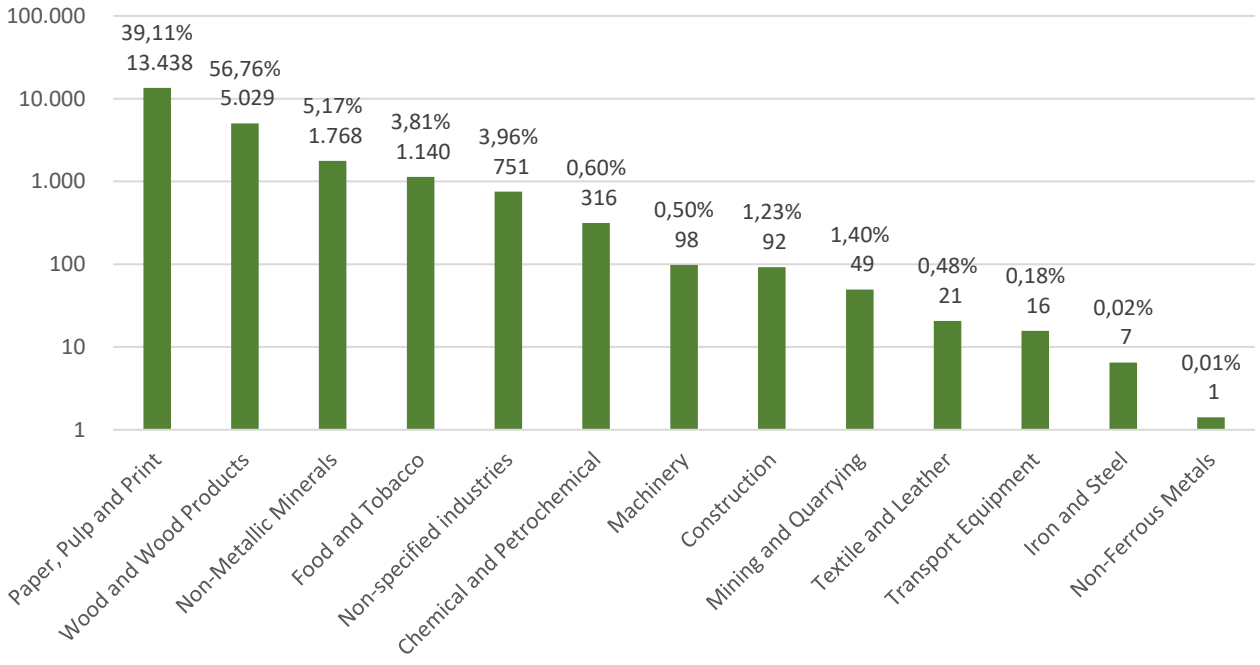
Figure 11 The Repartition of Biomass Usage in the Different Industries in 2017 – EU28 (ktoe - %)



Source: Eurostat

The paper, pulp, print as well as the wood and wood product industries used a combined 81% of the biomass used for energy within the industries in 2017. As they are dealing with biomass product for their main activity, it seems logical that they use residues for energy valorization. The non-metallic minerals including glass, ceramic, cement and other building material industries, is the third industrial sector user of biomass and it is the only industrial sector in the top 4 of industrial biomass users that do not deal with biomass or organic residues in its main activity.

Figure 12 Biomass Contribution for Final Energy Consumption in the different Industry Sectors in EU28 in 2017 (in ktoe and % of the total final energy consumption – logarithmic scale)

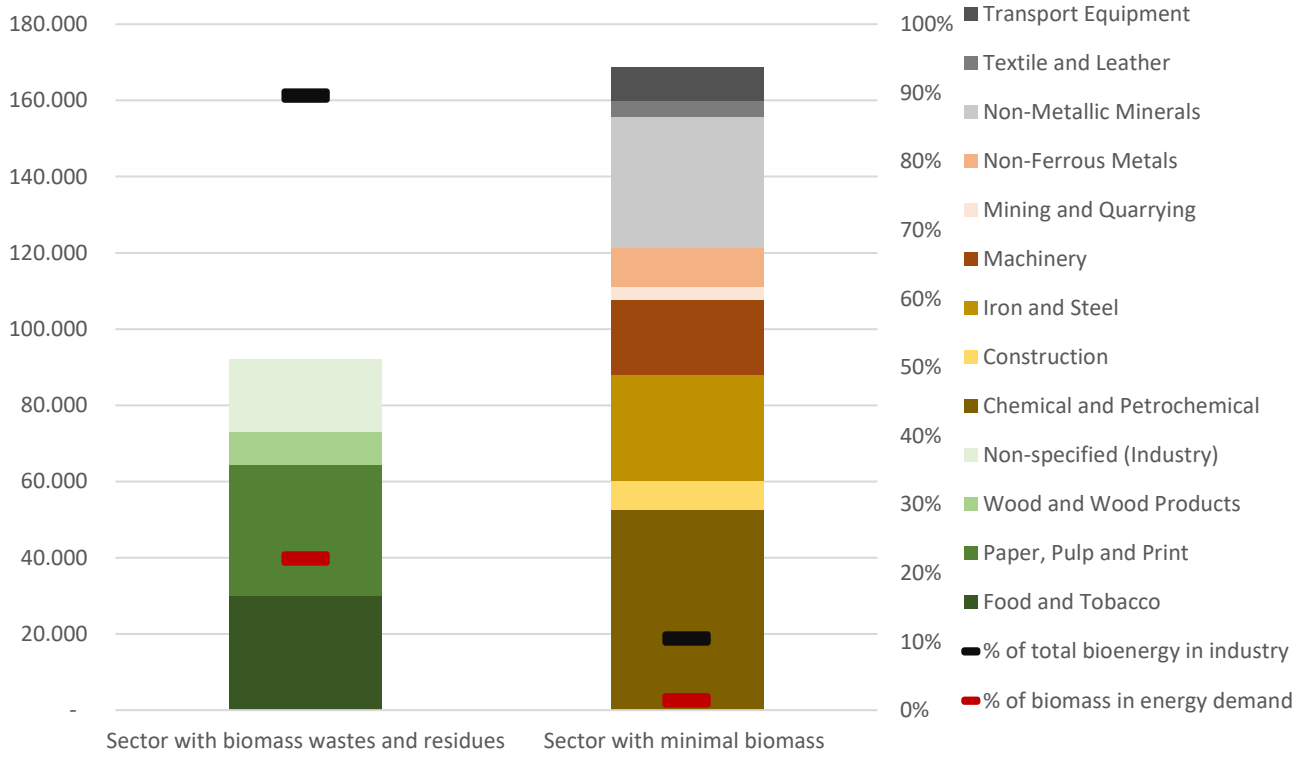


Source: Eurostat

In 2017, biomass contributed a significant share (>39%) of the total energy consumption but only in the paper, pulp and print as well as the wood and wood product industries. This important share shows that wood-working industries and bioenergy work very well together. The symbiosis of industrial processes, such as a sawmill or a pulp mill combined with bioenergy production, can increase resource efficiency as residues are used instead of ending up as waste. How this industrial symbiosis exactly looks like depends on the local needs and circumstances and should therefore not be influenced by rigid implementation of the cascading principle in legislation. The non-metallic minerals industry is the third on the podium where biomass represented 5% of its total energy consumption in 2017.

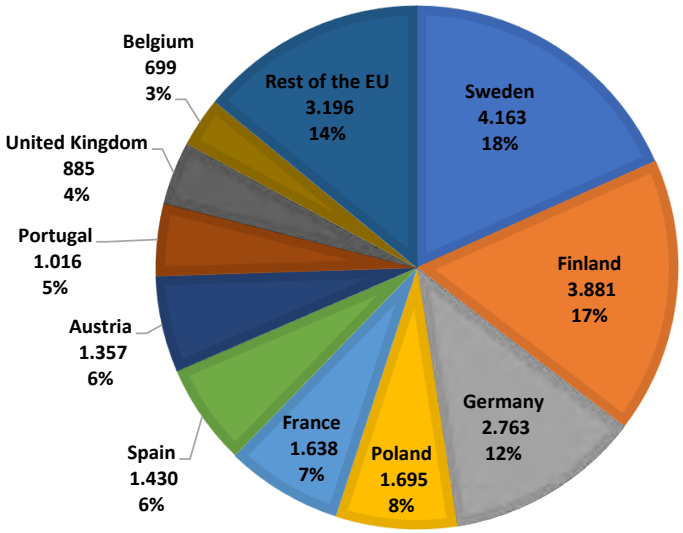
As illustrated in figure 13, in 2017, 90% of the biomass used in EU Member States industries was consumed by those sectors that deal with biomass within their main activity. This is reflected in the following figures, as bioenergy represented 22% of the total energy demand from within this group of industries. On the other hand, bioenergy represented just 1,4% of the total energy demand in comparison to the rest of the industries using just 10% of the bioenergy for industries. However, for those industrial activities often requiring high temperatures to process heat, bioenergy is one of the few solutions to decarbonise this segment of our economy. This clearly signifies that strong efforts as well as vital changes are crucially needed within the industrial sectors, where there is no (or minimal) biomass usage, to ensure that the (bio-based) fuel and the process are compatible, reliable and affordable.

Figure 13 Energy Demand by Industry and Share of Bioenergy for Sector dealing with Biomass Wastes and Residues and for the Other Sectors in 2017 (ktoe and %)



Source: Eurostat

Figure 14 Country Repartition of the Biomass used in Industries in 2017 within EU28 (ktoe and %)



Source: Eurostat

Sweden, Finland as well as Germany use a combined total of 47,6% of the entirety of biomass in industries from within the EU28 biomass. This is mainly due to those countries being among the top producers for both pulp & paper as well as wood products in the EU.

EXPERT REVIEW

The role of bioenergy in heating is very different compared to bioenergy in electricity production. In renewable electricity generation hydro, wind and solar have a significant role jointly representing 80% and bioenergy only representing 18%. While bioheat represents 86.6% of the renewable heat used.

The shift in heat and power generation towards renewables will require also continued investment in more flexible power plants. As an example, advanced Biomass to Energy plants are capable to adjust the production to compensate for the varying supply of other renewable sources.

The industrial sector and district heating already now has a substantial role in utilizing bioheat – in producing both heat and steam. The use of bioheat has increased during the past years. Especially the cities in Northern Europe have invested in biomass powered district heating in the pursuit of carbon-neutral cities. Taking into consideration the significant portion of fossil fuels used in these sectors, there is large growth potential for biomass utilization and by that reducing fossil greenhouse gas emissions. Biomass can be also combined with industrial residues and waste, thus supporting resource efficiency and fuel flexibility.

Combined heat and power production based on biomass is a sustainable and resource efficient solution, which more energy intensive industries could take use of. I don't claim the road to replacing fossil fuels in heat production would be an easy task. There are several constrains regarding biomass availability, affordability and process requirements. On the other hand, by investing in flexible production technology and high efficiency, it is possible to mitigate these constraints.

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Kai Janhunen
Vice President, Energy Business, Valmet
Vice President, Energy Technologies Europe

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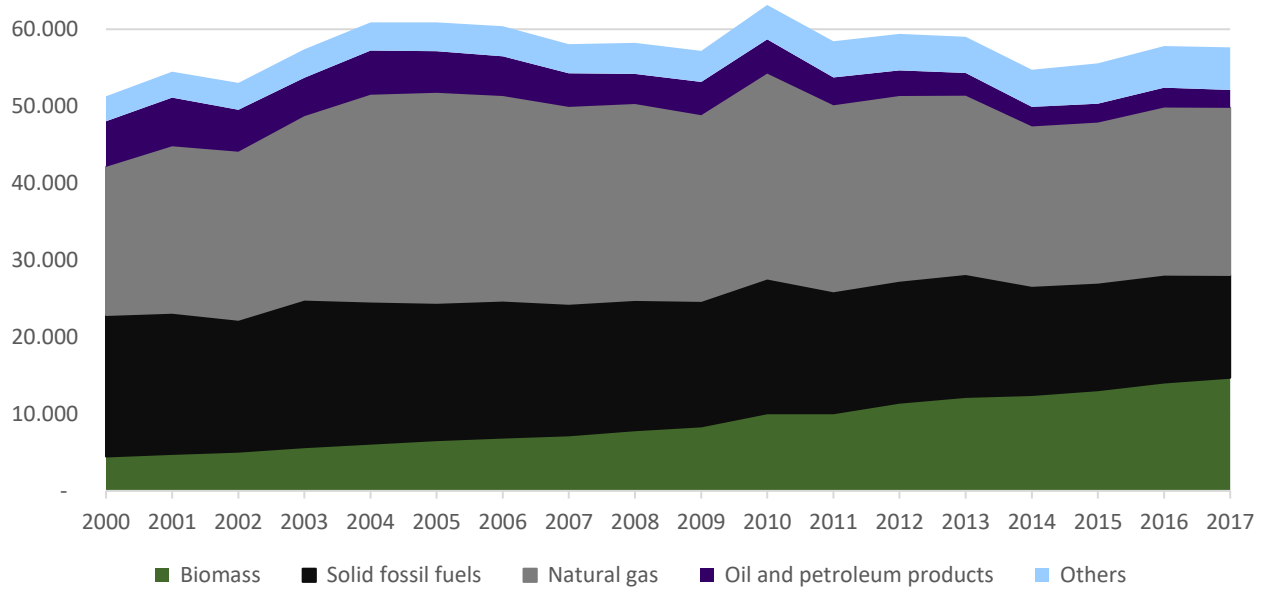
4. The Derived Heat

Derived heat is the heat that is distributed to final consumer through a grid. It can be produced from Combined Heat and Power (CHP) or heat only plants. The heat that is then auto-produced and therefore directly auto-consumed is not included in derived heat but is instead included in the relevant final consumption sector. The derived heat is mainly used for the residential sector (22.423 ktoe) followed by the industrial sector (16.122 ktoe) and the commercial & services sector (9.632 ktoe), the rest is distributed among the other sectors and partly for the internal use for the heat production as well as distribution losses.

Figure 15 Evolution of Derived Heat Production by Fuel in EU28 (ktoe)



Note: when referring to fuels it is related to the final derived heat produced from those fuels and not the fuel input for heat production.
Source: Eurostat

Most of the district heating plants still rely on fossil fuels. In the last few decades, solid fossil fuels as well as oil and petroleum products have decreased while for natural gas the situation is quite stable. In 2017, renewables represented 26% of the energy used for derived heat production and 96% of these renewables were bioenergy. The share of renewables is increasing, mainly biomass for derived heat - it has been multiplied by more than 3 from 2000.

However, the celerity of this switch has the potential to change in the future. The recast of the Renewable Energy Directive incentivises the use of efficient and renewable district heating solutions as it gives consumers the right to disconnect from inefficient district heating solutions to enable the production of their own renewable heat. This provision not only incentivises individual consumers to produce their own renewable heat but also pushes the district heating plant providers to switch to renewable fuels to prevent consumers from disconnecting.

In order to foster the switch from fossil fuels to biomass, the 'polluter pays principle' should either be strengthened or introduced within the heat sector so that heat from fossil fuel production is gradually phased out.

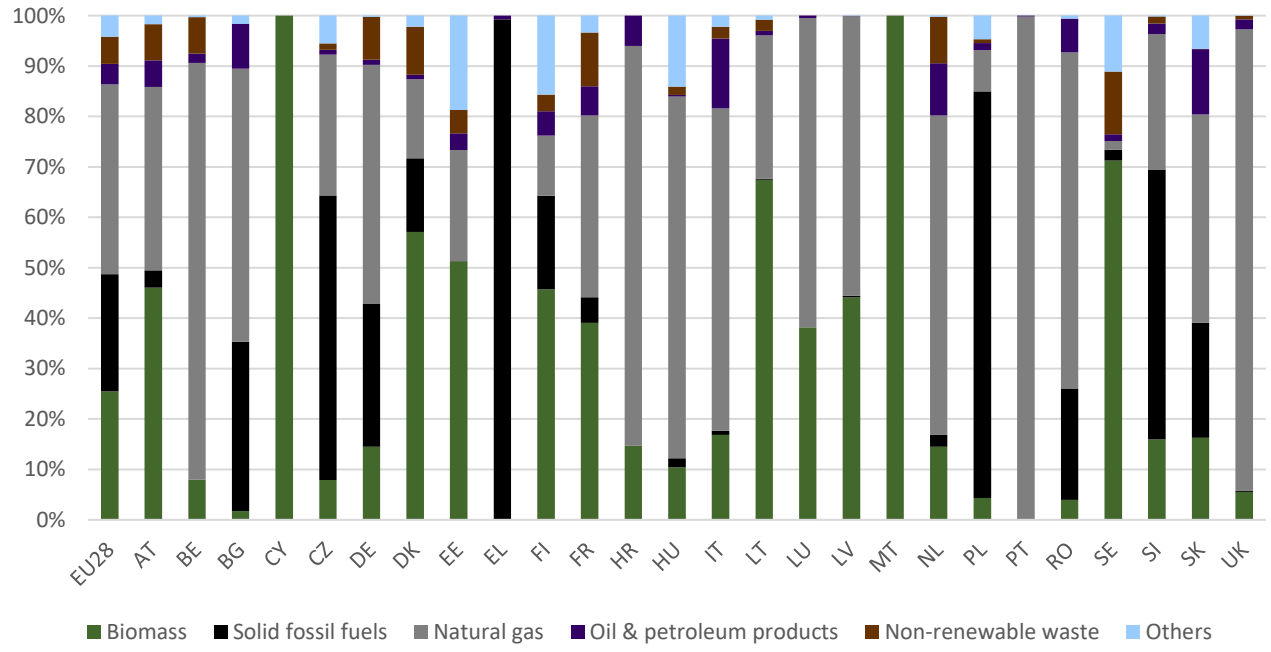
Table 7 Derived Heat Production by Fuel in EU28 in 2017 (ktoe)

Heat from:	Total Gross Heat Production	Growth Rate (2016-2017)	CHP	Heat Only
All fuels	57.628	-0,3%	40.271	17.358
Solid Fossil Fuels	13.378	-4,4%	10.633	2.745
Natural Gas	21.699	-0,2%	14.289	7.409
Oil and Petroleum Products	2.342	-9,3%	1.688	654
Non-Renewable Waste	3.108	3,9%	2.464	644
Manufactured Gases	908	6,7%	802	106
Peat and Peat Products	722	-5,5%	531	191
Oil Shale and Oil Sands	46	-10,0%	46	0
Nuclear Heat	108	4,9%	108	0
Electricity	46	11,9%	11	35
All Renewables	15.271	4,1%	9.698	5.573
Solid Biomass	10.952	4,3%	6.593	4.359
Liquid Biofuels	100	-13,0%	59	40
Biogas	734	7,8%	624	110
Renewable Municipal Waste	2.905	4,1%	2.332	573
Geothermal	258	8,8%	0	258
Solar Thermal	43	24,6%	0	43
Ambient Heat (Heat Pumps)	280	-7,2%	90	190

Note: when referring to fuels it is related to the final derived heat produced from those fuels and not the fuel input for heat production.

Source: Eurostat

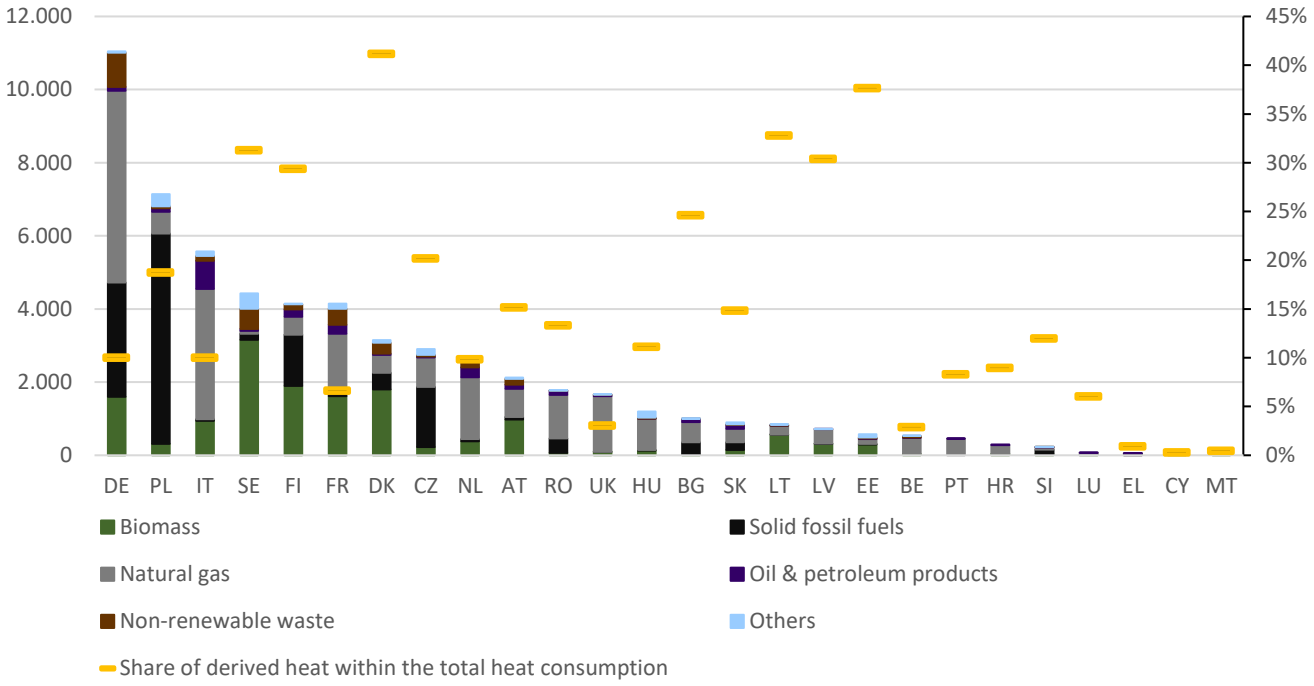
Figure 16 Divsion per fuel of the Derived Heat Production in the EU28 Member States in 2017 (%)



Note: when referring to fuels it is related to the final derived heat produced from those fuels and not the fuel input for heat production.

Source: Eurostat

Figure 17 Derived Heat Production by fuel and share of Derived Heat within the total Heat Consumption in the EU28 Member States in 2017 (%)

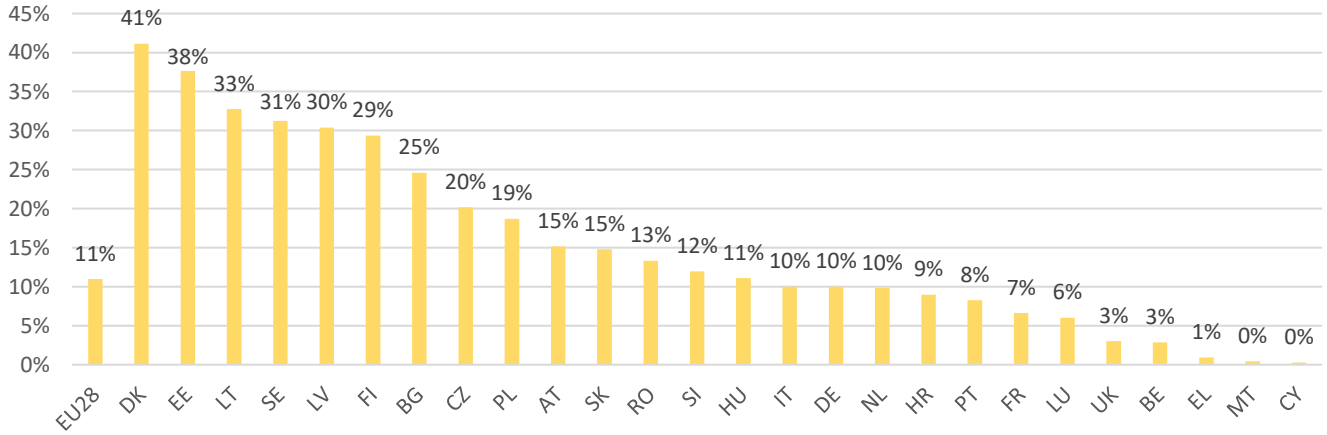


Note: when referring to fuels it is related to the final derived heat produced from those fuels and not the fuel input for heat production.

Source: Eurostat

The share of derived heat within the total heat consumption might be underestimated here, since it is the final heat that is accounted for. Whilst for the rest of the sectors it is the final consumption of the fuels for heat production that is measured and not the useful heat produced. Germany, Poland, and Italy are the main users of derived heat in absolute terms, and in those countries fossil fuels accounted for the majority in 2017. In Poland, more than 80% of the derived heat was still produced from coal while bioenergy accounted for only 4,4%. Biomass could therefore have a significant role to play to retrofit those installations using coal in Poland but also in Germany, Finland or Czech Republic for instance. That would be a significant improvement in terms of Greenhouse Gas Emissions among other advantages.

Figure 18 Share of Derived Heat within the Total Heat Consumption in the EU28 Member States in 2017 (%)



Source: Eurostat

Looking at the importance of derived heat within the total heat consumption (figure 16) it is Denmark, Estonia and Lithuania ranking first followed by Sweden. Sweden is the country using the largest amount of bioenergy in the derived heat production, totalling 71% of the derived heat being produced from biomass.

Table 8 Gross Production of Derived Heat by type of Fuels in EU28 Member States in 2017 (ktoe)

	Total derived heat	Solid Fossil Fuels	Natural Gas	Oil & Petroleum Products	Non-Renewable Waste	Biomass	Other Sources
EU28	57.628	13.378	21.699	2.342	3.108	14.690	2.411
Growth Rate (2016-2017)	-0,3%	-4%	0%	-9%	4%	5%	-3%
AT	2.123	73	772	112	152	977	36
BE	530	0	438	10	39	42	2
BG	1.011	340	547	89	0	17	17
CY	1	0	0	0	0	1	0
CZ	2.903	1.640	810	29	36	229	160
DE	11.042	3.126	5.241	109	936	1.600	30
DK	3.148	459	493	29	300	1.797	69
EE	579	0	128	19	27	297	109
EL	51	51	0	0	0	0	0
ES	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FI	4.150	771	495	199	137	1.897	651
FR	4.148	211	1.495	240	442	1.621	139
HR	297	0	235	18	0	44	0
HU	1.196	21	858	4	20	125	169
IE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
IT	5.575	46	3.563	771	133	941	122
LT	836	1	238	8	19	564	7
LU	67	0	41	0	0	26	0
LV	716	2	397	1	0	316	0
MT	0,4	0	0,0	0	0	0	0
NL	2.656	63	1.682	275	246	385	6
PL	7.142	5.755	589	98	56	312	332
PT	456	0	455	1	0	0	0
RO	1.782	394	1.188	118	0	70	11
SE	4.427	96	76	58	551	3.154	492
SI	226	121	61	5	3	36	0
SK	902	206	372	117	1	147	59
UK	1.663	2	1.524	32	12	93	1

Note: when referring to fuels it is related to the final derived heat produced from those fuels and not the fuel input for heat production.

'Other sources' includes: electricity, ambient heat, geothermal, solar thermal, manufactured gas, nuclear heat, oil shale and oil sands, and peat and peat products.

Source: Eurostat

Table 9 Gross Production of Derived Bioheat by type of Biomass in EU28 Member States in 2017 (ktoe)

	Total Biomass	Solid Biomass	Biogas	Renewable Waste	Liquid Biofuels	% of Derived Heat Produced from Biomass
EU28	14.690	10.952	734	2.905	100	25%
Growth Rate (2016-2017)	4%	4%	8%	4%	-13%	5%
AT	977	908	4	66	1	46%
BE	42	7	9	26	0	8%
BG	17	14	3	0	0	2%
CY	1	0	1	0	0	100%
CZ	229	171	17	41	0	8%
DE	1.600	609	215	773	3	14%
DK	1.797	1.352	75	366	4	57%
EE	297	296	1	0	0	51%
EL	0	0	0	0	0	0%
ES	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FI	1.897	1.706	21	167	3	46%
FR	1.621	1.124	62	434	0	39%
HR	44	36	8	0	0	15%
HU	125	112	2	11	0	10%
IE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
IT	941	544	226	124	47	17%
LT	564	545	2	16	0	67%
LU	26	24	2	0	0	38%
LV	316	292	24	0	0	44%
MT	0,4	0	0,4	0	0	100%
NL	385	101	6	277	0	14%
PL	312	279	21	11	0	4%
PT	0	0	0	0	0	0%
RO	70	65	5	0	0	4%
SE	3.154	2.518	10	584	42	71%
SI	36	30	5	0	0	16%
SK	147	133	13	1	0	16%
UK	93	86	0	7	0	6%

Source: Eurostat

5. Annexes

Table 10 Country Codes

EU28	European Union (28 members)
AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovak Republic
UK	United Kingdom

Table 11 Symbols and Abbreviations

Symbol	Meaning
,	Decimal separator
.	Thousand
n.a.	Data not available

Table 12 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 13 General Conversion Factor for Energy

to **from**	**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

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