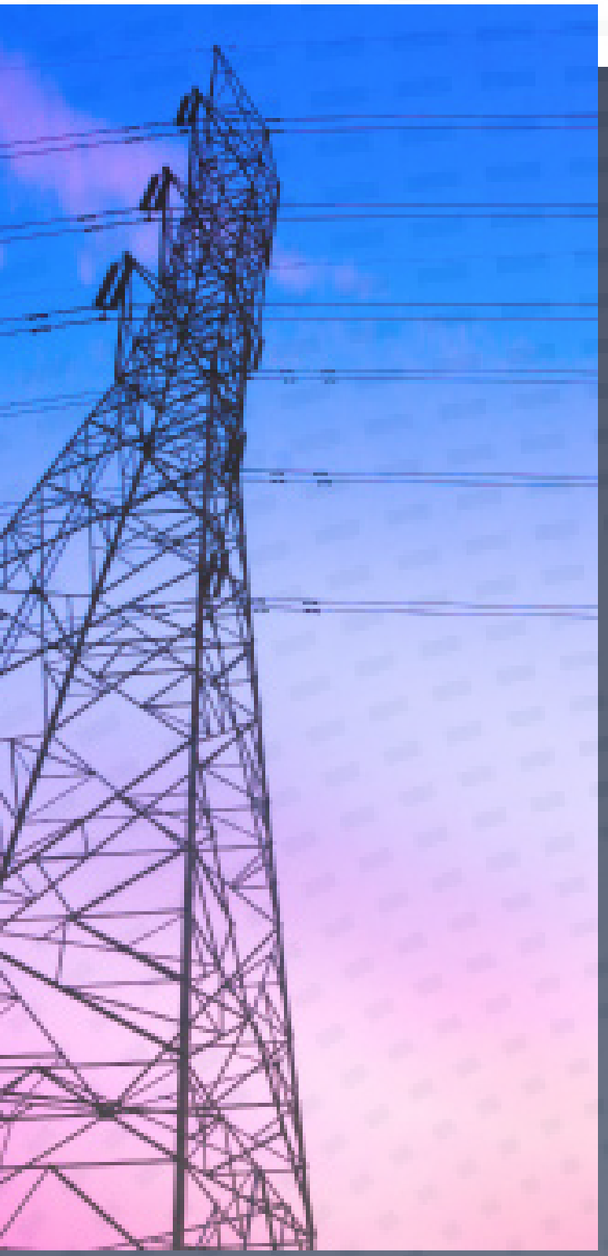
BIOENERGY EUROPE

STATISTICAL REPORT 2021

REPORT BIOELECTRICITY

Bioenergy EUROPE



Bioenergy Europe

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ABOUT

THE STATISTICAL REPORT

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 develops detailed reports that aid 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 published

2009
+ analysis on the National Renewable Energy Action Plan
+ (108 pages)

2010
89 pages

2011
+ pellet chapter
+ (108 pages)

2012
+ statistics on EN*plus*®
+ 2700 downloads
+ (124 pages)

2013
+ socio-economic indicators
+ 2600 downloads

2014
+ EPC European Wood Pellet
+ Overview + expert's view
+ 3000 downloads
+ 158 pages

2015
+ statistics on wood chip consumption
+ 200 page report on bioenergy support scheme in Europe
+ key findings report
+ 3500 downloads

2016
+ chapter on environmental impact of bioenergy
+ projections on bioheat & bioelectricity
+ awarded as 'the Best Provision of Industry Information & Intelligence'by the European Association Award
+ 4000 downloads
+ 300 pages

2017
+ updated information on bioelectricity / bioheat market & support schemes in all EU28 Member States
+ a seperate report on EN*plus*®

2018
+ report available to the public, free of charge
+ emphasis on providing transparent data & sharing knowledge to support private & public initiatives to promote bioenergy
+ 300 pages

2019 / 2020
+ Bioenergy Europe publishes **7 focussed reports** published throughout the year

2021

ABOUT

BIOENERGY EUROPE

A bit of history

Bioenergy Europe is the voice of European bioenergy.

It aims to develop a sustainable bioenergy market based on fair business conditions. Founded in 1990, Bioenergy Europe is a non-profit, Brussels-based international organisation bringing together more than 40 associations and 90 companies, as well as academia and research institutes from across Europe.

Our vision

Bioenergy Europe will be the leading player in ensuring that sustainable bioenergy is a key pillar in delivering a carbon neutral Europe.

Our mission

Bioenergy Europe facilitates the development of a sustainable, strong, and competitive bioenergy sector through:

- Promotion towards European policymakers and stakeholders for awareness, acceptance, and reputation of bioenergy.
- Promote the development of consistent, realistic, and sustainable bioenergy scenarios in the heat, electricity, and transport sectors.
- Pro-active proposals to develop more favourable European legislation.
- Market intelligence to support decision making.
- Services to members, including a support to advocacy at national level.
- Tools, including certification schemes, to sustain market growth and credibility.
- Industry collaboration throughout the entire supply chain.
- Promotion of efficient and innovative technologies within the bioeconomy.

OUR

ACTIVITIES

Bioenergy Europe carries a wide range of activities aimed at supporting its members on the latest EU and national policy developments. Bioenergy Europe works to voice their concerns to EU and other authorities, including, advocacy activities in key policy areas as well as the organisation of dedicated working groups.

Working Groups

Bioenergy Europe's working groups act as a platform for members to 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.

Certification Schemes

Thanks to the experience and authority acquired over the last 20 years, Bioenergy Europe has successfully established three international certification schemes to guarantee high quality standard for fuels, namely, **EN*plus*®, GoodChips®** as well as the latest edition in the certification for sustainable bioenergy: **SURE**.

Networks

Bioenergy Europe is the umbrella organisation of both 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 and beyond.

The European Pellet Council (EPC), founded in 2010, represents the interests of the European wood pellet sector. Its members are national pellet associations or related organisations from over 18 countries.

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

Launched in 2012, **the International Biomass Torrefaction Council (IBTC),** aims to build the first platform for companies that have common interests in the development of torrefied Biomass markets. Currently, the IBTC initiative is supported by more than 23 companies 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

For further information on Bioenergy Europe's Networks & Certification Schemes visit www.bioenergyeurope.org

OUR

MEMBERS*

As the common voice of the bioenergy sector, Bioenergy Europe, aims to develop a sustainable bioenergy market based on fair business conditions and does so by bringing together national associations and companies from all over Europe – thus representing more than 4000 indirect members, including companies and research centres.

Associations

Academia

*Members as of May 2021.

Companies

ENHANCED VISIBILITY & SPONSORSHIP OPPORTUNITIES

Enhanced Visibility

(Exclusive to Bioenergy Europe Members)

This opportunity entails a free of charge promotion for Bioenergy Europe members only. This offer includes the chance to display your organisation's logo as well as a featured 100-word description, placed in 1 of the 7 annual statistical reports of your choice.

This enhanced visibility opportunity is limited and interested members are required to contact the team via info@bioenergyeurope.org

You can find further information about this opportunity on the Bioenergy Europe website.

Sponsorship

Bioenergy Europe offers a sponsorship opportunity for the Statistical Report where you will have the opportunity to have the highest level of visibility. In addition to having full page adverts in all 7 statistical reports, you will also have your logos placed on publications, policy briefs, and enjoy content-driven tweets, as well as Linkedin posts, amongst a variety of additional advantages.

You can find more information in regard to the sponsorship on our website or get in touch with our Team at info@bioenergyeurope.org .

*Bioenergy Europe Members receive a 50% discount on this sponsorship package

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Européenne de Biomasse

Speed up your decarbonization with the HPCI Green Pellet®

Européenne de Biomasse's edb-HPCI® technology is now an industrial reality: the **FICA-HPCI** plant started the **HPCI Green Pellet®** production. (125 kt, Reims, France)

www.ebiomass.eu

Européenne de Biomasse

HPCI Green Pellet®

Easier to use and competitive due to its advanced properties

- All biomasses
- Standardized, high energy density
- Highly stable, water-resistant, low dust, no CO
- Outdoor storage and transportation
- Grindable at any co-firing mix ratio
- Limited supply chain and conversion costs

ELETTRICITÀ FUTURA
imprese elettriche italiane

Bioenergy EUROPE

Elettricità Futura is the leading Association in Italy representing the broad electricity sector and bringing together large, medium and small enterprises involved in the entire supply chain (traditional and RES generation, retail, distribution, services). Elettricità Futura has 500+ members representing 70% of the electricity market in Italy. It is part of Con ndustria as well as being member of the main European associations of the power sector. The Association, with a total of 50 members dealing with bioenergy, supports the role of sustainable bioliquids, biofuels, solid biomass, biogas and biomethane, recognising their valuable contribution to the energy system and its decarbonisation.

https://www.elettricitafutura.it/

SURE
SUSTAINABLE RESOURCES
Verification Scheme GmbH

SURE enables all economic operators along the supply chain, from biomass producers to conversion plants, to prove sustainable use of biomass in electricity production

SUSTAINABLE RESOURCES Verification Scheme (SURE) is a voluntary certification scheme that aims at ensuring the sustainable and responsible use of biomass within the energy sector. SURE's set of criteria is in accordance with the principles of the European Energy Directive (RED II) and enables all economic operators within the bioenergy sector to demonstrate compliance with RED II requirements*.

Interested to learn more? Visit our website:
www.sure-system.eu
* after recognition by the European Commission

SYNCRAFT®
Das Holzkraftwerk.

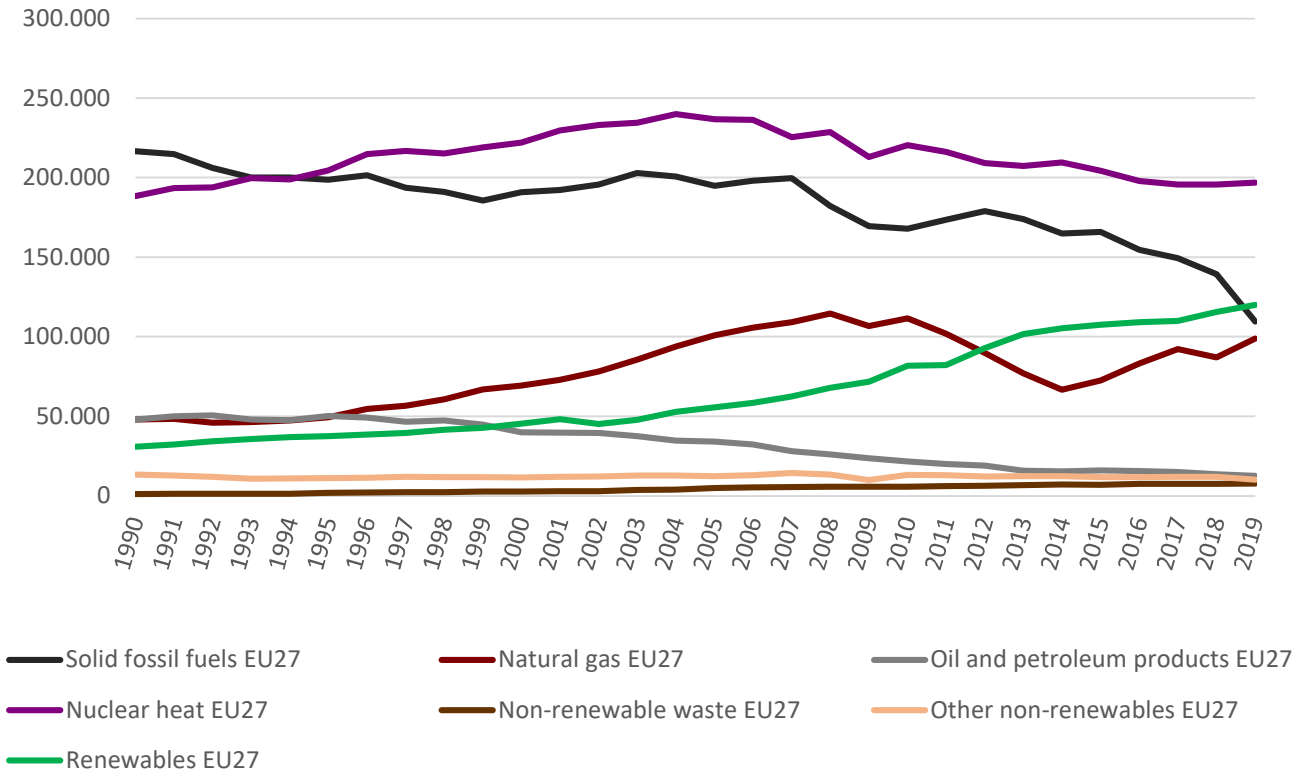
Electricity, heat and carbon from wood. SYNCRAFT, an Austrian high-tech company based in Tyrol, has been building and implementing energy systems worldwide for over 10 years now, that generate electricity, heat and green carbon from residual wood. SYNCRAFT's energy systems become climatepositive if the pure green carbon produced is used for nonthermal applications, e.g. as soil conditioner for the production of fertile black earth. In this way, the carbon originally withdrawn from the atmosphere via the tree is stored in the soil in a long-term, stable and benefiial manner. Our initially CO2-neutral power plant thus becomes a CO2-negative "reverse power plant".

https://en.syncraft.at/

1. Electricity and renewable electricity in Europe

2019 was a landmark year as fuel input of renewables has overpassed the solid fossil fuels (coal, lignite) input for electricity production in EU27, while the renewable electricity production increase trend was maintained. The positive effects of the EU ETS must also be underlined, which supported the faster decarbonization of the power mix, and called for the uniform carbon pricing signal across the entire energy system (transport, heating).

Figure 1 Evolution of fuels inputs for electricity generation in EU27 (ktoe)



Note: *Fuels inputs for electricity consider all the fuels used for the production of electricity, including auto-producers and CHP.*
Non-renewable waste consists of materials coming from combustible industrial, institutional, hospital and household waste, such as rubber, plastics, fossil oils waste and other similar types of waste, either solid or liquid.
The nuclear fuel input considers the generated heat and not the generated electricity.
Other non-renewables include manufactured gases, oil shale and oil sands, peat products.
Source: *Eurostat*

Table 1 Fuels inputs for electricity generation changes 1990-2019 in EU27 (ktoe)

	1990	2019	Absolute change	Growth rate (1990-2019)
Total	546.555	555.704	9.149	2%
Solid fossil fuels	216.614	109.566	-107.049	-49%
Oil and petroleum products	47.976	12.584	-35.392	-74%
Natural gas	48.024	98.789	50.765	106%
Nuclear heat	188.580	196.928	8.348	4%
Non-renewable waste	1.149	7.635	6.486	564%
Other non-renewables	13.270	10.098	-3.172	-24%
Renewables	30.941	120.105	89.164	288%

Source: *Eurostat*

Figure 1 shows a progressive phase out of coal in the last 5 years, partly replaced by natural gas. Gas, being considered a transitional source and less harmful than coal has gained market. Five countries are leading this growth for natural gas, being Italy (+17.155 ktoe), Spain (+12.487 ktoe), Germany (+6.164 ktoe), France (+6.155 ktoe) and the Netherlands (+4.186 ktoe). It should be noted that the increase of gas consumption goes hand in hand with an increasing dependency on energy imports in Europe as the import dependency of gas in EU is about 77%.
As it can be seen in Table 1, the consumption of coal and oil for electricity production has decreased notably in the last 20 years. Nuclear has slightly increased (+4%) and natural gas consumption doubled since 1990. Finally, the increasing penetration of variable renewables and their lowering costs, the demand for flexibility and localized, has been on the raise. The increase of gas consumption is equal with the increasing dependency on import being 90% in 2019. Contrary, the biomass dependency on import is only 3% in 2019.

Table 2 Fuels inputs for electricity generation in EU27 in 2019 (ktoe)

Fuel	Power only		CHP		Total	Total growth rate (2018-2019)
Solid fossil fuels	66.235	60%	43.340	40%	109.566	-21%
Oil and petroleum products	6.836	54%	5.749	46%	12.584	-7%
Natural gas	45.247	46%	53.542	54%	98.789	19%
Nuclear	190.821	98%	3.107	2%	196.928	0,1%
Non-renewable waste	2.625	34%	5.009	66%	7.635	-1%
Other non-renewable	1.185	11%	9.913	89%	11.098	-14%
Renewables	**89.208**	**74%**	**32.809**	**26%**	**120.128**	**4%**
Hydro	27.503	100%	0	0	27.503	-7%
Geothermal	1.754	100%	0	0	1.754	0,4%
Wind	91.566	100%	0	0	91.566	15%
Solar thermal	2.232	100%	0	0	2.232	17%
Solar photovoltaic	16.021	100%	0	0	16.021	9%
Tide, wave, ocean	43	100%	0	0	43	4%
Solid biomass	5.769	25%	17.679	75%	23.448	5%
Biogas	2.866	28%	7.517	72%	10.404	1%
Municipal waste renewable	2.569	33%	5.222	67%	7.791	1%
Bioliquids	562	54%	480	46%	1.043	9%
TOTAL	410.140	74%	145.559	26%	555.704	-1%

Note: Transformation input covers all inputs into the transformation plants destined to be converted into derived products or transformation output (electricity and derived heat). Transformation is only recorded when the energy products are physically or chemically modified to produce other energy products, in this case electricity. For wind, solar, tide, wave & ocean technologies, it corresponds to the gross electricity produced. For hydro, the final inputs exclude the production from pumped hydro.
Source: Eurostat

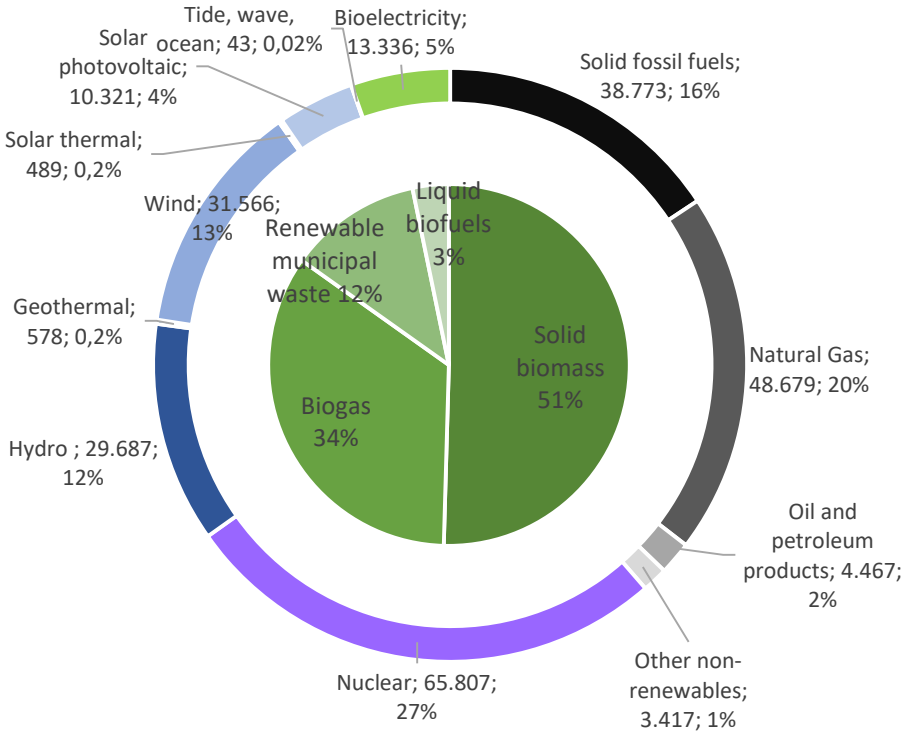
Table 3 Fuels inputs for electricity generation in EU27 Member States and UK in 2019 (ktoe)

	Total	Solid fossil fuels	Oil and petroleum products	Gas	Nuclear	Wastes (non-ren)	Other non-renewables	Renewables	Total Biomass
EU27	917.246	109.566	12.564	96.789	196.918	8.571	10.098	120.105	42.665
EU27+UK	910.555	111.814	12.993	119.759	210.180	9.819	10.403	135.290	50.719
AT	9.019	356	184	2161	0	325	439	5314	1285
BE	16.954	9	11	3.877	11.340	499	468	2.435	1.193
BG	10.595	4.507	72	857	4.302	3	7	1.041	552
CY	1.062	0	1.015	0	0	0	0	48	8
CZ	21.057	10.125	45	1.080	7.548	53	567	1.622	1.190
DE	108.212	38.452	964	16.778	19.332	2.543	2.323	27.418	10.938
DK	5.224	799	71	458	0	377	0	3.519	2.046
EE	2.019	0	7	8	0	25	1.364	615	548
EL	10.609	4.979	1.116	3.015	0	42	0	1.456	108
ES	46.002	8.267	2.415	12.760	15.218	809	262	11.572	1.625
FI	13.417	1.126	69	742	5.676	215	1.062	4.466	2.868
FR	126.852	952	1.213	6.542	103.987	1.172	599	12.388	3.306
HR	1.902	339	8	586	0	0	0	970	296
HU	7.751	965	16	1.586	4.106	79	109	850	624
IE	6.432	152	79	2.516	0	89	443	3.153	213
IT	53.161	4.335	3.705	25.180	0	899	642	18.401	5.421
LT	812	0	10	179	0	34	0	402	235
LU	232	0	0	56	0	23	0	151	109
LV	1.337	1	0	568	0	0	0	536	343
MT	334	0	10	306	0	0	0	19	1
NL	20.390	3.502	397	10.965	910	776	547	3.273	1.819
PL	35.767	26.364	354	2.527	0	234	857	3.369	1.860
PT	7.890	1.156	251	3.154	0	101	0	3.147	902
RO	11.563	4.033	227	2.355	2.846	0	36	2.236	162
SE	29.447	96	64	107	16.239	753	938	11.879	6.494
SI	3.978	1.851	3	106	1.375	9	0	685	73
SK	6.455	725	76	650	4.048	13	47	894	458
UK	53.309	1.748	439	20.944	13.253	1.362	505	15.168	8.054

Source: Eurostat

78% of the fuels used for electricity production are still fossil fuels and nuclear. this share increased to more than 90% in countries such as Bulgaria, Cyprus, Czech Republic, France, Malta, or Poland. In the last two decades, the use of natural gas for electricity production has doubled, half of it being consumed by three countries: Germany, Spain, and Italy. Germany and Poland are the two main users of solid fossil fuels for electricity generation: together they represent more than 60% of the EU28 solid fossil fuels input for electricity. Within EU27, Italy, Spain and France are the biggest users of petroleum products for electricity generation. The use of natural gas for electricity is increasing under the less emissions per energy unit compared to solid or petroleum products. To improve the carbon footprint of their electricity, these countries will need to implement substantial changes: bioelectricity is a good option, and it will ensure the grid stability and an efficient use of primary energy via CHP when relevant. Countries with high share of bioenergy such as Luxembourg (69%), Denmark (39%) and Latvia (31%) are leading the race.

Figure 2 Gross electricity generation by product type in the EU27 in 2019 (ktoe)



Note: *Hydro and wind are not normalised (more information about normalised production available in the SHARES Tool Manual).*
Source: *Eurostat*

The total gross electricity generation has decreased by 1,5 % between 2018 and 2019, while the renewable generation has increased by 4,3%. The electricity generation from fossil fuels has decreased for all fossil fuels type, but the highest decrease was observed for solid fossil fuels (-25,2% representing 13.285 ktoe). As shown in Table 4, the percentage of renewables is 34,7% and the general growth rate for renewables between 2018 and 2019 (3,8%) is mainly influenced by solar thermal (16,8%), wind (14,5%), solar photovoltaics (8,6%) and tide, wave, ocean (4%). Bioelectricity is the third main source of renewable electricity after hydro and wind, producing 5,3% of the total electricity in EU27 or 15,4% of the total renewable electricity. The largest producers of bioelectricity in EU are Germany (4.375 ktoe, 8%), Italy (1.647 ktoe, 7%), Finland (1.110 ktoe, 19%) and former EU member UK (2.826 ktoe, 10%). The three EU member countries with the highest share of bioelectricity production among renewables are Estonia (61%), Hungary (49%) and Czech Republic (43%).

Table 4: Gross electricity generation from all sources and from renewables in EU Member States and UK in 2019 (ktoe)

	Total	Solid fossil fuels	Oil and petroleum products	Natural Gas	Nuclear	Wastes (non-ren.)	Other non-renewables	Renewables	Bioelectricity	Hydro	Wind	Solar photovoltaic	Solar thermal	Geothermal	Tide, wave, ocean
EU27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Growth rate (2018-2019)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EU27+UK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Growth rate (2018-2019)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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MT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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PT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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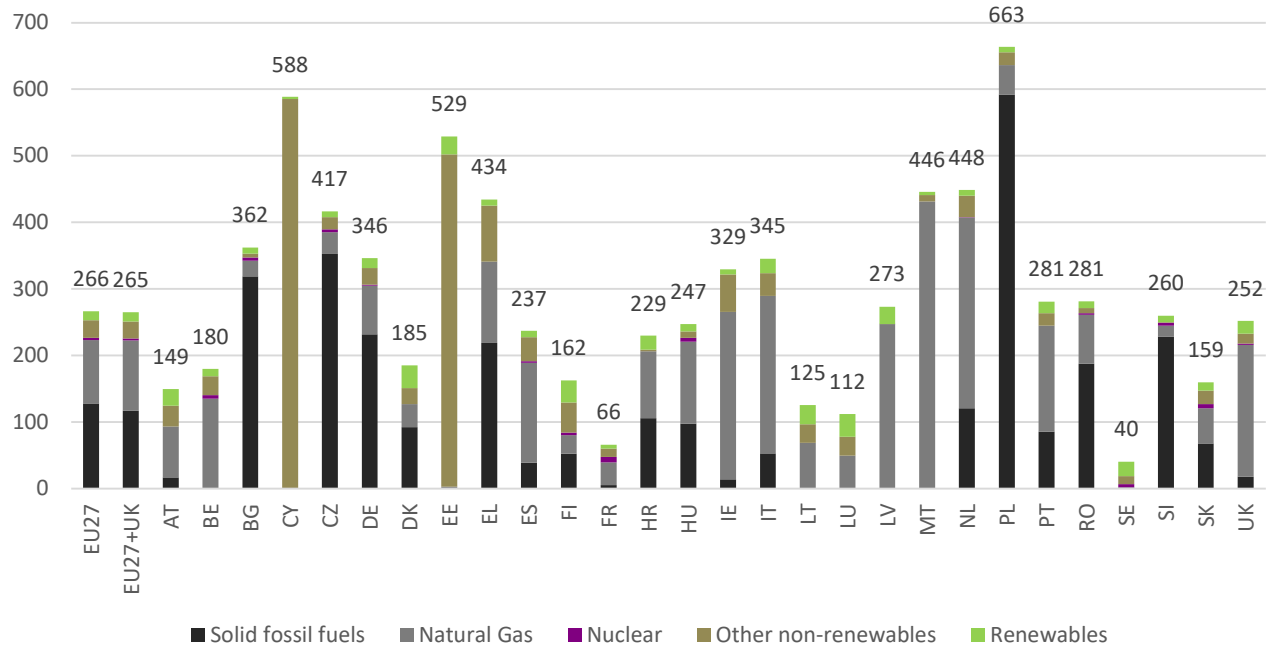
SE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SI	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
UK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: The gross electricity generation from hydro is higher than its fuel input presented in table 2 because pumped hydro is included here.
Source: Eurostat

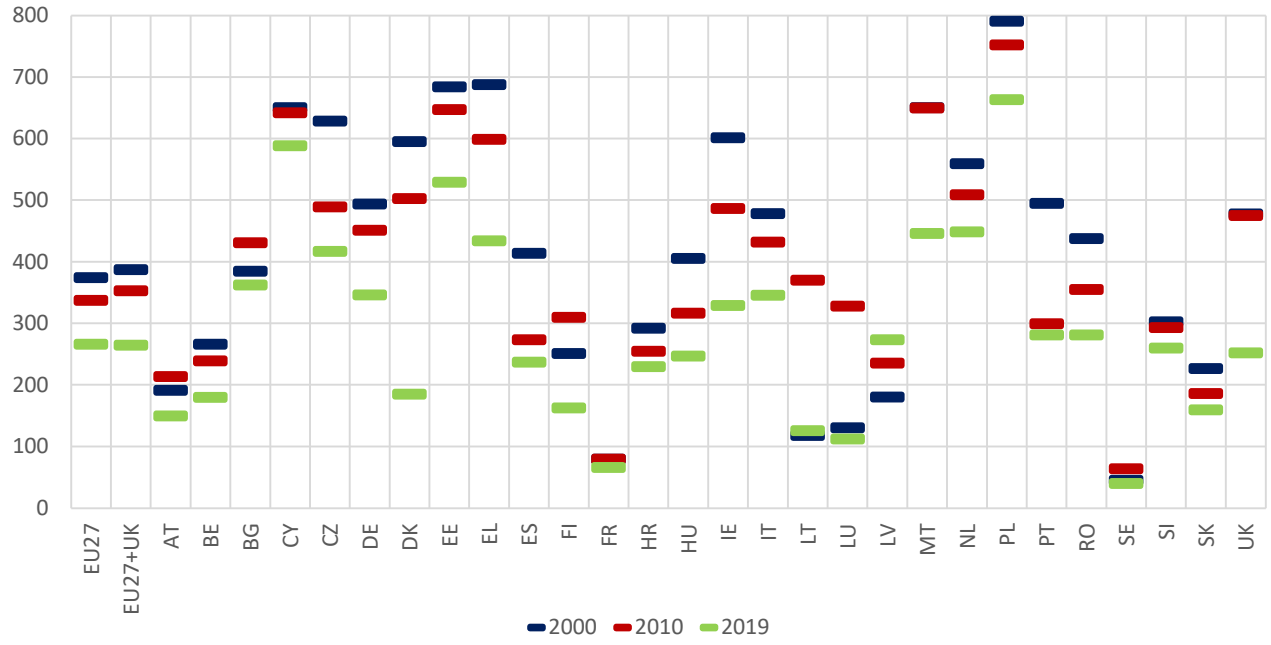
Figure 3 Electricity production footprint by EU Member State and UK for 2019 in gCO_2eq/kWh of electricity and shares by main fuel



Note: *Other non-renewables include non-renewable waste, oil & petroleum products, manufactured gases, oil shale and oil sands, peat products. The share presented for each fuel depends on its share in the gross electricity production and its emissions factor – i.e. variations of importance for a specific fuel between countries are due to differences in share of gross electricity production.*

Source: *Bioenergy Europe calculations based on the 2019 gross electricity generation from Eurostat, the median GHG emission factor of the IPCC 2014, Tomorrow - ElectricityMap, Paolini et al. (2018), RED II values with Bioenergy Europe assumptions and calculations. GHG emissions are taken into account, as well as the Life Cycle Assessment emissions and not only the stack emissions.*

Figure 4 Electricity production footprint by EU Member State and UK for 2000-2010 and 2019 in gCO_2eq/kWh of electricity



Source: *Bioenergy Europe calculations based on the 2018 gross electricity generation from Eurostat, the median GHG emission factor of the IPCC 2014, Tomorrow - ElectricityMap, Paolini et al. (2018), RED II values with Bioenergy Europe assumptions and calculations.*

It has to be noted that the above figures look at the footprint of the electricity production and not the consumption, therefore the potential impact of imports is not addressed. The Lithuanian electricity footprint increased when comparing 2000 and 2010 because of the phasing out of nuclear electricity generation in 2010. This choice resulted in a contraction of total electricity generation from around 1000 ktoe in 2000 to 322 ktoe in 2019, and therefore induced growing of the electricity imports. For other countries such as Latvia, the carbon footprint increased. In Latvia the total generation was relatively low in 2000 and mainly based on renewables (e.g. mainly hydro). Since 2000, electricity consumption has increased, and the additional capacity installed to cover the demand was fossil-based. (e.g. natural gas).

Despite the fact that the carbon footprint of EU electricity is decreasing, the figures show that natural gas has partly filled in the gap left by the reduction of nuclear and fossil-based electricity production. Natural gas is, after nuclear, the second most important fuel for electricity production in EU27 for the first time in 2019. It is evident that natural gas is playing a predominant role in the high carbon footprint of the electricity production. Although less polluting than oil and coal, natural gas cannot be considered as a clean fuel. The future challenge towards carbon neutrality in Europe will be to phase out fossil gas that is currently substituting coal at large scale.

Considering the persisting and significant carbon intensity of the electricity produced in the EU, we may pose a question if electrification of heating and transport sectors are the right way forward? Increasing demand of electricity would most likely mean that reducing carbon intensity will be further prolonged.

Table 3: Final electricity consumption and electricity export-import by EU Member States and UK in 2019 (ktoe)

	Final consumption energy use	Export	Import	Balance (Export - Import)
EU27	**213.660**	**31.512**	**31.765**	**-253**
Growth rate (2018-2019)	-1,0%	0,4%	-0,8%	/
EU27+UK	**220.058**	**31.803**	**33.877**	**-2.074**
Growth rate (2018-2019)	-1,1%	1,1%	0,1%	/
AT	5.461	1.971	2.240	-269
BE	7.048	1.254	1.095	159
BG	2.590	761	262	500
CY	456	0	0	0
CZ	5.025	2.079	948	1.130
DE	42.950	6.259	3.450	2.809
DK	2.682	875	1.374	-500
EE	629	233	418	-185
EL	4.916	97	952	-855
ES	20.166	1.020	1.610	-590
FI	7.021	335	2.058	-1.723
FR	37.141	6.303	1.344	4.958
HR	1.389	453	980	-527
HU	3.467	625	1.707	-1.082
IE	2.444	132	187	-55
IT	25.102	503	3.761	-3.260
LT	906	337	1.141	-803
LU	700	81	586	-505
LV	572	830	896	-66
MT	214	2	56	-55
NL	9.420	1.680	1.754	-74
PL	12.073	623	1.536	-913
PT	4.117	404	696	-292
RO	3.919	342	472	-131
SE	10.710	3.028	780	2.249
SI	1.176	803	776	27
SK	2.166	1.018	1.164	-146
UK	25.398	291	2.111	-1.820

*Export and import for the EU27 and EU27+UK includes EU internal trades.
Source: Eurostat

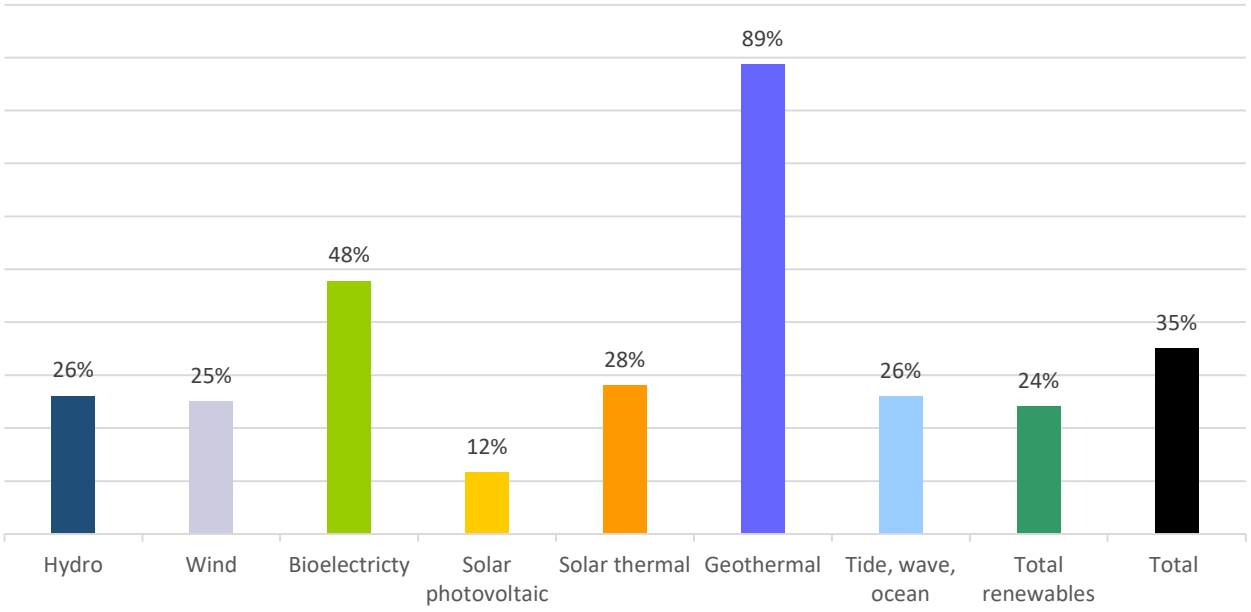
Luxembourg and Lithuania mainly rely on imports for their electricity consumption (92% and 89% respectively) and in absolute terms Italy remains the biggest importer of electricity. Croatia, Malta, Hungary, and Finland are net importers for more than 24% of their consumption. The three main exporters in absolute terms are France, Germany, and Sweden.

Table 6: Total electrical installed capacity and electrical capacity for renewables in EU Member States and UK in 2019 (MW) – with growth rate

	Total	Total renewables	Hydro	Wind on shore	Wind offshore	Bioelectricity	Solar photovoltaic	Solar thermal	Geothermal	Tide, wave, ocean
EU27	947 208	476 557	150 811	155 121	12 417	37 036	116 478	2 306	866	214
Growth rate (2018-2019)	1,8%	6,2%	0,3%	5,8%	14,3%	3,0%	16,0%	0,0%	0,6%	-1,0%
EU27+UK	1 053 180	526 617	155 484	169 246	21 988	44 863	131 428	2 306	866	234
Growth rate (2018-2019)	1,3%	6,2%	0,3%	5,8%	17,4%	3,1%	14,5%	0,0%	0,6%	-1,0%
AT	25 902	21 045	14 587	3 224	0	1 521	1 702	0	1	0
BE	24 060	10 996	1 424	2 306	1 556	1 032	4 687	0	0	0
BG	11 233	5 186	3 378	700	0	57	1 048	0	0	0
CY	1 619	322	0	158	0	13	151	0	0	0
CZ	22 012	5 548	2 265	339	0	857	2 086	0	0	0
DE	231 621	131 612	10 755	53 193	7 528	11 072	49 045	2	40	0
DK	15 187	9 353	7	4 402	1 701	2 163	1 080	0	0	0
EE	2 796	801	6	316	0	358	121	0	0	0
EL	20 478	9 923	3 412	3 589	0	88	2 834	0	0	0
ES	109 970	56 220	20 114	25 583	0	1 241	8 973	2 304	0	5
FI	17 470	7 885	3 273	2 211	73	2 106	222	0	0	0
FR	136 242	55 583	25 469	16 427	0	2 262	10 795	0	16	214
HR	4 712	3 068	2 200	646	0	127	85	0	10	0
HU	9 914	2 282	56	323	0	456	1 400	0	0	0
IE	11 137	4 869	529	4 160	0	149	31	0	0	0
IT	116 435	56 755	22 541	10 679	0	3 850	20 865	0	767	0
LT	3 378	1 626	877	534	0	112	103	0	0	0
LU	1 776	1 001	1 330	136	0	45	160	0	0	0
LV	2 908	1 820	1 587	78	0	158	3	0	0	0
MT	741	158	0	0	0	5	154	0	0	0
NL	37 086	12 907	37	3 527	957	1 209	7 177	0	0	0
PL	43 440	10 828	2 387	5 837	0	1 055	1 539	0	0	0
PT	21 575	14 228	7 262	5 223	0	741	901	0	29	0
RO	20 938	11 260	6 486	3 038	0	135	1 386	0	0	0
SE	42 829	31 723	16 462	8 478	203	5 866	714	0	0	0
SI	3 820	1 480	1 351	5	0	60	264	0	0	0
SK	7 724	3 251	2 527	4	0	232	590	0	0	0
UK	104 847	50 060	4 773	14 125	9 971	7 828	13 346	0	0	20

Source: Eurostat

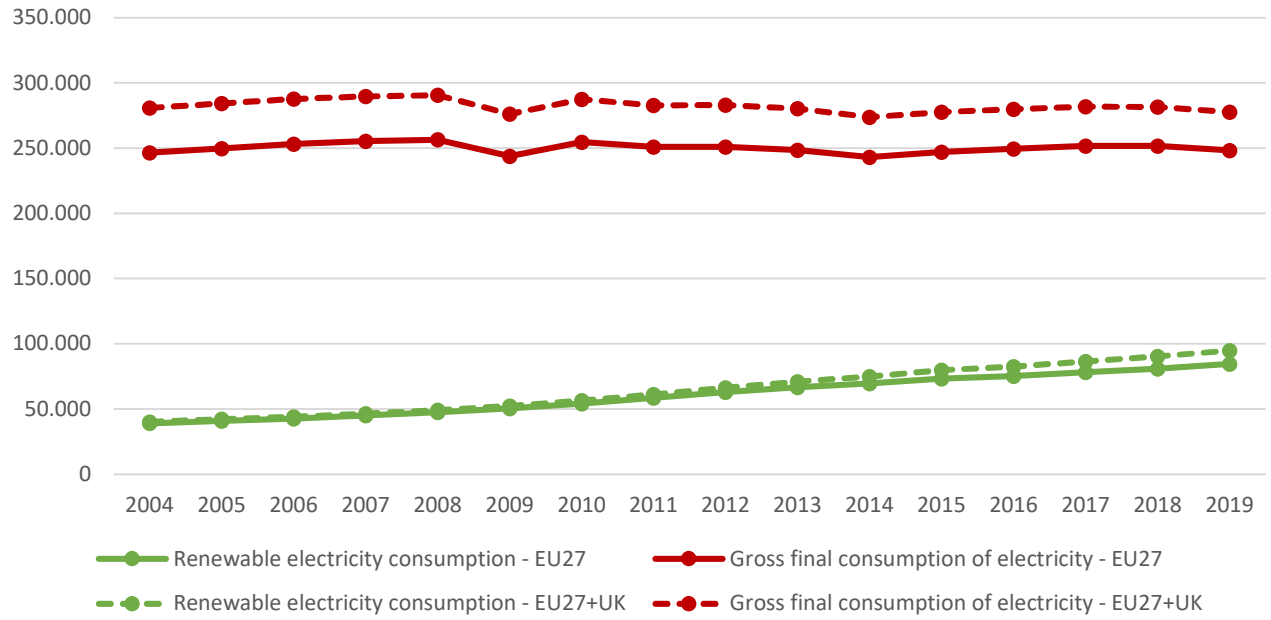
Figure 5 Average load factor* for the different renewable technologies and for the total installed capacities in the EU27 in 2019



**The load factor represents the percentage of the time equivalent (annual average) during which the unit is operating at its nominal capacity.*
***Note:** Total considers all the electricity sources and technologies.*
***Source:** Eurostat and Bioenergy Europe's calculations*

Bioelectricity's load factor is twice higher than the average for renewables. Indeed, bioelectricity is dispatchable and allows to adjust production to stabilize the grid. The stability and reliability of the grid is a big challenge for the energy transition due to the large increase of non-dispatchable/intermittent technologies (wind and solar). However, bioelectricity is a very viable solution for the EU being a dispatchable, flexible, not site-specific, and affordable technology. Bioelectricity generation has experienced the third largest growth rate within renewables in terms of installed capacity, proving that the advantages of bioelectricity technologies are already being recognized. The intermittency of wind and sun induces a lower load factor for technologies exploiting those energy sources, meaning that for producing the same amount of electricity, more installed capacity will be needed, that could lead to overcapacity in certain circumstances, as electricity is hard to store. This happens in cases of strong wind and high sunshine. Maintenance and grid management for stability will be more challenging as the share of intermittent sources is increasing. Furthermore, when the production is non-dispatchable, storage solutions might be needed, increasing the overall costs. Therefore biopower is complementary with the long-term power system development marked by increased share of intermittent power production.

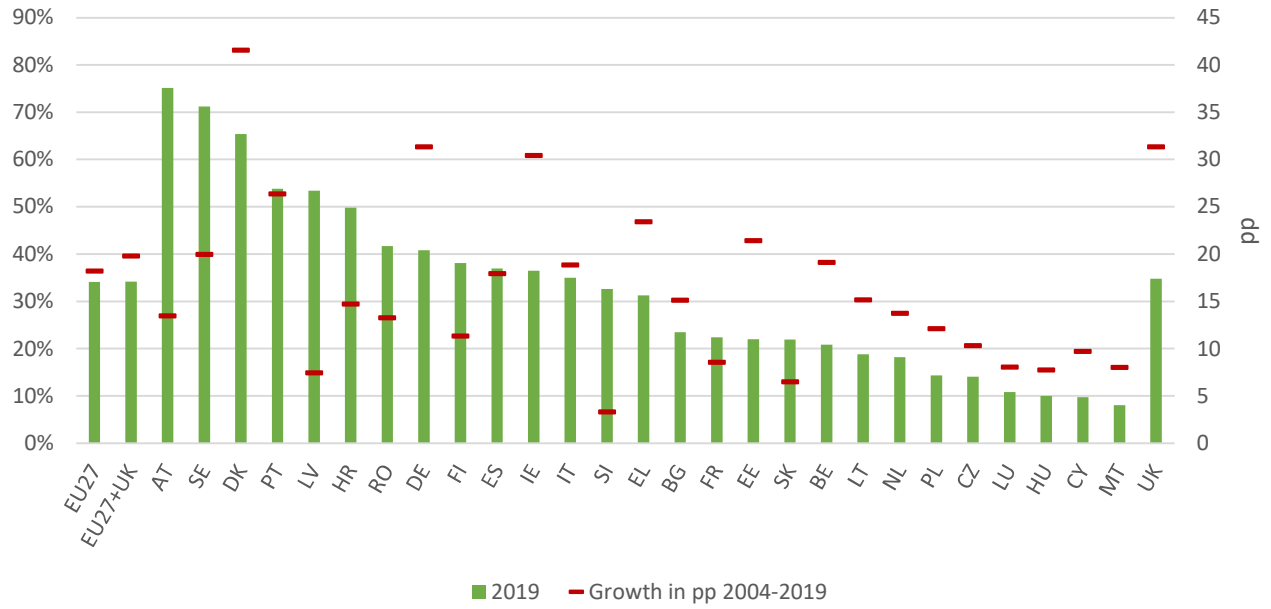
Figure 6 Evolution of the gross final consumption of electricity and gross final consumption of electricity from renewable sources in EU27 and EU27+UK (ktoe)*



** Gross final consumption of electricity is calculated according to the methodology established by Directive 2009/28/EC and Regulation (EC) No 1099/2008.*
Source: *Eurostat, SHARES 2019*

The renewable energy share in the power sector keeps growing steadily for the past years reaching a share of 34% for 2019. The share of renewables in the amount of electricity gross final consumption more than doubled between 2004 and 2018 (from 14,3% in 2004 to 34,3% in 2019), being the sector where renewables have experienced the largest increase. Bioenergy comes with a respectable share of 16% among renewables for EU27.
Yet, Figure 6 also shows there is still a large gap to be filled to achieve 100% renewable electricity; further efforts are needed, such as an increased Carbon price in the ETS or a phase-out of direct and indirect subsidies to fossil fuels. Today and in the near future, electrification is by no means equal to decarbonisation at the EU27 scale.

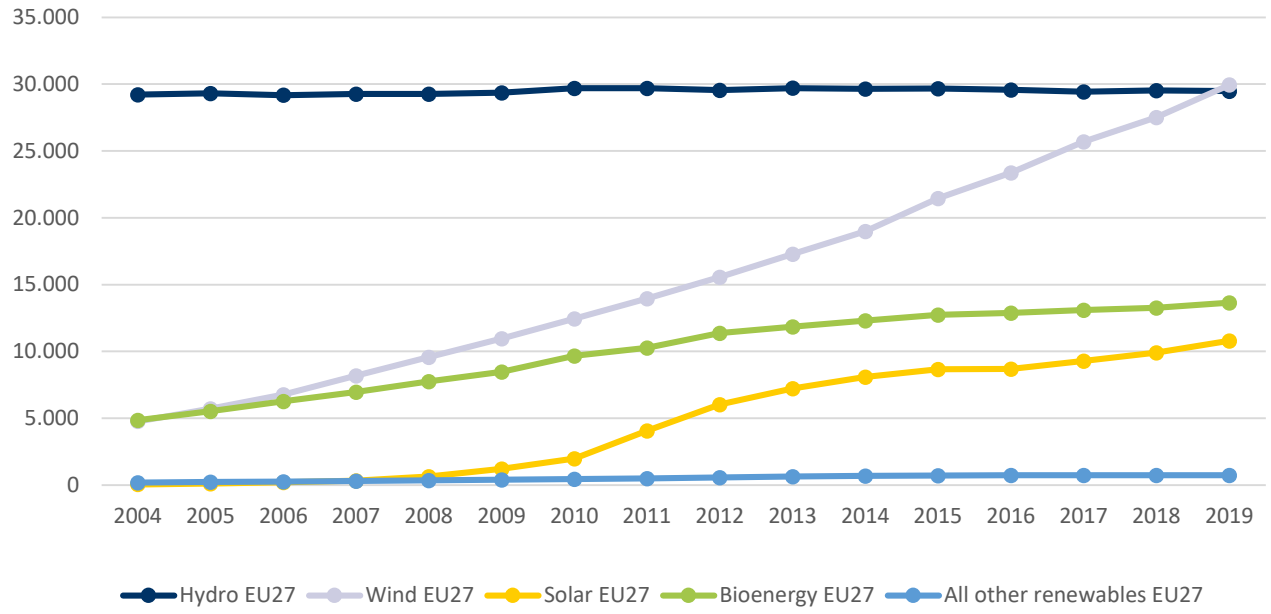
Figure 7 Share of renewables in gross final consumption of electricity* in EU Member States and UK in 2019 (%) and growth of this share between 2004 and 2019 (in percentage points)



** Calculated according to the methodology established in Directive 2009/28/EC and also Regulation (EC) No 1099/2008.*
***Source:** Eurostat, SHARE 2019 (with wind and hydro normalised and pumped hydro excluded)*

As Figure 7 shows, there are still significant divergences between Member States with respect to the deployment of renewable electricity in Europe. Austria, Sweden, Denmark, and Portugal are leading for the share of renewables in gross final consumption of electricity. Hydropower is the main contributor for Austria and Sweden, while it is wind power for Denmark and Portugal (Cf Table 4). Bioelectricity also has an important role in these four countries as it represents their second or third main source of renewable electricity. Denmark, Finland, and Estonia have the biggest share of bioenergy (Cf Table 4) among renewables, 20%, 19% and 17%, respectively. It has to be noted that Figure 7 expresses the contribution of renewables in relative terms; in absolute terms the top countries producing the most renewable electricity are Germany, France, Italy, Spain, Sweden, and Austria (Cf Table 4).

Figure 8 Evolution of gross final consumption of electricity from renewable sources* in EU27 and EU27+UK between 2004 and 2019 (ktoe)



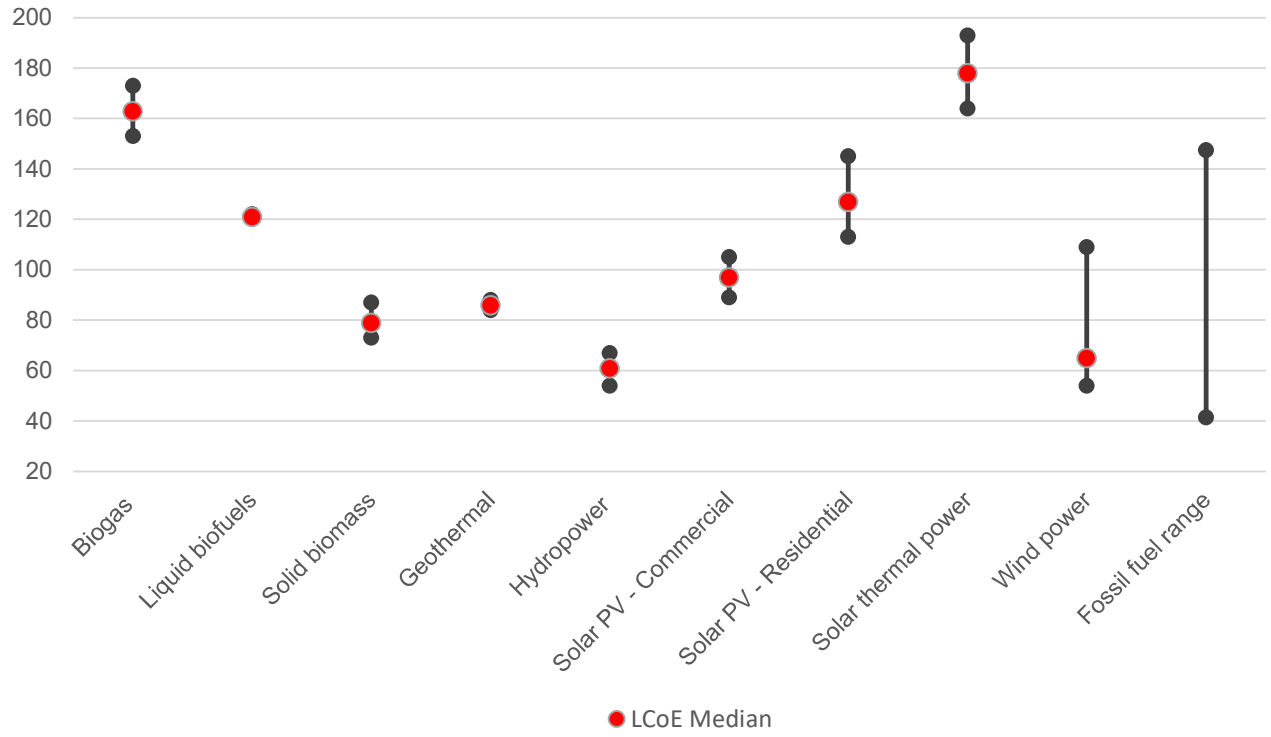
** Calculated according to the methodology established on Directive 2009/28/EC and also Regulation (EC) No 1099/2008.*
***Note:** Wind and hydro are normalised to smoothen the annual changes due to weather conditions – that is the reason why the data is not exactly matching the one presented in table 4.More information about normalised production is available in the SHARES Tool Manual.*
Solar include both solar PV and concentrated solar plants. All other renewables include electricity generation from geothermal and tide, wave & ocean.
***Source:** Eurostat, SHARES 2019, and Bioenergy Europe's calculations*

The fast growth of wind farms has resulted in slightly overpassing the hydro power plants in 2019. Renewable electricity sources like wind and solar lead the growth in the power sector, but because of their variable nature, they require flexible and dispatchable electricity generation to complement them. Bioenergy power plants (solid, liquid, or gaseous) can serve as baseload units or, most crucial, as peak load units and provide stability to the grid. The grid stability is of great importance when variable energy sources (wind and solar) are in high shares.

It is also interesting to note the decentralisation trend of energy production, which allows the consumer to be put at the centre of the energy system. Not only in the heat sector, where decentralised production of bioheat has an important role to play, but also in the electricity sector where micro- and medium-scale CHP can play an important role in empowering citizens and other electricity consumers in the fight against climate change.

In the years to come, the role of dispatchable and flexible sources of electricity such as bioenergy, will be increasingly important to bring stability to electricity grids and facilitate the fast deployment of other variable sources of renewable electricity.

Figure 9 Levelised cost of electricity for different renewable technologies compared with the range cost for fossil fuel technologies (€/MWh).



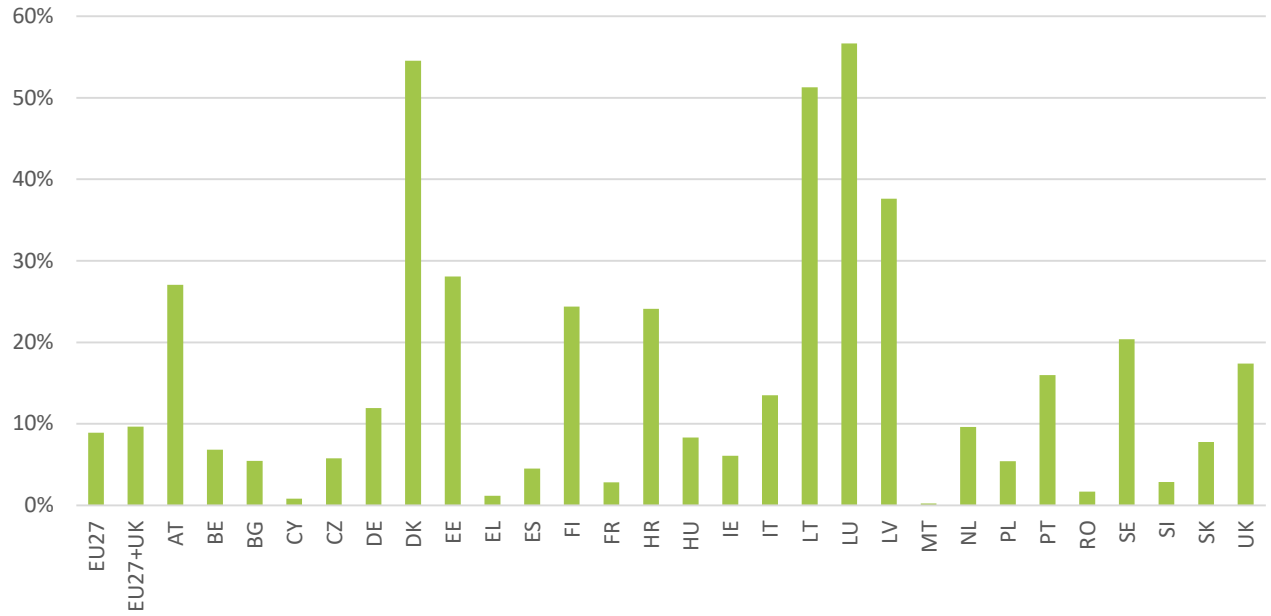
Source: *Eurobserver 2018 (for renewables) and Irena (for the range of fossil fuel costs)*

Figure 9 shows that bioelectricity is competitive. Indeed, generally the LCOEs of bioelectricity technologies are in the range of fossil fuels, except for biogas technologies where cost reductions are expected. It has to be noted that the range of cost for biomass technologies may be in reality very large (more than what is shown in Figure 9) depending on the technologies, feedstock and geographical conditions considered. The limitations of LCOE should also be acknowledged: while it allows for a simple comparison of technologies with varied features, it does not cover the "how, when and where" of electricity production, which in turn means that the utility of the produced electricity is not considered, there is no distinction between units that are flexible and dispatchable (able to adapt their production to the actual needs of the grid), nor the place of production (grid connection and losses). Furthermore, none of the social and environmental externalities are included in the LCOEs which would lead to a decrease of the performance of the fossil fuel technologies. Additionally, the levelized cost of electricity does not consider the potential valuation of heat within CHP plants which would lead to more advantageous results.

Considering these limits of the LCOEs, the analysis leads to even better results for bioelectricity technologies as they use renewable fuels and are flexible, dispatchable technologies. Additionally, they generally value heat with co-generation plants.

2. Bioelectricity in Europe

Figure 10 Share of biomass fuels within the fuel inputs for electricity generation considering conventional thermal energy sources* and biomass fuels per country in 2019



**i.e. fossil fuels, nuclear and non-renewable waste inputs.*
Source: *Eurostat*

In Luxemburg, Denmark and Lithuania, biomass fuels represent more than 50% of all conventional thermal sources used for electricity production (i.e. not considering wind, hydro, solar, and tide, wave, ocean and geothermal). Luxembourg imports most of its electricity, and thus has low total fuels inputs for electricity generation. In Denmark, Lithuania and Latvia 100% of the bioelectricity is produced from CHP. Latvia's percentage is high because hydro is not accounted and is a large part of their electricity generation.

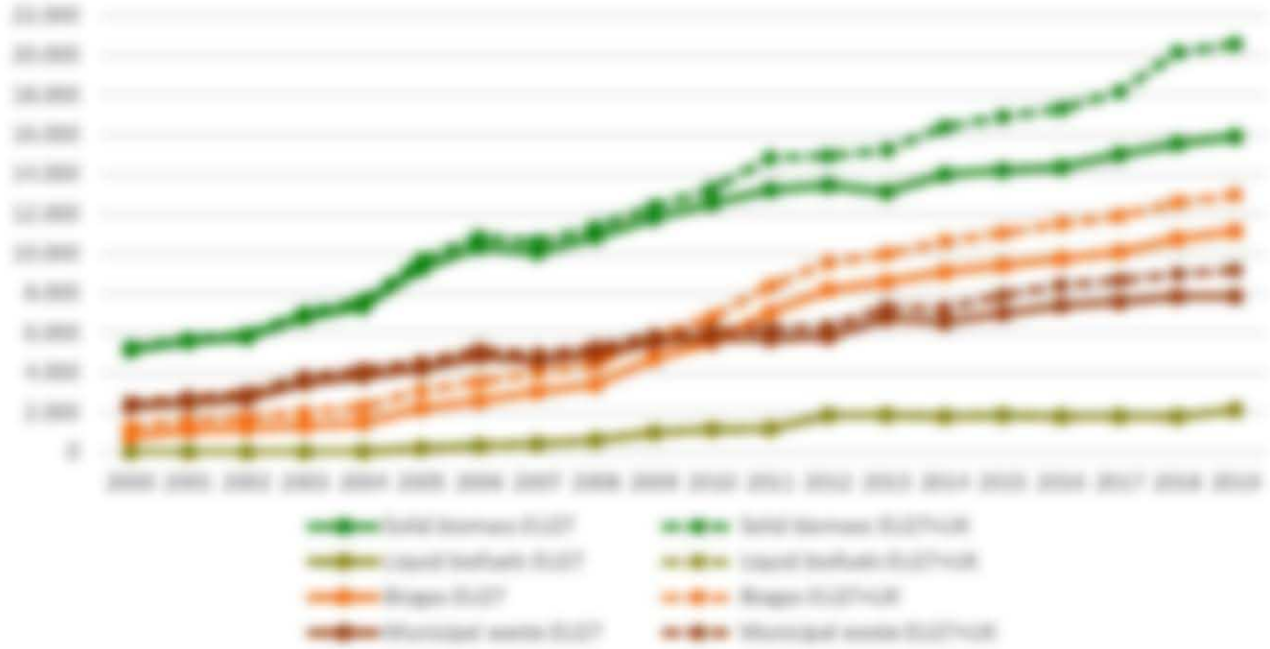
Table 7 Fuels inputs for bioelectricity generation in EU Member States and UK in 2019 (ktoe)

	Total Biomass	Solid biomass	Biogas	Renewable municipal waste	Liquid biofuels
EU27	42.605	23.448	10.404	7.791	1.043
EU27+UK	50.719	28.221	12.581	8.875	1.043
AT	1.265	909	177	169	0
BE	1.193	666	134	372	20
BG	552	495	44	14	0
CY	8	0	8	0	0
CZ	1.190	689	432	69	0
DE	10.936	3.019	5.649	2.178	91
DK	2.040	1.452	133	461	0
EE	548	518	5	25	0
EL	108	19	90	0	0
ES	1.425	1.174	198	251	3
FI	2.868	2.533	77	257	1
FR	3.308	1.561	841	1.084	0
HR	296	215	82	0	0
HU	624	510	59	56	0
IE	213	77	40	96	0
IT	5.421	1.759	1.936	873	910
LT	235	187	30	18	0
LU	106	81	12	14	0
LV	343	271	72	0	0
MT	1	0	1	0	0
NL	1.819	815	129	875	0
PL	1.860	1.405	256	49	1
PT	902	710	73	118	1
RO	162	153	9	0	0
SE	4.494	3.675	8	796	15
SI	73	51	21	0	1
SK	468	333	119	16	0
UK	8.034	4.773	2.177	1.084	0

Source: Eurostat

Solid biomass represents 55% of the fuel inputs for bioelectricity in the EU27 in 2019, followed by biogas (24%) and renewable waste (18%). Romania (95%), Estonia (94%) and Bulgaria (90%) share the top three countries among EU27 with highest solid biomass shares for bioelectricity.

Figure 11 Evolution of electrical capacity from biomass plants by type in the EU27 and UK (in MW)



Source: Eurostat

Following the adoption of the first Renewable Energy Directive, bioelectricity increased over the last decade, with particularly strong growth rates for biogas and solid biomass. Future growth trends of bioelectricity may be incentivized by the combined effect of the coal phase out strategies, and increasing need for the clean and dispatchable generation capacities, needed to stabilise the energy system increasingly dependent on intermittent RES. One the other hand, factor undermining the growth of bioelectricity may be lack of legal certainty concerning EU's sustainability policy.

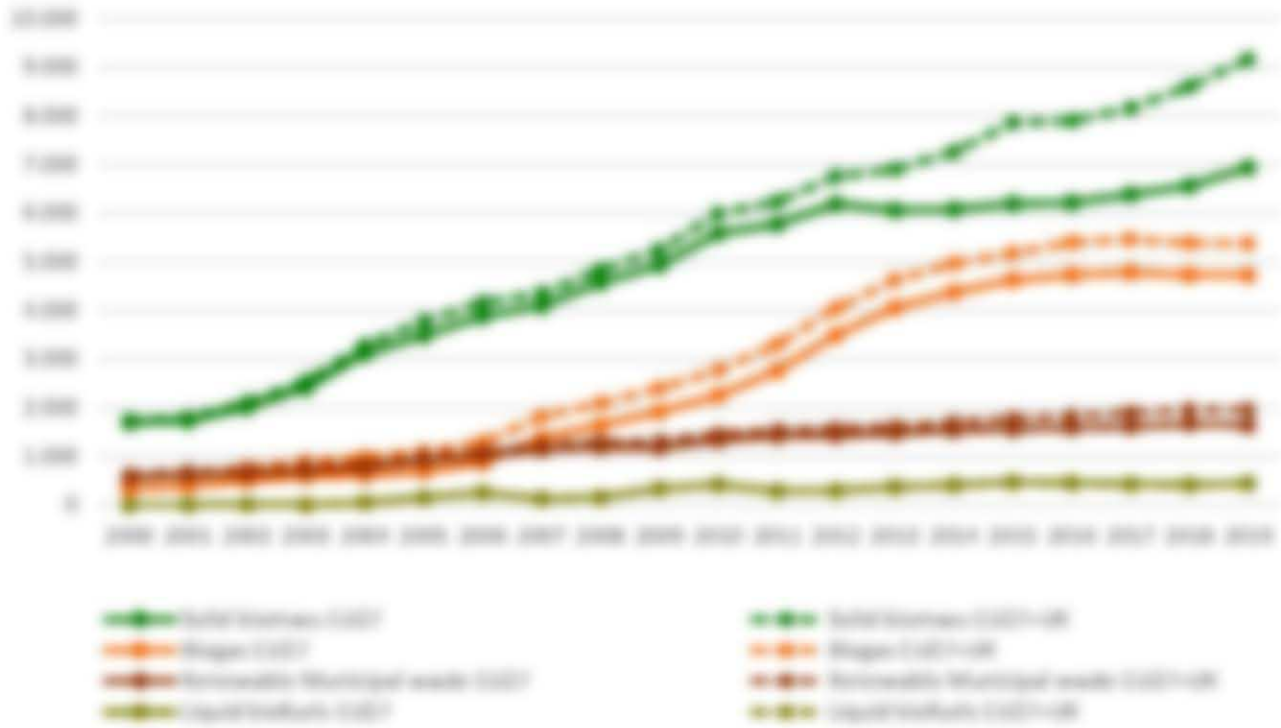
Table 4 Electricity capacity from biomass plants by type in EU Member States and UK in 2019 (in MWE) with average EU Member States and UK load factor

	Total biomass	Solid biomass	Biogas	Municipal waste	Liquid biofuels
EU27	**37.038**	**23.912**	**11.138**	**7.860**	**2.128**
Growth rate (2018-2019)	3,0%	2,3%	3,6%	0,1%	16,8%
Load factor	48%	58%	56%	38%	28%
EU27+UK	**84.861**	**35.585**	**12.969**	**9.182**	**2.128**
Growth rate (2018-2019)	3,1%	2,3%	3,1%	2,3%	16,8%
Load factor	48%	59%	55%	38%	28%
AT	1.521	813	164	543	1
BE	1.032	539	197	252	45
BG	57	24	33	0	0
CY	13	0	13	0	0
CZ	857	494	268	55	0
DE	11.072	1.405	7.068	2.168	231
DK	2.163	1.687	119	357	0
EE	358	180	4	170	0
EL	88	13	75	0	0
ES	1.241	723	271	241	4
FI	2.106	1.963	5	138	0
FR	2.262	874	535	849	3
HR	127	76	52	0	0
HU	498	374	79	45	0
IE	149	7	59	83	0
IT	3.832	728	1.362	791	948
LT	112	63	35	14	0
LU	65	35	12	17	0
LV	108	97	61	0	0
MT	1	0	1	0	0
NL	1.339	232	199	776	0
PL	1.055	702	210	91	0
PT	743	590	72	82	0
RO	139	119	20	0	0
SE	5.866	3.834	2	1.135	895
SI	60	34	25	0	1
SK	232	138	82	12	0
UK	7.826	4.673	1.832	1.321	0

Note: electrical capacities (from CHP units are included – considering the net maximum electrical capacity (from European definitions). Municipal waste: installed capacity could also include non-renewable municipal waste.

Source: Eurostat

Figure 12 Evolution of the gross electricity generation from biomass by type in the EU27 and UK (ktoe)



Source: Eurostat

Biogas used for electricity is flattening, while its other uses are increasing, mainly its final consumption in the industrial and agricultural sectors but also in commercial & public services. This plateau corresponds to the end of support measures to biogas-based production of electricity and to the new national targets of biogas in the heating sector or biomethane use in transport and/or injection in the natural gas grid. Solid biomass continues to grow with a rhythm of 6% per year, two times more than the two past years.

Figure 13 Gross electricity generation from biomass by type in the EU27 and UK in 2019 (ktoe)

Source: Eurostat

Table 5 Gross electricity generation from biomass in EU Member States and UK in 2019 (ktoe) with growth rate

	Total bioelectricity	Growth rate (2018-2019)	Solid biomass	Biogas	Renewable municipal waste	Liquid biofuels
EU27	13 753	1,2%	6 941	4 725	1 640	447
Share (%)	100%	/	50%	34%	12%	3%
Growth rate (2018-2019)	1,7%	/	1,7%	-0,1%	-1,6%	6,3%
EU27+UK	16 961	1,6%	9 171	5 376	1 967	447
Share (%)	100%	/	54%	32%	12%	3%
Growth rate (2018-2019)	3,5%	/	4,5%	-0,3%	0,04%	6,3%
AT	408	-1,7%	335	53	21	0
BE	451	-4,3%	263	81	80	6
BG	107	16%	100	20	4	0
CY	1	1,8%	0	1	0	0
CZ	400	4,2%	206	217	9	0
DE	4 018	-1,3%	951	2 430	499	34
DK	512	1,0%	374	55	83	0
EE	117	4,3%	108	3	4	3
EL	35	26,0%	2	32	0	0
ES	479	-5,7%	334	78	66	1
FI	3 149	3,0%	3 058	35	52	0
FR	743	3,2%	334	222	187	0
HR	76	81,5%	41	34	0	0
HU	191	-5,3%	152	27	12	1
IE	73	0,4%	30	16	28	0
IT	1 682	2,1%	965	712	204	402
LT	46	-1,8%	28	13	4	0
LU	24	27,7%	14	6	4	0
LV	80	-1,7%	49	30	0	0
MT	1	28,6%	0	1	0	0
NL	920	27,2%	244	77	178	0
PL	941	17,3%	514	98	9	0
PT	289	4,6%	236	23	30	0
RO	43	15,3%	39	1	0	0
SE	1 115	9,4%	965	1	102	3
SI	22	-6,1%	13	8	0	0
SK	146	4,2%	97	46	3	0
UK	3 208	6,8%	2 230	651	327	0

Source: Eurostat

The top 5 EU27 countries in bioelectricity production (Germany, Italy, Finland, Sweden, and France) represent 66% of the total EU27 bioelectricity generation. While in Germany and Italy the majority of bioelectricity is produced in a high number of small/medium size biogas plants, the United Kingdom has an alternative model with a limited number of large installations consuming woody biomass.

Figure 14 Share of bioelectricity generation out of total gross electricity generation in EU Member States and UK in 2019 (%)

Source: Eurostat

Figure 15 Share of gross electricity generation of conventional thermal power plants* produced from CHP and share of bioelectricity produced from CHP in 2019 in EU Member States and UK (%)

*conventional thermal power plants: plants producing electricity from gas, coal, petroleum products, nuclear and non-renewable waste.

Source: Eurostat

Most bioelectricity (70% in 2018) is generated in combined heat and power plants. This is the case for 19 of the 27 EU Member States. Spain, Hungary, and Ireland are the only countries with less than 50% of their bioelectricity produced in CHP plants. Cyprus, Lithuania, Latvia, Malta, and Sweden produce bioelectricity only in CHP plants.

In 2018, only 27% of the electricity from conventional thermal sources was generated in CHP. this number reached 72% in 2019 from 71% in 2018 for bioelectricity. This is reflecting the synergies between renewable energies and energy efficiency, and it is a clear indicator of how bioenergy is a strong promoter of energy efficiency. Indeed, it is an important contribution of biopower towards EU Energy System Integration Strategy that identifies development of a more circular energy system, as one of the main examples of sector coupling.

Bioelectricity is mostly produced in efficient CHP plants, but it is also important to recognize the role of biopower-only installations when the conditions justify it (e.g. in locations where heat is less/not needed or when retrofitting of existing installations). In fact, the form of energy needed depends strongly on the local circumstances, suggesting that rigid top-down approaches should be avoided.

In general terms, it should further be noted that CHP bioelectricity plants can apply carbon capture and storage technologies (BECCS) enabling carbon dioxide removal and making bioenergy an alternative technology for negative emissions.

Table 10 Evolution of bioelectricity generation 2000-2019 in EU Member States and UK (ktoe)

	Total bioelectricity			Bioelectricity from electricity only plants			Bioelectricity from CHP plants		
	2000	2010	2019	2000	2010	2019	2000	2010	2019
EU27	2 591	9 594	13 356	875	3 363	3 818	1 716	6 291	9 935
EU27+UK	2 629	10 448	14 182	1 179	4 271	4 721	1 750	6 377	10 239
AT	131	365	458	37	177	137	95	209	271
BE	49	364	470	33	228	220	16	156	251
BG	0	3	128	0	0	35	0	3	122
CY	0	3	5	0	0	0	0	3	5
CZ	45	186	415	14	56	4	31	130	429
DE	372	2 917	4 375	372	1 134	1 357	0	1 783	2 961
DK	112	395	507	0	0	0	112	395	512
EE	1	64	112	0	20	22	1	44	91
EL	0	16	27	0	14	5	0	2	30
ES	128	345	508	70	232	377	58	113	102
FI	743	944	1 110	56	146	102	687	798	1 011
FR	213	382	717	68	197	167	125	185	176
HR	0	3	57	0	0	3	0	3	73
HU	4	197	197	4	170	141	4	28	50
IE	8	27	70	8	23	67	0	4	4
IT	120	812	1 447	64	532	776	56	280	906
LT	0	13	47	0	0	0	0	13	46
LU	2	7	19	2	2	4	0	5	15
LV	0	6	81	0	1	0	0	5	80
MT	0	0	1	0	0	0	0	0	1
NL	171	606	992	107	255	77	65	350	915
PL	19	542	563	3	21	134	16	521	526
PT	111	225	271	23	90	141	89	135	149
RO	0	10	38	0	4	6	0	1	37
SE	852	1 048	1 024	0	0	0	852	1 048	1 131
SI	6	19	23	0	1	0	6	18	21
SK	0	57	140	0	0	12	0	57	134
UK	138	1 054	1 615	304	969	1 904	35	86	304

Source: Eurostat

Germany, Italy, and Sweden are taking the first three positions among EU27 countries with the biggest growth for total bioenergy in absolute figures, while we see the highest proportional increase in Croatia, Slovakia, and Bulgaria since 2000. 76% of the increase in bioelectricity between 2000-2019 corresponds to productions in CHP plants. This trend confirms the importance of sound regulatory framework, which in this case of art. 29 (11) of Renewable Energy Directive, incentivized use of biomass in highly efficient facilities. This is common for all the countries, besides the UK, in which bioelectricity growth was driven by power-only installations. For the same period, Germany, Spain, and Italy had the biggest growth in absolute figures from bioelectricity deriving wholly from power plants. At the same time, Estonia, Hungary, and Poland had the biggest growth in relevant figures. Finally, in regard to the bioelectricity from CHP plants, it was Germany that had the biggest growth in both absolute and relevant figures since 2000. Italy and Sweden follow for absolute figures, and Hungary with Slovakia for relative figures.

The Italian and German growths are mainly due to the increase in biogas capacities. The Polish increase is attributed to solid biomass capacities that are predominant (retrofitted, upgraded or new units). Some other countries with no significant bioelectricity production in 2000, such as Estonia, Croatia, or Hungary, are now producing between 0.1% and 17.9% of their electricity from biomass (1 Figure 14), mainly on solid biomass (Estonia (92%) and Hungary (80%) or biogas (Croatia). All the countries mentioned above have seen their solid fossil fuels (oil shales & oil sands for Estonia) consumption decreased (compared with 2010) alongside with the increase of bioelectricity and other renewables. However, electricity generation from natural gas in 2019 is still significant (except for Estonia and Sweden) and often

higher than its 2000 level – explaining its current importance in the electricity footprint (cf Figure 4) and showing the need for clean and dispatchable units, such as bioelectricity, in the transition to a low-carbon electricity grid.

Table 11: 2030 Bioelectricity projection according to the National Energy and Climate Plans (NECPs) in the EU27 Member States (blue) and growth rate between 2019 and 2030 (%)

	Total bioelectricity in 2019	Total bioelectricity in 2030	Absolute change	Growth rate
AT	408	478	70	17%
BE	451	247	-203	-45%
BG	157	140	-17	-11%
CY	3	n.a.	n.a.	n.a.
CZ	433	397	-36	-8%
DE	4.918	3.412	-706	-14%
DK	512	601	89	17%
EE	117	103	-14	-12%
EL	35	136	103	296%
ES	479	997	518	108%
FI	1.143	1.376	233	20%
FR	743	n.a.	n.a.	n.a.
HR	76	105	30	39%
HU	191	286	95	50%
IE	73	n.a.	n.a.	n.a.
IT	1.682	1.350	-332	-20%
LT	46	82	36	78%
LU	24	31	7	31%
LV	80	n.a.	n.a.	n.a.
MT	1	1	1	105%
NL	559	n.a.	n.a.	n.a.
PL	661	1.365	704	107%
PT	269	631	362	134%
RO	43	77	34	79%
SE	1.121	1.376	255	23%
SI	22	50	28	132%
SK	146	218	73	50%

Note: n.a. means that this information is not available because the final NECPs of those countries is not yet available and their draft NECPs do not give details for bioelectricity or that this information is not available in the final NECP.
Source: Eurostat, NECPs

It should be noted that Belgium, Bulgaria, Czech Republic, Germany, Estonia, and Italy foresee a decrease in total bioelectricity generation for 2030. On the other hand, the highest increase is expected to be seen in Poland, Spain, and Portugal.

Figure 14 EU27 projection for bioelectricity for 2030 based on the NECPs (blue)

Note: for the countries with no data available (NECPs not yet public or no details about bioelectricity), the average growth rate obtained with the data available was applied. A linear trend was applied for the visualisation of the evolution to the 2030 objective according to NECPs, but this is not necessarily representative of the implementation plans of the Member States.
Source: Eurostat, NECPs and Bioenergy Europe assumptions

Projections show that bioelectricity should reach nearly 11 Mtoe by 2030 in the EU27. The steep rise of bioelectricity during the past decade and the steady growth during this decade clearly demonstrates that Member States are relying on bioelectricity to reach their RES target. An overall increase of around 1,3 Mtoe is foreseen in the next decade for EU27 (+13%). This confirms that Member States are counting on bioelectricity to be part of the future electricity mix and to play a key role in enabling higher intermittent renewable technology penetration rate.

3. Annexes

Table 12 Country codes

EU27	European Union (27 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 13 Symbols and abbreviations

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

Table 14 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 15 Table 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

BIOENERGY EUROPE STATISTICAL REPORT 2021

Supported by:

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