BIOENERGY EUROPE
STATISTICAL REPORT 2022

REPORT
BIOELECTRICITY

Bioenergy EUROPE

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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-27 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-27 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.

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.

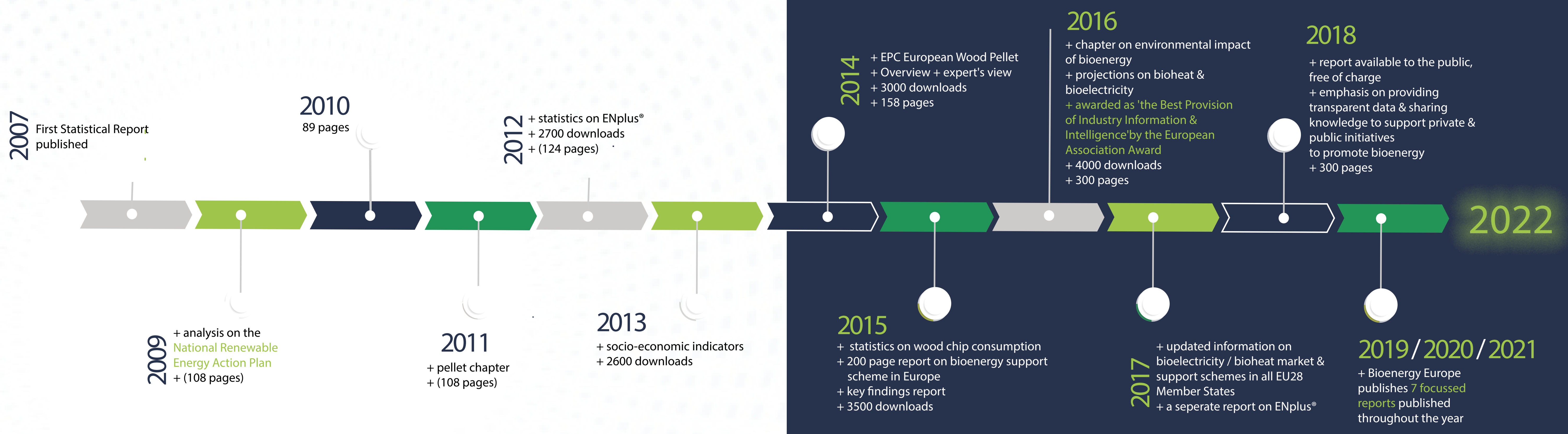
Our vision

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 support to advocacy at a 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 8 active working groups:

- Agro-biomass;
- Competitiveness;
- Domestic Heating;
- Pellets;
- Sustainability;
- Wood Supply;
- Task Force Carbon Removal;
- Task Force National Advocacy.

Certification Schemes

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

EN plus®

SURE
SUSTAINABLE RESOURCES
Verification Scheme GmbH

Networks

EUROPEAN PELLET COUNCIL
A NETWORK OF BIOENERGY EUROPE

INTERNATIONAL BIOMASS TORREFACTION COUNCIL
A NETWORK OF BIOENERGY EUROPE

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 17 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 20 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 to help to overcome barriers of market deployment.

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

Companies

*Members as of June 2022.

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

Bioelectricity

Trusted.
Independent.
Committed.

Assuring the safety, quality and sustainability of renewable energy

We have extensive experience in testing and inspection services for solid biofuels and biogas – for clients delivering to industrial users – for power generation, as well as commercial and residential users – for heat.

Testing

Solid biofuels:

- Moisture
- Proximate analysis
- Ultimate analysis
- Calorific values
- Halogens
- Major Elements (MAA)
- Minor Elements (Trace)
- Mechanical durability
- Bulk density
- Biomass content
- Length & diameter
- Particle size distribution
- Ash melting behaviour (AFT's)
- DNA (Rice husk)

Biogas:

- Gas composition
- Critical components analysis including sulphur, silica and chlorine
- Oil condition monitoring

Inspection

Our experienced and certified experts offer a full range of proactive inspection, fumigation and stock monitoring services to help you identify and manage operational risks, and ensure quality and quantity of your cargo as well as its compliance with local and international regulations. You can trust SGS to be your representative in any port and every location, worldwide.

Audit and certification

Our audit and certification services cover the entire value chain, from product certification to process and systems certification, helping you demonstrate your excellent operating standards to your clients. Our specialists conduct Chain of custody certification (CoC), ENplus®, ISCC Plus, sustainability report assurance, GHG and environmental impact assessments, carbon credit certification, EUTR DD and more.

We are SGS – the world's leading testing, inspection and certification company. We are recognized as the global benchmark for quality and integrity.

Both in the field and in the laboratory, we deliver unrivalled solutions along the entire value chain to help our customers ensure transparency, demonstrate compliance, improve quality and maximize profits.

Contact us

naturalresources@sgs.com

www.sgs.com/naturalresources

SGS Natural Resources

WHEN YOU NEED TO BE SURE

SGS

SYNCRAFT®

Climate Positive Solutions.

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 climate-positive 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 bene cial manner. Our initially CO_2-neutral power plant thus becomes a CO_2-negative "reverse power plant".

www.syncraft.at

SURE

SUSTAINABLE RESOURCES
Verification Scheme GmbH

SURE enables all economic operator 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 accordance with the principles of the European Energy Directive (RED II) and enables all economic operators within the bioenergy sector to demonstrate compliance RED II requirements.

Interested to learn more? Visit our website:
www.sure-system.eu

ELETTRICITÀ FUTURA
imprese elettriche italiane

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.

www.elettricitafutura.it

Bioenergy EUROPE

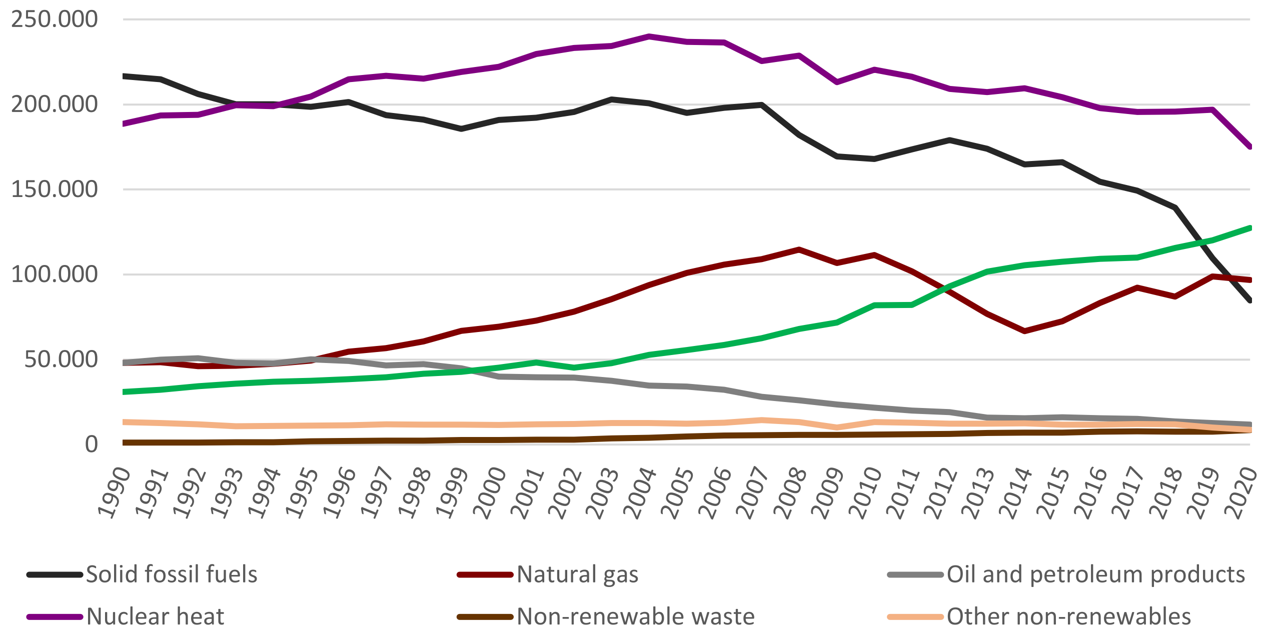
1. Electricity and renewable electricity in Europe

The coronavirus pandemic made the second quarter of 2020 an exceptionally challenging period for the electricity markets. Widespread lockdown measures suddenly reduced energy demand and electricity consumption dropped by 11% in the EU27 compared to same period in 2019.

Renewables overtook fossil fuels as EU's main power source already in 2019, as a result of a standing increase in the last decade. Stronger climate policies and the positive effects of the EU ETS are supporting the faster decarbonization of the power mix, but faster deployment of renewables is needed to reach carbon neutrality. Electricity generated from coal or nuclear has been decreasing since 2003 while the input of gas has been increasing since 2014. The use of coal has experienced a remarkable decrease, falling by 20%, between 2019 and 2020, this is partly attributed to the growth of renewables but also due to the falling energy demand that followed the COVID crisis.

Figure 1 shows that the progressive phase out of coal in the last decade has not been entirely replaced by renewables but also by natural gas which increased by 48.740 ktoe between 2000 and 2020. Unfortunately, natural gas has been considered as a transitional source and less harmful than coal and has therefore gained acceptance among both citizens and policymakers. While most countries decreased their use of oil and coal for electricity production between 2019 and 2020, the contribution of natural gas increased in 18 Member States. It should be noted that the increase of gas consumption in Europe goes hand in hand with an increasing energy dependency as natural gas has the second-highest import dependency rate after oil with 83.6% in 2020. Indeed, in 2021, the EU imported more than 40% of its total gas consumption, around 27% of oil imports and approximately 46% of coal imports from Russia. Energy represented 62% of EU total imports from Russia, and cost 99 billion €.

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



Note: Fuels inputs for electricity consider all the fuels used to produce 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 1990-2020 in EU27 (ktoe)

	1990	2020	Absolute change	Growth rate (1990-2020)
Total	546.555	512.855	-33.700	-6%
Solid fossil fuels	216.614	84.717	-131.897	-61%
Oil and petroleum products	47.976	11.748	-36.228	-76%
Natural gas	48.024	96.764	48.740	101%
Nuclear heat	188.580	175.101	-13.479	-7%
Non-renewable waste	1.149	8.486	7.337	639%
Other non-renewables	13.270	8.678	-4.592	-35%
Renewables	30.941	127.361	96.420	312%

Source: Eurostat

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	66.225	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	13%
Nuclear	193.821	98%	3.107	2%	196.928	0,1%
Non-renewable waste	2.625	34%	5.009	66%	7.635	-1%
Other non-renewable	6.185	61%	3.912	39%	10.098	-34%
Renewables	89.206	74%	30.899	26%	120.105	4%
Hydro	29.777	100%	/	/	29.777	1%
Geothermal	5.758	100%	/	/	5.758	0,4%
Wind	34.172	100%	/	/	34.172	24%
Solar thermal	1.960	100%	/	/	1.960	3%
Solar photovoltaic	11.973	100%	/	/	11.973	26%
Tide, wave, ocean	43	100%	/	/	43	4%
Solid biomass	5.826	24%	18.413	76%	24.239	9%
Biogas	2.832	27%	7.743	73%	10.575	2%
Municipal waste renewable	2.431	31%	5.410	69%	7.841	1%
Bioliquids	558	55%	463	45%	1.021	6%
TOTAL	410.146	74%	145.559	26%	555.704	-3%

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 fuel inputs exclude the production from pumped hydro.
Source: Eurostat

Table 3 Fuels inputs for electricity generation in EU27 Member States and UK* in 2020 (ktoe)

	Total	Solid fossil fuels	Oil and petroleum products	Gas	Nuclear	Other non-renewables	Wastes (non-renewable)	Renewables	Total Biomass
EU27	512.855	84.717	11.748	96.764	175.101	8.678	8.486	127.361	44.069
AT	8.692	130	206	1.916	0	420	342	5.678	1.311
BE	16.436	8	16	4.087	8.370	685	482	2.788	1.272
BG	9.589	3.564	56	676	4.295	12	1	985	489
CY	991	0	937	0	0	0	0	54	8
CZ	19.554	8.493	32	1.280	7.496	503	58	1.692	1.253
DE	98.505	30.326	998	17.539	16.577	2.126	2.467	28.472	11.157
DK	5.033	687	72	264	0	0	380	3.630	2.160
EE	1.559	0	6	6	0	844	25	678	593
EL	7.642	1.664	1.179	3.197	0	0	10	1.592	125
ES	42.520	1.461	2.159	10.663	15.174	148	346	12.569	1.785
FI	12.741	650	56	774	5.548	860	198	4.655	2.619
FR	115.114	823	1.164	5.874	92.211	515	1.129	13.398	3.361
HR	1.990	256	7	722	0	0	0	1.005	310
HU	7.733	932	11	1.699	4.018	84	77	912	611
IE	4.498	188	108	2.562	0	229	93	1.318	239
IT	50.562	3.360	3.499	23.954	0	439	878	18.432	5.438
LT	1.027	0	20	335	0	186	57	429	398
LU	289	0	0	57	0	0	21	211	160
LV	949	0	0	371	0	0	0	578	339
MT	363	0	24	318	0	0	0	21	1
NL	19.718	1.525	324	11.094	956	542	753	4.524	2.513
PL	33.851	25.797	378	2.918	0	742	230	3.786	2.079
PT	7.531	556	240	3.187	0	0	91	3.457	1.015
RO	10.385	2.723	147	2.351	2.887	39	0	2.238	169
SE	25.965	1	42	32	12.028	261	820	12.781	4.099
SI	3.134	973	3	117	1.497	0	10	535	78
SK	6.482	601	64	770	4.044	45	17	941	487
UK	53.309	1.748	409	20.944	13.253	1.262	505	15.188	8.034

*UK data for 2019
Source: Eurostat

Table 4 Fuels inputs for electricity generation in EU27 Member States and UK* in 2020 (%)

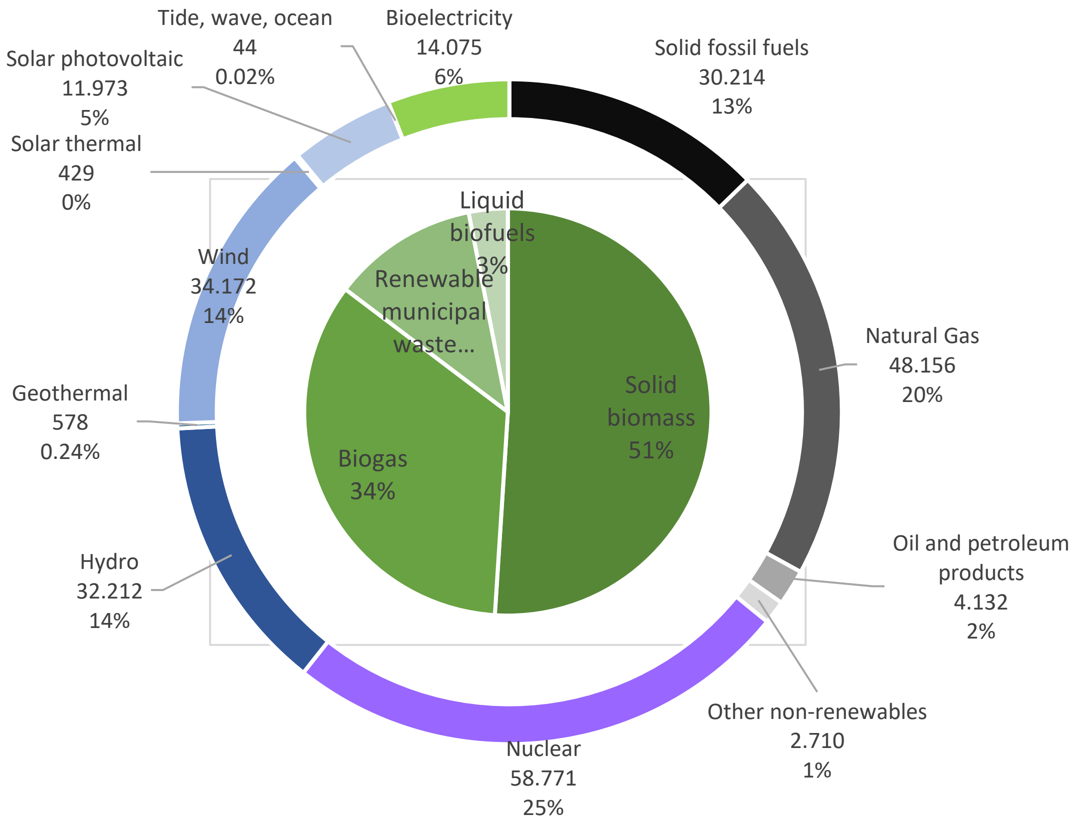
	Solid fossil fuels	Oil and petroleum products	Gas	Nuclear	Other non-renewables	Wastes (non-renewables)	Renewables	Total Biomass
EU27	16,5%	2,3%	18,9%	34,1%	1,7%	1,7%	24,8%	8,6%
AT	1,5%	2,4%	22,0%	0,0%	4,8%	3,9%	65,3%	15,1%
BE	0,0%	0,1%	24,9%	50,9%	4,2%	2,9%	17,0%	7,7%
BG	37,2%	0,6%	7,0%	44,8%	0,1%	0,0%	10,3%	5,1%
CY	0,0%	94,6%	0,0%	0,0%	0,0%	0,0%	5,4%	0,8%
CZ	43,4%	0,2%	6,5%	38,3%	2,6%	0,3%	8,7%	6,4%
DE	30,8%	1,0%	17,8%	16,8%	2,2%	2,5%	28,9%	11,3%
DK	13,6%	1,4%	5,2%	0,0%	0,0%	7,6%	72,1%	42,9%
EE	0,0%	0,4%	0,4%	0,0%	54,1%	1,6%	43,5%	38,0%
EL	21,8%	15,4%	41,8%	0,0%	0,0%	0,1%	20,8%	1,6%
ES	3,4%	5,1%	25,1%	35,7%	0,3%	0,8%	29,6%	4,2%
FI	5,1%	0,4%	6,1%	43,5%	6,7%	1,6%	36,5%	20,6%
FR	0,7%	1,0%	5,1%	80,1%	0,4%	1,0%	11,6%	2,9%
HR	12,9%	0,4%	36,3%	0,0%	0,0%	0,0%	50,5%	15,6%
HU	12,1%	0,1%	22,0%	52,0%	1,1%	1,0%	11,8%	7,9%
IE	4,2%	2,4%	57,0%	0,0%	5,1%	2,1%	29,3%	5,3%
IT	6,6%	6,9%	47,4%	0,0%	0,9%	1,7%	36,5%	10,8%
LT	0,0%	1,9%	32,6%	0,0%	18,1%	5,6%	41,8%	38,8%
LU	0,0%	0,0%	19,7%	0,0%	0,0%	7,3%	73,0%	55,4%
LV	0,0%	0,0%	39,1%	0,0%	0,0%	0,0%	60,9%	35,7%
MT	0,0%	6,6%	87,6%	0,0%	0,0%	0,0%	5,8%	0,3%
NL	7,7%	1,6%	56,3%	4,8%	2,7%	3,8%	22,9%	12,7%
PL	76,2%	1,1%	8,6%	0,0%	2,2%	0,7%	11,2%	6,1%
PT	7,4%	3,2%	42,3%	0,0%	0,0%	1,2%	45,9%	13,5%
RO	26,2%	1,4%	22,6%	27,8%	0,4%	0,0%	21,6%	1,6%
SE	0,0%	0,2%	0,1%	46,3%	1,0%	3,2%	49,2%	15,8%
SI	31,0%	0,1%	3,7%	47,8%	0,0%	0,3%	17,1%	2,5%
SK	9,3%	1,0%	11,9%	62,4%	0,7%	0,3%	14,5%	7,5%
UK	3,3%	0,8%	39,3%	24,9%	2,4%	0,9%	28,5%	15,1%

*UK data for 2019
Source: Eurostat

72% of the electricity production still comes from fossil fuels and nuclear; this share is more than 85% in certain countries, such as Bulgaria, Cyprus, Czech Republic, Hungary, France, Malta, Poland, and Slovakia. 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 largest users of coal for electricity generation: together they represent more than 60% of the EU27 solid fossil fuels input for electricity. Italy, Spain, and France are the biggest users of petroleum products for electricity generation. To reduce the carbon footprint of their electricity supply, the aforementioned 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 combined heat and power (CHP) when relevant. The country with the highest share of biomass in their electricity production is Luxembourg (55%), followed by Denmark (43%), Lithuania (39%) and Estonia (38%).

Renewables generated 39% of the 27 Member States' electricity in 2020, beating fossil fuels which accounted for 36%. For some countries, renewable electricity generation represents close or more than two thirds of their electricity, for example in Luxembourg (89%), Denmark (82%), Austria (81%), Sweden (68%), Croatia (65%), and Latvia (64%).

Figure 2 Gross electricity generation by product type in the EU27 in 2020 (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 decreased by 4% between 2019 and 2020 as electricity demand dropped in 2020 due to the impact of the Covid-19 along with the resulting lockdown measures and their impact on the energy system. Nevertheless, the extraordinary situation led to an increase on the share of renewables due to depressed electricity demand, low operating costs and priority access to the grid through new regulation. In 2020, renewable electricity generation increased by 8% in comparison with the previous year, particularly due to the increased production of wind and solar. Nevertheless, the pandemic challenged grid operators who had to manage increased volumes of intermittent renewable energy in a low-demand environment with fewer thermal power plants online to call upon for grid stability. Increasing production of power with intermittent sources could cause the risk of grid instability if not perfectly balanced with base load sources like biomass. The largest absolute producers of bioelectricity in EU are Germany (4.373 ktoe), Italy (1.704 ktoe), and Finland (996 ktoe). The three EU member countries with the highest share of bioelectricity production among renewables are Estonia (65%), Czech Republic (45%) and Hungary (39%).

Table 5 Gross electricity generation from all sources and from renewables in EU27 Member States and UK* in 2020 (ktoe)

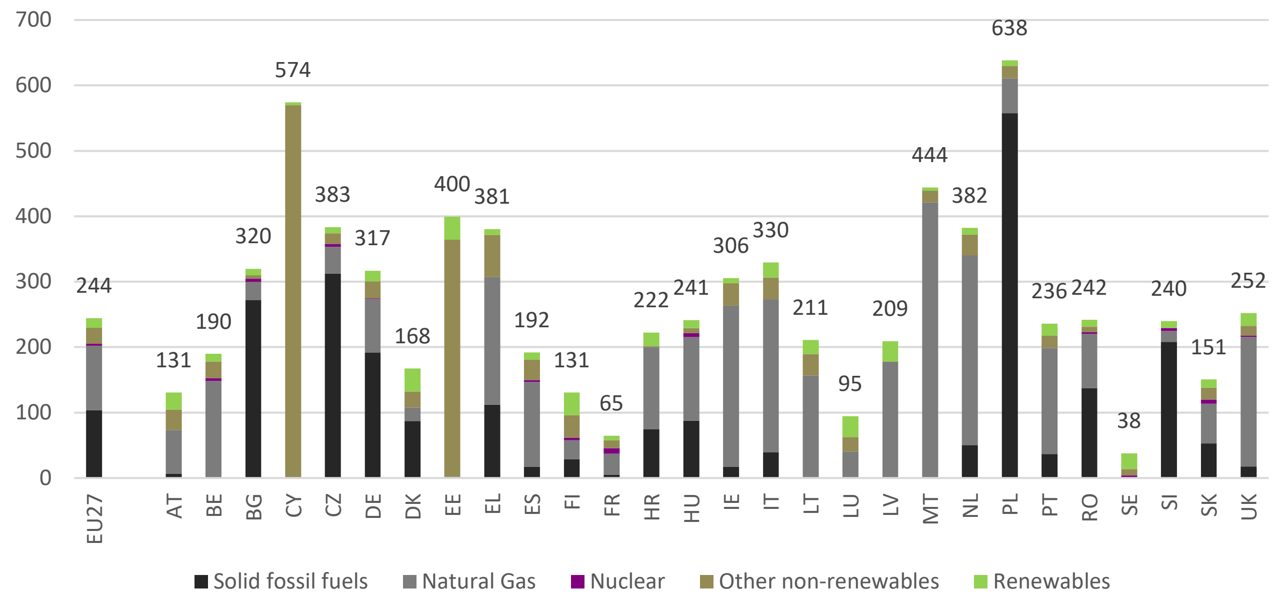
	Total	Solid fossil fuels	Oil and petroleum products	Natural Gas	Nuclear	Wastes (non-ren.)	Other non-renewables	Renewables	Bioelectricity	Hydro	Wind	Solar photovoltaic	Solar thermal	Geothermal	Tide, wave, ocean
EU27	239.160	30.214	4.132	48.156	58.771	1.782	2.710	93.395	14.075	32.212	34.172	11.973	429	578	44
Growth rate (2019-2020)	-4,1%	-22,1%	-7,5%	-1,1%	-10,7%	-3,6%	-20,7%	8,0%	2,3%	8,5%	8,3%	16,0%	-12,2%	-0,1%	2,0%
AT	6.239	48	62	856	0	64	154	5.054	396	3.900	584	176	0	0	0
BE	7.643	7	10	2.302	2.961	106	154	2.103	454	113	1.097	439	0	0	0
BG	3.502	1.162	26	197	1.430	0	2	686	146	285	127	127	0	0	0
CY	417	0	366	0	0	0	0	51	5	0	21	25	0	0	0
CZ	6.999	2.666	8	589	2.583	8	145	1.001	448	296	60	197	0	0	0
DE	49.105	11.487	420	8.186	5.536	566	838	22.073	4.373	2.139	11.359	4.182	0	20	0
DK	2.471	263	23	102	0	66	0	2.016	524	1	1.404	102	0	0	0
EE	512	0	2	2	0	6	257	245	159	3	73	11	0	0	0
EL	4.149	568	406	1.653	0	3	0	1.518	39	296	801	382	0	0	0
ES	22.632	475	920	5.996	5.013	90	54	10.084	530	2.923	4.853	1.348	429	0	2
FI	5.909	210	17	343	2.003	39	235	3.062	996	1.366	683	19	0	0	0
FR	45.675	265	482	3.037	30.424	199	160	11.108	775	5.721	3.421	1.152	0	11	41
HR	1.151	105	3	296	0	0	0	748	84	500	148	8	0	8	0
HU	2.991	319	4	782	1.380	21	10	475	186	21	56	211	0	1	0
IE	2.776	58	34	1.396	0	26	79	1.184	81	105	993	5	0	0	0
IT	24.078	1.150	864	11.495	0	207	143	10.220	1.704	4.256	1.613	2.145	0	518	0
LT	457	0	11	146	0	12	0	288	51	93	133	11	0	0	0
LU	192	0	0	16	0	6	0	170	32	94	30	14	0	0	0
LV	492	0	0	178	0	0	0	314	74	224	15	0	0	0	0
MT	184	0	5	158	0	0	0	21	1	0	0	20	0	0	0
NL	10.580	654	115	6.248	351	161	213	2.837	798	4	1.319	754	0	0	0
PL	13.581	9.235	150	1.486	0	43	170	2.497	718	253	1.359	168	0	0	0
PT	4.564	203	104	1.513	0	23	0	2.721	326	1.172	1.057	148	0	19	0
RO	4.810	805	52	813	986	0	10	2.143	47	1.350	597	149	0	0	0
SE	14.087	0	12	8	4.230	133	57	9.647	961	6.229	2.367	90	0	0	0
SI	1.478	375	1	50	546	1	0	505	24	449	1	32	0	0	0
SK	2.485	160	35	307	1.328	4	29	622	144	421	0	57	0	0	0
UK	27.760	593	127	11.228	4.831	402	67	10.513	2.826	661	5.532	1.111	0	0	1

* UK data for 2019

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 2020 in gCO_2eq/kWh of electricity and shares by main fuel

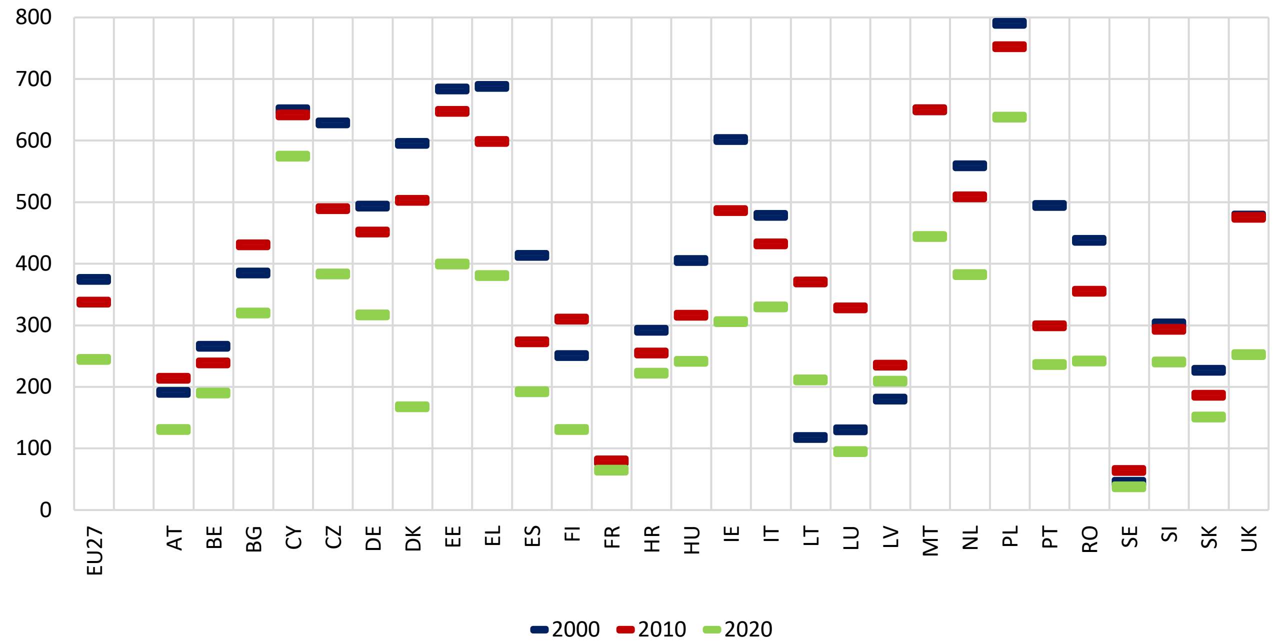


* UK data for 2019

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 considered, 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 2020 in gCO_2eq/kWh of electricity



* UK data for 2019

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.

As emissions from electricity generation are usually produced in a different location than where it's consumed, consumers often do not realize the real carbon footprint of their electricity consumption. Understanding the emissions implications of electricity use has become increasingly important as the electrification of transport, as well as heating and cooling, is rising. As can be seen in figure 4, the shift away from fossil fuels has caused the carbon footprint of electricity generation in the EU27 to fall on an annual basis over the past two decades.

Nevertheless, we can witness the opposite on some occasions. If we take the case of Lithuania for example, we see that the carbon footprint of electricity production has increased between 2000 and 2010. This is because Lithuania shut down its last nuclear reactor during this period and, since electricity generation from nuclear sources is relatively small in terms of carbon emissions, this led to an increase in the footprint of electricity generation as it was necessary to compensate for the amount produced by nuclear with other energy sources.

It must be noted that the positive evolution in carbon emissions of the figure above hides behind an increase of natural gas which has partly filled in the gap left by the reduction of nuclear and coal electricity production. Natural gas is, after nuclear, the second most important fuel for electricity production in EU27 and, although less polluting than oil and coal, natural gas cannot be considered as a clean fuel.

Looking ahead, electricity is expected to play a bigger role in heating, cooling, and transport as well as many digitally integrated sectors such as communication, finance, and healthcare. The need for clean and secure electricity is essential for the achievement of EU climate objectives and the proper functioning of modern economies.

Table 6 Final electricity consumption and electricity export-import by EU27 Member State and UK* in 2020 (ktoe)

	Final consumption - energy use	Export	Import	Balance (Export - Import)
EU27	205.061	31.560	32.750	-1.190
Growth rate (2019-2020)	-4,00%	0,10%	3,10%	/
AT	5.263	1.920	2.109	-189
BE	6.801	1.208	1.180	29
BG	2.459	612	319	293
CY	376	0	0	0
CZ	4.904	2.022	1.149	873
DE	41.257	5.751	4.115	1.636
DK	2.685	1.007	1.599	-592
EE	617	320	633	-313
EL	4.087	83	845	-762
ES	18.887	1.260	1.542	-282
FI	6.612	574	1.861	-1.288
FR	35.371	5.552	1.680	3.873
HR	1.308	503	902	-399
HU	3.434	645	1.649	-1.004
IE	2.463	164	151	13
IT	23.663	653	3.421	-2.769
LT	890	353	1.033	-680
LU	526	93	563	-470
LV	561	219	359	-140
MT	202	0	36	-36
NL	9.378	1.929	1.700	229
PL	11.808	633	1.773	-1.141
PT	3.977	524	649	-125
RO	3.785	469	710	-240
SE	10.584	3.166	1.017	2.149
SI	1.114	784	612	172
SK	2.048	1.115	1.143	-27
UK	25.398	291	2.111	-1.820

* UK data for 2019
*Export and import for the EU27 include EU internal trade.
Source: Eurostat

EU27 trades electricity with most of its neighbours. The most important partners in terms of volumes are Norway, the UK, and Switzerland. In the first two countries, generators are covered by EU ETS obligations and in the Swiss case, the local trading system is linked to the EU ETS. Large volumes of nuclear generation in France made the country Europe's biggest exporter of electricity. Luxembourg and Lithuania mainly rely on imports for their electricity consumption and in absolute terms Germany remains the biggest importer of electricity experiencing a growth of imports of 38,8% compared with the previous year due to the coal and nuclear power stations being shut down/decommissioned.

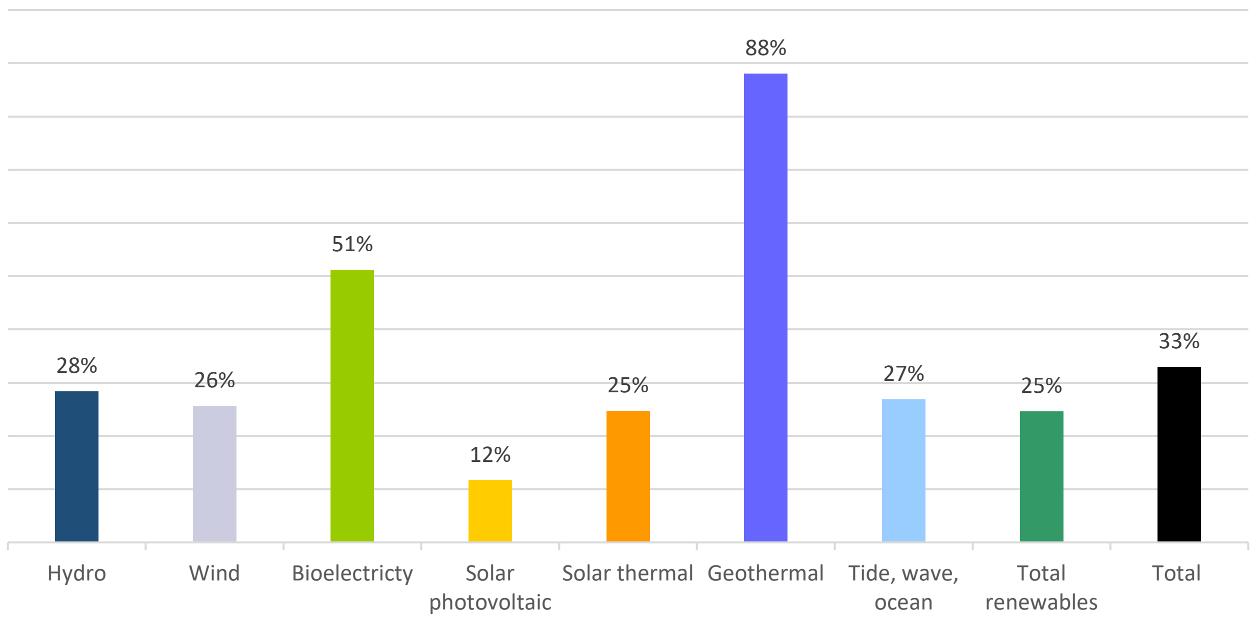
Installed electrical capacity from renewables increased by 6% between 2019 and 2020, a trend particularly driven by wind and solar photovoltaics. Such rapid growth in variable renewable sources will help alleviate traditional fuel security concerns, but it will call for the flexibility in power systems to rapidly increase. Over the same period, the installed capacity for bioelectricity decreased by 536 MW. Sharp decreases, particularly in Austria (from 1.521 to 1.058 MW), Belgium (from 1.032 MW to 48 MW), and Italy (from 3.850 to 65MW) are largely responsible for the decline, though it was partially offset by other countries (Cyprus, Czech Republic, and Spain) which saw a doubling of their installed capacity of bioelectricity.

Table 7 Total electrical installed capacity and electrical capacity for renewables in EU27 Member States and UK* in 2020 (MW) – with growth rate

	Total	Total renewables	Hydro	Wind on shore	Wind offshore	Bioelectricity	Solar photovoltaic	Solar thermal	Geothermal	Tide, wave, ocean
EU27	962.401	505.787	150.771	162.487	14.497	36.502	136.137	2.306	871	217
Growth rate (2019-2020)	1,61%	5,71%	-0,09%	4,75%	20,64%	-1,45%	15,29%	0,00%	0,58%	-1,11%
AT	26.312	20.932	14.605	3.226	0	1.058	2.043	0	1	0
BE	25.702	11.720	1.416	2.419	2.262	48	5.575	0	0	0
BG	10.989	6.050	3.376	703	0	873	1.097	0	0	0
CY	1.897	2.354	0	158	0	1.967	229	0	0	0
CZ	21.402	16.123	2.265	339	0	11.395	2.123	0	0	0
DE	233.747	127.122	10.792	54.414	7.774	381	53.719	2	40	0
DK	15.489	7.720	7	4.559	1.701	149	1.304	0	0	0
EE	2.738	630	8	317	0	97	208	0	0	0
EL	20.795	12.209	3.417	4.119	0	1.385	3.288	0	0	0
ES	108.421	61.829	20.117	26.819	0	2.298	10.285	2.304	0	5
FI	17.301	6.203	3.164	2.513	73	135	318	0	0	0
FR	136.637	59.288	25.712	17.484	0	3.841	12.022	0	16	212
HR	4.662	3.132	2.200	801	0	13	109	0	10	0
HU	10.708	2.669	58	321	0	156	2.131	0	3	0
IE	11.244	5.061	529	4.307	0	133	93	0	0	0
IT	116.383	56.052	22.695	10.871	0	65	21.650	0	772	0
LT	3.491	2.117	877	540	0	536	164	0	0	0
LU	1.808	1.674	1.331	153	0	5	187	0	0	0
LV	2.944	2.929	1.586	78	0	1.260	5	0	0	0
MT	783	1.709	0	0	0	1.521	188	0	0	0
NL	42.233	18.700	37	4.159	2.460	1.095	10.950	0	0	0
PL	49.368	13.409	2.400	6.298	0	756	3.955	0	0	0
PT	21.655	13.658	7.241	5.097	25	165	1.100	0	29	0
RO	20.585	11.114	6.652	3.013	0	67	1.383	0	0	0
SE	43.672	27.720	16.406	9.773	203	231	1.107	0	0	0
SI	3.929	4.310	1.352	3	0	2.585	370	0	0	0
SK	7.707	7.354	2.529	3	0	4.287	535	0	0	0
UK	104.847	50.060	4.773	14.125	9.971	7.826	13.346	0	0	20

* UK data for 2019
Source: Eurostat

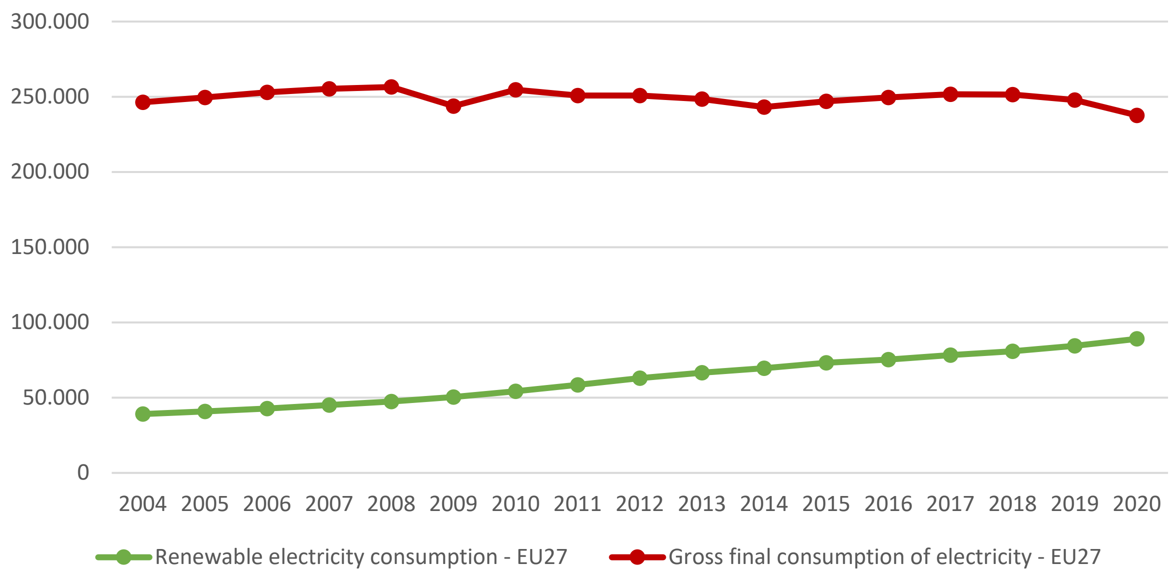
Figure 5 Average load factor* for the different renewable technologies and for the total installed capacities in the EU27 in 2020



*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 the average for renewables and second only to geothermal. Indeed, bioelectricity is dispatchable and production can be adjusted to stabilize the grid. The stability and reliability of the grid is a big challenge for the energy transition due to the significant increase of intermittent technologies (e.g. wind and PV). As an affordable, dispatchable, flexible, and non-site-specific electricity source, bioelectricity is an important complementary electricity source and an important and viable solution. The intermittency of wind and sun irradiation induces a lower load factor for technologies exploiting those energy sources, meaning that to produce the same amount of electricity, more installed capacity will be needed. This could lead to overcapacity in certain circumstances, as electricity is hard to store. 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, more storage solutions will be needed, increasing the overall system costs. Therefore, biopower is complementary with the long-term power system development marked by increased share of intermittent sources.

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

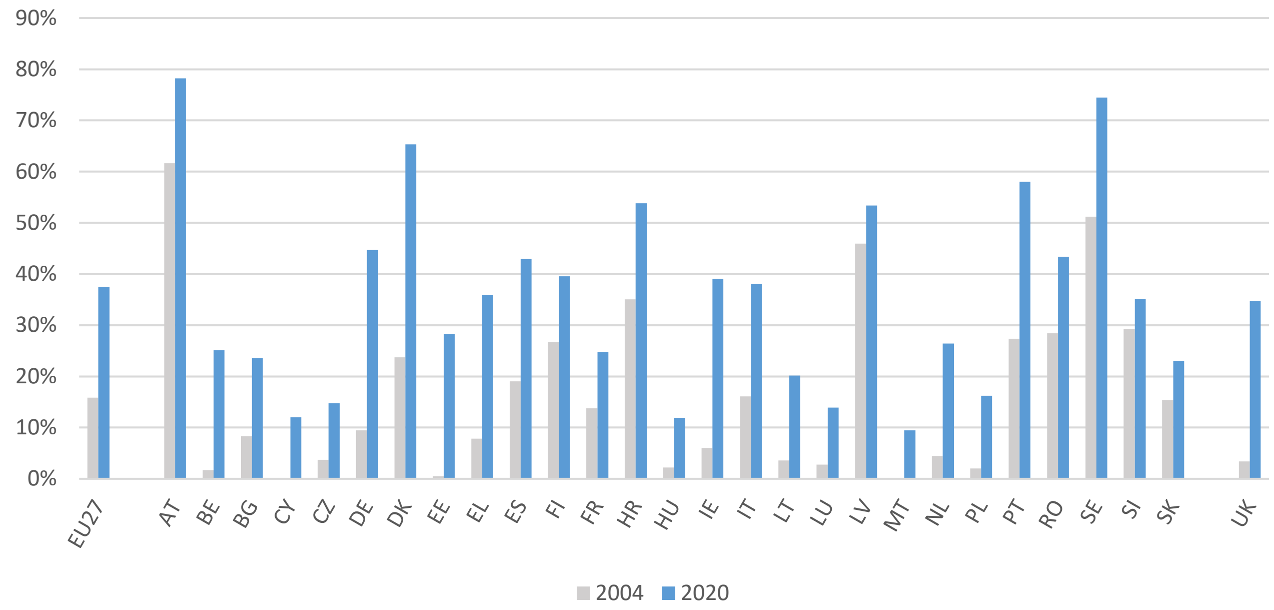


* Gross final consumption of electricity is calculated according to the methodology established by Directive 2009/28/EC and Regulation (EC) No 1099/2008.
Source: Eurostat, SHARES 2020

Between 2004 and 2020 the gross final consumption of electricity in EU27 decreased from 246.397 ktoe to 237.668 ktoe, while at the same time renewable electricity consumption increased from 39.106 ktoe to 89.082ktoe. Electricity is the sector where renewables have experienced the highest penetration and contribute to the highest share (37,5%).

Yet, Figure 6 also shows there is still a large gap to be filled to achieve 100% renewable electricity; today and in the near future, electrification is by no means equal to decarbonisation at the EU27 scale. Further efforts are needed, such as a complete phase-out of direct and indirect subsidies to fossil fuels.

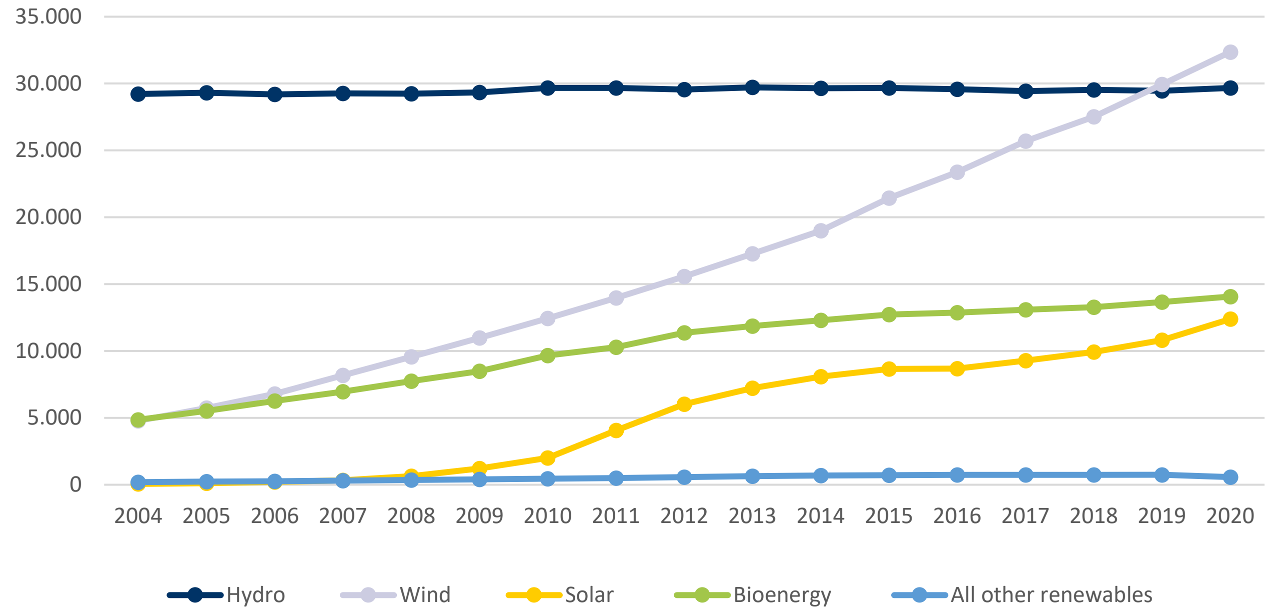
Figure 7 Share of renewables in gross final consumption of electricity* in EU27 Member States and UK* in 2004 and 2020



* Data of UK for 2019
* Calculated according to the methodology established in Directive 2009/28/EC and Regulation (EC) No 1099/2008.
Source: Eurostat, SHARE 2020 (with wind and hydro normalised and pumped hydro excluded)

Figure 7 shows the divergences between Member States with respect to the deployment of renewables in power. 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, Portugal and Sweden, while wind is the main source in Denmark (Cf Table 4). Bioelectricity also has a key role in these four countries as it represents their second or third largest source of renewable electricity. Estonia, Czech Republic and Hungary, have the biggest share of bioenergy (Cf Table 4) among renewables in power, with 65%, 44,8%, 39,2% respectively. It must 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, Finland and Sweden (Cf Table 4).

Figure 8 Evolution of gross final consumption of electricity from renewable sources* in EU27 between 2004 and 2020 (ktoe)

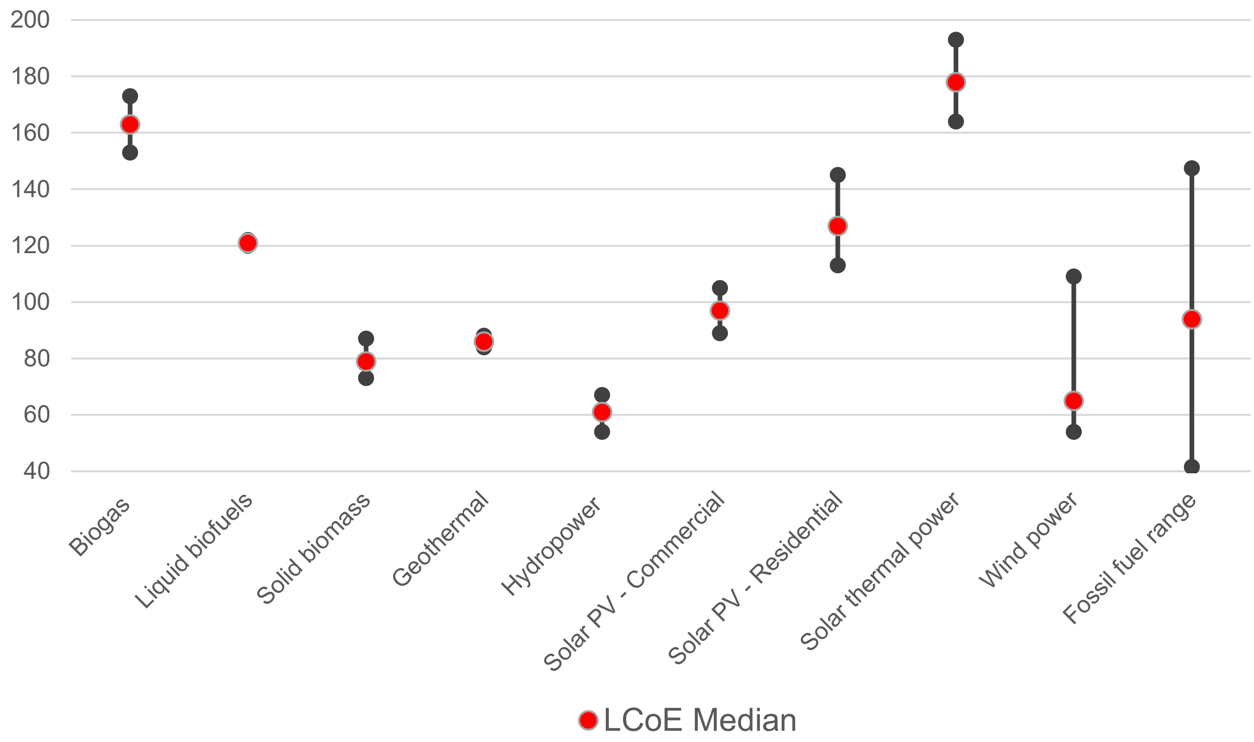


* Calculated according to the methodology established on Directive 2009/28/EC and Regulation (EC) No 1099/2008.
Note: Wind and hydro are normalised to smoothen the annual changes due to weather conditions – that is the reason why the data is not exactly matching the one presented in table 4.More information 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

Wind power experienced a fast-paced growth in the last decades, overpassing the electricity produced from hydro and becoming the most important renewable energy source in the power sector. 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 is the third largest source in the power sector and can be used to provide baseload electricity or crucially peak load units which provide stability to the grid. As already stated before, the grid stability is of foremost importance when variable energy sources (wind and solar) are in high shares.

It is also interesting to note that energy production is increasingly decentralising allowing the consumer to be put at the centre of the energy transition.

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



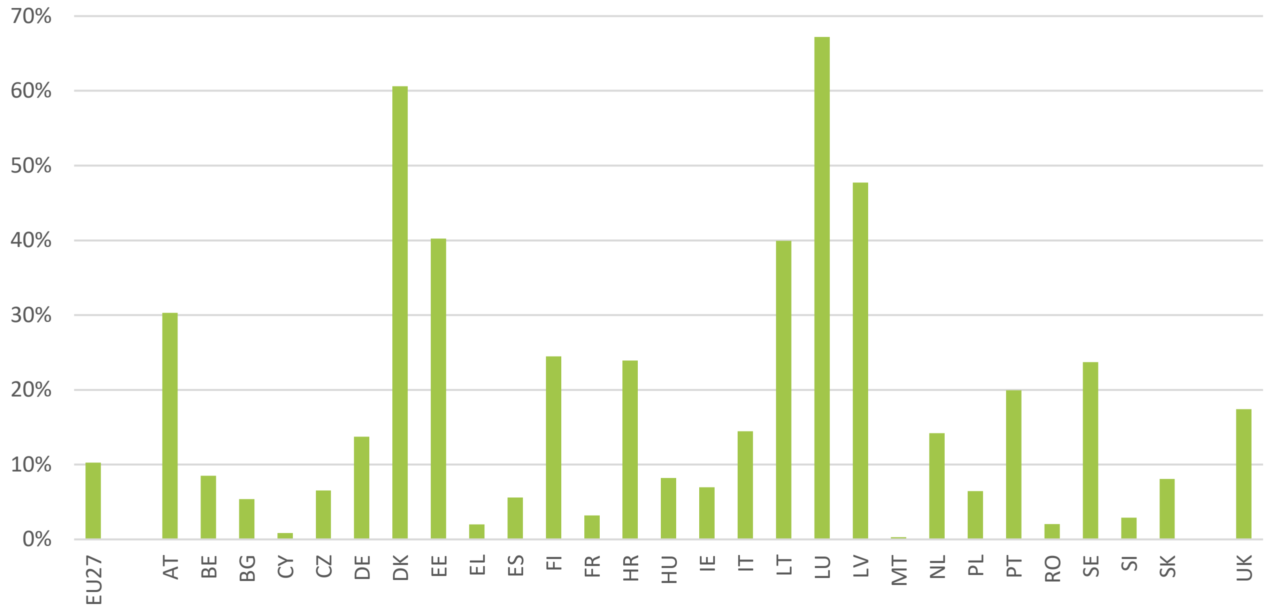
Source: Eurobserv'er (for renewables) and Irena (for the range of fossil fuel costs)

Figure 9 shows that bioelectricity is competitive. Indeed, the Levelised cost of electricity (LCoE, defined as the "average revenue per unit of electricity generated that would be required to recover the costs of building and operating a generating plant during an assumed financial life and duty cycle") of bioelectricity technologies are in the range of fossil fuels, except for biogas technologies where cost reductions are expected. It must be noted that the range of cost for biomass technologies may be larger 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 in the performance of the fossil fuel technologies. Additionally, the LCoE 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 benefits of bioelectricity technologies are understated as they use renewable fuels and are flexible, dispatchable technologies that can valorise heat production through 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 2020**



*i.e., fossil fuels, nuclear and non-renewable waste inputs.
** Data of UK for 2019
Source: Eurostat

In Luxemburg, Denmark and Latvia, biomass fuels represent more than 40% of all conventional thermal sources used for electricity production (i.e., not considering wind, hydro, solar, and tide, wave, ocean and geothermal). Although Luxembourg has the highest share of biomass fuels, this is a little misleading as Luxembourg imports most of its electricity. Furthermore, given the low total fuels inputs for electricity generation, even an individual plant can have an impact on the share of biomass fuels. The input of biomass for electricity increased by 1.384 ktoe between 2019 and 2020. Solid biomass represents 55% of the fuel inputs for bioelectricity in the EU27 in 2020, followed by biogas (24%) and renewable waste (18%). Romania (94%), Estonia (94%) and Bulgaria (90%) are the top three EU27 countries with the highest solid biomass shares for bioelectricity.

Table 8 Fuels inputs for bioelectricity generation in EU27 Member States and UK* in 2020 (ktoe)

	Total Biomass	Solid biomass	Biogas	Renewable municipal waste	Liquid biofuels
EU27	44.069	24.240	10.575	7.842	1.021
AT	1.311	953	181	173	0
BE	1.272	707	145	371	6
BG	489	441	47	0	0
CY	8	0	8	0	0
CZ	1.253	736	440	75	0
DE	11.157	3.088	5.776	2.203	91
DK	2.160	1.519	139	464	0
EE	593	560	7	25	0
EL	125	26	99	0	0
ES	1.785	1.354	194	231	3
FI	2.619	2.300	66	222	0
FR	3.361	1.569	712	1.051	1
HR	310	227	83	0	0
HU	611	487	57	66	0
IE	239	98	39	102	0
IT	5.438	1.755	1.899	843	904
LT	398	202	30	28	0
LU	160	135	11	13	0
LV	339	267	72	0	0
MT	1	0	1	0	0
NL	2.513	1.444	119	884	0
PL	2.079	1.762	229	85	1
PT	1.015	827	76	112	1
RO	169	158	11	-	0
SE	4.099	3.210	6	874	10
SI	78	53	24	0	1
SK	487	363	104	20	0
UK	8.034	4.773	2.177	1.084	0

* UK data for 2020
Source: Eurostat

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

Source: Eurostat

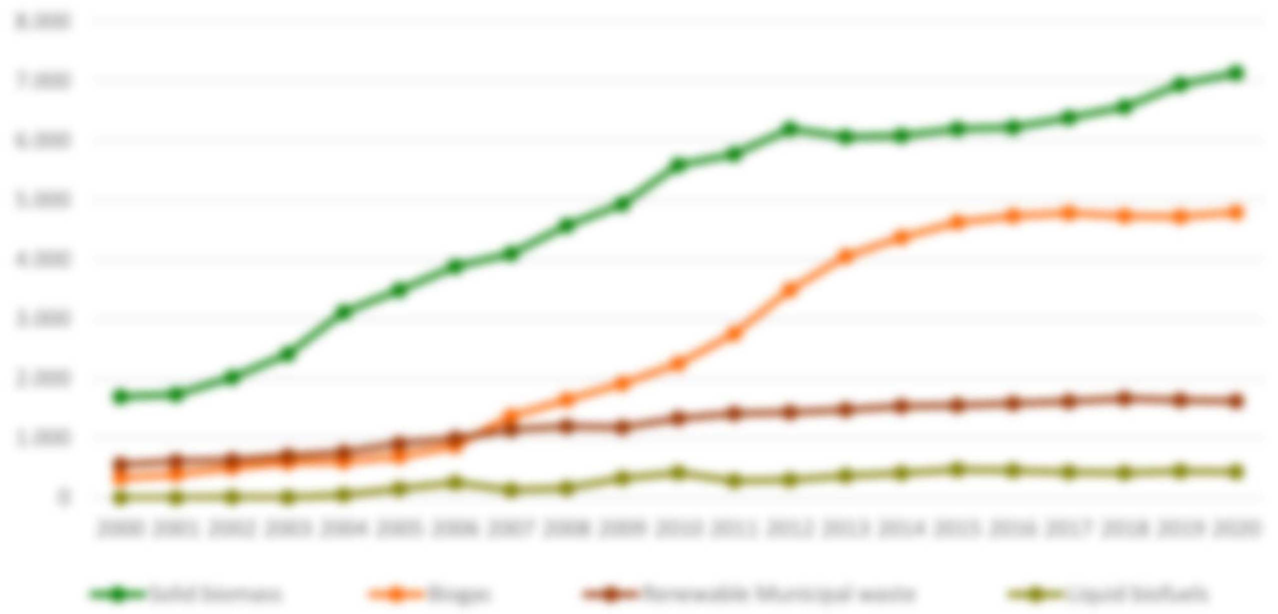
Bioelectricity increased over the last two decades from 8.243 ktoe to 36.502 ktoe, with particularly robust growth rates for biogas and solid biomass. Currently the future growth trends of bioelectricity are difficult to predict due to conflicting pressures. On the one hand, growth rates may be augmented by the increasing need for clean and dispatchable generation capacities to stabilise an energy system increasingly dependent on intermittent RES. One the other hand, the growth of bioelectricity is/may be undermined by the lack of legal certainty concerning the EU's sustainability policy that can potentially discourage investors.

Table 9 Electrical capacity from biomass plants by type in the EU27 and UK* in 2020 (in MW) with average EU27 Member States and UK load factor

	Total bioelectricity	Solid biomass	Biogas	Municipal waste	Liquid biofuels
EU27	36.502	15.561	11.735	7.997	1.209
Growth rate (2019-2020)	-1,45%	-2,21%	5,36%	1,74%	-43,18%
AT	1.521	816	165	540	0
BE	1.058	564	199	272	23
BG	48	15	33	0	0
CY	13	0	13	0	0
CZ	873	452	366	55	0
DE	11.395	1.597	7.465	2.102	231
DK	1.967	1.485	119	363	0
EE	381	200	11	170	0
EL	97	14	83	0	0
ES	1.385	868	269	241	6
FI	2.585	2.442	5	138	0
FR	2.298	847	533	905	15
HR	135	80	55	0	0
HU	536	397	85	54	0
IE	149	7	59	83	0
IT	3.841	726	1.379	804	932
LT	133	63	36	34	0
LU	65	35	12	17	0
LV	156	96	60	0	0
MT	5	0	5	0	0
NL	1.260	271	209	780	0
PL	1.095	734	261	100	0
PT	756	603	71	82	0
RO	165	136	30	0	0
SE	4.287	2.942	100	1.245	0
SI	67	35	30	0	1
SK	231	137	82	12	0
UK	7.826	4.673	1.832	1.321	0

* UK data for 2019
Note: electrical capacities from CHP units are included – considering the net maximum electrical capacity from Eurostat definition
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 (ktoe)



Source: Eurostat

Although the amount of biogas used for electricity is stagnating, its other uses are increasing, for example, final consumption in the industrial and agricultural sectors as well as 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 at a rate of 6% per year, twice the rate of the past two years.

Figure 13 Gross electricity generation from biomass by type in the EU27 2020 (ktoe)

Source: Eurostat

The total installed capacity from bioelectricity in the EU27 decreased between 2019 and 2020 by 506 ktoe while the final electricity generation increased by 322 ktoe. The country that experiences the highest growth in bioelectricity generation in the last year was the Netherlands which went from 500ktoe to 798 representing an increase of 60%. The top 6 bioelectricity producing EU27 countries (Germany, Italy, Sweden, Finland, The Netherlands and France) represent two thirds (66%) of the total EU27 bioelectricity generation.

While overall production increased, some countries also experienced a reduction in their bioelectricity generation between 2019 and 2020, particularly remarkable are the decreases in Finland and Sweden, which both cut their production by nearly 15%.

Table 10 Gross electricity generation from biomass in EU27 Member States and UK* in 2020 (ktoe) with growth rate

	Total bioelectricity	Growth rate (2019-2020)	Solid biomass	Biogas	Renewable municipal waste	Liquid biofuels
EU27	**14.076**	**2,3%**	**7.136**	**4.794**	**1.624**	**434**
Share (%)	100%	/	51%	34%	12%	3%
Growth rate (2019-2020)	2,33%	/	2,8%	1,5%	-0,97%	-2,9%
AT	396	-3%	313	54	28	0
BE	454	1%	285	87	79	2
BG	146	-7%	127	19	0	0
CY	5	0%	0	5	0	0
CZ	448	3%	215	223	10	0
DE	4.373	1%	965	2.880	501	26
DK	524	2%	370	58	81	0
EE	159	36%	150	3	6	0
EL	39	11%	4	35	0	0
ES	530	11%	390	76	60	1
FI	996	-13%	925	26	44	0
FR	775	4%	340	236	184	0
HR	84	11%	48	36	0	0
HU	186	-3%	143	28	14	0
IE	81	11%	37	15	28	0
IT	1.704	1%	384	702	200	401
LT	51	11%	32	13	6	0
LU	32	33%	23	5	4	0
LV	74	-8%	45	30	0	0
MT	1	0%	0	1	0	0
NL	798	60%	497	75	189	0
PL	718	9%	596	106	16	0
PT	326	13%	276	22	28	0
RO	47	9%	42	5	0	0
SE	961	-14%	817	1	142	2
SI	24	9%	13	10	0	1
SK	144	-1%	96	44	4	0
UK	3.208	0%	2.230	651	327	0

*UK data for 2019
Source: Eurostat

Figure 14 Share of bioelectricity generation out of total gross electricity generation in EU27 Member States and UK* in 2020 (%)

*UK data for 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 2020 in EU27 Member States and UK* (%)

*UK data for 2019
* Conventional thermal power plants: plants producing electricity from gas, coal, petroleum products, nuclear and non-renewable waste.
Source: Eurostat

The greatest share of bioelectricity (73% in 2020) is generated in combined heat and power (CHP) plants. Only a few countries, namely Spain and Ireland, have a different model with most of the electricity being produced in power-only plants.

Unlike bioelectricity, conventional thermal sources are generally only operating in power-only plants; only 22% of their electricity was generated in CHP units. This dramatic differential (51 pp difference) in the share of bioelectricity CHP and conventical thermal CHP, illustrates 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, the combined production of electricity and heat from biomass is an important asset of biopower towards the 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 recognise that there are some situations for which CHP is not the optimal solution and that biopower-only installations also play an important role when justified by certain conditions. (e.g., in locations where there is no, or little commercial heat need that would not justify the retrofitting of existing installations). In fact, the form of energy (heat or electricity) needed depends strongly on the local circumstances, suggesting that rigid top-down approaches should be avoided.

On top of this, it should be further noted that CHP bioelectricity plants can also apply carbon capture and storage technologies (BECCS) which enable carbon dioxide removal, making bioenergy one of the only available options for negative emissions.

Table 11 Evolution of bioelectricity generation 2000-2020 in EU27 Member States and UK* (ktoe)

	Total bioelectricity			Bioelectricity from electricity only plants			Bioelectricity from CHP plants		
	2000	2010	2020	2000	2010	2020	2000	2010	2020
EU27	2.591	9.594	14.075	875	3.303	3.821	1.716	6.291	10.254
AT	131	385	396	37	177	144	95	209	252
BE	49	384	454	33	228	211	16	156	243
BG	0	3	146	0	0	21	0	3	125
CY	0	3	5	0	0	0	0	3	5
CZ	45	186	448	14	56	3	31	130	445
DE	372	2.917	4.373	372	1.134	1.366	0	1.783	3.007
DK	112	395	524	0	0	0	112	395	524
EE	1	64	159	0	20	32	1	44	128
EL	0	16	39	0	14	6	0	2	33
ES	128	345	530	70	232	429	58	113	100
FI	743	944	996	56	146	103	687	798	893
FR	213	382	775	88	197	171	125	185	604
HR	0	3	84	0	0	3	0	3	81
HU	6	197	186	0	170	55	6	28	130
IE	8	27	81	8	23	73	0	4	7
IT	120	812	1.704	64	532	772	56	280	932
LT	0	13	51	0	0	0	0	13	51
LU	2	7	32	2	2	0	0	5	32
LV	0	6	74	0	1	0	0	5	74
MT	0	0	1	0	0	0	0	0	1
NL	171	606	798	107	255	108	65	350	689
PL	19	542	718	3	21	134	16	521	584
PT	111	225	326	23	90	173	89	135	152
RO	0	10	47	0	4	8	0	5	39
SE	352	1.048	961	0	0	0	352	1.048	961
SI	6	19	24	0	1	0	6	18	23
SK	0	57	144	0	0	8	0	57	136
UK	338	1.054	2.826	304	969	2.904	35	86	304

*UK data for 2019
Source: Eurostat

Germany, Italy, and Poland are the 3 countries among the EU27 that experienced the highest increase for total bioelectricity in absolute figures, while we see the highest proportional increase in Estonia, Poland, and Croatia since 2000. The 76% of the increase in bioelectricity between 2000-2019 was mostly driven by CHP plants. This trend demonstrates the importance of a sound regulatory framework, for example article 29 (11) of the Renewable Energy Directive which incentivized the use of biomass in highly efficient facilities, is likely to have promoted these trends. This is the case for all EU countries, unlike the UK, where bioelectricity growth was driven by power-only installations. For the same period, Germany, Spain, and Italy experienced the biggest growth in absolute figures from bioelectricity deriving from power plants, whilst Poland, Italy and Ireland had the biggest growth in relative figures. Finally, regarding the bioelectricity from CHP plants, Germany experienced the sharpest increase in both absolute and relative figures since 2000. Italy and The Netherlands follow for absolute figures, and Estonia and Poland for relative figures.

The Italian and German trends are due to the increase in their biogas capacities. The Polish increase is attributed to solid biomass facilities 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 6,5% and 17,9% of their electricity from biomass (Cf Figure 14), mainly from 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 decrease (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 solutions, such as bioelectricity, in the transition to a low carbon electricity grid.

Table 12 2030 Bioelectricity projection according to the National Energy and Climate Plans (NECPs) in the EU27 Member States (ktoe) and growth rate between 2020 and 2030 (%)

	Total bioelectricity in 2020	Total bioelectricity in 2030	Absolute change	Growth rate
AT	396	478	82	21%
BE	454	247	-206	-46%
BG	146	140	-6	-4%
CY	5	n.a.	/	
CZ	448	397	-52	-12%
DE	4.373	3.612	-761	-17%
DK	524	601	77	15%
EE	159	103	-56	-35%
EL	39	138	99	253%
ES	530	997	468	88%
FI	996	1.376	380	38%
FR	775	n.a.	/	
HR	84	105	21	25%
HU	186	286	100	54%
IE	81	n.a.	/	
IT	1.704	1.350	-354	-21%
LT	51	82	31	60%
LU	32	31	-1	-3%
LV	74	n.a.	/	
MT	1	1	1	154%
NL	798	n.a.	/	
PL	718	1.365	647	90%
PT	326	631	305	94%
RO	47	77	30	65%
SE	961	1.376	415	43%
SI	24	50	26	112%
SK	144	218	75	52%

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

While it should be noted that Belgium, Bulgaria, Czech Republic, Germany, Estonia, and Italy all foresee a decrease in their total bioelectricity generation for 2030, other countries forecast an increase. The highest increases are expected to be seen in Poland, Spain, and Portugal.

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

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 15 Mtoe in the EU27 by 2030. The steep rise of bioelectricity during the past decade (2010-2020) and the expected steady growth in the next one clearly demonstrates that Member States are relying on bioelectricity to reach their RES-target and to play a key role in enabling higher intermittent renewable technology penetration rate. An overall increase of around 1,5 Mtoe is foreseen in the next decade for EU27 (+10%).

3. Annexes

Table 13 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 14 Symbols and abbreviations

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

Table 15 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 16 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
2022

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