

European Electricity Generation Summary

Q2-2022

April to June

Generation and Contribution by Fuel Type

Renewables: 280.4TWh (-11%)

Fossil Fuels: 216.9TWh (-21%)

Nuclear: 146.4TWh (-23%)

Percentage changes are from the previous quarter

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1 Quarterly Review of European Electricity Market Q2 2022

As with the previous quarter, Q2 2022 was impacted most strongly by the war in Ukraine which had far reaching consequences throughout Europe. Since Russia began the invasion in March, gas supplies to Europe have been reduced significantly, and future plans for increased supply, including the Nord Stream 2 pipeline from Russia to Germany, have been cancelled. The uncertainty caused by these events has resulted in increased gas prices across the continent and LNG imports have now become more economically favourable.

Although the average wholesale gas prices were 45% lower than last quarter's average, they were still more than double those seen in Q2 2021, thereby causing distress in the EU energy market. Due to the soaring gas prices in the EU as well as a multitude of other factors, the wholesale electricity prices relative to the prices in the GB market have become higher for many EU nations for the first time. Interconnector flows between many EU countries and GB switched from an export position to an import position.



Figure 1: Gas (TTF) and carbon prices from Q1 2015 to Q2 2022

High levels of gas and coal/lignite generation were continued from the last quarter as hydro generation was still materially lower than generally expected levels and nuclear output fell further than the levels in Q1 due to France continuing to see more unprecedented levels of unplanned outages in the nuclear fleet.

The key points from the quarter are:

- The war in Ukraine creating concerns over gas supply and increasing gas prices across the continent
- Several European countries like Germany, Spain and the Netherlands saw gas-to-coal switches as coal utilisation increased over previous second quarters
- Technical issues in the French nuclear fleet caused a change in interconnector flows and France became a net importer
- A drought in Norway reduced Norwegian hydro generation and reversed the flow of its interconnectors from a net export to net import position for extended periods

- Spain and Portugal implemented a cap on gas prices for power generation, resulting in lower power prices and more export to France.

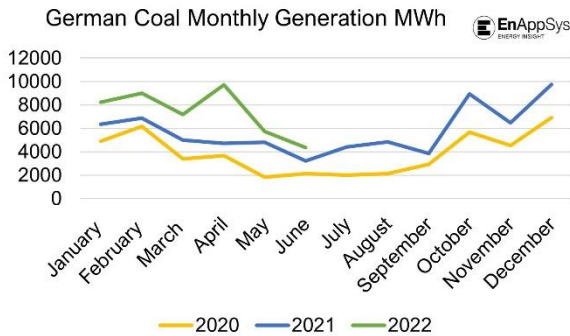
1.1 Gas Prices

The second quarter of 2022 was record high compared to the Q2 of previous years. Q2 2022 started with a second wave of soaring prices driven by the infamous Presidential Decree No. 172 of 31st March by Russian President Vladimir Putin which imposed severe limitations on gas imports to Europe from Russia by requiring all transactions to be paid in roubles. The TTF Gas Prices on the following day reached as high as ~126EUR/MWh. As a result, Europe has accelerated its renewable development plans, plans for LNG capacity and gas supply from Russia has been replaced by LNG from the US. Additional offshore wind plans have been launched in NL and BE and “Gas as a transition fuel” is getting a new dimension as countries scramble to sever ties with Russia.



Figure 2: TTF gas prices from January 2021 to June 2022 (EUR/MWh)

Fuel Switching Germany/Netherlands



Coal/lignite saw 98.2TWh of generation, a 10% increase over Q2 2021 which saw 89.4TWh. This is driven by the extremely high gas prices, and low hydro generation which eventually led to gas-to-coal and gas-to-lignite switches in some countries. As part of measures to mitigate the effects of high gas prices, some countries announced that they

Figure 3: German coal monthly generation in MWh from 2020 to 2022

will remove production restrictions imposed on coal-fired power plants. As can be seen in figures 3 and 4, coal generation in Germany and Spain has been notably higher this quarter than in the same period in previous years. Although the Netherlands has kept its generation within the range of previous years, it was still marginally higher on average than any Q2 since Q2 2018.

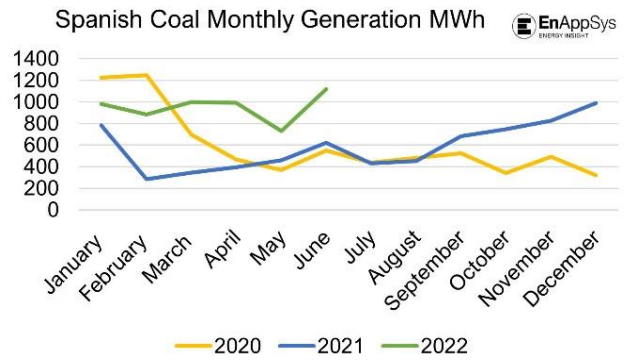


Figure 4: Spanish coal monthly generation in MWh from 2020 to 2022

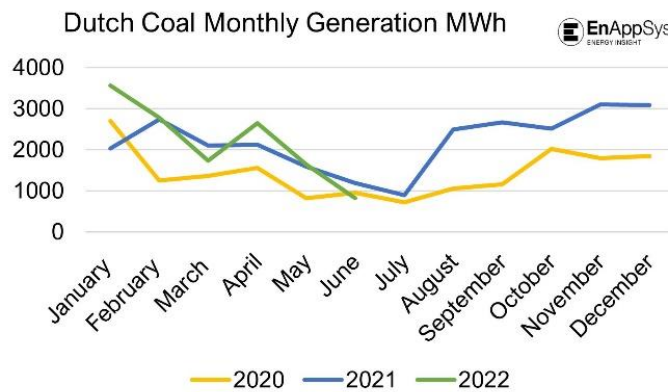


Figure 5: Dutch coal monthly generation in MWh from 2020 to 2022

The Iberian Exception

On the 14th of June, Spain and Portugal have implemented the “Iberian Exception”. This exception concerns the gas price used for power generation, the introduction of a cap on the gas price, has resulted in lower prices on Iberian power markets, reversing the flow across the border into France permanently. Where in periods of high demand, France was already importing from Spain, this situation reversed when more moderate weather arrived.

The Iberian Exception is controversial as it is unusual for the EU to allow interference in markets. Part of the benefit also flows across the border to France, with the interconnector operators (TSO’s) generating an additional profit, when market prices between France and Spain do not converge.

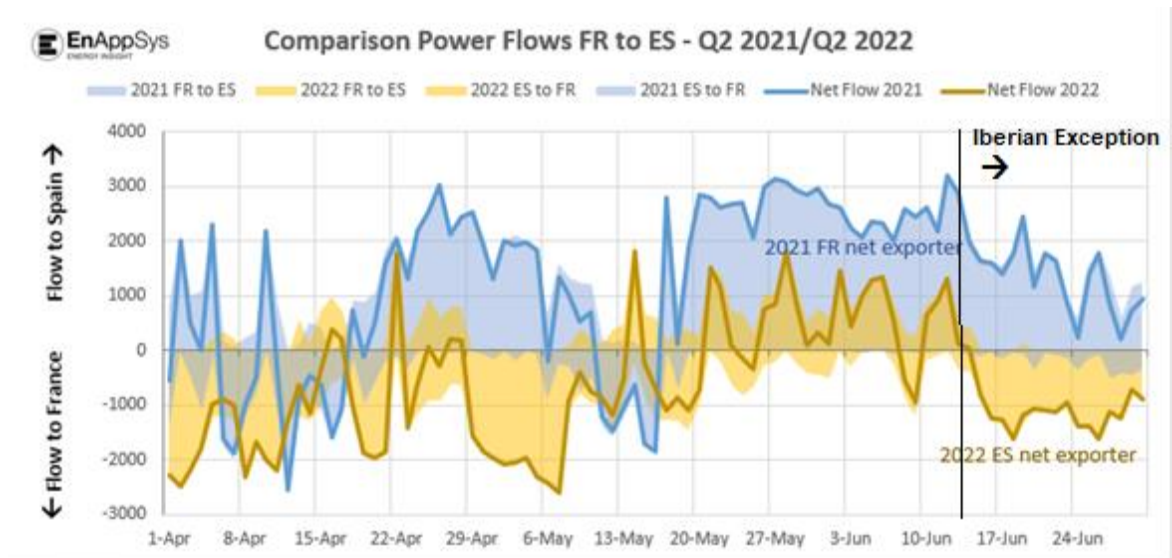


Figure 6: Cross Border Flows between Spain and France, before and after the ‘Iberian Exception’

1.2 Nuclear availability in the French system

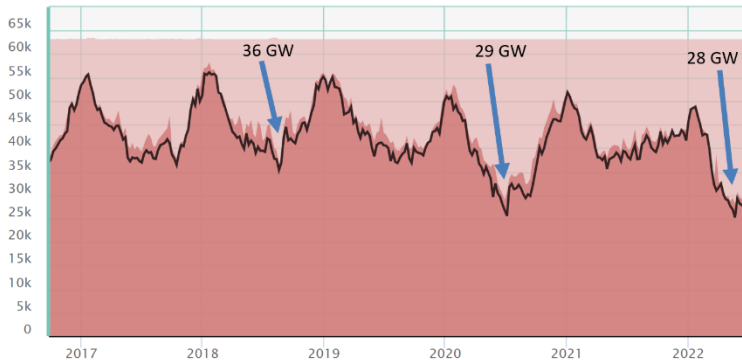


Figure 7: French nuclear generation from 2016 to 2022. Notable low points have been highlighted

French nuclear output has been in a continuous decline since the end of January with 7.5GW going offline over February and 12.9GW going offline over March for maintenance. The continued decline into Q2 2022 has put added pressure on the European wholesale market since France has always been the primary exporter in Europe.

Most of the French units were laid over based on scheduled outage, whereas a few were shut-down due to the safety protocols, following the discovery of stress corrosion cracking problems. In Q2 2022, we have seen the added issue arising from a hotter climate that is making it harder to cool the aging reactors. As a result, the French nuclear fleet continued to see a declined path. After the region’s biggest producer cut its nuclear output target for a third time this year, the nuclear fleet saw a historic low of 28GW on 22nd May.

France’s nuclear issues have resulted in an exceptional net-import position for the French market which is even more exceptional combined with high

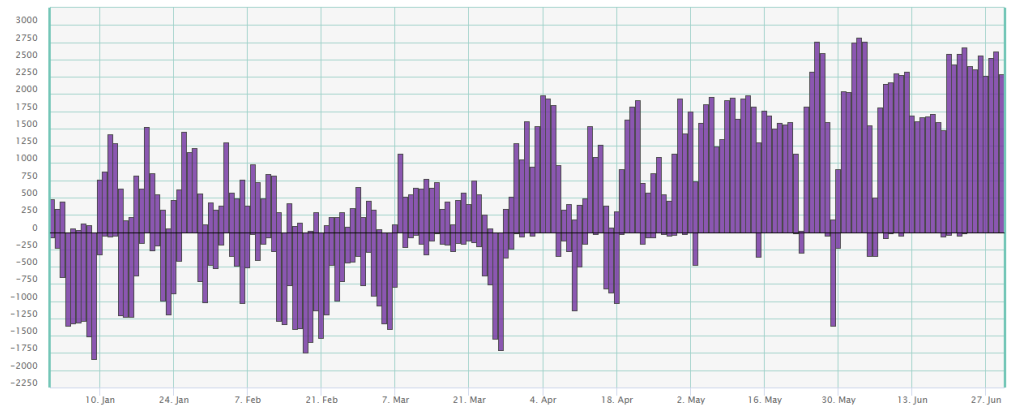


Figure 8: Interconnector flows between GB and France in 2022. High levels of imports to France can be seen in Q2 (positive value indicates import to France)

gas prices as France would normally be the exporter, pushing gas assets out of merit across Europe. The difference is highlighted in the interconnector flow between GB and France; GB has always been the primary importer and for the first time, we are seeing consistent GB exports and have done so for the majority of Q2 2022.

1.3 Interconnector switch between Norway and GB

In addition to France, Norway also saw significant changes in its interconnector flows this quarter. Historically a net exporter due to its high levels of renewable hydro generation, this quarter saw a drought in Norway that reduced

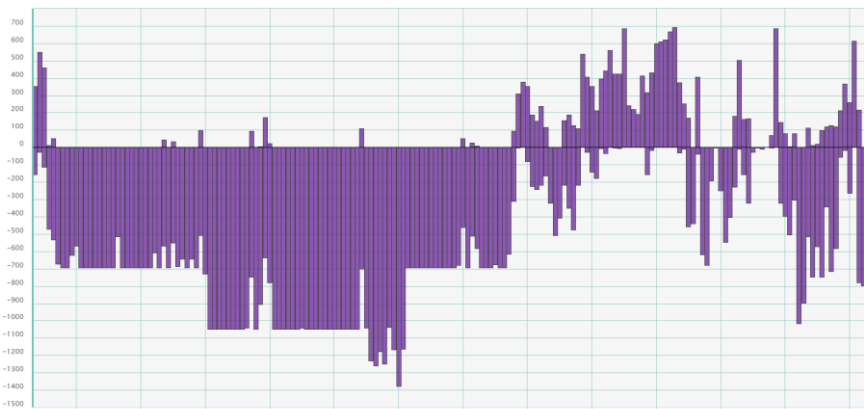


Figure 9: Interconnector flows between Norway and GB in 2022. Higher levels of import can be seen in Q2 (positive value indicates import to Norway)

thereby limited its renewable generation. In the south-west of Norway, where all the interconnectors are located, as well as the majority of its population, water reservoir levels dipped to just ~12%, the lowest level ever recorded. Other areas experienced similarly low levels. Since a major bulk of Norwegian energy relies on the hydro fleet, the drought has caused steep wholesale electricity prices this quarter at €168/MWh for NO1-2-5.

Typically, Norway’s high levels of hydro generation result in low wholesale prices and high levels of exports to its interconnected markets, but the drought has caused this spike in prices and thereby a reversal in the interconnector flows. This reversal can be seen in figure 8 which shows the flows of the North Sea Link interconnector between Norway and GB in 2022 this far.

2 Day-ahead Price Trends

This quarter wholesale markets were under the heavy influence of the elevated gas prices which sustained the high levels seen in the last quarter. Prices in Q2 2022 were between twice and three times as high as Q2 2021, which was itself seen as an expensive quarter compared to the previous second quarters. Italy, with large dependence on gas generation for meeting its demand, was exposed to the highest average day ahead price this quarter at €245.7/MWh, which is more than triple the levels of Q2 2021. For GB, despite low gas prices bringing wholesale prices down considerably from the extreme highs seen in the previous two quarters, prices this quarter were still very high within a wider historical context, being around double the prices from Q2 2021. As a result of their declining nuclear fleet, France also saw extremely high wholesale levels this quarter at €224.4/MWh, which was almost quadruple the levels seen in Q2 2021.

Table 1: EPEX Day-ahead quarterly average prices (EUR/MWh)

	BE	DE	DK (Ave)	ES	FR	GB	IT (Ave)	NL	NO 1-2-5	NO 3-4	SE 3-4	SE 1-2
Q1 2015	47.0	33.0	28.1	45.9	45.2	39.6	51.9	43.2	27.3	28.0	28.9	27.7
Q2 2015	41.4	28.3	23.0	48.4	32.6	42.0	47.6	39.1	20.0	20.9	22.1	20.8
Q3 2015	45.8	32.8	19.9	55.7	35.8	41.4	56.6	40.2	11.0	13.8	15.7	14.7
Q4 2015	44.8	33.2	23.8	51.2	40.6	37.6	52.5	37.9	21.2	20.8	23.2	21.6
Q1 2016	28.4	25.2	22.9	30.7	28.8	34.7	39.3	27.7	22.7	22.9	24.3	23.1
Q2 2016	27.1	24.8	25.7	29.5	25.9	35.1	36.3	28.4	22.8	24.1	26.5	26.4
Q3 2016	32.6	28.3	28.9	41.7	32.3	39.6	42.1	31.4	22.4	27.3	29.6	29.5
Q4 2016	58.1	37.6	34.6	56.5	59.8	52.4	53.1	41.4	33.7	33.1	37.0	36.7
Q1 2017	51.7	41.3	31.0	55.6	55.0	48.0	55.3	42.8	31.0	28.7	32.3	31.7
Q2 2017	35.7	29.8	28.7	47.0	33.9	40.0	46.4	34.6	27.1	26.2	28.8	28.5
Q3 2017	34.2	32.7	33.8	48.4	34.5	43.0	52.1	35.4	27.6	25.6	33.7	33.0
Q4 2017	56.8	33.0	30.6	58.0	56.5	50.2	61.0	44.5	29.9	30.0	32.0	30.2
Q1 2018	44.9	35.5	36.8	48.1	43.8	52.7	54.2	45.1	37.8	38.3	39.2	38.9
Q2 2018	44.1	36.0	39.7	52.0	36.8	52.7	55.0	46.1	38.7	39.7	39.5	38.5
Q3 2018	60.7	53.5	53.2	65.8	57.2	61.3	70.3	58.1	49.7	50.2	52.6	51.8
Q4 2018	71.1	52.6	50.4	63.0	62.7	63.0	68.3	60.6	46.8	47.1	50.2	47.4
Q1 2019	48.6	40.9	43.0	55.0	47.2	51.8	59.3	48.6	48.0	46.1	46.7	46.0
Q2 2019	34.5	35.8	36.9	48.7	34.9	41.3	52.3	39.1	37.0	35.3	33.8	33.0
Q3 2019	35.0	37.4	38.0	46.2	35.5	38.5	52.9	37.9	33.2	34.7	36.6	35.3
Q4 2019	39.4	36.6	38.9	41.0	40.3	40.1	48.5	39.3	39.0	37.7	39.4	37.5
Q1 2020	30.1	26.6	21.2	34.9	29.4	32.7	40.4	30.5	15.1	15.4	19.5	15.6
Q2 2020	18.5	20.3	20.5	23.2	18.0	24.3	25.2	20.9	4.5	5.6	16.2	8.2
Q3 2020	36.5	36.1	33.9	37.5	39.0	36.4	43.9	35.3	4.8	5.7	29.1	18.6
Q4 2020	42.3	38.8	31.0	40.1	42.2	47.5	49.5	42.1	12.6	10.0	29.2	15.1
Q1 2021	51.0	49.6	49.1	45.2	53.0	73.0	58.8	50.6	46.8	35.5	47.6	37.5
Q2 2021	62.3	60.3	58.7	71.8	63.9	84.5	77.2	62.1	47.2	30.0	46.5	33.1
Q3 2021	97.3	97.1	96.0	117.8	96.6	150.8	126.2	101.5	77.8	45.1	80.8	54.8
Q4 2021	204.3	178.9	147.1	211.0	221.4	240.3	237.4	196.0	126.4	41.5	117.3	44.5
Q1 2022	208.0	184.6	152.6	229.4	232.2	239.3	246.0	207.5	151.4	20.1	105.6	24.8
Q2 2022	192.2	185.4	178.0	183.4	224.4	180.3	245.7	194.1	166.8	18.8	117.4	51.9

3 Generation Activity Overview

This quarter saw the highest wind generation and highest solar generation of any Q2 on record with 95.6TWh of wind and 56.6TWh of solar across the continent. Hydro, however, saw its lowest

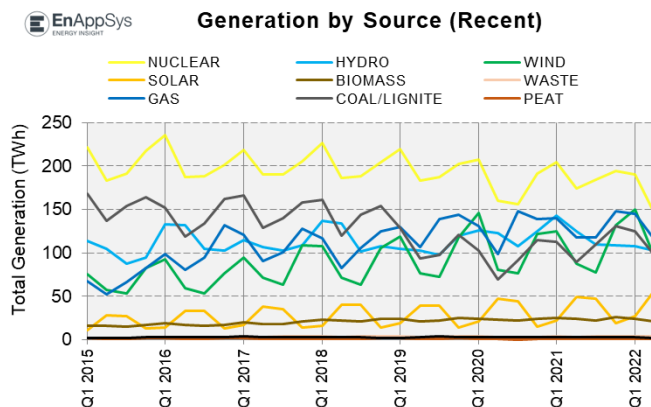


Figure 10: Generation by source in Europe from 2015 to 2022

generation for any Q2 since Q2 2019 as a consequence of the drought. This was enough to offset the increases in wind and solar and overall renewable generation was lower than in Q2 2021 by over 10TWh. Gas generation was lower than in Q2 2021 due to the high gas prices and nuclear generation was due to the issues in the French nuclear fleet. Coal/lignite generation was higher than Q2 2021 with the fuel switching that was seen, particularly in Germany and Spain.

Table 2: Quarterly generation summary Q2 2020 – Q2 2022

	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022
TOTAL GENERATION BY FUEL (TWh)									
Biomass	23.5	21.9	24.4	25.6	24.6	22.4	25.8	23.9	21.3
Coal/Lignite	70.0	91.2	114.9	113.0	89.4	110.1	131.3	124.5	98.2
Gas	98.2	147.8	138.9	139.9	118.3	117.9	148.4	144.5	115.9
Hydro	122.9	108.2	124.8	143.3	125.2	109.4	109.0	107.8	103.1
Nuclear	160.1	156.0	191.4	204.6	174.6	184.4	194.6	190.2	146.4
Oil	3.1	3.3	2.8	3.4	3.4	3.3	3.2	3.2	1.8
Peat	0.7	0.4	1.1	1.4	0.8	0.6	1.3	1.5	1.0
Solar	47.3	43.9	15.5	21.8	49.6	47.5	18.8	26.9	56.6
Waste	3.0	3.2	3.5	3.7	3.6	4.1	4.2	4.2	3.7
Wind	80.2	76.9	121.6	124.5	87.6	77.3	132.3	150.5	95.6
FOSSIL FUELS	172.0	242.7	257.7	257.7	211.9	232.0	284.2	273.7	216.9
NUCLEAR	160.1	156.0	191.4	204.6	174.6	184.4	194.6	190.2	146.4
RENEWABLE (INCLUDES WASTE)	276.9	254.1	289.8	318.9	290.6	260.7	290.1	313.3	280.4
TOTAL	609.0	652.8	738.8	781.1	677.0	677.1	769.0	777.2	643.7
Fossil Fuel Percentage	28%	37%	35%	33%	31%	34%	37%	35%	34%
Clean Percentage	72%	63%	65%	67%	69%	66%	63%	65%	66%
Renewable Share of Clean Power	63%	62%	60%	61%	62%	59%	60%	62%	66%
SHARE OF GENERATION (%)									
Biomass	3.9%	3.3%	3.3%	3.3%	3.6%	3.3%	3.4%	3.1%	3.3%
Coal/Lignite	11.5%	14.0%	15.5%	14.5%	13.2%	16.3%	17.1%	16.0%	15.3%
Gas	16.1%	22.6%	18.8%	17.9%	17.5%	17.4%	19.3%	18.6%	18.0%
Hydro	20.2%	16.6%	16.9%	18.3%	18.5%	16.2%	14.2%	13.9%	16.0%
Nuclear	26.3%	23.9%	25.9%	26.2%	25.8%	27.2%	25.3%	24.5%	22.7%
Oil	0.5%	0.5%	0.4%	0.4%	0.5%	0.5%	0.4%	0.4%	0.3%
Peat	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%	0.2%	0.2%
Solar	7.8%	6.7%	2.1%	2.8%	7.3%	7.0%	2.4%	3.5%	8.8%
Waste	0.5%	0.5%	0.5%	0.5%	0.5%	0.6%	0.5%	0.5%	0.6%
Wind	13.2%	11.8%	16.5%	15.9%	12.9%	11.4%	17.2%	19.4%	14.9%
FOSSIL FUELS	28.1%	37.1%	34.7%	32.8%	31.2%	34.2%	36.8%	35.0%	33.5%
NUCLEAR	26.3%	23.9%	25.9%	26.2%	25.8%	27.2%	25.3%	24.5%	22.7%
RENEWABLE (INCLUDES WASTE)	45.5%	38.9%	39.2%	40.8%	42.9%	38.5%	37.7%	40.3%	43.6%

Table 2: Year-on-year comparison of Q2 generation (TWh and %)

	Q2 2017	Q2 2018	Q2 2019	Q2 2020	Q2 2021	Q2 2022
TOTAL GENERATION BY FUEL (TWh)						
Biomass	18.6	22.2	21.4	23.5	24.6	21.3
Coal/Lignite	129.0	119.4	93.7	70.0	89.4	98.2
Gas	90.3	82.6	106.3	98.2	118.3	115.9
Hydro	107.3	133.9	102.4	122.9	125.2	103.1
Nuclear	190.1	186.7	183.1	160.1	174.6	146.4
Oil	2.8	3.0	2.9	3.1	3.4	1.8
Peat	1.4	1.4	1.1	0.7	0.8	1.0
Solar	38.4	40.1	39.0	47.3	49.6	56.6
Waste	3.5	3.4	3.3	3.0	3.6	3.7
Wind	71.6	71.5	76.8	80.2	87.6	95.6
FOSSIL FUELS	223.5	206.4	204.0	172.0	211.9	216.9
NUCLEAR	190.1	186.7	183.1	160.1	174.6	146.4
RENEWABLE (INCLUDES WASTE)	239.3	271.1	243.0	276.9	290.6	280.4
TOTAL	652.9	664.3	630.1	609.0	677.0	643.7
Fossil Fuel Percentage	34%	31%	32%	28%	31%	34%
Clean Percentage	66%	69%	68%	72%	69%	66%
Renewable Share of Clean Power	56%	59%	57%	63%	62%	66%
CHANGE SINCE Q1 2017 (%)						
Biomass		19%	15%	26%	32%	14%
Coal/Lignite		-7%	-27%	-46%	-31%	-24%
Gas		-8%	18%	9%	31%	28%
Hydro		25%	-5%	15%	17%	-4%
Nuclear		-2%	-4%	-16%	-8%	-23%
Oil		6%	3%	9%	20%	-36%
Peat		2%	-18%	-50%	-41%	-24%
Solar		5%	2%	23%	29%	48%
Waste		-2%	-5%	-14%	2%	7%
Wind		0%	7%	12%	22%	34%
FOSSIL FUELS		-8%	-9%	-23%	-5%	-3%
NUCLEAR		-2%	-4%	-16%	-8%	-23%
RENEWABLE (INCLUDES WASTE)		13%	2%	16%	21%	17%

4 Notes on the Report

The figures used in the report refer to data provided through ENTSO-E for the period from 2015 which have been aggregated by EnAppSys into a European total. This data does sometimes suffer from outages or gaps in reporting, but it is considered generally complete. This report is based on the most recently available data as at quarter and year ends. National Grid data is used for GB demand.

Included Countries

Albania	Germany	Norway
Austria	Great Britain	Poland
Belgium	Greece	Portugal
Bosnia & Herzegovina	Hungary	Romania
Bulgaria	I-SEM	Serbia
Croatia	Italy	Slovakia
Czech Republic	Latvia	Slovenia
Denmark	Lithuania	Spain
Estonia	Montenegro	Sweden
Finland	Netherlands	Switzerland
France	North Macedonia	

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*This report has been created using our pan-European **market data platform**, which has flexible configurable screens and automated data feeds. If you would like to gain more detailed information and insight, please contact us to arrange trial access to the platform via: sales@enappsys.com*

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EnAppSys Ltd.

Blenheim House, 1 Falcon Court, Stockton On-Tees, TS18 3TS, U.K.
Company Registration No.: 04685938

EnAppSys B.V.

Oostelijk Bolwerk 9, 1st Floor, 4531 GP, Terneuzen, The Netherlands
Company Registration No.: 67992358

