

# European Electricity Fuel Mix Summary

Q1-2021

January to March

## Generation and Contribution by Fuel Type

Renewables: 318.9TWh (+10%)

Fossil Fuels: 257.7TWh (0%)

Nuclear: 204.6TWh (+7%)

Percentage changes are from the previous quarter

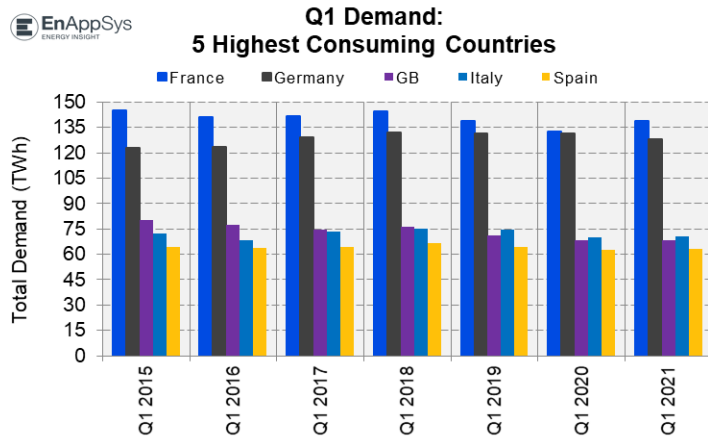
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## 1 Executive Summary

Latest data for Q1 2021 indicates that total generation levels were up across Europe, compared to the past quarter, as the continent was hit by cold spells and most of the countries loosened lockdown measures. The Q1 total was 781TWh, up 6% from the 739TWh in 2020 Q4, and 2% higher than the 766TWh in Q1 last year.



Renewable generation (including biomass and waste) contributed 41% of this total continuing the trend of renewables being the largest share of the generation mix that began in Q4 2019. Nuclear contributed 26%, gas 18% and coal/lignite 15%.

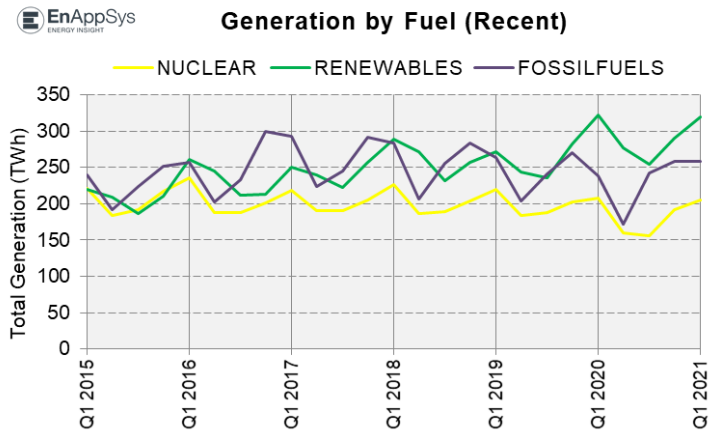
This quarter fossil fuel generation was high and outlined from the decreasing trend that we have observed since 2016 for transitions from Q4 to Q1, due to the higher demand. The wind generation was lower by 15% compared to the previous Q1, despite to the capacity increase in the offshore fleets. Q1 2020 had been exceptionally windy, leading to high wind generation levels across the continent. Q1 2021 on the other hand has seen less wind due to the presence of a persistent high-pressure system during the cold spell. This means that whilst wind generation this Q1 is lower than that last year, the levels are still part of a general upward trend in wind generation over time across Europe.

The chart above shows Q1 demand for the five countries with the highest demand (these five remained as the highest since 2015). For the last three years, GB demand has been fourth highest, falling from the third place in 2018.

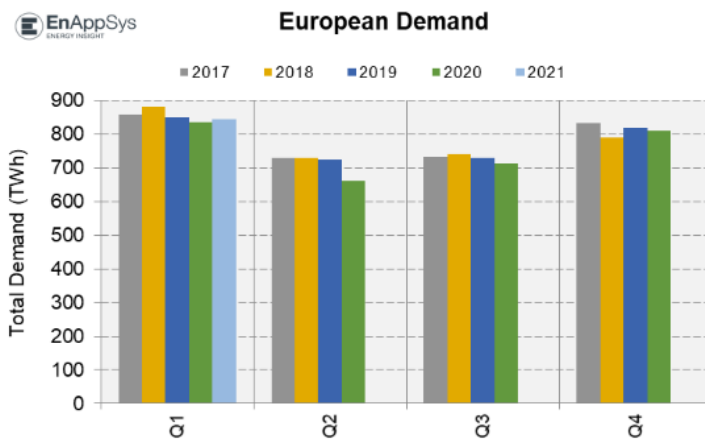
## 2 Fuel Activity Overview

### Europe Totals

Renewable (including biomass and waste) dominance in the European fuel mix since the 4<sup>th</sup> quarter of 2019 has continued in this quarter as well, as the sixth consecutive quarter, with maintaining the remarkable difference achieved on 2020 1<sup>st</sup> quarter. This can be seen in the chart on the right, which presents total generation by the grouped categories of renewables, fossil fuels, and nuclear.



In total, 319TWh was generated by renewables, up 10% from the 290TWh in Q4 of 2020, but down 1% from the 322TWh in Q1 of 2020. The 319TWh of renewables contributed 40.8% of total generation, followed by 258TWh of fossil fuel-fired generation (32.8% contribution) and 204.6TWh of nuclear generation (26.2% contribution).

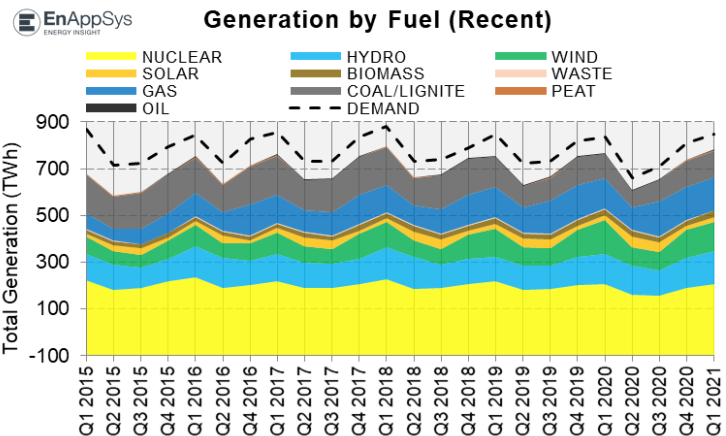


As can be seen from the European Demand chart, demand across the continent has gradually recovered from the impact of Covid-19 since last Q3. **There is about 10TWh increase in the demand compared to 2020 Q1 due to the cold winter bringing temperatures about 5 degrees lower on average in mid-February and mid-March, compared to the last year.**

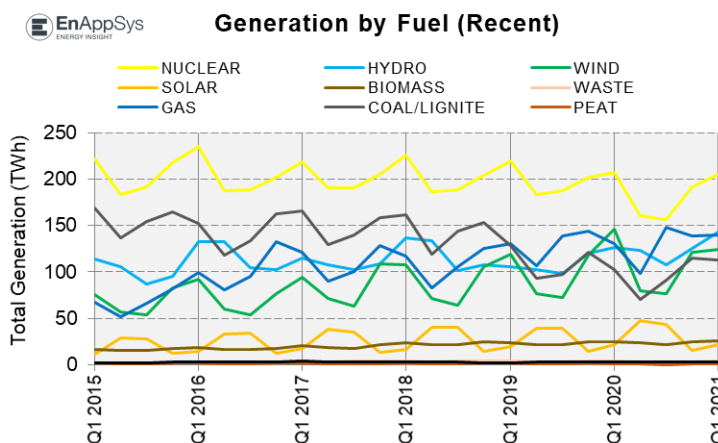
Fossil fuel generation remained the same in comparison to the past quarter in contrast to the declining trend we have observed in the transition of Q4 2019 to 2020 Q1. This lack of demand drop Q4 to Q1 was due to the cold spells in this Q1. Compared to Q1 of last year, the fossil fuel-fired fleet saw 8% more generation in Q1 2021, as more dispatchable generation was required to

meet demand in the cold weather. The nuclear fleet saw just 1% less. Total generation levels were up across Europe, versus Q4 levels, as winter increased demand across the continent. The Q1 total was 781TWh, up 6% from the 739TWh in Q4 of 2020.

When individual technology types, rather than groupings (i.e. renewable and fossil fuel), are considered, **nuclear consistently has the largest generation of any single fuel type. This remains true this quarter, however the second highest individual type became hydro taking the place of gas.** Nuclear generation of Europe was



205TWh being 61TWh higher than the 143TWh of hydro, the second highest individual fuel type which is closely followed by the gas fuelled generation at 140TWh. Whereas nuclear is consistently the highest contributor because of its high installed capacity and consistent operation, the second highest is more variable over time. Coal used to often be the second highest contributor but decommissioning of coal units across Europe has led to its share reducing over time. Now, the amount of wind and rainfall and so the amount of dispatchable thermal generation needed to meet demand is the main factor in what takes second place.



Gas-fired generation had a significant increase of 7% in comparison to the last year's Q1. However, the continuing upwards trend of hydro EU generation meant that hydro was higher, despite the increase in the gas-fired generation. The declining trend of coal/lignite fired generation can still be observed with 2% decrease

compared to the last quarter, yet the cold spell meant that there was a 10% increase this quarter from the Q1 of 2020. Another noticeable trend is solar. As the solar installed capacity increases across Europe, the solar generation has seen a steady increase by 10% since 2019 Q1.

## Statistics

The following tables set out key statistics relating to generation in the quarter:

	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021
<b>TOTAL GENERATION BY FUEL (TWh)</b>									
Biomass	24.2	21.4	22.0	25.0	24.5	23.5	21.9	24.4	25.6
Coal/Lignite	128.7	93.7	97.9	120.7	102.9	70.0	91.2	114.9	113.0
Gas	130.2	106.3	139.0	143.7	130.5	98.2	147.8	138.9	139.9
Hydro	105.2	102.4	98.0	119.9	125.9	122.9	108.2	124.8	143.3
Nuclear	219.2	183.1	187.4	202.5	207.2	160.1	156.0	191.4	204.6
Oil	2.5	2.9	3.6	3.4	3.0	3.1	3.3	2.8	3.4
Peat	1.9	1.1	1.0	1.7	1.2	0.7	0.4	1.1	1.4
Solar	19.7	39.0	39.8	14.6	21.3	47.3	43.9	15.5	21.8
Waste	3.8	3.3	3.6	4.0	3.8	3.0	3.2	3.5	3.7
Wind	118.8	76.8	72.6	118.0	146.1	80.2	76.9	121.6	124.5
FOSSIL FUELS	263.3	204.0	241.5	269.5	237.7	172.0	242.7	257.7	257.7
NUCLEAR	219.2	183.1	187.4	202.5	207.2	160.1	156.0	191.4	204.6
RENEWABLE (INCLUDES WASTE)	271.7	243.0	236.1	281.4	321.5	276.9	254.1	289.8	318.9
<b>TOTAL</b>	<b>754.2</b>	<b>630.1</b>	<b>664.9</b>	<b>753.5</b>	<b>766.4</b>	<b>609.0</b>	<b>652.8</b>	<b>738.8</b>	<b>781.1</b>

Fossil Fuel Percentage	35%	32%	36%	36%	31%	28%	37%	35%	33%
Clean Percentage	65%	68%	64%	64%	69%	72%	63%	65%	67%
Renewable Share of Clean Power	55%	57%	56%	58%	61%	63%	62%	60%	61%

<b>SHARE OF GENERATION (%)</b>									
Biomass	3.2%	3.4%	3.3%	3.3%	3.2%	3.9%	3.3%	3.3%	3.3%
Coal/Lignite	17.1%	14.9%	14.7%	16.0%	13.4%	11.5%	14.0%	15.5%	14.5%
Gas	17.3%	16.9%	20.9%	19.1%	17.0%	16.1%	22.6%	18.8%	17.9%
Hydro	13.9%	16.2%	14.7%	15.9%	16.4%	20.2%	16.6%	16.9%	18.3%
Nuclear	29.1%	29.1%	28.2%	26.9%	27.0%	26.3%	23.9%	25.9%	26.2%
Oil	0.3%	0.5%	0.5%	0.5%	0.4%	0.5%	0.5%	0.4%	0.4%
Peat	0.3%	0.2%	0.1%	0.2%	0.2%	0.1%	0.1%	0.1%	0.2%
Solar	2.6%	6.2%	6.0%	1.9%	2.8%	7.8%	6.7%	2.1%	2.8%
Waste	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Wind	15.8%	12.2%	10.9%	15.7%	19.1%	13.2%	11.8%	16.5%	15.9%
FOSSIL FUELS	34.7%	32.2%	36.2%	35.6%	30.9%	28.1%	37.1%	34.7%	32.8%
NUCLEAR	29.1%	29.1%	28.2%	26.9%	27.0%	26.3%	23.9%	25.9%	26.2%
RENEWABLE (INCLUDES WASTE)	36.0%	38.6%	35.5%	37.4%	42.0%	45.5%	38.9%	39.2%	40.8%

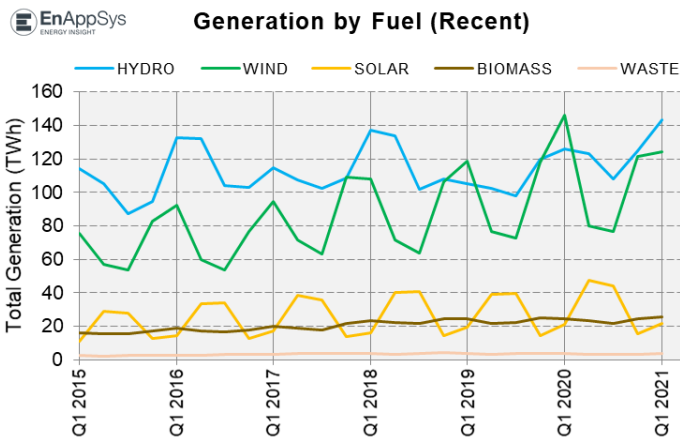
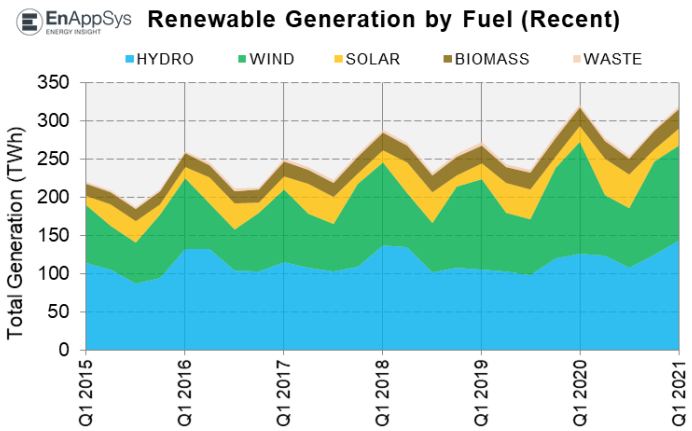
	Q1 2016	Q1 2017	Q1 2018	Q1 2019	Q1 2020	Q1 2021
<b>TOTAL GENERATION BY FUEL (TWh)</b>						
Biomass			18.9	20.3	23.6	25.6
Coal/Lignite	151.8	166.2	161.2	128.7	102.9	113.0
Gas	99.1	121.3	116.6	130.2	130.5	139.9
Hydro	132.5	114.9	137.0	105.2	125.9	143.3
Nuclear	235.6	218.2	226.1	219.2	207.2	204.6
Oil	3.5	3.8	3.4	2.5	3.0	3.4
Peat	1.9	1.9	1.5	1.9	1.2	1.4
Solar	14.5	17.1	16.0	19.7	21.3	21.8
Waste	2.4	3.2	3.7	3.8	3.8	3.7
Wind	92.2	94.6	108.0	118.8	146.1	124.5
FOSSIL FUELS	256.3	293.2	282.7	263.3	237.7	257.7
NUCLEAR	235.6	218.2	226.1	219.2	207.2	204.6
RENEWABLE (INCLUDES WASTE)	260.4	250.1	288.4	271.7	321.5	318.9
<b>TOTAL</b>	<b>752.3</b>	<b>761.6</b>	<b>797.3</b>	<b>754.2</b>	<b>766.4</b>	<b>781.1</b>

Fossil Fuel Percentage	34%	39%	35%	35%	31%	33%
Clean Percentage	66%	61%	65%	65%	69%	67%
Renewable Share of Clean Power	52%	53%	56%	55%	61%	61%

<b>CHANGE SINCE Q1 2016 (%)</b>						
Biomass			8%	25%	28%	36%
Coal/Lignite			9%	6%	-15%	-26%
Gas			22%	18%	31%	41%
Hydro			-13%	3%	-21%	8%
Nuclear			-7%	-4%	-7%	-13%
Oil			9%	-4%	-28%	-4%
Peat			2%	-19%	0%	-27%
Solar			18%	11%	36%	51%
Waste			33%	55%	59%	53%
Wind			3%	17%	29%	35%
<b>FOSSIL FUELS</b>			<b>14%</b>	<b>10%</b>	<b>3%</b>	<b>-7%</b>
<b>NUCLEAR</b>			<b>-7%</b>	<b>-4%</b>	<b>-7%</b>	<b>-13%</b>
<b>RENEWABLE (INCLUDES WASTE)</b>			<b>-4%</b>	<b>11%</b>	<b>4%</b>	<b>22%</b>

### 3 Renewables

Across Europe as a whole, Q1 2021 saw 319TWh of power production from renewable sources, amounting to 41% of total European electricity generation. This is an increase of 10% from the 290TWh in Q4 2020, as the output from all the generation types, most significantly wind and hydro, increased. The renewable proportion of the mix was the highest growing share with 1.6% increase from the previous quarter.

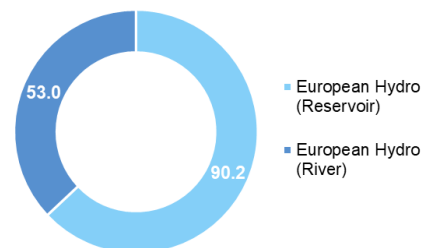


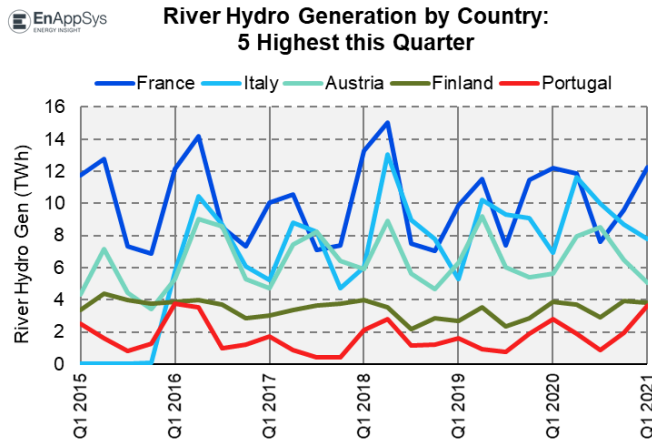
All renewable sectors except solar saw an increase in generation from the past quarter, with solar seeing the largest rise (41%) to a total of 22TWh. In contrast to the last Q1, this year Hydro (reservoir + river) was the largest individual component of renewable generation with a difference of 19TWh from the second largest renewable generation component, wind at 125TWh. The

increased wind generation capacity across Europe in recent years has meant that Q1 wind generation has surpassed that of hydro in the last two years, however less wind over this Q1 meant that even with the increased capacity, there was not enough wind to meet the levels of hydro generation.

This quarter, Hydro (reservoir + river) reached the highest generation level observed since 2015 Q1. Historically the first quarter has been the most abundant periods for hydro generation in a year, which is proven to be true this year as well, yet with a 14% increase from the last year's Q1. The reservoir- and river-based hydro generation saw increases of 15% and 8%, respectively compared to the previous Q1.

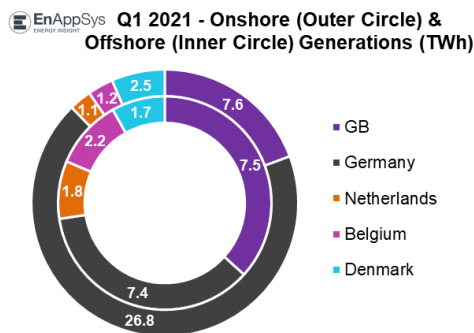
EnAppSys Q1 2021-Hydro Generation (TWh)



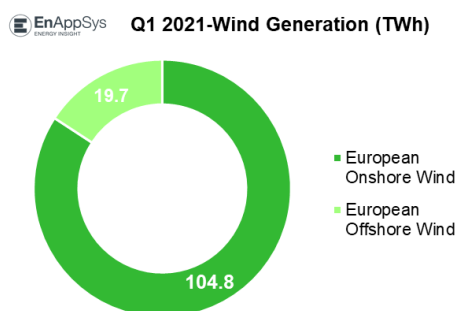


The ranking of the countries which produce the largest run-of-river- and reservoir-based generation did not change. The wet winter in Portugal has boosted the river-hydro generation by 30% compared to the previous Q1, but this was not enough to move Portugal into third place, which has long been occupied by Finland.

France had the largest level of run-of-river hydro generation in the quarter, at 12.3TWh, a 23% share of the 53TWh total, closely followed by Italy with 7.8TWh and an 15% share. Reservoir hydro, on the other hand, is highest in Norway, where 37.5TWh were produced in Q1, a 42% share of the 90TWh total. Norway's reservoir based generation increased by 10% compared to the previous Q1. Sweden produced the second largest, at 21.5TWh, a 24% share.



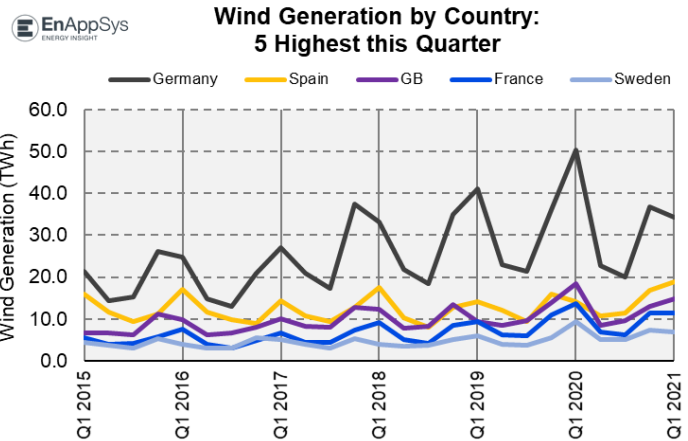
Wind generation decreased by 15%, almost an equal decline both in offshore and onshore, compared to the first quarter of 2020, which saw the highest wind generation in a quarter. Whilst offshore generation declined compared to the Q1 2020, Belgium and Netherlands recorded the highest generation in offshore this Q1 thanks to the increase in the offshore capacity last quarter. Germany contributed large shares to both onshore and offshore generation with 34.2TWh in total (28%). GB has been contributing a large portion of the offshore wind mix, since it's most recent offshore farm commissioned in the late 2019. Whilst in Q4 2020, Germany had the highest share (8.3TWh versus 8.2TWh in GB), this quarter GB had recovered its first place as an offshore generation leader with 7.5TWh compared to 7.4TWh in Germany. Compared to Q1 2020, Denmark saw a decrease 20%



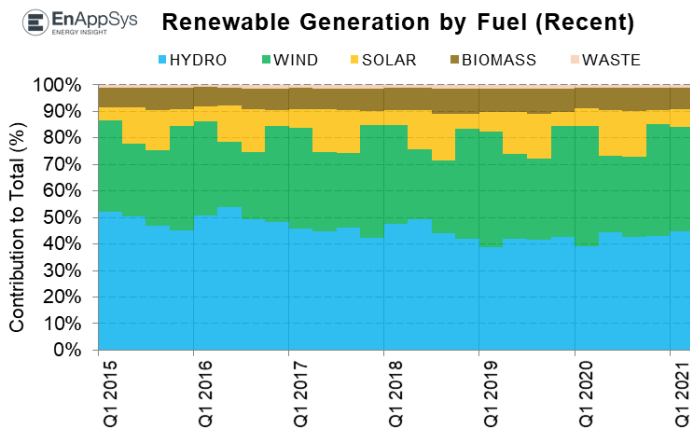
and 34% in offshore and onshore generations, respectively.



This quarter the five highest generators of wind energy had not changed from those leading this area since 2015. Despite the significant decline, Germany protects its position at first. On the contrary to the Northern countries, Spain had a better generation than Q1 2020. Spain has recovered from the previous quarter's step back and produced 18.9TWh wind generation, solely from onshore farms and surpassed GB. French wind generation decreased from 13.8TWh in Q1 2020 down to 11.3TWh, still 4.4TWh ahead of Sweden.



The third largest share of renewable power was the biomass fleet, which is closely followed by solar with 3.8TWh difference as daylight hours continue to increase since the beginning of the quarter. Biomass output levels are generally fairly static at 20-25TWh per quarter, and this quarter the highest generation since 2015 Q1 with 25.6TWh.



Compared to Q1 last year, although besides waste (-3%) and wind (-15%) the other generation types saw increases (biomass by 4%, hydro by 14% and solar by 3%), there was a net decrease of 1% due to the significant drop in the wind generation.

## Statistics

The following table sets out key statistics by quarter:

	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021
<b>TOTAL GENERATION BY FUEL (TWh)</b>									
Biomass	24.2	21.4	22.0	25.0	24.5	23.5	21.9	24.4	25.6
Hydro	105.2	102.4	98.0	119.9	125.9	122.9	108.2	124.8	143.3
Solar	19.7	39.0	39.8	14.6	21.3	47.3	43.9	15.5	21.8
Waste	3.8	3.3	3.6	4.0	3.8	3.0	3.2	3.5	3.7
Wind	118.8	76.8	72.6	118.0	146.1	80.2	76.9	121.6	124.5
<b>TOTAL</b>	<b>271.7</b>	<b>243.0</b>	<b>236.1</b>	<b>281.4</b>	<b>321.5</b>	<b>276.9</b>	<b>254.1</b>	<b>289.8</b>	<b>318.9</b>
Primary Renewable Source	WIND	HYDRO	HYDRO	HYDRO	WIND	HYDRO	HYDRO	HYDRO	HYDRO
<b>SHARE OF RENEWABLES (%)</b>									
Biomass	8.9%	8.8%	9.3%	8.9%	7.6%	8.5%	8.6%	8.4%	8.0%
Hydro	38.7%	42.1%	41.5%	42.6%	39.1%	44.4%	42.6%	43.1%	44.9%
Solar	7.2%	16.1%	16.9%	5.2%	6.6%	17.1%	17.3%	5.3%	6.9%
Waste	1.4%	1.4%	1.5%	1.4%	1.2%	1.1%	1.3%	1.2%	1.1%
Wind	43.7%	31.6%	30.8%	41.9%	45.4%	29.0%	30.3%	42.0%	39.1%

The following table contains the key statistics comparing the quarter with the same quarter in previous years:

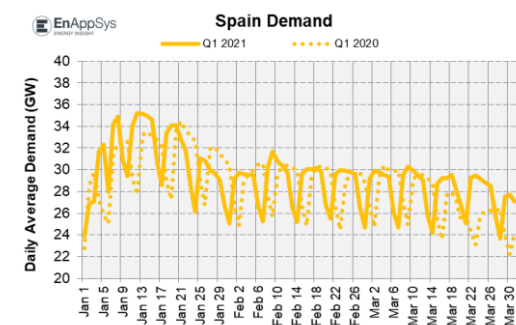
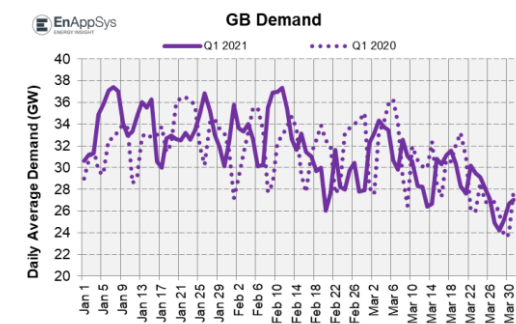
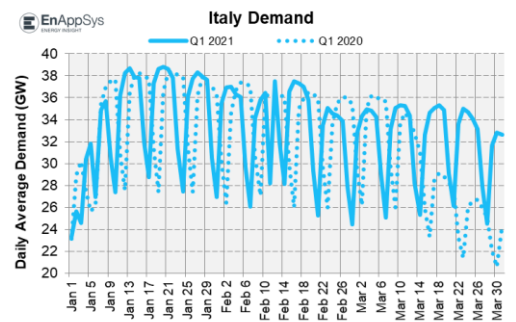
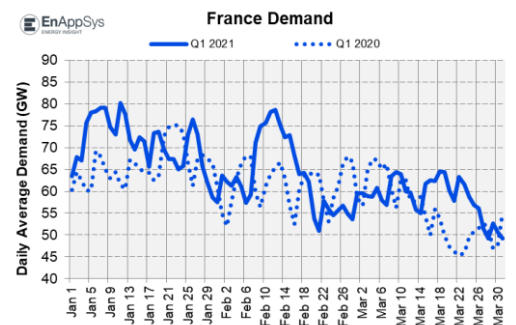
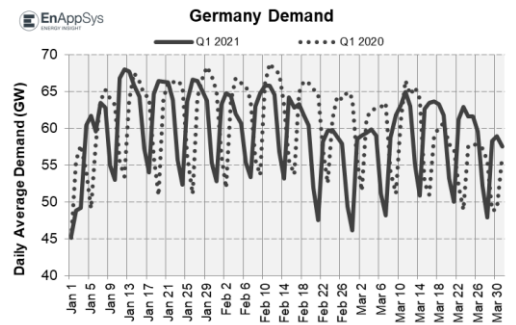
	Q1 2016	Q1 2017	Q1 2018	Q1 2019	Q1 2020	Q1 2021
<b>TOTAL GENERATION BY FUEL (TWh)</b>						
Biomass	18.9	20.3	23.6	24.2	24.5	25.6
Hydro	132.5	114.9	137.0	105.2	125.9	143.3
Solar	14.5	17.1	16.0	19.7	21.3	21.8
Waste	2.4	3.2	3.7	3.8	3.8	3.7
Wind	92.2	94.6	108.0	118.8	146.1	124.5
<b>TOTAL</b>	<b>260.4</b>	<b>250.1</b>	<b>288.4</b>	<b>271.7</b>	<b>321.5</b>	<b>318.9</b>
Primary Renewable Source	HYDRO	HYDRO	HYDRO	WIND	WIND	HYDRO
<b>CHANGE SINCE Q1 2016 (%)</b>						
Biomass		8%	25%	28%	30%	36%
Hydro		-13%	3%	-21%	-5%	8%
Solar		18%	11%	36%	47%	51%
Waste		33%	55%	59%	58%	53%
Wind		3%	17%	29%	58%	35%

## 4 Coronavirus Lockdown Effects

The security measures introduced by the governments of European Nations since the end of Q1 2020 had a profound impact on the demand curves in the past quarters. However starting from the third quarter of 2020, the European total demand has gradually recovered. The impact of the previous and recent lockdown measures can be observed from the first quarter daily average demand 2020 and 2021 comparison charts of the five countries with the largest shares of the total demand.

This quarter the total demand was 846TWh, 1% higher than the previous Q1. This resulted from the cold spell that hit the continent by mid-February and mid-March reducing temperatures by 5 degrees compared to the last year. The impact of the cold spell is most visible in the French demand curve by mid-February, since the heat demand is closely related with the electricity demand in France. At this time last year the impact of Corona was not yet apparent in France, as it announced the first lockdown on 17<sup>th</sup> of March 2020. The recovery of the demand curve can clearly be noticed by comparing the last two weeks of March in 2020 and 2021.

As Italy was one the first countries to impose lockdowns last year starting on 9<sup>th</sup> of March, the recovery of the demand curve can be better observed in the second half of March. The daily average demand increase is ~10GW. In Germany, the last lockdown was originally meant to end on 14<sup>th</sup> of February 2021, yet has been extended until the end of March. Although Germany had a significantly colder winter, the daily average demand decreased by ~5GW throughout the February cold spell.



## 5 Notes on the Report

The figures used in the report refer to data provided through ENTSO-E which have been aggregated by EnAppSys into a European total. This data does sometimes suffer from outages or gaps in reporting but is considered to be 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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