EnAppSys
ENERGY INSIGHT

European Electricity Fuel Mix Summary

Q2-2020

April to June

Generation and Contribution by Fuel Type

Renewables:	274.3 TWh (45%)	Fossil Fuels:	186.5 TWh (31%)	Nuclear:	149.9 TWh (25%)

Contents

1 Executive Summary

European energy demand had seen a significant drop at the end of Q1, shortly after the World Health Organization announced the coronavirus as a pandemic on the 11th March 2020 and many countries went into lockdown. This continued into Q2 with daily demand shapes being both lower and flatter than usual, losing the morning and evening peak shape. Since then, some individual countries such as Italy, France and Spain have seen a return to more usual demand levels and shapes, while others such as Ireland, Germany and GB are still seeing lower levels of demand.

The impact of lower demand was reflected in market prices. The prevailing Spectron carbon prices saw a marked decrease at the end of last quarter from ~24.00 Euro/te to ~16.50 Euro/te, but, driven by the effect of the Market Stability Reserve which absorbs up to 24% of surplus annual allowances, have gradually recovered over the course of Q2 to 26.91 Euro/te at the close of Q2, approaching an all-time high. Prevailing gas prices meanwhile remained fairly static throughout the quarter at around 7.00 to 8.00 Euro/MWh for the Netherlands, France, Germany and GB. This came after a decrease for these countries from around 12.00 Euro/MWh at the beginning of Q1. Belgium's Gas price remained significantly higher at around 18.00 Euro/MWh throughout Q2.

Renewables, fossil fuels and nuclear all saw a decrease in generation from Q1, but while fossil fuels and nuclear generation decreased from Q2-2019 by 9% and 18% respectively, renewables increased by 16% compared to Q2-2019. Solar generation saw an all-time quarterly high of 47.6 TWh during a period of extended sunny weather.

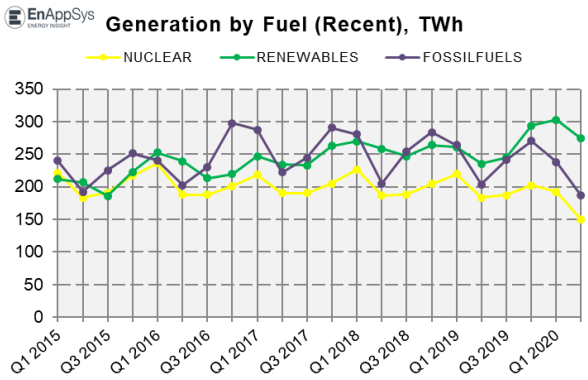
While the levels of wind generation were not as high as the record breaking levels in Q1, renewable generation still made up the largest proportion of the generation mix at 45%, ahead of fossil fuels (31%) and nuclear (25%). Hydro was the largest source of renewable generation at 44% of total renewables, followed by wind at 30%. Solar saw an all-time high in quarterly generation and provided 17% of total renewable generation. Norway was the largest reservoir hydro generator with 42% of the total share of total reservoir hydro, while Italy was the largest river hydro generator, contributing 22% to total river hydro.

Generation from coal/lignite and nuclear were both at their lowest since before 2015, seeing a decrease from Q1 of 32% and 22% respectively. The largest coal/lignite output is still provided by Germany, though their coal/lignite generation has been decreasing rapidly over recent years.

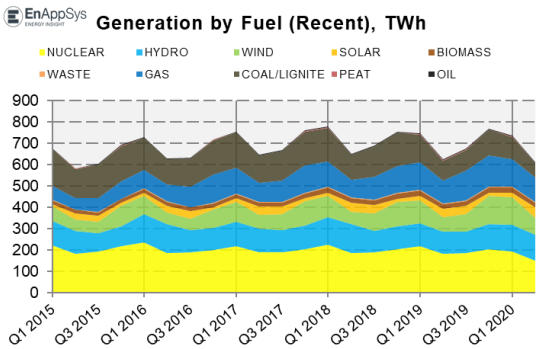
Biomass, gas, hydro, oil, solar and wind all saw increases in generation levels in TWh compared with Q2-2019, while decreases came from coal/lignite, nuclear, peat and waste.

2 Fuel Activity Overview

Across Europe in Q2-2020, the largest share of electricity generation came from renewables, if looking at the total generation on a simplified categorisation by fossil fuels, nuclear and renewables (including biomass and waste). In total, 274 TWh was generated by renewables, a proportion of 45% of the total quarterly fuel mix. This represents a increase from 41% share in Q1-2020 levels, but a decrease of 9% in generation output levels (TWh). Both fossil fuels and nuclear saw their lowest quarterly generation this quarter since before 2015. While renewables saw a decrease in generation from Q1, it remains on an upward trajectory, while both fossil fuels and nuclear trended downwards. For a more detailed breakdown of renewables, see the Renewables section of this report.



Hydro was the largest source of renewable generation, providing 43.8% of generation from renewables, and 19.7% of total generation.



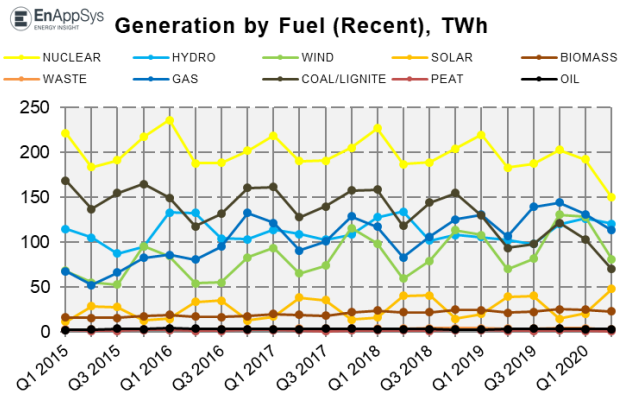
After renewables, the next largest share of generation came from fossil fuels with a total generation of 186.5 TWh, which was 31% of the total generation. This represents a decrease from Q1 of 8%. The largest share of fossil fuel generation came from gas-fired plants providing a total of 113.0 TWh, with this being down by 14% in TWh terms and also down 18% from Q2-2019. Within this total, Denmark experienced one of the most significant decreases– their gas generation decreased 40% from Q2-2019. Gas-fired generation represented 18.5% of total generation.

After gas, the largest share of fossil fuels was coal and lignite, which experienced a further decrease of 32% compared to the previous quarter and a reduction of 25% compared to Q2-2019.

Generation from coal and lignite continues a sustained downward trend, comprising only 11.5% of the total Q2 generation.

The largest coal/lignite output is still provided by Germany, though their coal/lignite generation has been decreasing rapidly over recent years. Poland is the next largest coal/lignite generator, though its output is 41% lower than that of Germany. Total European coal/lignite generation has decreased by 40% since Q1-2015.

Nuclear has the largest generation of any single fuel type at 149.9 TWh, though it is significantly down this quarter, down 22% from Q1-2020. While the seasonal profile of nuclear is usually lowest in Q2 of the year, this quarter sees nuclear generation down 18% from Q2-2019.



Statistics

The following tables contain some of the key statistics relating to generation in the quarter:

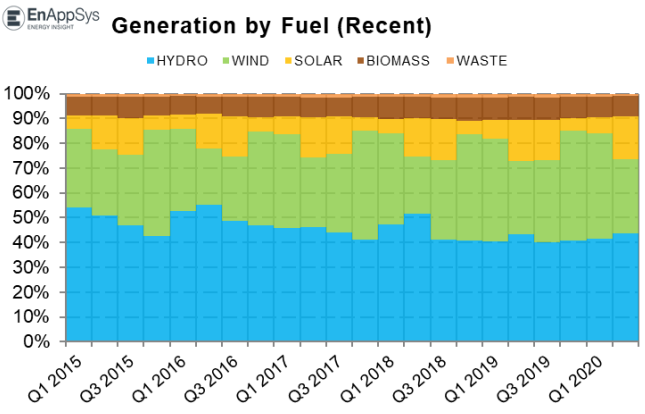
	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020
TOTAL GENERATION BY FUEL (TWh)									
Biomass	21.9	21.7	24.5	24.2	21.4	22.0	25.0	24.5	22.9
Coal/Lignite	118.0	143.9	154.5	129.4	93.7	97.7	121.3	103.1	70.0
Gas	82.7	106.0	125.4	130.4	106.4	139.0	144.2	130.8	113.0
Hydro	133.8	101.8	107.8	105.4	102.3	98.0	120.1	126.1	120.2
Nuclear	186.8	188.7	204.1	219.6	183.1	187.4	202.5	192.3	149.9
Oil	3.0	3.2	2.3	2.5	2.9	3.6	3.4	3.1	3.1
Peat	1.4	1.3	1.9	1.9	1.1	1.0	1.7	1.2	0.4
Solar	40.1	40.6	14.5	19.6	39.1	40.0	14.5	20.4	47.6
Waste	3.4	3.8	4.1	3.8	3.3	3.6	4.0	3.8	2.6
Wind	59.3	79.2	113.0	108.0	69.7	81.3	130.5	128.2	81.2
FOSSIL FUELS	205.0	254.4	284.1	264.2	204.1	241.3	270.6	238.3	186.5
NUCLEAR	186.8	188.7	204.1	219.6	183.1	187.4	202.5	192.3	149.9
RENEWABLE (INCLUDES WASTE)	258.5	246.9	263.9	261.0	235.8	244.9	294.1	303.0	274.3
TOTAL	**650.3**	**690.0**	**752.0**	**744.8**	**623.0**	**673.7**	**767.2**	**733.6**	**610.8**
Fossil Fuel Percentage	32%	37%	38%	35%	33%	36%	35%	32%	31%
Clean Percentage	68%	63%	62%	65%	67%	64%	65%	68%	69%
Renewable Share of Clean Power	58%	57%	56%	54%	56%	57%	59%	61%	65%
SHARE OF GENERATION (%)									
Biomass	3.4%	3.1%	3.3%	3.3%	3.4%	3.3%	3.3%	3.3%	3.7%
Coal/Lignite	18.1%	20.9%	20.5%	17.4%	15.0%	14.5%	15.8%	14.1%	11.5%
Gas	12.7%	15.4%	16.7%	17.5%	17.1%	20.6%	18.8%	17.8%	18.5%
Hydro	20.6%	14.7%	14.3%	14.1%	16.4%	14.5%	15.7%	17.2%	19.7%
Nuclear	28.7%	27.3%	27.1%	29.5%	29.4%	27.8%	26.4%	26.2%	24.5%
Oil	0.5%	0.5%	0.3%	0.3%	0.5%	0.5%	0.4%	0.4%	0.5%
Peat	0.2%	0.2%	0.2%	0.3%	0.2%	0.1%	0.2%	0.2%	0.1%
Solar	6.2%	5.9%	1.9%	2.6%	6.3%	5.9%	1.9%	2.8%	7.8%
Waste	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.4%
Wind	9.1%	11.5%	15.0%	14.5%	11.2%	12.1%	17.0%	17.5%	13.3%

	Q2 2016	Q2 2017	Q2 2018	Q2 2019	Q2 2020
TOTAL GENERATION BY FUEL (TWh)					
Biomass	16.9	18.6	21.9	21.4	22.9
Coal/Lignite	117.3	127.6	118.0	93.7	70.0
Gas	80.6	90.4	82.7	106.4	113.0
Hydro	132.3	108.8	133.8	102.3	120.2
Nuclear	187.6	190.2	186.8	183.1	149.9
Oil	3.3	2.8	3.0	2.9	3.1
Peat	1.3	1.4	1.4	1.1	0.4
Solar	33.3	38.3	40.1	39.1	47.6
Waste	2.5	3.5	3.4	3.3	2.6
Wind	54.1	65.3	59.3	69.7	81.2
FOSSIL FUELS	202.4	222.2	205.0	204.1	186.5
NUCLEAR	187.6	190.2	186.8	183.1	149.9
RENEWABLE (INCLUDES WASTE)	239.2	234.6	258.5	235.8	274.3
TOTAL	**629.2**	**646.9**	**650.3**	**623.0**	**610.8**
Fossil Fuel Percentage	32%	34%	32%	33%	31%
Clean Percentage	68%	66%	68%	67%	69%
Renewable Share of Clean Power	56%	55%	58%	56%	65%
CHANGE SINCE Q1 2015 (%)					
Biomass		10%	29%	27%	35%
Coal/Lignite		9%	1%	-20%	-40%
Gas		12%	3%	32%	40%
Hydro		-18%	1%	-23%	-9%
Nuclear		1%	0%	-2%	-20%
Oil		-13%	-8%	-11%	-4%
Peat		4%	6%	-15%	-66%
Solar		15%	20%	17%	43%
Waste		37%	35%	31%	1%
Wind		21%	10%	29%	50%
FOSSIL FUELS		**10%**	**1%**	**1%**	**-8%**
NUCLEAR		**1%**	**0%**	**-2%**	**-20%**
RENEWABLE (INCLUDES WASTE)		**-2%**	**8%**	**-1%**	**15%**

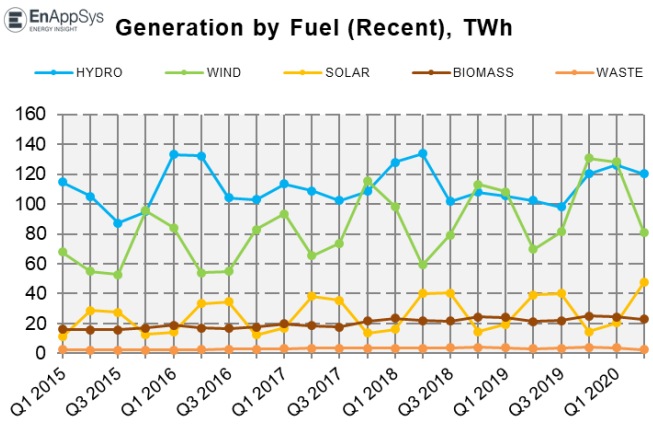
3 Renewables

Overall, the quarter saw 274 TWh of power production from renewable sources amounting to 45% of European electricity generation. This is a decrease of 9% from Q1-2020, partially due to reduced demand, but an increase of 16% from Q2-2019.

The largest source of renewable generation in this quarter was from hydro (both reservoir and river), making up 43.8% of renewable generation. Norway was the largest reservoir hydro generator with 42% of the total share, and Sweden second with 26%. This represents a 31% increase for Norway from Q1-2020 to Q2-2020 and a 21% increase across the whole of Europe. For river hydro, Italy was the largest generator, contributing 22%, followed by France with 21%. Despite being the largest contributor this quarter, Italy saw a decrease of 43% in river hydro generation from last quarter.



Hydro generated 120.2 TWh of power, with this being down 5% from the previous quarter, but up 17% in TWh terms from Q2-2019. These levels show an overall increase of 4% in TWh terms from Q1-2015.



Wind was the second largest source of renewable generation with 81.2 TWh, with Germany providing the largest share of that at 12%. The level of wind generation has decreased by 37% in TWh terms compared to Q1-2020 but saw an increase of 16% from Q2-2019 levels.

The next largest share of renewable generation came from solar, generating 47.6 TWh in the quarter, an all-time quarterly high. This is 19% higher than the previous record of 40.6 TWh set in Q3-2018, and represents a 17.3% share of all renewables.

Biomass generation dropped below that of solar, typical of Q2 and Q3. Biomass output levels are generally fairly static between quarters but there was a 7% decrease in biomass from Q1.

Compared to Q2-2019, all renewables but waste have shown an increase in generation. Waste remains the smallest share with 2.6 TWh, a 0.9% share of total renewables.

Statistics

The following tables contain some of the key statistics relating to renewable electricity output during the quarter:

	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020
TOTAL GENERATION BY FUEL (TWh)									
Biomass	21.9	21.7	24.5	24.2	21.4	22.0	25.0	24.5	22.9
Hydro	133.8	101.8	107.8	105.4	102.3	98.0	120.1	126.1	120.2
Solar	40.1	40.6	14.5	19.6	39.1	40.0	14.5	20.4	47.6
Waste	3.4	3.8	4.1	3.8	3.3	3.6	4.0	3.8	2.6
Wind	59.3	79.2	113.0	108.0	69.7	81.3	130.5	128.2	81.2
TOTAL	**258.5**	**246.9**	**263.9**	**261.0**	**235.8**	**244.9**	**294.1**	**303.0**	**274.3**
Primary Renewable Source	HYDRO	HYDRO	WIND	WIND	HYDRO	HYDRO	WIND	WIND	HYDRO
SHARE OF RENEWABLES (%)									
Biomass	8.5%	8.8%	9.3%	9.3%	9.1%	9.0%	8.5%	8.1%	8.3%
Hydro	51.8%	41.2%	40.9%	40.4%	43.4%	40.0%	40.8%	41.6%	43.8%
Solar	15.5%	16.4%	5.5%	7.5%	16.6%	16.3%	4.9%	6.7%	17.3%
Waste	1.3%	1.5%	1.5%	1.5%	1.4%	1.5%	1.4%	1.2%	0.9%
Wind	22.9%	32.1%	42.8%	41.4%	29.5%	33.2%	44.4%	42.3%	29.6%

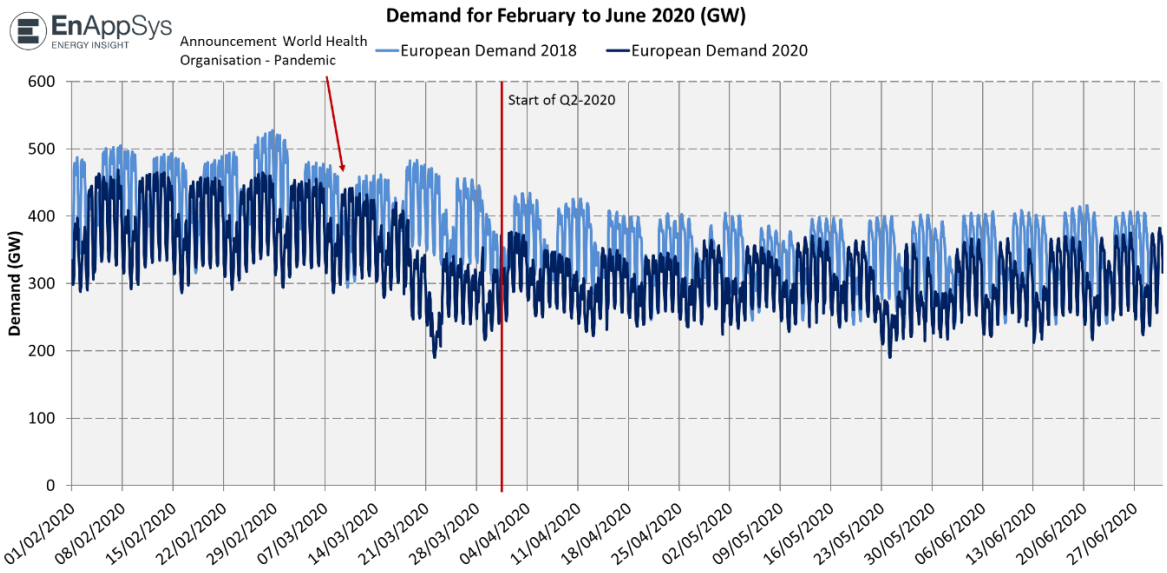
	Q2 2016	Q2 2017	Q2 2018	Q2 2019	Q2 2020
TOTAL GENERATION BY FUEL (TWh)					
Biomass	16.9	18.6	21.9	21.4	22.9
Hydro	132.3	108.8	133.8	102.3	120.2
Solar	33.3	38.3	40.1	39.1	47.6
Waste	2.5	3.5	3.4	3.3	2.6
Wind	54.1	65.3	59.3	69.7	81.2
TOTAL	**239.2**	**234.6**	**258.5**	**235.8**	**274.3**
Primary Renewable Source	HYDRO	HYDRO	HYDRO	HYDRO	HYDRO
CHANGE SINCE Q1 2015 (%)					
Biomass		10%	29%	27%	35%
Hydro		-18%	1%	-23%	-9%
Solar		15%	20%	17%	43%
Waste		37%	35%	31%	1%
Wind		21%	10%	29%	50%

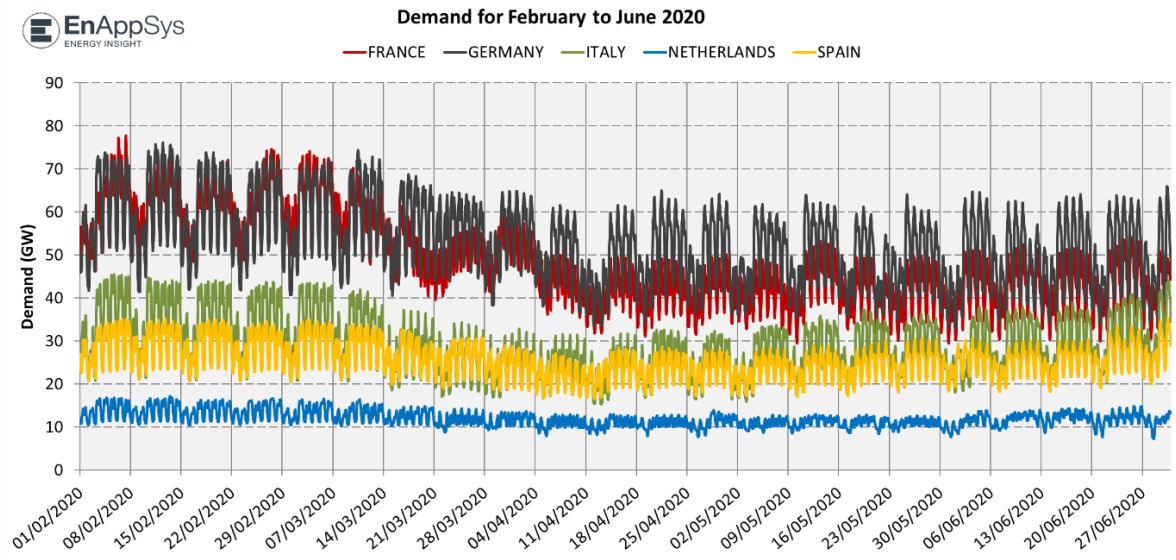
4 Coronavirus Lockdown Effects

The security measures introduced by the governments of European Nations from Q1-2020 continued into Q2-2020 and were in full effect for most of the quarter with some easing of restrictions beginning towards the end of the quarter. While the minimum demand level in Q2, 189.69GW on 24/05/2020, was only marginally less than that for Q1, 189.72 GW on 22/03/2020, the average was significantly lower; 298GW down from 345GW – a 13% decrease which is greater than the seasonal decrease that would otherwise be expected.

After the upwards correction at the end of Q1, demand remained within relatively tight bounds at the start of the quarter, varying by about 130GW from peak to trough. However, towards the end of Q2, the peaks were generally higher and the troughs lower, with a difference of around 160GW.

Overall, demand levels seem to have stabilised after the initial drop, with little change in average level since then. While generally lower than historical levels, the differences are comparable in magnitude with the range of normal year-to-year variations and the lockdown effects less clear.



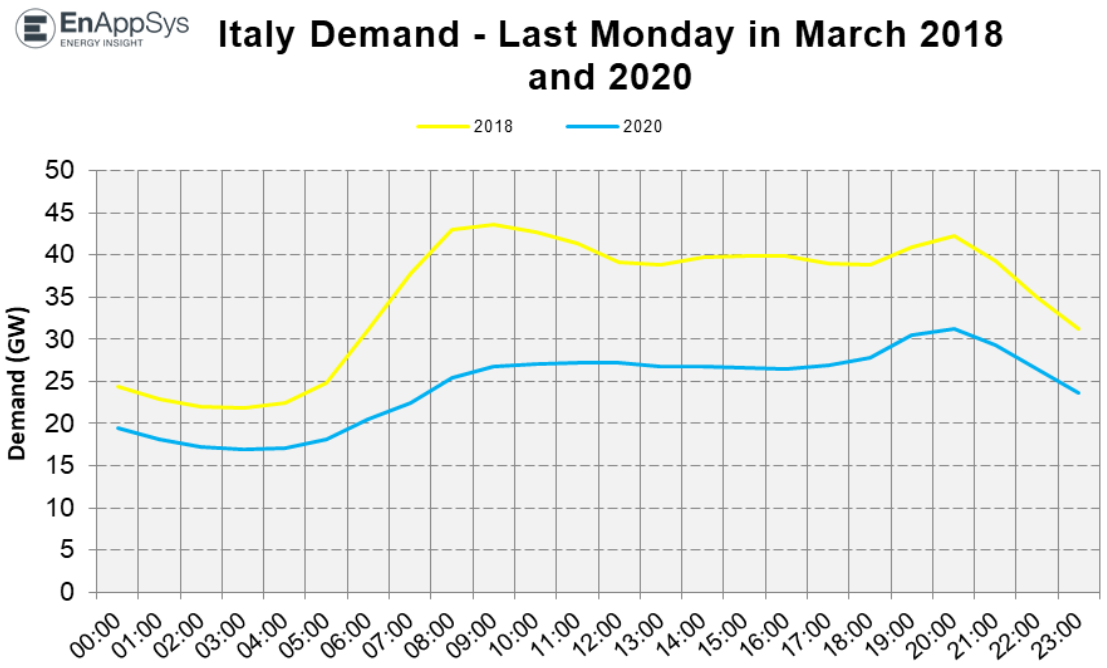


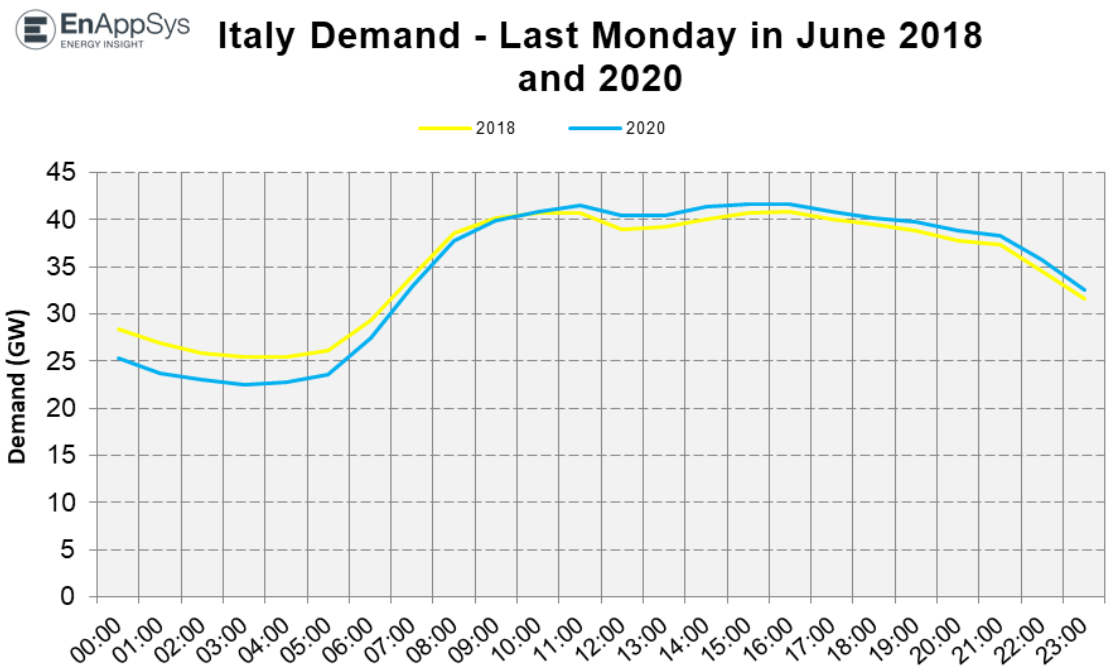
All European countries except Finland saw a decrease in demand from the first 7 days in February to the last 7 days in March. After this global event, some countries have had periods of significantly lower demand, while others have been relatively unaffected. The following table shows that some countries have recovered from the low demand period, while others were still experiencing it by the end of the quarter. The table is ordered by the most negative change between 2018 and 2020 to the most positive change. i.e. Ireland, Germany and GB are seeing lower drops in demand than usual, while Italy, France and Spain have generally recovered.

There can be differences in how demand is reported country to country. Some countries can report it as demand from the grid which excludes demand that is met by local generation and also can include interconnector exports as demand. So comparisons are not fully on a like for like basis.

	Average Demand (GW)						
	2020			2018			
	First 7 days in February	Last 7 days in June	Change in demand	First 7 days in February	Last 7 days in June	Change in demand	Difference in Change from 2018 to 2020
MONTENEGRO	0.8	0.3	-60.95%	0.4	0.4	-16.95%	-44.00%
IRELAND	4.7	3.8	-18.47%	3.6	4	9.16%	-27.63%
SLOVENIA	1.7	1.2	-31.25%	1.7	1.4	-17.01%	-14.24%
MACEDONIA	1	0.6	-41.05%	0.9	0.6	-28.43%	-12.62%
GERMANY	60.7	49.6	-18.33%	61.4	57.7	-6.08%	-12.26%
GB	37.3	25.1	-32.88%	41.1	31.5	-23.40%	-9.48%
AUSTRIA	7.9	6	-23.71%	8.2	6.9	-15.49%	-8.22%
CZECH REPUBLIC	8.4	6.5	-23.29%	8.5	7.3	-15.11%	-8.18%
SLOVAKIA	3.6	2.9	-19.21%	3.7	3.2	-11.91%	-7.30%
BULGARIA	4.9	3.6	-26.38%	4.9	3.9	-20.84%	-5.54%
HUNGARY	5.4	4.6	-14.90%	5.3	4.8	-10.15%	-4.74%
SWITZERLAND	8.1	6.4	-21.54%	7.7	6.3	-17.50%	-4.04%
ESTONIA	1.1	0.7	-32.95%	1.1	0.8	-29.48%	-3.48%
EUROPEAN DEMAND	399.2	309.3	-22.52%	425.5	343.1	-19.36%	-3.16%
ITALY	34.2	32.3	-5.68%	35.8	34.7	-2.99%	-2.69%
ROMANIA	7.4	6.1	-17.62%	7.7	6.5	-15.55%	-2.07%
POLAND	20.5	17.9	-12.80%	21.1	18.7	-11.10%	-1.69%
PORTUGAL	6	5.1	-14.55%	6.5	5.7	-12.96%	-1.59%
LITHUANIA	1.5	1.3	-15.44%	1.5	1.3	-14.09%	-1.35%
NETHERLANDS	13.8	11.8	-13.97%	14.3	12.4	-13.32%	-0.65%
BELGIUM	10.3	8.8	-14.66%	11.3	9.7	-14.19%	-0.47%
SPAIN	28.8	26.9	-6.38%	32.5	30.3	-6.65%	0.27%
LATVIA	0.9	0.7	-20.41%	0.9	0.7	-20.85%	0.44%
NORWAY	18.7	11.6	-38.07%	20.5	12.1	-40.93%	2.86%
DENMARK	4.2	3.7	-13.15%	4.4	3.7	-16.16%	3.01%
SERBIA	5.2	3.9	-26.20%	5.2	3.7	-29.34%	3.14%
SWEDEN	18.8	12.2	-35.39%	20.9	12.8	-38.64%	3.25%
GREECE	6	5.6	-7.41%	6.1	5.4	-10.74%	3.34%
CROATIA	2.1	1.9	-9.79%	2.2	1.9	-13.75%	3.96%
FRANCE	61.2	43	-29.74%	72.5	45.6	-37.18%	7.43%
FINLAND	9.6	7.9	-17.02%	12.1	8	-34.01%	16.99%

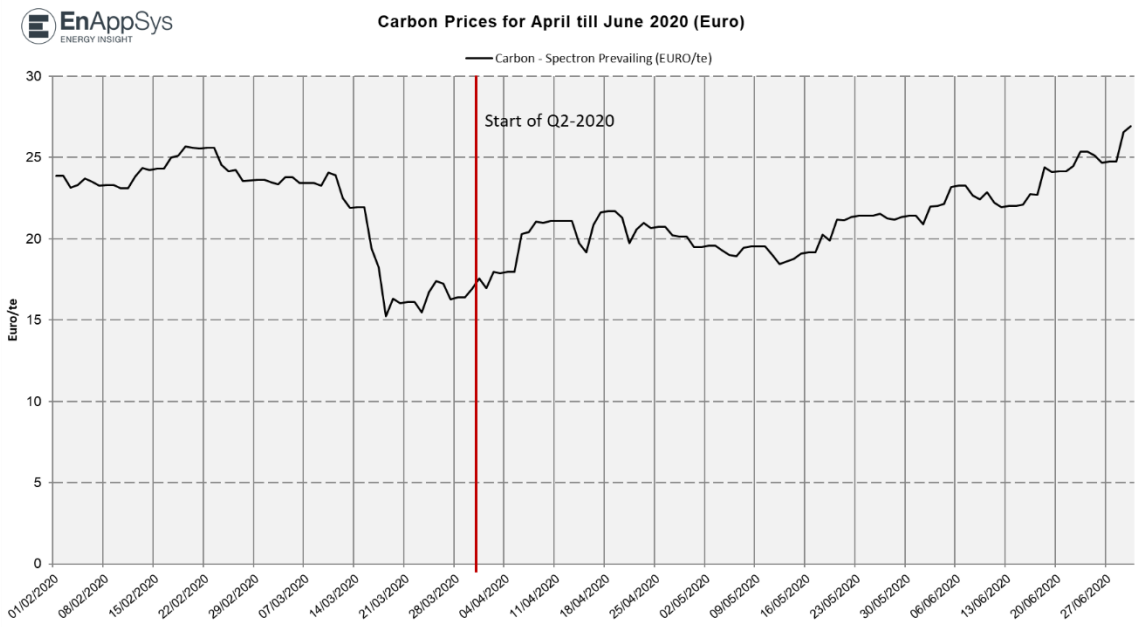
The changes in daily demand shapes has also altered significantly for some countries. For example, Italy saw a large deviation from its usual demand shape at the end of Q1, but by the end of Q2, the shape was very close to what is typical for this time of year. Other countries such as GB are yet to see a full return to their usual demand shapes, and again this depends on a variety of factors in including political ones. A comparison of Italy's demand shapes at the end of Q1 and Q2 can be seen in the following two graphs.





The reduction in demand has had a knock on effect in fuel and carbon input costs with carbon EU ETS prices seeing a particular sharp reduction from the start of 'lockdown' measures falling from 24.00 Euro/te to ~16.50 Euro/te at the close of Q1. Since then, Q2 has seen a gradual rise again in carbon prices throughout the quarter, recovering to above the level before the coronavirus was

declared a pandemic by the WHO. The value was 26.91 Euro/te at the close of Q2, steadily approaching the all-time high for Spectron prevailing carbon prices of 29.78 Euro/te on 23/07/2019. This recovery was driven by the effect of the Market Stability Reserve which absorbs up to 24% of surplus annual allowances.



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 in reporting but is generally complete.

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

EnAppSys B.V.
M2GO City, Stadhuisplein 3, 4531 GZ, Terneuzen, The Netherlands
Company Registration No.: 67992358