European Electricity Fuel Mix Summary

Q3 2019

July to September

Fossil Fuels: 235.8TWh (+11%) **Renewables:** 232.1TWh (-6%) **Nuclear:** 188.0TWh (+6%)

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Executive Summary

The third quarter of 2019 – running from the start of July through to the end of September – has seen a significant shift in levels of generation from gas-fired plants and coal/lignite plants.

In Q3 2018 the levels of generation from gas and coal/lignite were 111.2TWh and 145.9TWh respectively, with 31% more power coming from coal/lignite than from gas. By contrast, Q3 2019 has seen levels revert to 134.6TWh and 95.8TWh, with 41% more power coming from gas stations.

With gas having lower levels of carbon emissions per MWh of power produced, this shift should result in a significant reduction in levels of European carbon emissions.

The size of the shift from gas to coal is variable by market and is dependent on the availability of both coal and gas plants and infrastructure in each respective market. For instance in the Czech Republic coal/lignite continues to provide a large share of generation, whilst other markets such as Greece, Italy and Spain have seen an increased shift from coal/lignite to gas.

Renewables continue to provide a large share of European power generation, but growth has stalled to a degree, with renewable output levels having declined 2% from the previous year.

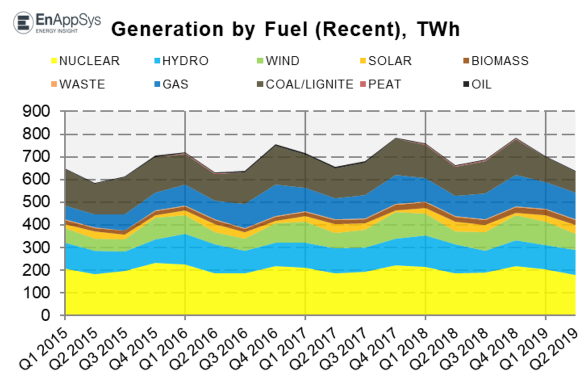
The last five years have seen renewable generation levels in the third quarter of the year total 178TWh, 200TWh, 237TWh, 237TWh and 232TWh respectively. This shows strong growth to Q3 2016 (200TWh), but with output plateauing at around 230TWh/annum.

This stalled growth will be offset by the gains made by switching from coal/lignite to gas, but highlights a market requiring fresh momentum in order to further grow renewable generation levels significantly.

In the quarter nuclear plants produced 28.7% of generation, gas 20.5%, coal/lignite 14.6%, hydro 14.3%, wind 11.1%, solar 6.0%, biomass 3.4%, oil 0.7%, waste 0.6% and peat 0.2%.

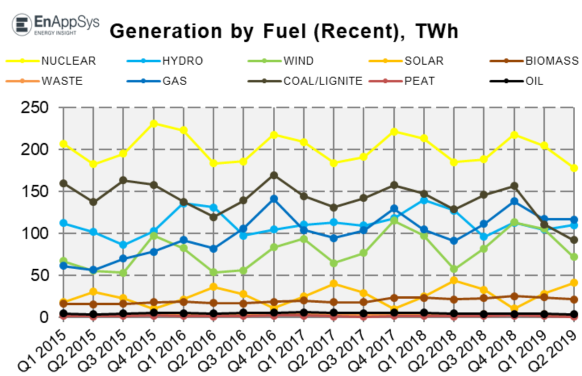
Fuel Activity Overview

Across Europe in Q3 2018, the largest share of electricity production came from nuclear power plants, which produced 188.0TWh, with this being nominally down from the levels produced in the previous year.

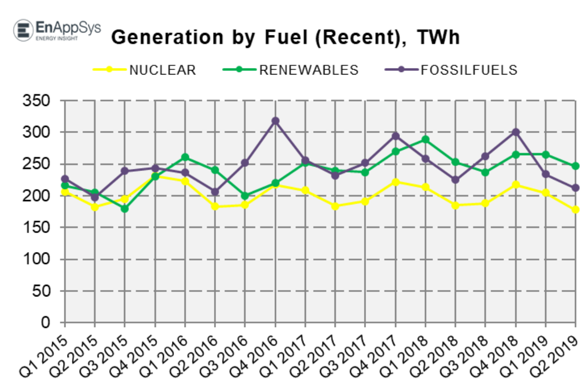


Nuclear production levels have been very consistent for the past few years and for the past five years nuclear output in the third quarter has ranged between 188.0TWh and 194.9TWh.

The next largest share of electricity production came from gas-fired power stations, which generated 134.6TWh. Gas plants across Europe generated more power than coal and lignite in Q2 and Q3 of 2019, but prior to this coal had been the dominate secondary source of electricity generation after nuclear.



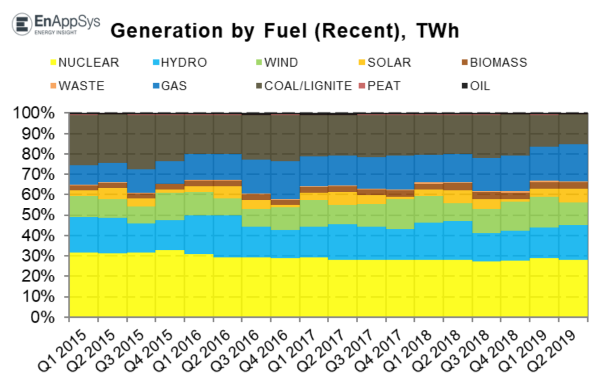
The third largest source of power generation came from coal/lignite plants, which generated 95.8TWh in the quarter, with this being down 34% from the levels in Q3 2018 as levels of coal-fired generation dropped by a third year-on-year.



One of the most significant changes has been in Spain where coal has been pushed almost entirely out the market by gas, whilst Germany as a major consumer of coal and lignite for electricity generation has seen significant reductions in levels of generation from these sources.

The degree of change by market has depended on the ability to switch from one source to the other, with the Czech Republic for instance continuing to rely on lignite and coal sources without the same ability to switch as in the case for markets such as Greece, Italy and Spain where both coal and gas plants compete in the market.

In Britain levels of coal generation have already been reduced as that market has higher carbon taxes.



Hydro power plants generated 94.0TWh, down from levels in all three of the previous years, with this being very slightly below levels of coal/lignite generation.

Windfarms then provided the next largest share at 72.5TWh, which was down 12% from the previous year as growth in capacity across Europe has generally slowed having grown significantly up to 2017.

The remainder of power was met by biomass (22.2TWh), oil (4.3TWh), waste (3.9TWh) and peat (1.1TWh).

On a simplified basis 36% of generation came from fossil fuels, 35% from renewables and 29% from nuclear plants.

Looking in more detail, 28% came from nuclear plants, 21% from gas plants, 15% from coal/lignite, 14% from hydro, 11% from wind, 6% from solar, 3% from biomass and the remaining amount from oil, peat and waste.

Statistics

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

	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019
TOTAL GENERATION BY FUEL (TWh)									
Biomass	18.1	23.3	23.3	21.4	22.6	25.1	23.6	21.3	22.2
Coal/Lignite	142.2	157.6	147.3	128.6	145.9	156.6	110.9	91.8	95.8
Gas	103.7	129.7	104.7	90.9	111.2	138.1	117.0	116.4	134.6
Hydro	109.4	118.0	139.6	126.9	95.9	112.7	104.7	109.6	94.0
Nuclear	191.1	221.6	213.3	185.0	188.4	217.6	204.4	177.9	188.0
Oil	5.1	5.2	5.2	4.2	4.2	4.1	4.0	3.6	4.3
Peat	0.8	1.4	1.7	1.1	1.5	2.0	1.7	0.8	1.1
Solar	29.2	9.9	24.5	43.8	32.6	10.1	27.9	40.9	39.6
Waste	3.6	3.6	3.7	3.2	4.0	4.0	3.6	3.1	3.9
Wind	76.6	115.0	97.3	57.4	82.0	112.9	105.4	71.9	72.5
FOSSIL FUELS	251.8	294.0	258.9	224.8	262.7	300.8	233.6	212.6	235.8
NUCLEAR	191.1	221.6	213.3	185.0	188.4	217.6	204.4	177.9	188.0
RENEWABLE (INCLUDES WASTE)	236.8	269.8	288.4	252.8	237.1	264.8	265.2	246.8	232.1
TOTAL	**679.7**	**785.4**	**760.6**	**662.7**	**688.1**	**783.2**	**703.3**	**637.3**	**655.9**
Fossil Fuel Percentage	37%	37%	34%	34%	38%	38%	33%	33%	36%
Clean Percentage	63%	63%	66%	66%	62%	62%	67%	67%	64%
Renewable Share of Clean Power	55%	55%	57%	58%	56%	55%	56%	58%	55%
SHARE OF GENERATION (%)									
Biomass	2.7%	3.0%	3.1%	3.2%	3.3%	3.2%	3.4%	3.3%	3.4%
Coal/Lignite	20.9%	20.1%	19.4%	19.4%	21.2%	20.0%	15.8%	14.4%	14.6%
Gas	15.3%	16.5%	13.8%	13.7%	16.2%	17.6%	16.6%	18.3%	20.5%
Hydro	16.1%	15.0%	18.4%	19.2%	13.9%	14.4%	14.9%	17.2%	14.3%
Nuclear	28.1%	28.2%	28.0%	27.9%	27.4%	27.8%	29.1%	27.9%	28.7%
Oil	0.8%	0.7%	0.7%	0.6%	0.6%	0.5%	0.6%	0.6%	0.7%
Peat	0.1%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	0.1%	0.2%
Solar	4.3%	1.3%	3.2%	6.6%	4.7%	1.3%	4.0%	6.4%	6.0%
Waste	0.5%	0.5%	0.5%	0.5%	0.6%	0.5%	0.5%	0.5%	0.6%
Wind	11.3%	14.6%	12.8%	8.7%	11.9%	14.4%	15.0%	11.3%	11.1%

	Q3 2015	Q3 2016	Q3 2017	Q3 2018	Q3 2019
TOTAL GENERATION BY FUEL (TWh)					
Biomass	16.0	16.5	18.1	22.6	22.2
Coal/Lignite	163.1	138.9	142.2	145.9	95.8
Gas	70.0	106.1	103.7	111.2	134.6
Hydro	86.0	97.3	109.4	95.9	94.0
Nuclear	194.9	185.8	191.1	188.4	188.0
Oil	4.6	5.4	5.1	4.2	4.3
Peat	1.5	1.5	0.8	1.5	1.1
Solar	22.5	27.5	29.2	32.6	39.6
Waste	2.5	3.0	3.6	4.0	3.9
Wind	52.8	55.7	76.6	82.0	72.5
FOSSIL FUELS	239.1	251.9	251.8	262.7	235.8
NUCLEAR	194.9	185.8	191.1	188.4	188.0
RENEWABLE (INCLUDES WASTE)	179.9	200.0	236.8	237.1	232.1
TOTAL	**613.9**	**637.7**	**679.7**	**688.1**	**655.9**
Fossil Fuel Percentage	39%	39%	37%	38%	36%
Clean Percentage	61%	61%	63%	62%	64%
Renewable Share of Clean Power	48%	52%	55%	56%	55%
CHANGE SINCE Q1 2015 (%)					
Biomass		3%	13%	41%	38%
Coal/Lignite		-15%	-13%	-11%	-41%
Gas		52%	48%	59%	92%
Hydro		13%	27%	11%	9%
Nuclear		-5%	-2%	-3%	-4%
Oil		18%	12%	-8%	-5%
Peat		2%	-47%	0%	-28%
Solar		22%	29%	45%	76%
Waste		18%	44%	58%	54%
Wind		5%	45%	55%	37%
FOSSIL FUELS		**5%**	**5%**	**10%**	**-1%**
NUCLEAR		**-5%**	**-2%**	**-3%**	**-4%**
RENEWABLE (INCLUDES WASTE)		**11%**	**32%**	**32%**	**29%**

Renewables

Overall the quarter saw 232.1TWh of power production from renewable sources, amounting to 35% of European electricity generation.

The largest share of renewable generation continues to come from hydro plants, which generated 94.0TWh in the quarter, with hydro only having been overtaken by wind generation for the two winter quarters of 2018/19 in recent years.

Total hydro generation totaled 94.0TWh, down 2% from the previous year, with the typical range for hydro generation for quarter three over the past five years ranging from 86.0TWh through to 109.4TWh.

The next largest share of renewable generation came from wind farms, which generated 72.5TWh, with this being down 12% from the previous year. Wind farm generation has risen from 52.8TWh in Q3 2015 and 55.7TWh in Q3 2016, but with the levels in Q3 2019 being below those in the third quarter of the two previous years.

Solar output levels rose to their highest for a third quarter to 39.6TWh, but with this being down 3% from the previous quarter. These levels were up 22.5TWh from Q3 2015, with significant growth over the past two years.

Biomass plants generated 22.2TWh in the quarter, roughly level with the amounts achieved in the previous third quarter, but up from 16.0TWh in Q3 2015. Waste plants generated 3.9TWh, which was also up from levels in Q3 2015 (2.5TWh).

In the quarter, 40.5% of renewable power came from hydro projects, 31.2% from wind, 17.1% from solar, 9.5% from biomass and the remaining amount from waste to energy.

Statistics

The following table contains some of the key statistics relating to the quarter:

Renewables

	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019
TOTAL GENERATION BY FUEL (TWh)									
Biomass	18.1	23.3	23.3	21.4	22.6	25.1	23.6	21.3	22.2
Hydro	109.4	118.0	139.6	126.9	95.9	112.7	104.7	109.6	94.0
Solar	29.2	9.9	24.5	43.8	32.6	10.1	27.9	40.9	39.6
Waste	3.6	3.6	3.7	3.2	4.0	4.0	3.6	3.1	3.9
Wind	76.6	115.0	97.3	57.4	82.0	112.9	105.4	71.9	72.5
TOTAL	**236.8**	**269.8**	**288.4**	**252.8**	**237.1**	**264.8**	**265.2**	**246.8**	**232.1**
Primary Renewable Source	HYDRO	HYDRO	HYDRO	HYDRO	HYDRO	WIND	WIND	HYDRO	HYDRO
SHARE OF RENEWABLES (%)									
Biomass	7.6%	8.6%	8.1%	8.5%	9.5%	9.5%	8.9%	8.6%	9.5%
Hydro	46.2%	43.7%	48.4%	50.2%	40.4%	42.6%	39.5%	44.4%	40.5%
Solar	12.3%	3.7%	8.5%	17.3%	13.8%	3.8%	10.5%	16.6%	17.1%
Waste	1.5%	1.3%	1.3%	1.3%	1.7%	1.5%	1.4%	1.3%	1.7%
Wind	32.4%	42.6%	33.7%	22.7%	34.6%	42.6%	39.7%	29.1%	31.2%

	Q3 2015	Q3 2016	Q3 2017	Q3 2018	Q3 2019
TOTAL GENERATION BY FUEL (TWh)					
Biomass	16.0	16.5	18.1	22.6	22.2
Hydro	86.0	97.3	109.4	95.9	94.0
Solar	22.5	27.5	29.2	32.6	39.6
Waste	2.5	3.0	3.6	4.0	3.9
Wind	52.8	55.7	76.6	82.0	72.5
TOTAL	**179.9**	**200.0**	**236.8**	**237.1**	**232.1**
Primary Renewable Source	HYDRO	HYDRO	HYDRO	HYDRO	HYDRO
CHANGE SINCE Q1 2015 (%)					
Biomass		3%	13%	41%	38%
Hydro		13%	27%	11%	9%
Solar		22%	29%	45%	76%
Waste		18%	44%	58%	54%
Wind		5%	45%	55%	37%

Notes on the Report

The figures used in the report refer to data provided through Entsoe which have been aggregated into a European total. This data does sometimes suffer from outages in reporting, but is generally complete.

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