



GB Electricity Market Summary

FIRST QUARTER 2018
JAN TO MAR

Recorded Levels of GB Generation by Fuel (based upon Ofgem & NG Embedded Forecasts & FUELHH data):

GAS: 14.9GW (+1%)
COAL: 3.8GW (+7%)

RENEWABLES: 11.6GW (+16%)
IMPORTS: 2.5GW (+262%)

NUCLEAR: 7.2GW (+2%)

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EXECUTIVE SUMMARY

The first quarter of 2018 was particularly notable due to the very high levels of wind generation achieved in the quarter and for the high gas prices that occurred over the three month period.

These two factors combined to create a very positive three months for wind farms, which were able to benefit from higher power prices due to the higher gas prices and from windy conditions.

This came as wind farms set new records for half hourly, daily, weekly, monthly and quarterly levels of generation in the quarter, with 15.8TWh of power coming from wind sources.

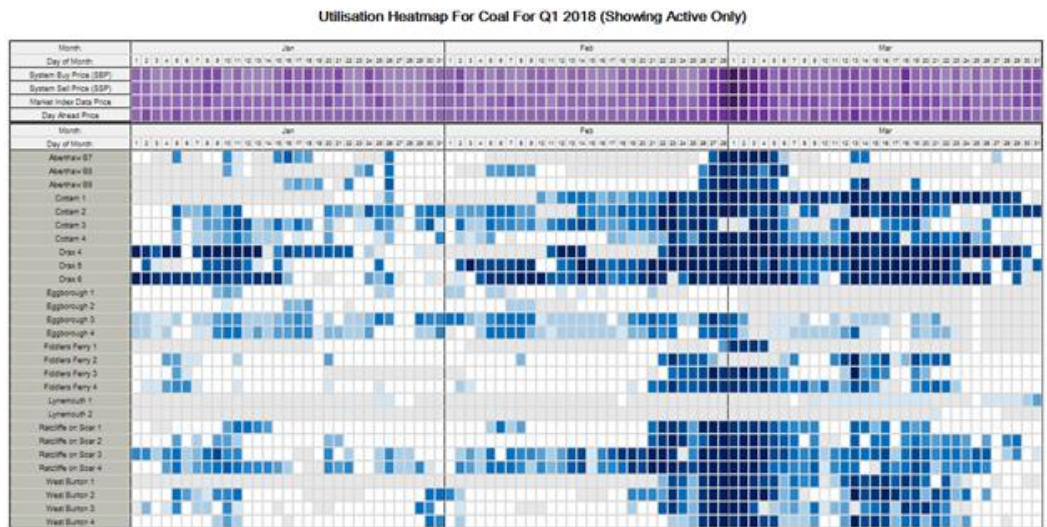
The high levels of wind generation meant that aggregated renewable output hit a total of 25.0TWh – the highest ever levels recorded in a single quarter in Great Britain – with renewables falling only slightly behind gas power stations as the second largest aggregated source of power generation within GB.

Despite this rise, gas power stations remained the largest source of electricity generation, with fossil fuels continuing to contribute 47% of the electricity generated in the period.

This saw a total of 32.2TWh of electricity come from these gas-fired power stations, with output only seeing a major drop around the 1st March 2018 when National Grid issued a gas deficit warning.

On this day levels of coal-fired generation rose to 10.5GW, whilst levels of wind generation were similarly high and these two power sources acted to reduce the demand for gas from power stations, reducing the demand being placed upon the gas system.

Despite the peaks around this period, coal plants still saw levels of generation fall back by 16% from Q1 2017 as coal was generally inactive, but seeing dramatic growth around the gas supply issues:



This period around the 1st March 2018 saw high power prices as the higher gas prices both pushed up the cost of generating and the potential cost of failing to generate power as required.

Otherwise, however, the quarter saw few major price peaks and the impact of the new capacity brought online via the Capacity Mechanism combined with the strong wind output levels contributed to this activity.

In the quarter 37.3% of electricity generation came from gas-fired power stations, with 29.0% coming from renewable projects, 18.1% from nuclear plants, 9.4% from coal-fired power stations and 6.3% from electricity imports.

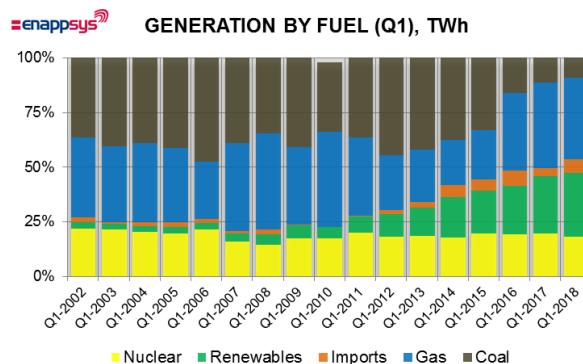
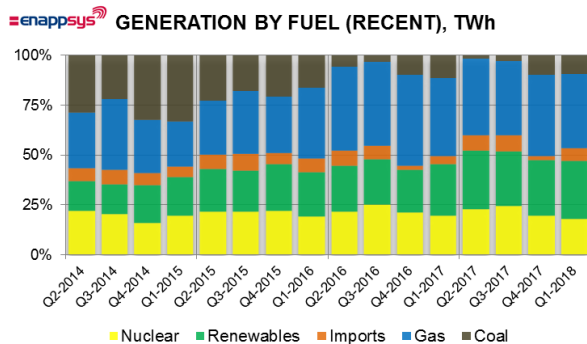
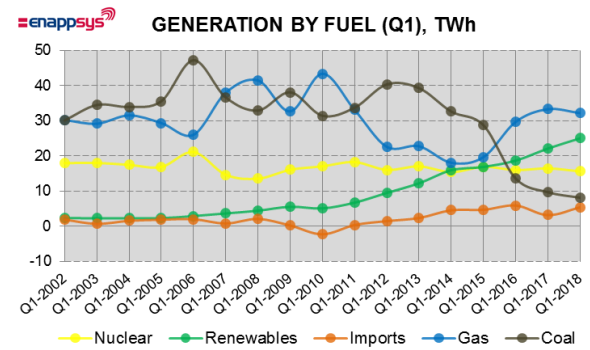
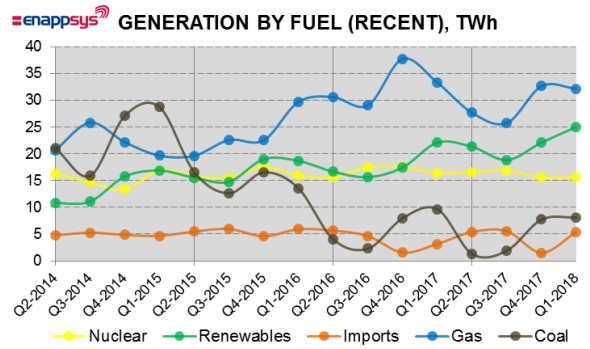
Of the renewable generation noted, 63.1% came from wind farms, 23.5% from biomass plants, 7.4% from solar farms and 6.0% from hydro plants.

FUEL ACTIVITY

In the three month period running from the first of January 2018 to the end of March 2018, gas continued to be the largest source of power generation, with renewables continuing to provide only slightly lower levels of generation than those provided at conventional gas plants.

This came as levels of coal-fired generation continued to pick up over the winter period, with the quarter including a period where gas prices spiked at over four-times the norm before returning to more normal levels, after only a few days of higher priced activity.

The total levels of coal-fired generation during this period did not particularly change the overall levels of coal output across the



whole period, but the ability for the system to fall back upon coal was highly beneficial over the period.

On Thursday 1st March 2018 National Grid issued a gas deficit warning, indicating that there was a potential shortage of gas on the system and on this day coal generated 10.5GW of

power, with this effectively being the highest possible levels of coal output achievable.

The additional coal generation helped reduce the reliance on gas on this day, with this showing the value of having coal as a backup source of generation, due to the ability to store coal at site and not be reliant upon external

sources of supply.

This suggests that in a market without coal, there will need to be a strategy for days with tight gas storage to ensure that gas supplies do not endanger the ability to provide electricity as required to the market.

Overall, gas-fired plants generated 32.2TWh of power in the quarter (down from 32.6TWh in the longer Q4 of 2017), with this representing a 1% increase in average levels of gas generation quarter-to-quarter. The values do represent a 3% decline in levels of gas-fired generation in Q1 2018.

Renewables continue to see levels of generation remain not too far behind levels of gas-fired generation, amounting to 25.0TWh of power, with Q1 2018 being the first Q1 period in which renewables generated more than coal and nuclear plants as a combined aggregate.

This highlights the degree to which renewables are now established within the GB power market.

Nuclear plants continue to provide the third largest source of generation, with power output totaling 15.6TWh in the quarter, with these levels being nearly identical on an aggregated level to Q4 2017, with average levels of nuclear output being up 2% from the previous quarter.

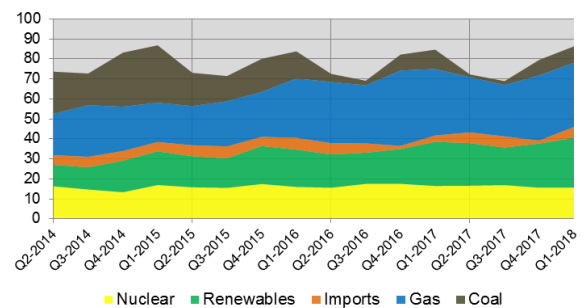
Despite levels of interconnector imports recovering from the previous month, coal plants continued to provide the fourth largest source of electricity supply, generating 8.1TWh of electricity in the quarter.

These average coal generation levels were up 7% from the previous quarter, but remained 16% down from the levels achieved in Q1 2017.

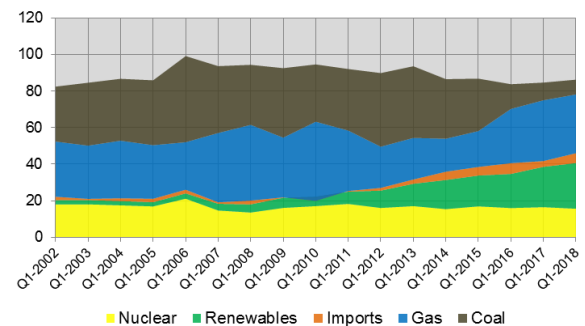
Interconnectors imported 5.4TWh of power, with these levels being significantly up from the 1.5TWh imported in Q4 2017, with interconnectors having imported more electricity than the 3.2TWh imported in Q1 2017.

The quarter saw 37.3% of electricity come from gas-fired power stations, 29.0% from renewable sources, 18.1% from nuclear plants, 9.4% from coal-fired power stations and

enappsys **GENERATION BY FUEL (RECENT), TWh**



enappsys **GENERATION BY FUEL (Q1), TWh**



6.3% from electricity imports. This meant that 47% of electricity came from fossil fuel sources (mostly gas).

Statistics

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

*GB Only (Excludes Northern Ireland)	Q1-2016	Q2-2016	Q3-2016	Q4-2016	Q1-2017	Q2-2017	Q3-2017	Q4-2017	Q1-2018
TOTAL GENERATION BY FUEL (TWh)									
Coal	13.56	4.05	2.28	7.97	9.67	1.30	1.91	7.73	8.13
Gas	29.68	30.58	29.02	37.70	33.27	27.65	25.73	32.61	32.15
Imports	5.92	5.67	4.65	1.57	3.18	5.41	5.56	1.53	5.42
Nuclear	15.98	15.57	17.51	17.52	16.46	16.59	16.91	15.58	15.60
Renewables	18.67	16.67	15.64	17.44	22.09	21.31	18.82	22.10	25.01
FOSSIL FUELS	43.24	34.63	31.31	45.67	42.95	28.95	27.64	40.34	40.28
TOTAL	83.82	72.54	69.11	82.20	84.68	72.26	68.92	79.56	86.31
Fossil Fuel Percentage	52%	48%	45%	56%	51%	40%	40%	51%	47%
Clean Percentage	41%	44%	48%	43%	46%	52%	52%	47%	47%
Renewable Share of Clean Power	54%	52%	47%	50%	57%	56%	53%	59%	62%
SHARE OF GENERATION (%)									
Coal	16.2%	5.6%	3.3%	9.7%	11.4%	1.8%	2.8%	9.7%	9.4%
Gas	35.4%	42.2%	42.0%	45.9%	39.3%	38.3%	37.3%	41.0%	37.3%
Imports	7.1%	7.8%	6.7%	1.9%	3.8%	7.5%	8.1%	1.9%	6.3%
Nuclear	19.1%	21.5%	25.3%	21.3%	19.4%	23.0%	24.5%	19.6%	18.1%
Renewables	22.3%	23.0%	22.6%	21.2%	26.1%	29.5%	27.3%	27.8%	29.0%

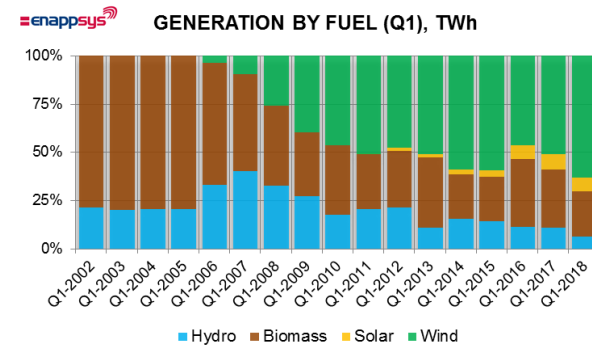
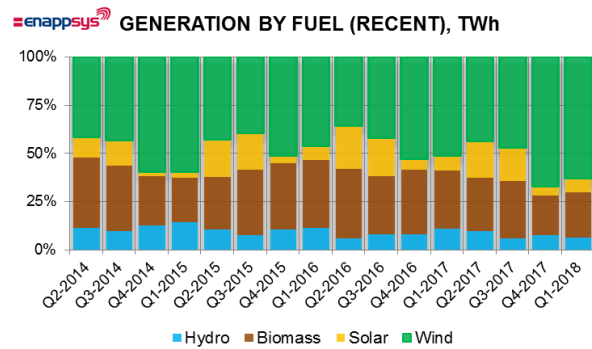
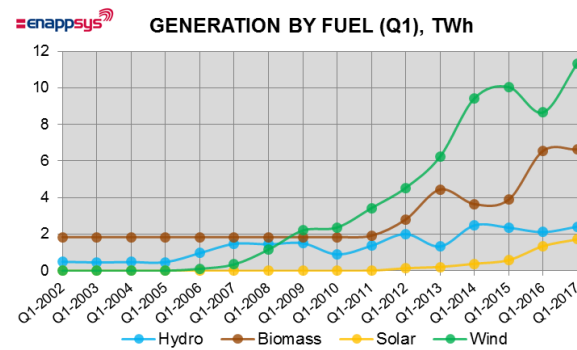
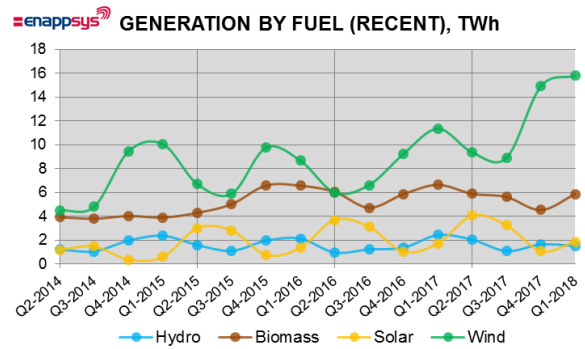
*GB Only (Excludes Northern Ireland)	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018
TOTAL GENERATION BY FUEL (TWh)									
Coal	31.41	33.69	40.33	39.26	32.61	28.71	13.56	9.67	8.13
Gas	43.35	33.08	22.57	22.75	18.06	19.66	29.68	33.27	32.15
Imports	-2.27	0.37	1.49	2.37	4.56	4.69	5.92	3.18	5.42
Nuclear	17.06	18.24	16.03	17.04	15.40	16.92	15.98	16.46	15.60
Renewables	5.11	6.73	9.49	12.22	15.94	16.87	18.67	22.09	25.01
FOSSIL FUELS	74.75	66.77	62.90	62.02	50.67	48.37	43.24	42.95	40.28
TOTAL	94.65	92.10	89.91	93.65	86.56	86.84	83.82	84.68	86.31
Fossil Fuel Percentage	79%	72%	70%	66%	59%	56%	52%	51%	47%
Clean Percentage	26%	34%	37%	36%	37%	47%	50%	48%	47%
Renewable Share of Clean Power	23%	27%	37%	42%	51%	50%	54%	57%	62%
SHARE OF GENERATION (%)									
Coal	37.5%	46.4%	58.4%	47.8%	38.5%	39.7%	19.7%	12.2%	9.4%
Gas	51.7%	45.6%	32.7%	27.7%	21.3%	27.2%	43.1%	41.8%	37.3%
Imports	-2.7%	0.5%	2.2%	2.9%	5.4%	6.5%	8.6%	4.0%	6.3%
Nuclear	20.3%	25.2%	23.2%	20.7%	18.2%	23.4%	23.2%	20.7%	18.1%
Renewables	6.1%	9.3%	13.7%	14.9%	18.8%	23.4%	27.1%	27.8%	29.0%

RENEWABLES

Renewables continued to increase the levels of clean generation being produced in Britain, with Q1 2017, seeing levels of renewable generation climb from to reach a record high level of 25.0TWh.

This was the highest level of renewable generation achieved in any quarter to date, with the major increase in levels of wind generation since Q4 2017 being the biggest contributor.

With offshore wind farms now being a very cheap and relatively uncontroversial source of additional renewables generation, these levels of wind generation are expected to continue to rise, with additional generation also set to be released once the Western Link becomes operational.



A lot of the onshore wind farm capacity within Britain is based in Scotland, but with the region not traditionally being such a large source of generation, the region has relatively limited levels of export capacity down into the rest of Britain through northern England.

To solve this a new interconnector is being finished that will move power from Scotland into England and this will reduce the amount of wind generation being paid to turn offline due to transmission constraints, providing further uplift in levels of wind generated nationally.

In the quarter, wind farms generated 15.8TWh of power, up from 14.9TWh in Q4 2017, with this being a record level of wind generation from a single quarter. More significantly, these levels were up 39% from the 11.3TWh achieved in Q1 2017.

The next largest source of renewable generation was biomass sources, which generated an estimated 5.9TWh (down from 6.6TWh in Q4 2017, but up from 3.7TWh in Q1 2017).

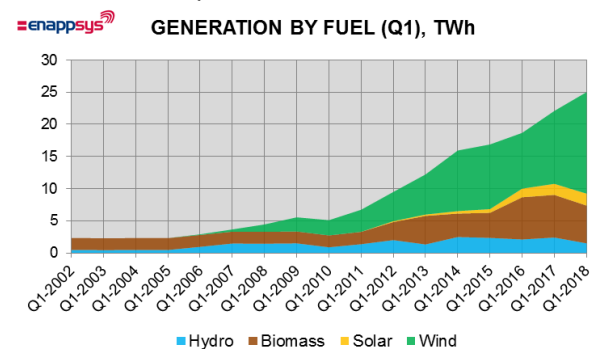
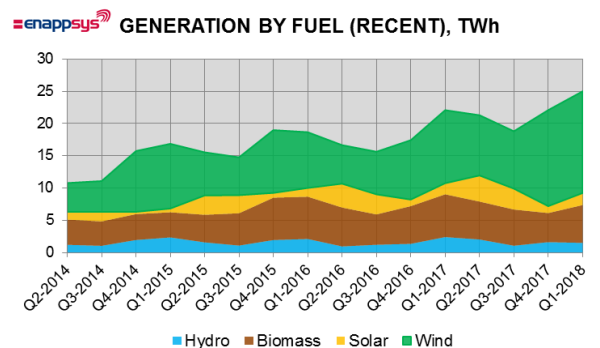
With the quarter being one of the two darker quarters of the year, solar generation levels were low in the quarter at 1.5TWh, with but with this still being down from 2.4TWh in Q1 2017.

The smallest of the four main renewable sources was hydro, which having formerly been a major source of renewable generation now provides only around 2% of all renewable generation annually. In the quarter hydro plants generated 1.5TWh, with this being down from the 1.6TWh achieved in Q4 2017.

The quarter saw 18.3% of generation come from wind farms, 6.8% from biomass plants, 2.2% from solar farms and 1.7% from hydro plants. Of the renewable generation produced 63.1% came from wind farms, 23.5% from biomass plants, 7.4% from solar farms and 6.0% from hydro plants.

In the quarter a number of wind records were broken, with all the records detailed in the following table:

GB ONLY		RECORD LEVEL		DATE	GWh/TWh EQUIVALENT	
HALF HOURLY	PEAK	14,245	MW	17/03/2018 11:30	7.12	GWh
	FUEL MIX PEAK	49%		17/03/2018 04:00		
DAILY	PEAK	13,181	MW	17/03/2018	316.34	GWh
	FUEL MIX PEAK	36%		17/03/2018		
WEEKLY	PEAK	9,338	MW	26/02/2018	1,568.78	GWh
	FUEL MIX PEAK	25%		02/10/2017		
MONTHLY	PEAK	7,553	MW	Jan-18	5.62	TWh
	FUEL MIX PEAK	22%		Oct-17		
QUARTERLY	PEAK	7,306	MW	Q1-2018	15.78	TWh
	FUEL MIX PEAK	19%		Q4-2017		
YEARLY	PEAK	5,080	MW	2017	44.5	TWh
	FUEL MIX PEAK	15%		2017		



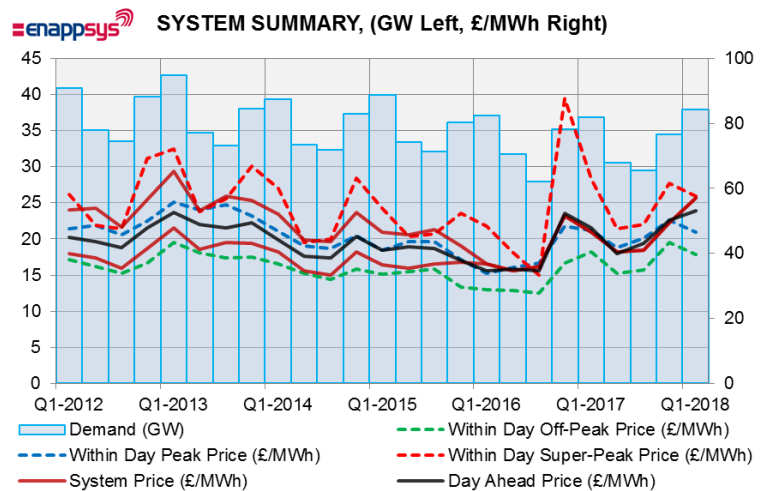
DEMAND AND PRICES

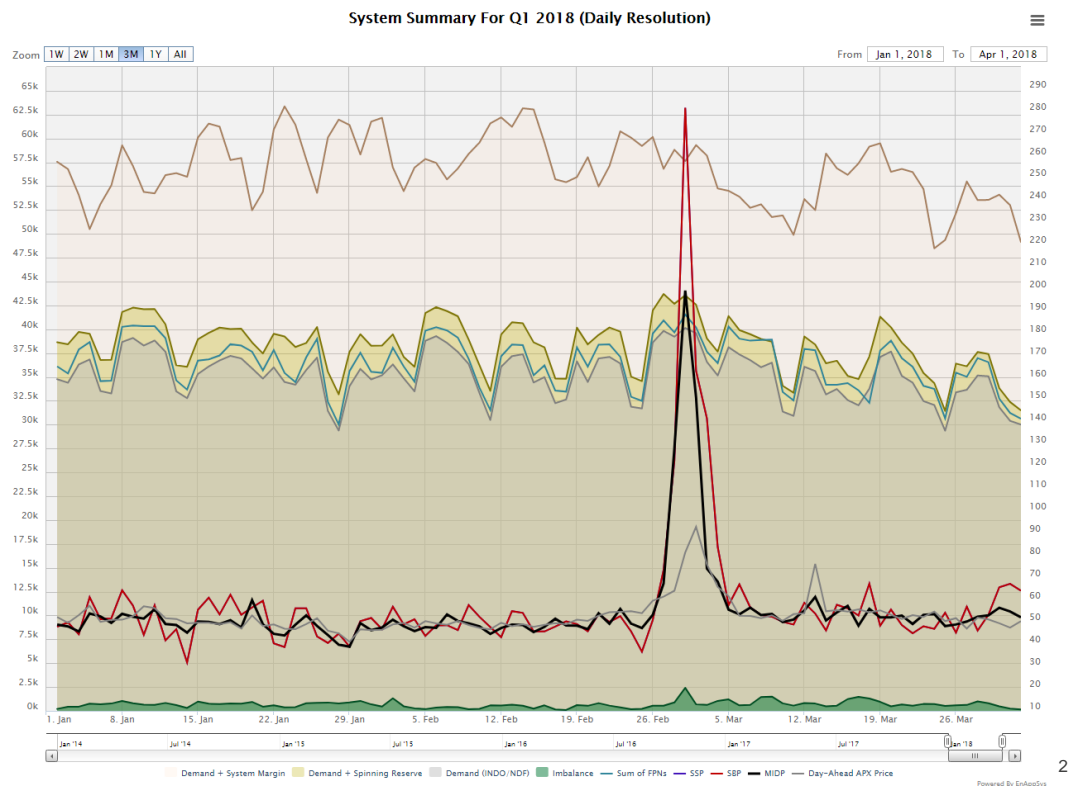
In Q1 2018 higher gas prices contributed to a higher underlying power price, with this meaning that renewable assets such as wind farms would have earned a higher revenue for any generation in the quarter.

With the cost of generation also increasing in the period, this did not translate into higher earnings at gas plants in the market, but there were times when coal plants were able to earn higher levels of income due to very high gas prices as a Gas Deficit Warning was issued on 1st March 2018.

The peak prices that were noted in winter 2016/17 did not recur in winter 2017/18 and this came as winter

2016/17 saw particularly exceptional activity, with the only exception to this being the period around 1st March when gas prices significantly pushed up the cost of generation at gas plants:





The winter period in 2016/17 had always been expected to be extreme ever since assets were removed from the commercial market and put into a reserve service called Supplementary Balancing Reserve (SBR).

The introduction of SBR meant that the system was able to meet its requirements for a minimum level of anticipated margin, but since the 3.5GW of capacity within SBR was unable to act commercially, from a commercial perspective the market had insufficient supply, driving up market prices.

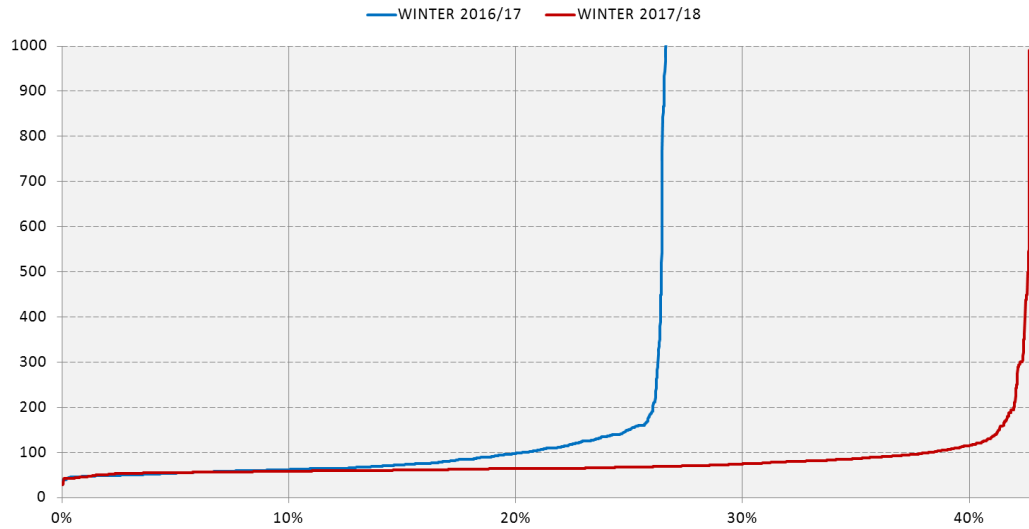
As a result of this, the expectation had always been for a drop in the potential revenues achievable in the 2017/18 period, with EnAppSys' own forecasts for the period having indicated value of £25/kW based upon the normally expected prices.

Against these forecasted values, the maximum levels of income achievable at flexible assets, from simple operation, declined from an estimated £57/kW for the 6-month period between October 2016 and March 2017 (inclusive), to £22/kW for the same 6-month period in 2017/18.

² <https://enbm.netareports.com/#systemsummary?country=uk&start=201801010000&end=201804010000>

There have, however, been some different characteristics in 2017/18 versus 2016/17, with the system being undersupplied at a much higher frequency, but with prices generally being much lower when the system has been undersupplied:

 SYSTEM (CASHOUT) PRICES DURING PERIODS IN WHICH THE SYSTEM HAS BEEN UNDERSUPPLIED



These system prices are a proxy for the cost of balancing the system and so are highly significant as an indication of levels of income available to flexible assets.

Statistics

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

*GB Only (Excludes Northern Ireland)	Q1-2016	Q2-2016	Q3-2016	Q4-2016	Q1-2017	Q2-2017	Q3-2017	Q4-2017	Q1-2018
WHOLESALE PRICES (£/MWh)									
Day Ahead Price	34.63	35.07	34.59	52.25	47.75	40.04	43.05	50.24	53.00
Within Day Price (MDP)	34.28	34.06	33.36	50.45	47.23	40.03	42.01	49.62	55.00
WITHIN DAY PRICE BREAKDOWN (£/MWh)									
Off-Peak Hours	28.72	28.65	27.75	37.13	40.53	33.87	34.79	43.34	39.62
Peak Hours (excl Superpeak)	33.86	35.78	36.95	48.29	47.15	41.81	44.67	50.30	46.50
Superpeak Hours	48.26	40.28	33.36	87.81	62.85	47.66	49.03	61.47	57.72
SYSTEM BUY PRICE (£/MWh)									
Maximum	517.55	480.38	801.77	1528.72	292.55	1509.80	176.69	1528.72	990.00
Average	36.67	34.62	35.91	51.45	46.42	40.48	41.10	49.46	57.00
Minimum	-63.02	-100.00	-114.99	-153.89	-14.00	-73.15	-25.00	-153.89	-150.00
SYSTEM SELL PRICE (£/MWh)									
Maximum	517.55	480.38	801.77	1528.72	292.55	1509.80	176.69	1528.72	990.00
Average	36.67	34.62	35.91	51.45	46.42	40.48	41.10	49.46	57.00
Minimum	-63.02	-100.00	-114.99	-153.89	-14.00	-73.15	-25.00	-153.89	-150.00
DEMAND (MW)	37,147	31,716	27,981	35,186	36,835	30,600	29,459	34,448	37,910
AVAILABILITY (MW)	56,430	46,968	46,133	50,859	55,672	47,496	44,155	54,618	59,411
MARGIN (MW)	21,100	17,851	21,597	17,303	21,062	20,031	17,401	22,138	24,100
MIN MARGIN (MW)	3,482	6,259	4,439	1,213	1,287	1,867	4,090	1,213	0
DEMAND (TWh)	80.2	69.3	61.8	77.7	79.6	66.8	65.0	76.1	81.9
AVAILABILITY (TWh)	121.9	102.6	101.9	112.3	120.3	103.7	97.5	120.6	128.3
MARGIN (TWh)	45.6	39.0	47.7	38.2	45.5	43.7	38.4	48.9	52.1
MIN MARGIN (TWh)	7.5	13.7	9.8	2.7	2.8	4.1	9.0	2.7	0.0

NOTES ON THE REPORT

The figures used in the report refer to GB only, against DECC figures that refer to GB and Northern Ireland. This selection has been made since Northern Ireland is separate from GB and is more closely linked to the electricity grid of the Republic of Ireland.

Generation levels by fuel from 2009 are based upon National Grid FUELHH data, which give the operationally metered totals by fuel, down to a 5-minute resolution.

Prior to 2009, individual plant data has been aggregated from our databased matching of National Grid fuel-type relationships.

To account for embedded wind and solar, the National Grid forecasts for these generators have been used as if they were output figures. Embedded hydro and biomass have been accounted for using analysis of Ofgem data on certificate awards.

Within this report, levels of offshore wind have not been separated from the wind total. This is because this can only be reliably done using metered volumes at a generating unit level. This is not a publicly available data stream and figures can only be estimated and not distributed. FPNs at wind farms do not correlate well with metered volumes and so cannot be used reliably.

Price and demand data primarily comes from Elexon (as does the FUELHH data), with the exception of the APX day-ahead prices.

Availability levels are calculated by totaling levels of recorded availability at all plants in the market.

ABOUT ENAPPSYS

EnAppSys provides services to companies in the energy and power markets, specifically by providing data, information and consultancy services.

The company has a GB power market database stretching back to 2002 and an online platform that provides readily available information ranging from forwards market prices to historic generator operations.

EnAppSys is focused on providing information and analytical services covering the energy sector and is actively growing the business to provide products with enhanced analysis and forecasting capabilities and extending the geographic and sector coverage beyond the UK and the electricity market.

The company serves customers across Europe and has market monitoring platforms used by a significant number of market parties in both Britain and the Netherlands and is increasing coverage continuously.

The company's business objective is to make available timely, optimal and insightful information, analysis and systems to the energy sector to ensure all sizes of company have the best available tools and information to make informed decisions and to optimise their business strategy.

To find out more about EnAppSys contact the company at about@enappsys.com or visit the company's website at www.enappsys.com.