



# GB Electricity Market Summary

**SECOND QUARTER 2016**  
**APR TO JUN**

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

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**CCGT:** 14GW (3%)  
**COAL:** 1.9GW (-70%)

**RENEWABLES:** 7.7GW (-9%)  
**INTERCONNECTIONS:** 2.6GW (-4%)

**NUCLEAR:** 7.1GW (-3%)

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## EXECUTIVE SUMMARY

Q2 2016 saw large decreases in coal generation as many plants exited the wholesale power market. Gas-fired plants again generated more electricity than during the previous quarter. Compared to Q2 2015, levels of electricity production at gas-fired generators increased by 56%. Levels of wind, nuclear and imports however all marginally reduced.

*Levels of coal generation fell by 70%.*

Nuclear plants saw levels of generation reduce by 3% compared to the last quarter, a reduction of 2% compared with Q2 2015. Levels of coal generation fell by 70% against the last quarter and were down 76% in comparison to Q2 2015. This drastic reduction reflects the closure or exit of many coal fueled generators from the conventional markets due to poor economic conditions for coal generation caused by the carbon price floor. Coal's quickening exit from the market led to solar generation overtaking levels of coal generation for the first time ever in May 2016 with coal generation producing 0.89TWh of electricity and solar producing 1.38TWh, a trend that we believe will continue unless the carbon price floor is altered or removed.

*drastic reduction reflects the closure or exit of many coal fueled generators from the conventional markets*

Coal has gone from being the frontrunner in the industry, with the majority stake of generation, to this quarter falling below levels of imports from other countries. The market is continuing to move towards a model that supports the intermittent supply of renewable generation through flexible generation.

With planned expansions in renewables, storage, import capacity and nuclear, the era of large thermal generation seems to be coming to an end. If nuclear plants are able to maintain necessary base load generation, the combination of interconnectors bringing power from the continent, renewables and nascent battery storage and greater demand-side response, potentially leaves less space for large coal and gas plants within the market.

*Renewables increased by 10% against the previous year*

The growth rate of renewable generation slowed again in Q2 2016 due to lower wind speeds and subsequently lower wind generation. Renewable generation levels reduced by 3% in Q2 2016 compared to the previous quarter, but increased by 10% against the previous year. The slightly lower levels of renewable generation are due to lower levels of wind generation as we enter the summer months even though solar generation capacity has increased.

*Renewables sector continues to grow with a 174% increase in solar and a 46% increase in biomass generation against Q2 2015*

Overall, however, the sector continues to grow with a 174% increase in solar and a 46% increase in biomass generation against Q2 2015. The expected rise of solar PV, due to the mass build-out during the last quarter by companies looking to obtain ROC's though sub 5MW solar PV sites, had a substantial effect on the market, the peak of which was in April 2016 with levels of solar output reported to be 6.85GW. Some estimates for total installed solar capacity on the network are as high as 12GW. Until Ofgem finishes the work of processing and recording new solar stations the true figure is unknown.

Biomass showed a 7% reduction in generation from the previous quarter, but when compared with the previous year levels of generation have risen 46%. This rise is due to the ongoing conversion of coal fired plants to biomass, which is expected to continue in the coming years as Lynemouth is converted from coal to biomass-fired generation.

*Demand fell by 14%  
in Q2 2016*

The second quarter of 2016 saw levels of power demand fall by 14% from the previous quarter as temperature and daylight hours rose into the summer; this is same level of demand as seen in the previous year. Average system imbalance prices fell by 6% from the previous quarter.

As demand fell by 14%, availability levels increased by 5%, however full withdrawals from the market at Eggborough, Ferrybridge and Rugeley, meant that levels of margin remained similar to in the previous quarter. The average margin was at the same level as Q2 2015 but the minimum margin levels were considerably smaller, this indicates the system's overall reduced capacity and reliance on smaller flexible generation.

*Minimum system  
price of -£78MWh*

Overall, the system was well-supplied causing system prices to, on occasion, turn negative overnight, with a minimum system price of -£78MWh over the quarter.

Wholesale prices increased slightly during Q2 2016 in the day ahead market and dropped in the within day market from the previous quarter; an overall 20% reduction in price [which one] compared with Q2 2015. This reflects the reduction in marginal cost of gas fueled power stations in line with falling gas prices, displacing more expensive generation such as coal.

*Black start contracts  
awarded to Fiddlers  
Ferry and Drax*

National Grid has identified that closing capacity within the market may leave winter 2016/17 extremely tight with regards to margin. With 3.5GW of generation already contracted in Supplemental Balancing Reserve, National Grid awarded 'expensive' black start contracts to SSE for Fiddlers Ferry and to Drax that has delayed closure of Fiddlers Ferry and strengthened Drax's continuing business operations. Black start contracts see generators paid a fee to keep their power station capable of coming back online without start up power from the grid in the event of a national power shortage.

*National Grid  
forecasts negative  
margin at times for  
winter 2016/17*

Looking ahead, winter 2016/17 will be without Corby, Deeside, Eggborough, Ferrybridge, Ironbridge, Killingholme, Longannet, Lynemouth (converting to biomass), Rugeley, half of South Humber Bank and half of Peterhead either because they have shut or are in SBR, although we should have Carrington and Keadby fully operational National Grid has already confirmed that winter 2016/17 will be the first time since the current market arrangements began in 2001 that it has not forecast a surplus margin of spare power plants in the UK market and has instead forecast "negative margins".

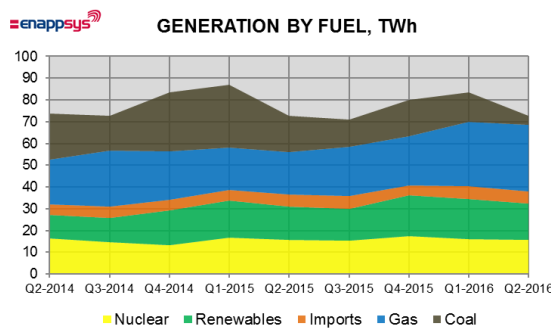
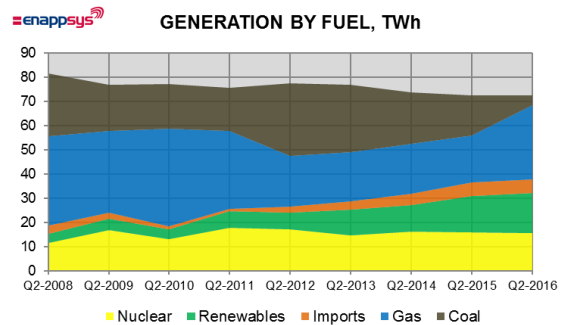
An investigation conducted by EnAppSys shows that Winter 2016/17 we could see 85 hours when the margin is less than 2GW and 12 hours when the margin is negative if extra capacity is not acquired by National Grid.

## FUEL ACTIVITY

The second quarter of 2016 saw a large decrease in coal generation as many plants exited the conventional markets. Gas plants were able to retain the share of generation they had captured from closing coal plants in the previous quarter, as generation levels of wind, nuclear and imports all marginally reduced.

Gas-fired plants again generated the most power in this quarter, contributing 30.58TWh (average half-hourly output of 14GW); a 3% increase from the previous quarter. Compared to Q2 2015, levels of electricity production at gas-fired generators increased by 56%.

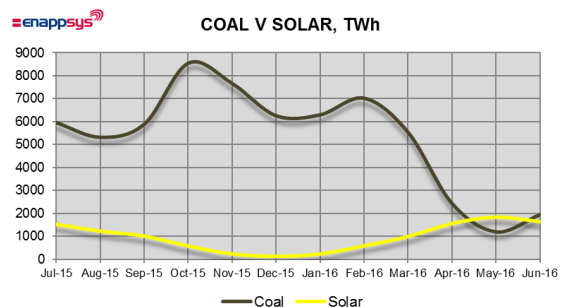
Nuclear plants saw levels of generation totaling 15.57TWh across the quarter (average half-hourly output of 7.7GW); a reduction of 3% compared to the last quarter and of 2% compared with Q2 2015. The Q1-Q2 reduction was caused by the closing of the Wylfa plant in Wales, planned outages at Heysham, Hunterston, Sizewell plus failed starts at Dungeness and Hartlepool after lengthy outages.



Levels of coal generation fell by 70% against the last quarter and were down 76% in comparison to Q2 2015. The coal fleet produced 4.05TWh of power (average half-hourly output of 1.9GW) in the last quarter. This drastic reduction reflects the closure or exit of many coal fueled generators from the wholesale power markets due to poor economic conditions for coal generation

caused by the carbon price floor.

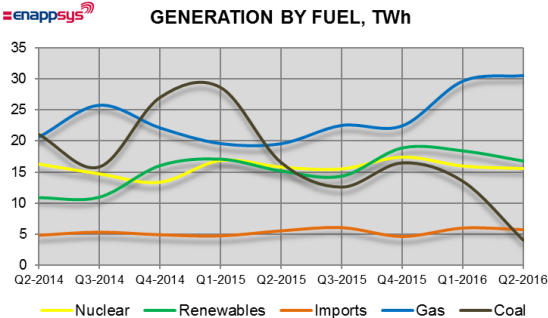
Coal's quickening exit from the market led to solar generation overtaking levels of coal generation for the first time ever in May 2016 with coal generation producing 0.89TWh of electricity and solar producing 1.38TWh, a trend that we believe will continue unless the carbon price floor is altered or removed.



Renewable generation levels reduced by 3% in Q2 2016 compared to the previous quarter, but increased by 10% against the previous year. The slightly lower levels of renewable generation are due to lower levels of wind generation as we enter the summer months. The expected rise of solar PV, due to the mass build-out during the last quarter, had a substantial effect on the market, the peak of which was in April 2016 with levels of solar output reported to be 6.85GW. Some estimates for total installed solar capacity on the network are as high as 12GW.

Coal has gone from being the frontrunner in the industry, with the majority stake of generation, to this quarter falling below levels of imports from other countries. The market is continuing to move towards a model that supports the intermittent supply of renewable generation through flexible generation.

With planned expansions in renewables, storage, import capacity and nuclear, the era of large thermal generation seems to be coming to an end. If nuclear plants are able to maintain necessary base load generation, the combination of interconnectors bringing power from the continent, renewables and potentially battery storage and greater demand-side response leaves less space for large coal and gas plants within the market.



## Statistics

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

*GB Only (Excludes Northern Ireland)	Q2-2014	Q3-2014	Q4-2014	Q1-2015	Q2-2015	Q3-2015	Q4-2015	Q1-2016	Q2-2016
<b>TOTAL GENERATION BY FUEL (TWh)</b>									
Coal	21.11	15.87	27.07	28.70	16.60	12.63	16.53	13.56	4.05
Gas	20.67	25.81	22.18	19.65	19.63	22.57	22.50	29.68	30.58
Imports	4.79	5.27	4.86	4.69	5.48	5.98	4.60	5.92	5.67
Nuclear	16.30	14.70	13.34	16.90	15.81	15.51	17.45	15.98	15.57
Renewables	10.87	10.95	16.00	17.05	15.15	14.31	18.83	18.37	16.74
<b>TOTAL</b>	<b>73.74</b>	<b>72.60</b>	<b>83.44</b>	<b>86.99</b>	<b>72.67</b>	<b>71.01</b>	<b>79.91</b>	<b>83.51</b>	<b>72.61</b>

<b>SHARE OF GENERATION (%)</b>									
Coal	28.6%	21.9%	32.4%	33.0%	22.8%	17.8%	20.7%	16.2%	5.6%
Gas	28.0%	35.5%	26.6%	22.6%	27.0%	31.8%	28.2%	35.5%	42.1%
Imports	6.5%	7.3%	5.8%	5.4%	7.5%	8.4%	5.8%	7.1%	7.8%
Nuclear	22.1%	20.2%	16.0%	19.4%	21.8%	21.8%	21.8%	19.1%	21.4%
Renewables	14.7%	15.1%	19.2%	19.6%	20.9%	20.2%	23.6%	22.0%	23.1%

*GB Only (Excludes Northern Ireland)	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016
<b>TOTAL GENERATION BY FUEL (TWh)</b>									
Coal	25.81	19.18	18.47	17.90	29.89	27.88	21.11	16.60	4.05
Gas	36.90	33.76	40.39	32.12	21.14	20.49	20.67	19.63	30.58
Imports	3.45	2.42	1.01	1.02	2.50	3.19	4.79	5.48	5.67
Nuclear	11.57	16.88	13.07	17.90	17.31	14.55	16.30	15.81	15.57
Renewables	3.73	4.69	4.23	6.67	6.62	10.87	10.87	15.15	16.74
<b>TOTAL</b>	<b>81.46</b>	<b>76.92</b>	<b>77.17</b>	<b>75.60</b>	<b>77.46</b>	<b>76.98</b>	<b>73.74</b>	<b>72.67</b>	<b>72.61</b>

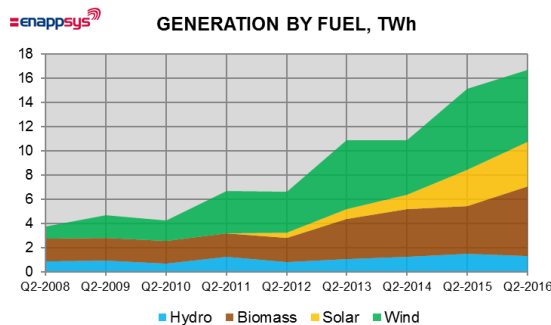
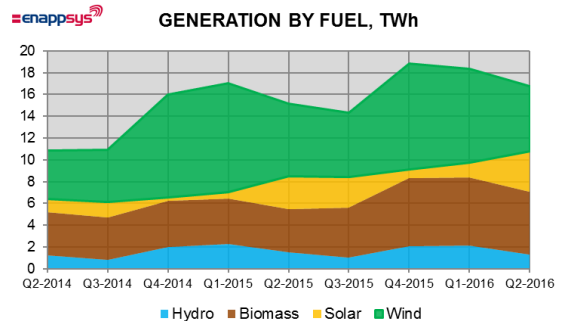
<b>SHARE OF GENERATION (%)</b>									
Coal	35.0%	26.4%	22.1%	20.6%	41.1%	39.3%	26.4%	19.9%	5.6%
Gas	50.0%	46.5%	48.4%	36.9%	29.1%	28.9%	25.9%	23.5%	42.1%
Imports	4.7%	3.3%	1.2%	1.2%	3.4%	4.5%	6.0%	6.6%	7.8%
Nuclear	15.7%	23.2%	15.7%	20.6%	23.8%	20.5%	20.4%	18.9%	21.4%
Renewables	5.1%	6.5%	5.1%	7.7%	9.1%	15.3%	13.6%	18.1%	23.1%

## RENEWABLES

The growth rate of renewable generation slowed again in Q2 2016 due to lower wind speeds and subsequently lower wind generation. Overall, however, the sector continues to grow with a 174% increase in solar and a 46% increase in biomass generation against Q2 2015.

Wind continued to provide the majority of power from renewable sources at 35.7% of the renewable market share. Wind generation amounted to 5.98TWh (average half-hourly output of 2.7GW); an 11% decrease from the same quarter of 2015.

The second largest share of generation came from biomass at 34.4% of the renewable total. Biomass showed a 7% reduction in generation from the previous quarter, but when compared with the previous year levels of generation have risen 46%. This rise is due to the ongoing conversion of coal fired plants to biomass, which is expected to continue in the coming years as Lynemouth is converted from coal to biomass-fired generation.



Solar generators provided the third largest share of renewable generation with levels of 3.69TWh (average half-hourly output of 1.7GW) for the quarter. Levels of solar generation in Q1 2015 were 1.51TWh (average half-hourly output of 1.4GW). This 23% increase from last quarter and 174% increase from the previous year is a result of a major build-out by companies looking to

obtain ROC's though sub 5MW solar PV sites.

Generation from hydro units dropped below solar generation and provided the fourth largest share of renewable generation at 7.8% with total levels of generation at 1.3TWh (average half-hourly output of 0.6GW). This is a 14% decrease from Q2 2015 and a 40% decrease from the previous quarter, as hydro plants saw lower generation levels due to lower levels of river flow.



### Statistics

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

*GB Only (Excludes Northern Ireland)	Q2-2014	Q3-2014	Q4-2014	Q1-2015	Q2-2015	Q3-2015	Q4-2015	Q1-2016	Q2-2016
<b>TOTAL GENERATION BY FUEL (TWh)</b>									
Biomass	3.97	3.85	4.25	4.17	3.95	4.63	6.27	6.21	5.76
Hydro	1.23	0.84	1.96	2.25	1.51	1.00	2.08	2.15	1.30
Solar	1.18	1.46	0.35	0.59	3.00	2.81	0.74	1.35	3.69
Wind	4.48	4.80	9.43	10.04	6.70	5.88	9.74	8.66	5.98
<b>TOTAL RENEWABLES</b>	<b>10.87</b>	<b>10.95</b>	<b>16.00</b>	<b>17.05</b>	<b>15.15</b>	<b>14.31</b>	<b>18.83</b>	<b>18.37</b>	<b>16.74</b>

<b>SHARE OF RENEWABLE GENERATION (%)</b>									
Biomass	36.5%	35.2%	26.6%	24.5%	26.1%	32.4%	33.3%	33.8%	34.4%
Hydro	11.3%	7.7%	12.2%	13.2%	10.0%	7.0%	11.0%	11.7%	7.8%
Solar	10.9%	13.3%	2.2%	3.4%	19.8%	19.6%	3.9%	7.3%	22.1%
Wind	41.2%	43.8%	59.0%	58.9%	44.2%	41.1%	51.7%	47.1%	35.7%

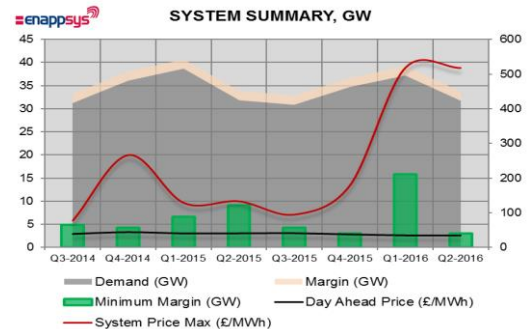
*GB Only (Excludes Northern Ireland)	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016
<b>TOTAL GENERATION BY FUEL (TWh)</b>									
Biomass	1.88	1.92	1.89	1.91	1.98	3.33	3.97	3.95	5.76
Hydro	0.86	0.94	0.70	1.26	0.85	1.05	1.23	1.51	1.30
Solar	0.00	0.00	0.00	0.05	0.45	0.85	1.18	3.00	3.69
Wind	1.00	1.84	1.63	3.45	3.35	5.64	4.48	6.70	5.98
<b>TOTAL RENEWABLES</b>	<b>3.73</b>	<b>4.69</b>	<b>4.23</b>	<b>6.67</b>	<b>6.62</b>	<b>10.87</b>	<b>10.87</b>	<b>15.15</b>	<b>16.74</b>

<b>SHARE OF RENEWABLE GENERATION (%)</b>									
Biomass	17.3%	17.5%	11.8%	11.2%	13.0%	23.3%	21.1%	21.5%	34.4%
Hydro	7.9%	8.5%	4.4%	7.4%	5.6%	7.4%	6.5%	8.2%	7.8%
Solar	0.0%	0.0%	0.0%	0.3%	2.9%	5.9%	6.3%	16.3%	22.1%
Wind	9.2%	16.8%	10.2%	20.2%	22.1%	39.4%	23.8%	36.5%	35.7%

## DEMAND, MARGIN AND PRICES

The second quarter of 2016 saw levels of power demand fall by 14% from the previous quarter as temperature and daylight hours rose into the summer; this is same level of demand as seen in the previous year. Average system prices fell by 6% from the previous quarter.

As demand fell by 14%, availability levels increased by 5%, however closures at Eggborough, Ferrybridge and Rugeley, plus lower utilisation at units at large plants such as Cottam, Drax and Fiddlers Ferry meant that levels of margin remained similar to in the previous quarter. The average margin was at the same level as Q2 2015 but the minimum margin levels were considerably smaller, changing from 9,125MW to 3,007MW; this indicates the system's overall reduced capacity and reliance on smaller flexible generation.



June 23rd 2016 saw an extremely tight margin which created a system price of £151. The tight margin was caused by a combination of plant trips at a number of CCGT plants with an over-forecast of renewable generation by National Grid.

Overall, however, the system was well-supplied causing system prices to, on occasion, turn negative overnight, with a minimum system price of -£78/MWh over the quarter.

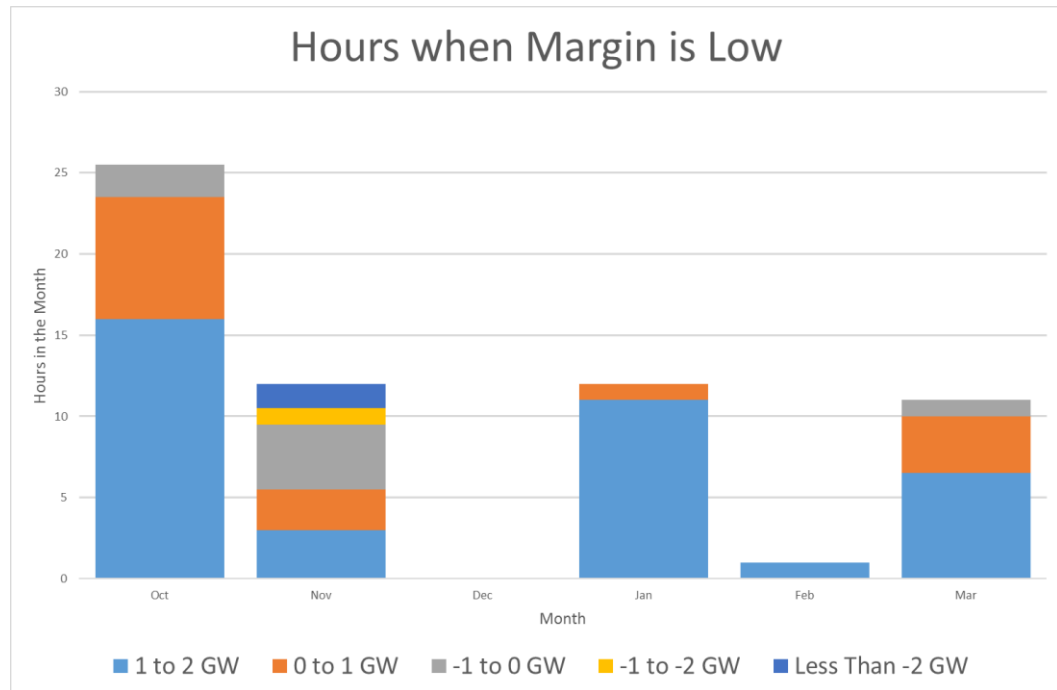
Wholesale prices increased by 1% during Q2 2016 in the day ahead market and dropped by 1% in the within day market from the previous quarter; an overall 20% reduction in price compared with Q2 2015. This reflects the reduction in marginal cost of gas fueled power stations in line with falling gas prices, displacing more expensive generation such as coal.

Looking ahead winter 2016/17 will be without Corby, Deeside, Eggborough, Ferrybridge, Ironbridge, Killingholme, Longannet, Lynemouth (converting to biomass), Rugeley, half of South Humber Bank and half of Peterhead either because they have shut or are in SBR, although we should have Carrington and Keadby fully operational National Grid has already confirmed that winter 2016/17 will be the first time since the current market arrangements began in 2001 that it has not forecast a surplus margin of spare power plants in the UK market and has instead forecast "negative margins".

An investigation conducted by EnAppSys shows that in 2015/16 we calculated the margin as being greater than 2GW all the way through the winter apart from for two hours when it averaged 1500 MW. When we take 2015/16 numbers and modify the margin by the plants that have closed and add in Carrington and Keadby at 100% we get 85 hours when the margin is less than 2GW and 12 hours when the margin is negative.

Interestingly the shoulder months have 46.5 hours of margin less than 2GW and 5.5 hours of negative margins, this is when SBR is not available because it is not Grid winter. The only time that there are

negative margins in Grid winter is the first week in November when wind was low and there was 7 hours of negative margins, the day in which prices of up to £2,500/MWh were achieved.



This has resulted in National Grid already contracting extra capacity outside of the conventional markets in order to keep the lights on. National grid has contracted some of the coal plants leaving the market via 'Supplemental Balancing Reserve (SBR)' contracts. These contracts enable plants that would have otherwise had to close continue to earn an income by remaining available in the winter months of November to February when the system could be under significant stress due to under supply.

If National Grid calls an SBR action then the default price of £3,000/MWh is used for the volume required when calculating the system price. This raises the overall system price, enticing other units to generate.

This will lead to extremely lucrative opportunities to generate but also extremely dangerous situations as if a power station fails to meet its supply position due to a unit trip or other unforeseen problem during an SBR event, it will face a penalty at the much higher system price created by the SBR action.

## Statistics

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

*GB Only (Excludes Northern Ireland)	Q2-2014	Q3-2014	Q4-2014	Q1-2015	Q2-2015	Q3-2015	Q4-2015	Q1-2016	Q2-2016
<b>WHOLESALE PRICES (£/MWh)</b>									
Day Ahead Price	39.18	38.65	45.21	40.88	41.97	41.41	37.74	34.63	35.07
Within Day Price (MDP)	39.65	38.77	44.62	40.47	40.80	41.19	37.33	34.28	34.06
<b>WITHIN DAY PRICE BREAKDOWN (£/MWh)</b>									
Off-Peak Hours	33.86	32.06	35.10	33.62	34.38	35.28	29.72	28.72	28.65
Peak Hours (excl Superpeak)	42.30	41.48	45.46	41.09	43.64	43.62	37.97	33.86	35.78
Superpeak Hours	43.46	44.46	63.20	53.91	45.33	46.06	52.37	48.26	40.28
<b>SYSTEM BUY PRICE (£/MWh)</b>									
Maximum	77.31	77.31	266.11	128.33	132.90	94.41	178.22	517.55	517.55
Average	44.28	43.69	52.62	46.47	45.79	47.22	42.20	36.67	34.62
Minimum	25.06	5.44	6.45	-2.61	-2.61	17.54	-73.48	-63.02	-73.48
<b>SYSTEM SELL PRICE (£/MWh)</b>									
Maximum	77.31	77.31	266.11	128.33	68.56	94.41	178.22	517.55	517.55
Average	34.57	33.23	40.34	36.54	35.46	36.86	37.20	36.67	34.62
Minimum	10.93	-78.00	-57.23	-35.33	-61.79	0.75	-73.48	-63.02	-78.00
<b>DEMAND (MW)</b>	31,977	31,251	36,049	38,682	31,791	30,854	34,732	37,147	31,716
<b>AVAILABILITY (MW)</b>		96,312	100,728	105,146	109,464	113,832	118,248	122,664	127,030
<b>MARGIN (MW)</b>		2,014	2,014	2,015	2,015	2,015	2,015	2,016	2,016
<b>MIN MARGIN (MW)</b>		4,869	4,233	6,638	9,125	4,217	3,007	15,790	3,007
<b>DEMAND (TWh)</b>	69.8	69.0	79.6	83.6	69.4	68.1	76.7	80.2	69.3
<b>AVAILABILITY (TWh)</b>		212.7	222.4	227.1	239.1	251.3	261.1	265.0	277.4
<b>MARGIN (TWh)</b>		4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
<b>MIN MARGIN (TWh)</b>		10.8	9.3	14.3	19.9	9.3	6.6	34.1	6.6

## **NOTES ON THE REPORT**

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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 publically 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**

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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 2001 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'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](mailto:about@enappsys.com) or visit the company's website at [www.enappsys.com](http://www.enappsys.com).