



EnAppSys
ENERGY INSIGHT

GB Electricity Market Summary

Second Quarter 2019

April to June

Gas: 28.3TWh (-13%)
Imports: 5.7TWh (-10%)

Renewables: 23.1TWh (-16%)
Coal: 0.4TWh (-87%)

Nuclear: 12.3TWh (-7%)

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Executive Summary

The second quarter of 2019, running from the start of April through to the end of June, continued to see coal be pushed out of the market in favour of gas, power imports and renewable generation.

This was despite a notable decline in levels of generation from nuclear plants in the market as a number of plants were in outage; with renewables generating almost twice as much power as that produced from nuclear plants in the market.

The impact of this lowest ever level of coal-fired generation in the market (down 60% from the already very low levels in Q2 2018), was a coal fleet that was inactive for much of the quarter and with a new coal-free record being set in the market at just over 18 days.

This in itself generally did not impact the rest of the market, but on the 24th June 2019 these periods of inactivity were a contributing factor in the Loss of Load Probability (LoLP) for the market climbing up to 17%.

This LoLP measures the probability of the system being at risk from a blackout, with a loss of load occurring whenever the system load exceeds the available generating capacity.

On the morning of this day, the system was left with a market in which a number of the coal plants offline were already unable to start in time for the evening demand peak (due to their long start requirements having been inactive) and when one of the coal plants were called on to start it tripped leaving the system short of reserve margin.

The consequence was that the price at which parties are penalised for failing to deliver against their contracted position rose to £375/MWh as coal plants were positioned in the market to be able to provide additional margin if needed, whilst the evening could easily have seen prices peak as high as £1,000/MWh under a slight change in circumstances.

Although this created a particularly notable day in the quarter, the rest of the activity was largely as expected, with the clean share of generation (share of generation from renewables and nuclear generation), rising above 50% once again in the quarter (having dipped below in Q1 2019).

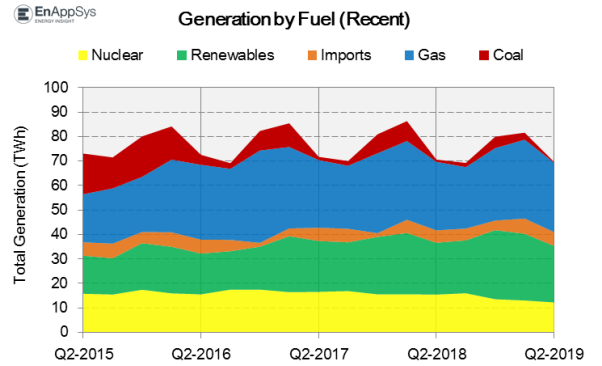
The main other activity of note saw 9 out of the 16 active nuclear units be on outage in the middle of June, with this reducing the overall levels of generation from nuclear plants across the quarter, this dip meant that renewables nearly generated twice as much power as nuclear plants over the three month period (23.1TWh for renewables vs 12.3TWh for nuclear).

Additionally, Spalding Expansion also commissioned in the quarter. This new unit is a 300MW open cycle gas turbine (less efficient than a combined cycle gas turbine but with faster start capabilities), which is set to support the peak load requirements in the coming winter period.

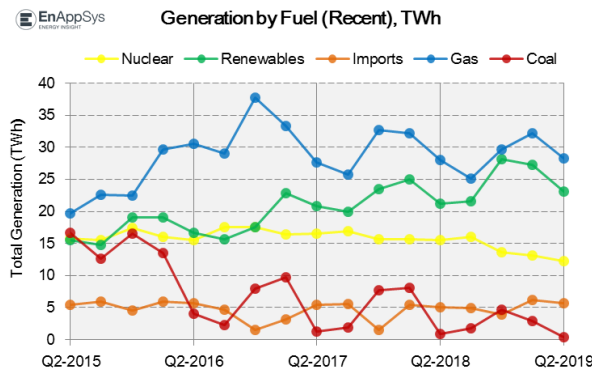
In the quarter 40.6% of power came from gas-fired plants, 33.1% from renewables, 17.6% from nuclear, 8.1% from imports and 0.5% from coal. Of the renewable generation 49.1% came from wind farms, 27.7% from biomass, 19.1% from solar and 4.1% from hydro plants.

Fuel Activity Overview

The second quarter of 2019, from the start of April through to the end of June, saw levels of clean generation (nuclear or renewable sources) climb back above 50%, having dipped below this level in Q1 2019, with the second quarter of the year having seen over 50% of power from clean sources for the third year running.



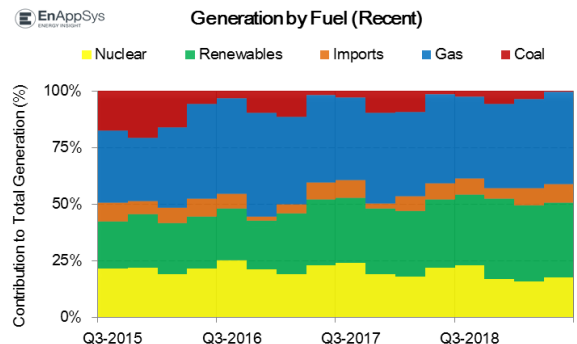
Once again gas-fired power plants continue to be the backbone of the GB electricity



market, generating over 40% of power, and 98.7% of generation from fossil fuel power sources of all types. With gas being a relatively clean source of generation (in comparison with coal and oil, but not with wind / solar) this helps contribute to reductions in carbon emissions.

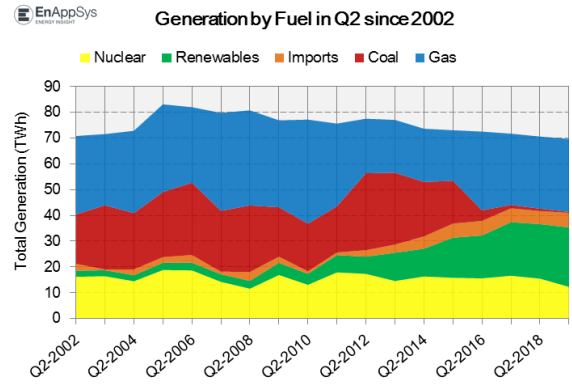
As the quarter saw a reduction in levels of nuclear generation – due to a number of outages – levels of generation from gas-fired sources were up 1% from Q2 2018, although these levels were down from Q1 2019. This came as gas-fired plants generated 28.3TWh of power.

By contrast, coal-fired power plants generated 0.4TWh in the quarter, with this representing 1.3% of all fossil fueled generation. These levels were down 87% from Q1 2019, and down 60% from Q2 2018 as coal continues to see declining activity. Of



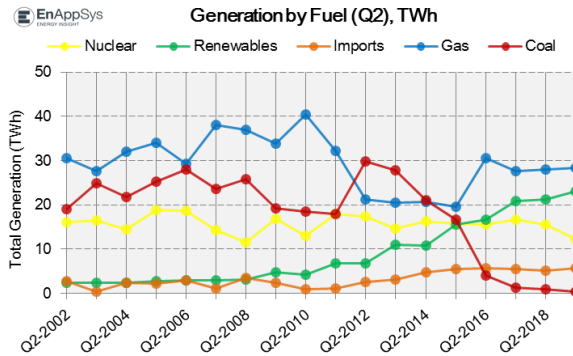
the coal-fired generation that did occur, much of the activity was at Cottam, which has been running down coal stocks, boosting the overall levels of generation.

This declining activity contributed to a tight system on the 24th June 2019 (see the Demand and Prices section of this report), but also saw a zero coal run extending beyond 18 days.



After gas-fired plants, renewables continue to be the second largest source of electricity

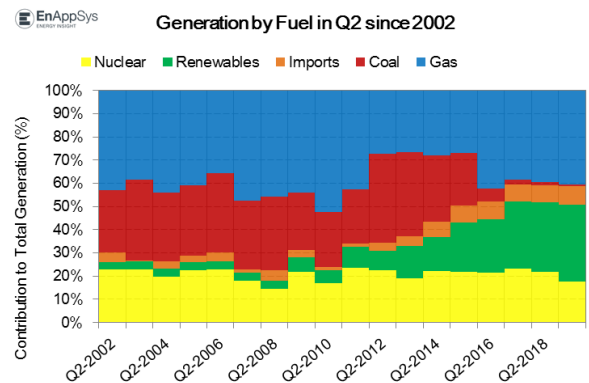
generation – and generated almost twice as much power as nuclear plants in the quarter – with an ever increasing share of total generation. This is highlighted by the 9% rise in levels of renewable generation against the levels noted in Q2 2018.



Nuclear plants generated 12.3TWh, with this being down 21% from the levels in Q2 2018. This decline was due to a large number of outage across the nuclear fleet that prevented generation.

Also notable in the quarter was a 12% increase in levels of electricity imports into the country from the same quarter in the previous year, with this being as a result of the commissioning of the NEMO Interconnector to Belgium early in the year.

This interconnector has predominantly seen high levels of flows from Belgium into Britain and



the higher carbon taxes within the UK will have contributed to this trend. This acts to reduce the actual amounts of generation within Britain by ~8% from the levels that would have been required without any interconnectors.

In the quarter 40.6% of power came from gas-fired power plants, 33.1% from renewables, 17.6% from nuclear, 8.1% from imports and 0.5% from coal-fired plants.

Statistics

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

*GB Only (Excludes Northern Ireland)	Q2-2017	Q3-2017	Q4-2017	Q1-2018	Q2-2018	Q3-2018	Q4-2018	Q1-2019	Q2-2019
TOTAL GENERATION BY FUEL (TWh)									
Coal	1.30	1.91	7.73	8.13	0.92	1.71	4.63	2.85	0.36
Gas	27.65	25.73	32.63	32.15	27.99	25.08	29.60	32.21	28.31
Imports	5.41	5.56	1.53	5.42	5.06	4.86	3.93	6.24	5.67
Nuclear	16.59	16.91	15.59	15.60	15.48	16.02	13.59	13.06	12.28
Renewables (Biomass, Wind, Solar & Hydro)	20.77	19.89	23.42	25.01	21.16	21.56	28.19	27.22	23.06
FOSSIL FUELS	28.95	27.64	40.36	40.28	28.91	26.79	34.24	35.05	28.67
TOTAL	71.72	69.99	80.91	86.30	70.60	69.23	79.94	81.58	69.67
Fossil Fuel Percentage	40%	39%	50%	47%	41%	39%	43%	43%	41%
Clean Percentage (Renewable & Nuclear)	52%	53%	48%	47%	52%	54%	52%	49%	51%
Renewable Share of Clean Power	56%	54%	60%	62%	58%	57%	67%	68%	65%
SHARE OF GENERATION (%)									
Coal	1.8%	2.7%	9.6%	9.4%	1.3%	2.5%	5.8%	3.5%	0.5%
Gas	38.6%	36.8%	40.3%	37.3%	39.6%	36.2%	37.0%	39.5%	40.6%
Imports	7.5%	7.9%	1.9%	6.3%	7.2%	7.0%	4.9%	7.6%	8.1%
Nuclear	23.1%	24.2%	19.3%	18.1%	21.9%	23.1%	17.0%	16.0%	17.6%
Renewables (Biomass, Wind, Solar & Hydro)	29.0%	28.4%	29.0%	29.0%	30.0%	31.1%	35.3%	33.4%	33.1%

*GB Only (Excludes Northern Ireland)	Q2-2017	Q3-2017	Q4-2017	Q1-2018	Q2-2018	Q3-2018	Q4-2018	Q1-2019	Q2-2019
AVERAGE GENERATION BY FUEL (GW)									
Coal	1.30	1.91	7.73	8.13	0.92	1.71	4.63	2.85	0.36
Gas	27.65	25.73	32.63	32.15	27.99	25.08	29.60	32.21	28.31
Imports	5.41	5.56	1.53	5.42	5.06	4.86	3.93	6.24	5.67
Nuclear	16.59	16.91	15.59	15.60	15.48	16.02	13.59	13.06	12.28
Renewables (Biomass, Wind, Solar & Hydro)	20.77	19.89	23.42	25.01	21.16	21.56	28.19	27.22	23.06
FOSSIL FUELS	28.95	27.64	40.36	40.28	28.91	26.79	34.24	35.05	28.67
TOTAL	71.72	69.99	80.91	86.30	70.60	69.23	79.94	81.58	69.67

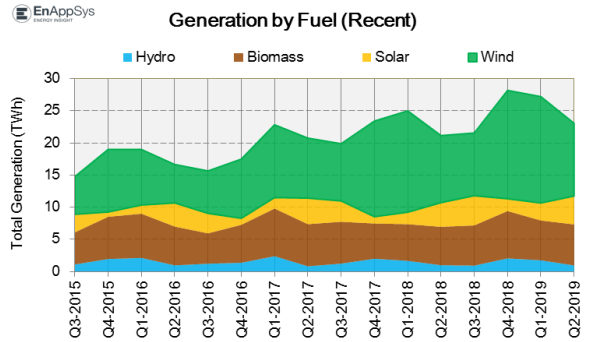
*GB Only (Excludes Northern Ireland)	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017	Q2-2018	Q2-2019
TOTAL GENERATION BY FUEL (TWh)									
Coal	17.90	29.89	27.88	21.11	16.60	4.05	1.30	0.92	0.36
Gas	32.12	21.14	20.49	20.67	19.63	30.58	27.65	27.99	28.31
Imports	1.02	2.50	3.20	4.79	5.48	5.67	5.41	5.06	5.67
Nuclear	17.90	17.31	14.55	16.30	15.81	15.57	16.59	15.48	12.28
Renewables (Biomass, Wind, Solar & Hydro)	6.70	6.70	10.95	10.79	15.54	16.66	20.77	21.16	23.06
FOSSIL FUELS	50.01	51.02	48.38	41.78	36.22	34.63	28.95	28.91	28.67
TOTAL	75.63	77.53	77.07	73.66	73.06	72.53	71.72	70.60	69.67
Fossil Fuel Percentage	66%	66%	63%	57%	50%	48%	40%	41%	41%
Clean Percentage	33%	31%	33%	37%	43%	44%	52%	52%	51%
Renewable Share of Clean Power	9%	9%	14%	15%	21%	23%	29%	30%	33%
SHARE OF GENERATION (%)									
Coal	23.7%	38.5%	36.2%	28.7%	22.7%	5.6%	1.8%	1.3%	0.5%
Gas	42.5%	27.3%	26.6%	28.1%	26.9%	42.2%	38.6%	39.6%	40.6%
Imports	1.3%	3.2%	4.1%	6.5%	7.5%	7.8%	7.5%	7.2%	8.1%
Nuclear	23.7%	22.3%	18.9%	22.1%	21.6%	21.5%	23.1%	21.9%	17.6%
Renewables (Biomass, Wind, Solar & Hydro)	8.9%	8.6%	14.2%	14.6%	21.3%	23.0%	29.0%	30.0%	33.1%

Renewables

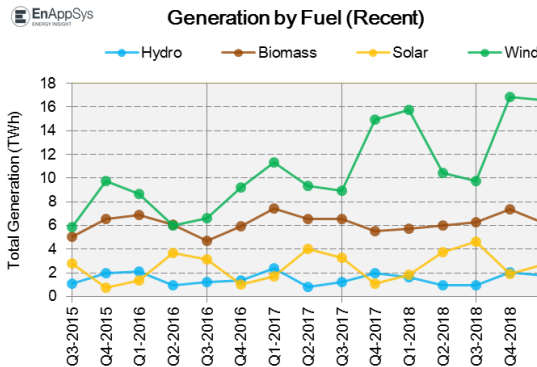
In the quarter renewable projects generated 23.1TWh of power which amounted to 33.1% of generation in the quarter.

Year on year, the contribution of renewable generation to the total fuel mix has increased, with this Q2 seeing 7% higher renewable generation than Q2 2018 and 9% higher than Q2 2017.

Of this the largest share of renewable generation came from wind farms, which generated 11.3TWh of power, with these levels being 8% up from the same period in



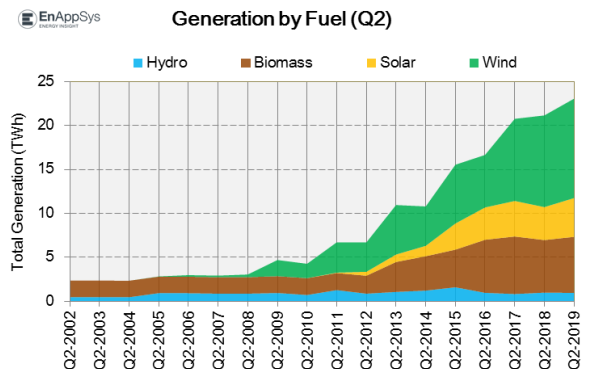
2018. Much of this growth is coming from the on-going increases in generation at offshore wind farms over time.



The next largest share of renewable generation came from biomass projects, which generated 6.4TWh of power. This was up from the

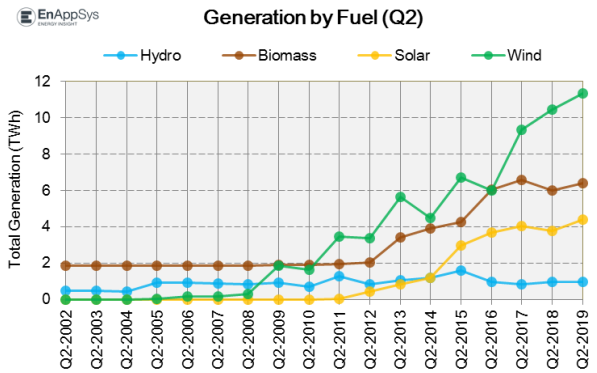
same period in 2018, but down from Q2 2017 as levels of biomass generation have generally remained stable.

The solar fleet also saw an increase a few years ago, though this has levelled off in the past year. Solar generation from the quarter was, however, up 18% from last year, with the start of Q2 2018 seeing the tail end of the cold and wintery weather during the ‘Beast from the East’. These solar generation levels totalled 4.4TWh.



Hydro plants generated 1.0TWh and the hydro fleet was the only one of the renewable sources listed that saw a decline in levels of generation from Q2 2018.

In the quarter wind farms generated 49.1% of all renewable generation, biomass 27.7%, solar farms 19.1% and hydro 4.1%. As a percentage of total generation wind farms produced 16.2%, biomass 9.2%, solar 6.3% and hydro 1.4%.



Statistics

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

*GB Only (Excludes Northern Ireland)	Q2-2017	Q3-2017	Q4-2017	Q1-2018	Q2-2018	Q3-2018	Q4-2018	Q1-2019	Q2-2019
TOTAL GENERATION BY FUEL (TWh)									
Biomass	6.56	6.52	5.49	5.71	5.98	6.26	7.38	6.20	6.38
Hydro	0.81	1.23	1.98	1.66	0.98	0.92	2.04	1.74	0.95
Solar	4.05	3.23	1.05	1.86	3.76	4.62	1.91	2.72	4.42
Wind	9.35	8.91	14.90	15.78	10.44	9.77	16.87	16.56	11.32
TOTAL RENEWABLES	20.77	19.89	23.42	25.01	21.16	21.56	28.19	27.22	23.06

SHARE OF RENEWABLE GENERATION (%)									
Biomass	31.6%	32.8%	23.4%	22.8%	28.3%	29.0%	26.2%	22.8%	27.7%
Hydro	3.9%	6.2%	8.5%	6.6%	4.6%	4.2%	7.2%	6.4%	4.1%
Solar	19.5%	16.3%	4.5%	7.4%	17.8%	21.4%	6.8%	10.0%	19.1%
Wind	45.0%	44.8%	63.6%	63.1%	49.4%	45.3%	59.8%	60.8%	49.1%

SHARE OF TOTAL GENERATION (%)									
Biomass	9.1%	9.3%	6.8%	6.6%	8.5%	9.0%	9.2%	7.6%	9.2%
Hydro	1.1%	1.8%	2.5%	1.9%	1.4%	1.3%	2.5%	2.1%	1.4%
Solar	5.6%	4.6%	1.3%	2.2%	5.3%	6.7%	2.4%	3.3%	6.3%
Wind	13.0%	12.7%	18.4%	18.3%	14.8%	14.1%	21.1%	20.3%	16.2%

LARGEST RENEWABLE SOURCE WIND WIND WIND WIND WIND WIND WIND WIND WIND

*GB Only (Excludes Northern Ireland)	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017	Q2-2018	Q2-2019
TOTAL GENERATION BY FUEL (TWh)									
Biomass	1.95	2.05	3.41	3.92	4.28	6.04	6.56	5.98	6.38
Hydro	1.26	0.85	1.05	1.21	1.58	0.95	0.81	0.98	0.95
Solar	0.05	0.45	0.85	1.18	2.98	3.68	4.05	3.76	4.42
Wind	3.45	3.35	5.64	4.48	6.70	5.98	9.35	10.44	11.32
TOTAL RENEWABLES	6.70	6.70	10.95	10.79	15.54	16.66	20.77	21.16	23.06

SHARE OF RENEWABLE GENERATION (%)									
Biomass	29.1%	30.6%	31.2%	36.3%	27.6%	36.3%	31.6%	28.3%	27.7%
Hydro	18.8%	12.7%	9.6%	11.2%	10.2%	5.7%	3.9%	4.6%	4.1%
Solar	0.7%	6.7%	7.7%	11.0%	19.2%	22.1%	19.5%	17.8%	19.1%
Wind	51.5%	50.0%	51.5%	41.5%	43.1%	35.9%	45.0%	49.4%	49.1%

SHARE OF TOTAL GENERATION (%)									
Biomass	2.6%	2.6%	4.4%	5.3%	5.9%	8.3%	9.1%	8.5%	9.2%
Hydro	1.7%	1.1%	1.4%	1.6%	2.2%	1.3%	1.1%	1.4%	1.4%
Solar	0.1%	0.6%	1.1%	1.6%	4.1%	5.1%	5.6%	5.3%	6.3%
Wind	4.6%	4.3%	7.3%	6.1%	9.2%	8.2%	13.0%	14.8%	16.2%

LARGEST RENEWABLE SOURCE WIND WIND WIND WIND WIND BIOMASS WIND WIND WIND

Demand and Prices

The second quarter of the year generally saw low prices and more limited market opportunities, in line with the typical activity of a summer quarter.

However, with coal units seeing very low levels of activity, these units saw long start times and lower reliability and this reduced the amount of usable margin in the market, even if there were plant available. This is because these coal plants could generate but only with a very long notice period.

As a result on the 24th June 2019, the system needed more plants to come online to boost levels of usable margin, but could not bring online the coal plants that were sat inactive as even in the early morning these plants needed too long to get started.

As a result, the coal plants that could be called upon were activated and one of these struggled to get started putting pressure on the system.

This increased the Loss of Load Probability to 17% on the evening peak on this day. This LoLP measures the probability of the system being at risk from a blackout, with a loss of load occurring whenever the system load exceeds the available generating capacity.

This mean that system prices spiked at £375/MWh on this day – and could easily have spiked as high as £1,000/MWh despite day ahead prices for the quarter dropping by 28% from the same period in Q2 2018.

Otherwise levels of demand in the market continued to fall, being 6% down from the levels in Q2 2018.

Statistics

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

*GB Only (Excludes Northern Ireland)	Q2-2017	Q3-2017	Q4-2017	Q1-2018	Q2-2018	Q3-2018	Q4-2018	Q1-2019	Q2-2019
WHOLESALE PRICES (£/MWh)									
Day Ahead Price	40.04	43.05	50.24	52.72	52.66	61.25	62.98	51.82	41.18
Within Day Price (MIDP)	40.03	42.01	49.62	54.62	51.65	59.73	61.67	50.83	40.99
WITHIN DAY PRICE BREAKDOWN (£/MWh)									
Off-Peak Hours	33.87	34.79	43.34	47.64	46.26	51.32	54.03	44.70	36.52
Peak Hours (excl Superpeak)	41.81	44.67	50.30	55.00	53.39	62.89	62.39	51.22	42.32
Superpeak Hours	47.66	49.03	61.47	68.81	57.77	67.71	76.64	62.29	45.97
SYSTEM PRICE (£/MWh)									
Maximum	1509.80	176.69	178.00	990.00	158.00	189.26	191.37	195.00	375.00
Average	40.48	41.10	49.46	57.50	50.64	59.38	62.42	50.81	41.27
Minimum	-73.15	-25.00	-69.17	-150.00	-92.38	-71.45	-68.40	-70.24	-71.26
DEMAND AND AVAILABILITY (MW)									
Demand (MW)	30,600	29,459	34,448	39,527	31,840	30,719	35,472	37,905	30,142
Availability (MW)	48,009	45,186	55,505	59,823	49,443	49,530	56,442	59,955	59,956
Margin (MW)	21,386	18,937	23,888	25,965	22,206	21,455	19,989	21,735	17,780
Minimum Margin (MW)	1,867	4,090	6,480	6,499	6,478	5,349	3,227	3,877	6,597
DEMAND AND AVAILABILITY (TWh)									
Demand (TWh)	66.8	65.0	76.1	85.4	69.5	67.8	78.3	81.9	65.8
Availability (TWh)	104.9	99.8	122.6	129.2	108.0	109.4	124.6	129.5	130.9
Margin (TWh)	46.7	41.8	52.7	56.1	48.5	47.4	44.1	46.9	38.8
Minimum Margin (TWh)	4.1	9.0	14.3	14.0	14.1	11.8	7.1	8.4	14.4

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 come 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.

