Feed-in Tariff load factor analysis

Introduction

This article updates the FIT load factor analysis presented in the December 2016 edition of Energy Trends[1] with data for FIT year seven (financial year 2016/17). We also present regional analysis of solar PV for the six years that data has been published (FIT years two to seven) and wind for years five to seven. All the data in this article is also available in Excel format at the following link, including quarterly load factors for solar PV:
www.gov.uk/government/statistics/quarterly-and-annual-load-factors

Background

The Feed-in Tariff (FIT) scheme was launched in April 2010. It is a financial support scheme for eligible low-carbon electricity technologies, aimed at small-scale installations. The following technologies are supported:

- Solar photovoltaic (PV; Up to 5 MW capacity)
- Anaerobic digestion (AD; Up to 5 MW capacity)
- Hydro (Up to 5 MW capacity)
- Wind (Up to 5 MW capacity)
- Micro combined heat and power (MicroCHP; Up to 2 kW capacity)

Installers receive support through generation and export tariffs, paid directly from electricity suppliers. The generation tariff is based on the number of kilowatt hours (kWh) generated whereas the export tariff is based on electricity that is generated on site, not used and exported back to the grid.

Since the start of the scheme, DECC/BEIS has provided regular updates on the number and capacity of installations installed under the scheme, currently publishing monthly updates on deployment levels with quarterly reports on geographical distribution, amongst other outputs[2]. From 2013, DECC/BEIS obtained meter readings for each registered installation from Energy Suppliers and used this to produce quarterly and annual load factors for FIT years two to seven (data from year one is not available as the number of installations running for the full year was very small).

Methodology

The methodology used for the load factor analysis has been described in detail in an Energy Trends article from September 2014[3]. One additional quality assurance (QA) step has been added since 2015, to remove any installations from the analysis where more than one generation meter is attached. This step has only been applied to FIT year five to seven data; previously produced statistics have not been revised. Please note that full QA on data from all installations has not been possible.

Table 1 shows how many installations were registered on the Central Feed-in Tariff Register at the start of FIT year seven and how many installations had meter readings in March 2016 and 2017. As generators can submit meter readings throughout the year, of the 784,414 schemes registered for FiTs at the start of the year, only around 16 per cent were found to have meter readings in both

[1] The article published in December 2014 can be found at the following link: www.gov.uk/government/statistics/energy-trends-december-2014-special-feature-article-feed-in-tariff-load-factor-analysis
[2] See this link for the full FIT statistics collection: www.gov.uk/government/collections/feed-in-tariff-statistics
[3] The article published in September 2014 can be found at the following link: www.gov.uk/government/statistics/energy-trends-september-2014-special-feature-article-analysis-of-feed-in-tariff-generation-data

March 2016 and March 2017, required to produce this analysis. Extreme load factor values were further excluded (as in previous years' analysis), although only accounting for around 92 (0.1%) of installations. The column 'Valid load factor' in Table 1 indicates how many installations were included in the final analysis for each technology for the annual generation data. Anaerobic Digestion data has been included in the main results, but this data must be treated with caution as the number of installations remains low.

Table 1: Installations included in analysis by Technology – FIT Year 7

Technology	Commissioned by 1st April 2016	Generation Data Reported*	Valid load factor	% remaining in analysis
Anaerobic digestion	351	45	44	13%
Hydro	883	98	98	11%
Micro CHP	529	41	41	8%
Photovoltaic	775,289	126,410	126,323	16%
Wind	7362	2,003	1,999	27%
All Technologies	**784,414**	**128,597**	**128,505**	**16%**

* Meter reading in March 2016 and March 2017.

Results

Table 2 gives the weighted mean and median load factors as well as associated percentiles for each technology. Chart 1 presents this data across all available years (FITs years two to seven), highlighting the large range present for Hydro compared to other technologies.

Table 2: FIT Year 7 (2016/2017) load factors by technology

Technology	Count	Mean	Weighted mean	Percentile				
				5th	25th	50th (median)	75th	95th
Anaerobic digestion	44	77.8	71.4	26.2	66.3	86.0	94.3	97.6
Hydro	98	37.7	36.5	10.8	25.8	34.3	46.6	74.1
Micro CHP	41	12.6	12.6	5.8	8.6	11.2	15.4	25.8
Photovoltaic	126,323	9.9	9.9	7.1	9.0	10.1	10.9	12.0
Wind	1,999	18.4	24.6	5.3	10.3	17.0	24.6	36.8

The median load factor for Solar PV in 2016/17 was lower than the preceding three years at 10.1%. This small decrease can be attributed to the small decrease in average daily sun hours from 4.3 hours to 4.2 hours[4] (see Table 3).

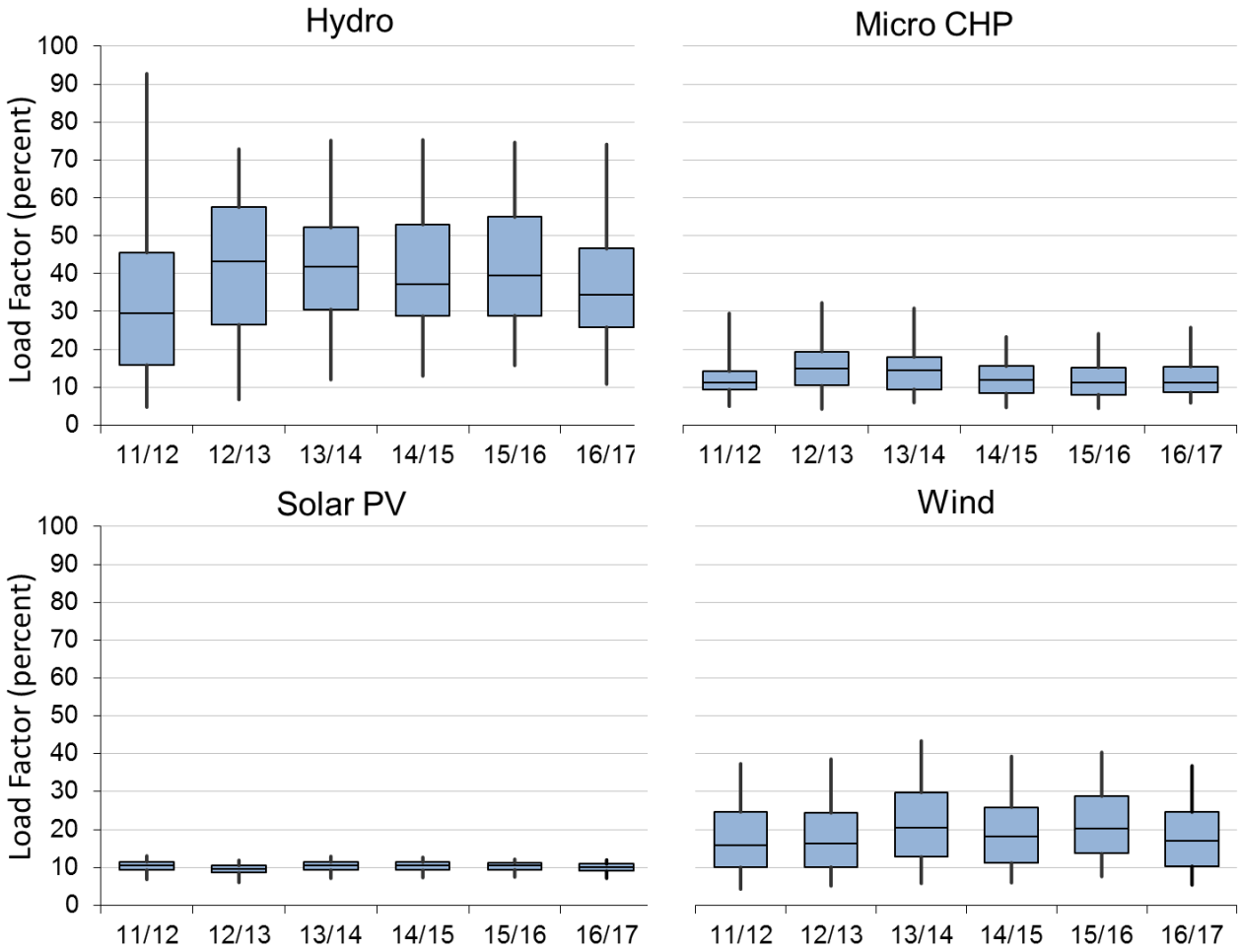
Table 3: Solar PV load factors and average sun index

Year	Median load factor	Average daily sun hours
2011/12	10.5	4.5
2012/13	9.6	3.7
2013/14	10.4	4.5
2014/15	10.4	4.5
2015/16	10.4	4.3
2016/17	10.1	4.2

[4] Average daily sun hours taken from Energy Trends section 7: weather, table 7.3 "Average daily sun hours and deviations from the long term mean (ET 7.3)" www.gov.uk/government/statistics/energy-trends-section-7-weather. Note that data for 2016/17 is provisional and subject to revision.

Chart 1: Load factor range by technology and year

Lines indicate range from 5th to 95th percentile. Boxes indicate range from lower to upper quartile (25th to 75th percentile) with median indicated.



As in previous years, the weighted mean load factor for Wind installations is higher than the mean (see Table 2), and this difference has generally increased over the time-series, possibly reflecting the increase in the number of higher performing larger wind schemes in the analysis. The relationship between average daily wind speed[5] and load factor for wind installations is less clear than between sun hours and solar load factors (see Table 4). For 2016/17 the median load factor decreased to 17.0% compared to 20.3% in 2015/16. This decrease reflects the reduction in wind installations, from 2,120 in 2015/16 to 1,999 in 2016/17, and the reduction in average wind speed (see Table 4).

[5] Average wind speed taken from Energy Trends section 7: weather, table 7.2 " Average wind speed and deviations from the long term mean (ET 7.2)" www.gov.uk/government/statistics/energy-trends-section-7-weather. Note that data for 2016/17 is provisional and subject to revision.

Table 4: Wind load factors and average wind speed

Year	Median load factor	Average wind speed (knots)
2011/12	15.9	9.2
2012/13	16.3	8.0
2013/14	20.5	9.3
2014/15	18.1	8.6
2015/16	20.3	9.2
2016/17	17.0	8.2

Solar PV Load Factors

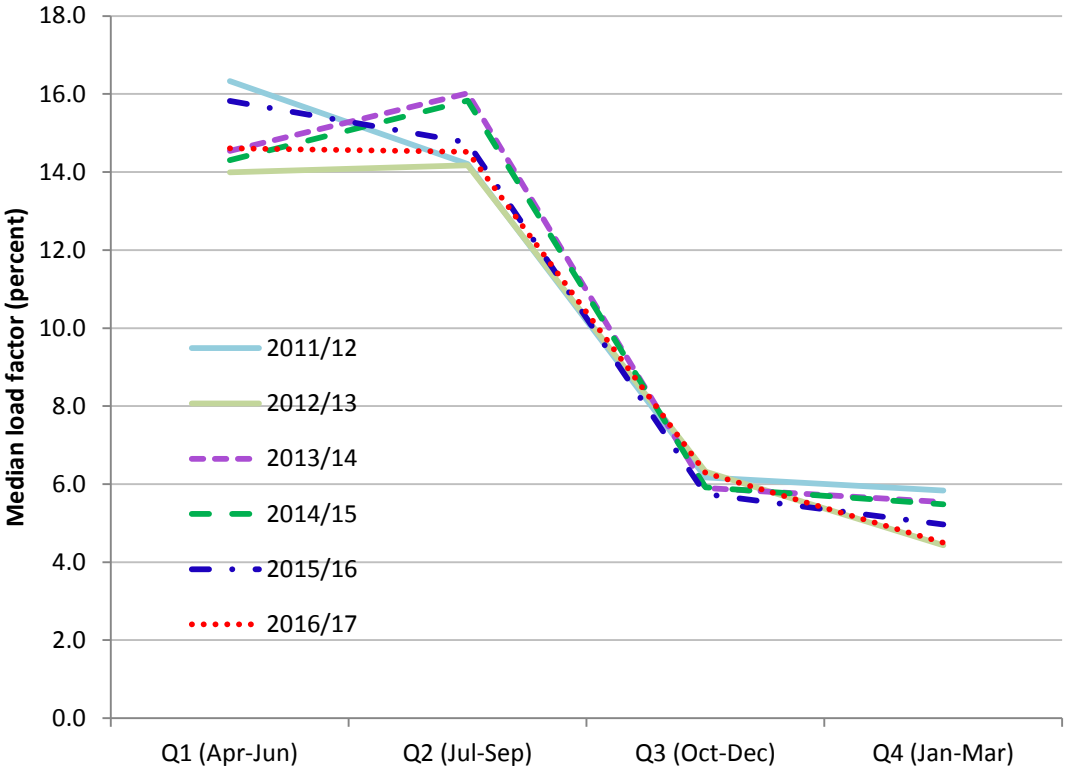
The number of Solar PV installations continues to slowly increase but – based on 2016/17 alone - there appears to be some evidence from our analysis that the load factor of installations decreases over time. When schemes are installed, their productivity may vary across time since the solar panels may degrade, losing efficiency. Newly installed schemes can benefit from technological improvements, but there is also a potential concern that early solar adopters used the most favourable sites, making newer sites less efficient. *However*, this could be countered by the increased share of larger, optimally oriented and unshaded, solar farms (as opposed to household schemes) in more recent years. Table 5 gives the data from all the installations in the FIT year seven analysis, broken down by calendar year commissioned.

Table 5: Solar PV Load Factors in FIT Year 7 by year commissioned

Year Commissioned	Count	Weighted Mean load factor
2010 and earlier	5,683	9.7
2011	54,274	9.9
2012	40,613	9.8
2013	19,144	9.9
2014	5,555	10.2
2015	940	10.2
2016	114	9.7

Quarterly load factors for Solar PV installations are available in the accompanying excel workbook and are presented graphically in Chart 2. These show an expected association between load factor and daily hours of sunshine, where the quarters mainly covering Autumn and Winter have the lowest load factors. This chart also highlights that the lower annual load factors seen in FIT year three (2012/13) for Solar PV are driven by lower load factors in all quarters except quarter three (Q3), and those in FIT year seven (2016/17) driven by low sun levels and load factors in the summer quarters (Q1 and Q2).

Chart 2: Quarterly PV load factors by FIT year



Regional Solar PV Load Factors

Solar PV Factors for each Government Office Region have been published for FIT years two to six and are updated with data from year seven in Table 4. Chart 3 highlights that the lowest load factors are seen in Scotland, while the highest are seen in the South West. Load factors in year three (2012/13) are lower than in other years, which are explained by the average daily sun hours also dropping for that year (see Table 3). For year seven (2016/17), the load factors are lower than in the preceding three years, reflecting the decrease in average daily sun hours. London again has a lower load factor than the South East which may be due to pollution or particles settling on the panels or because panels are shaded by tall buildings nearby.

Chart 3: Regional Solar PV load factors for FITs years 2-7

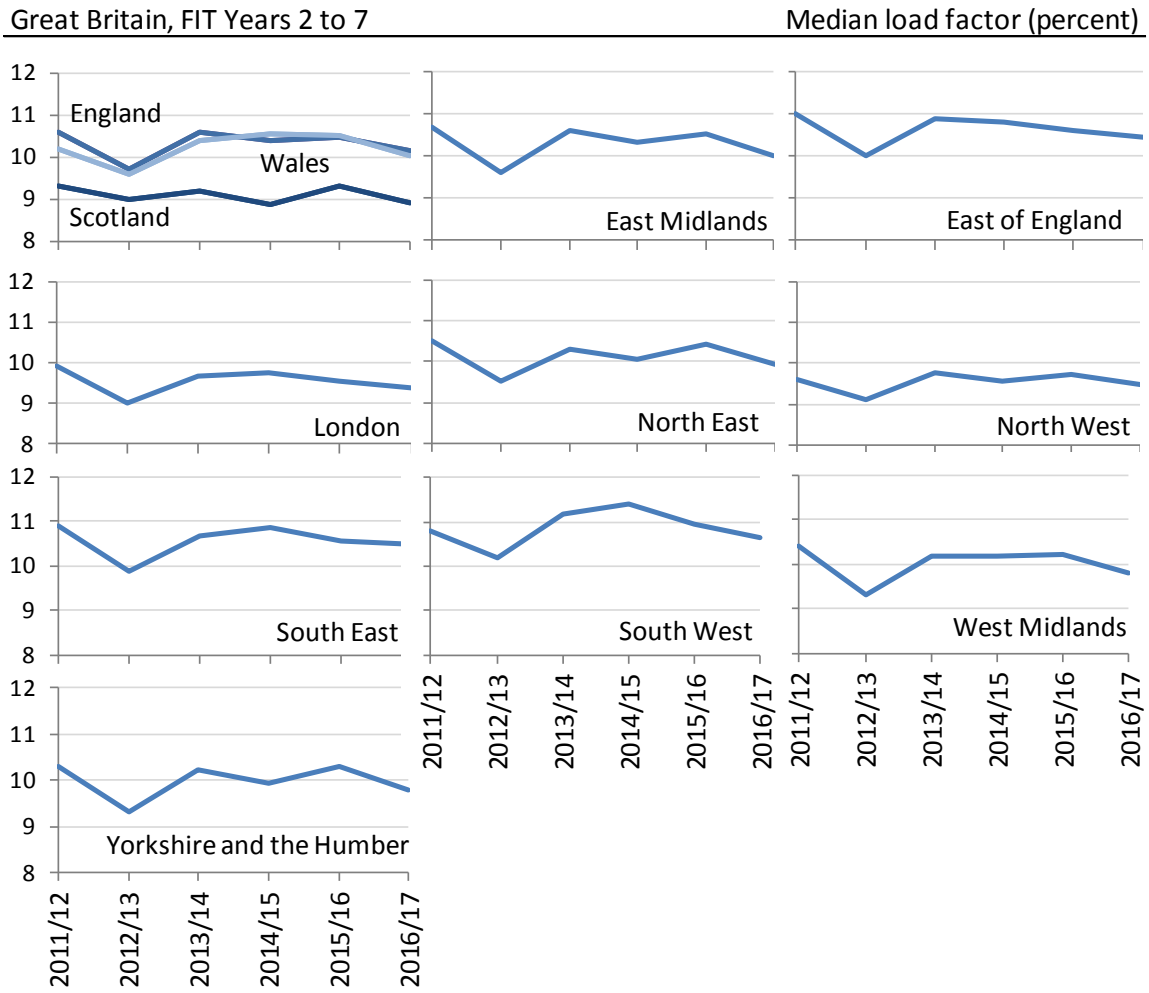


Table 6: Regional Solar PV load factors for FITs years 2-7

Region	FIT Year 2 (2011/12)		FIT Year 3 (2012/13)		FIT Year 4 (2013/14)		FIT Year 5 (2014/15)		FIT Year 6 (2015/16)		FIT Year 7 (2016/17)	
	Count	Median	Count	Median	Count	Median	Count	Median	Count	Median	Count	Median
East Midlands	855	10.7	7,520	9.6	12,936	10.6	18,735	10.3	13,489	10.5	11,548	10.0
East of England	1,465	11.0	10,521	10.0	16,306	10.9	21,247	10.8	16,917	10.6	14,308	10.5
London	523	9.9	3,283	9.0	4,117	9.7	4,996	9.8	3,813	9.6	3,240	9.4
North East	224	10.5	3,460	9.5	5,805	10.3	8,023	10.1	6,444	10.4	5,595	9.9
North West	718	9.6	8,867	9.1	13,024	9.8	17,360	9.5	13,689	9.7	11,546	9.5
South East	2,764	10.9	17,378	9.9	23,235	10.7	25,994	10.9	18,955	10.6	15,632	10.5
South West	2,649	10.8	24,445	10.2	31,965	11.2	36,938	11.4	29,331	11.0	25,715	10.6
West Midlands	974	10.4	7,139	9.3	11,118	10.2	15,312	10.2	12,013	10.2	10,219	9.8
Yorkshire and the Humber	798	10.3	7,292	9.3	11,299	10.2	18,507	9.9	15,058	10.3	12,826	9.8
England	**10,970**	**10.6**	**89,905**	**9.7**	**129,805**	**10.6**	**167,112**	**10.4**	**129,709**	**10.5**	**110,629**	**10.2**
Scotland	**508**	**9.3**	**7,722**	**9.0**	**11,531**	**9.2**	**11,363**	**8.9**	**6,802**	**9.3**	**5,731**	**8.9**
Wales	**645**	**10.2**	**9,882**	**9.6**	**13,643**	**10.4**	**15,100**	**10.5**	**11,614**	**10.5**	**9,946**	**10.0**

Regional Wind Load Factors

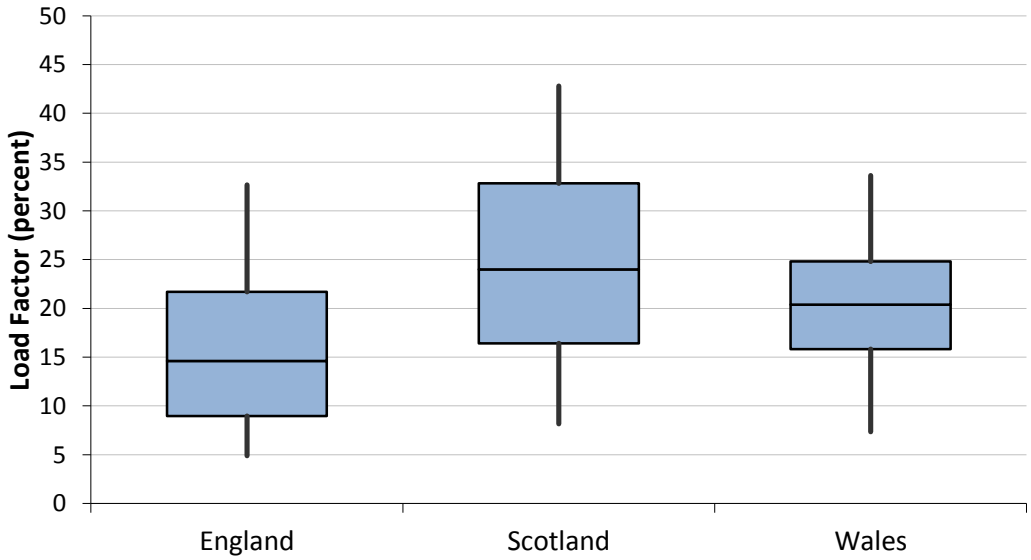
Similar to the regional solar load factors, we have also produced regional load factors for Wind schemes for FIT years five to seven; these are presented in Table 7. Data from London and the South East has been aggregated as there was a low number of installations within these regions with a valid load factor. Chart 4 summarises this data for England, Scotland and Wales, showing that the highest Wind load factors are found in Scotland.

Table 7: Regional Wind load factors for FITs years 5 to 7

Region	FIT Year 5 (2014/15)		FIT Year 6 (2015/16)		FIT Year 7 (2016/17)	
	Count	Median	Count	Median	Count	Median
East Midlands	134	14.4	123	17.5	134	13.6
East of England	453	10.0	405	13.0	361	8.6
London and South East	30	14.8	23	12.1	18	10.2
North East	84	16.5	73	17.5	67	14.2
North West	133	19.0	137	23.6	129	18.9
South West	318	19.6	296	25.7	276	20.7
West Midlands	63	13.6	63	17.1	63	13.6
Yorkshire and the Humber	319	18.9	318	20.8	321	17.0
England	**1,534**	**14.8**	**1,438**	**18.2**	**1,369**	**14.6**
Scotland	**743**	**24.8**	**469**	**25.6**	**436**	**24.0**
Wales	**190**	**20.0**	**178**	**24.4**	**192**	**20.4**

Chart 4: Wind regional load factors for FITs year 7 by country

Lines indicate range from 5th to 95th percentile. Boxes indicate range from lower to upper quartile (25th to 75th percentile) with median indicated.



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