Feed-in Tariff load factor analysis

Introduction

This article updates the FIT load factor analysis presented in the December 2017 edition of Energy Trends[1] with data for FIT year eight (financial year 2017/18). We also present regional analysis of solar PV for the seven years that data has been published (FIT years two to seven) and wind for years five to eight. 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

Load factors are a measure of the efficiency of electrify generation. A load factor is defined as the ratio of how much electricity was generated over a certain time period as a proportion of the total generating capacity.

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, BEIS[2] 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[3]. From 2013, BEIS obtained meter readings for registered installations from Energy Suppliers and used this to produce quarterly and annual load factors for FIT years two to eight (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 was described in detail in an Energy Trends article from September 2014[4]. 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 eight data; previously produced statistics have not been revised. Please note that full QA on data from all installations has not been possible.

[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] Department for Business, Energy & Industrial Strategy. FiTS was overseen by the Department for Energy & Climate Change (DECC) until machinery of government changes in 2016.
[2] See this link for the full FIT statistics collection: www.gov.uk/government/collections/feed-in-tariff-statistics
[4] 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

Table 1 shows how many installations were registered on the Central Feed-in Tariff Register at the start of FIT year eight and how many installations had meter readings in March 2017 and 2018. For this analysis a meter reading is required in both of these months in order to cover the whole financial year and remove seasonal effects which would otherwise bias the results. As generators can submit meter readings throughout the year, of the 830,509 schemes registered for FiTs at the start of the year, 24 per cent were found to have meter readings in both March 2017 and March 2018. Extreme load factor values were further excluded (as in previous years' analysis), accounting for around 4,065 (2.0%) 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 is 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 8

Technology	Commissioned by 1st April 2017	Generation Data Reported*	Valid load factor	% remaining in analysis
Anaerobic digestion	413	129	105	25%
Hydro	1,141	219	182	16%
Micro CHP	512	60	43	8%
Photovoltaic	820,939	199,537	195,771	24%
Wind	7,504	1,337	1,116	15%
All Technologies	**830,509**	**201,282**	**197,217**	**16%**

* Meter reading in March 2017 and March 2018.

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 eight), highlighting the large range present for Hydro compared to other technologies.

Table 2: FIT Year 8 (2017/2018) load factors by technology

Technology	Count	Mean	Weighted mean	Percentile				
				5th	25th	50th (median)	75th	95th
Anaerobic digestion	105	77.6	75.8	21.9	66.0	86.9	95.6	97.6
Hydro	182	44.4	39.0	16.9	30.6	44.2	56.4	80.2
Micro CHP	43	13.5	13.5	6.5	8.9	12.6	15.4	25.2
Photovoltaic	195,771	9.7	9.7	7.1	8.8	9.8	10.7	11.9
Wind	1,116	20.5	28.4	5.6	12.5	20.5	28.0	36.8

The median load factor for Solar PV in 2017/18 was the lowest since 2012/13 at 9.8%. This small decrease can be attributed to a decrease in average daily sun hours from 4.2 hours to 4.1 hours[5] and possibly installations being older on average, since the performance of solar installations degrades slowly over time.

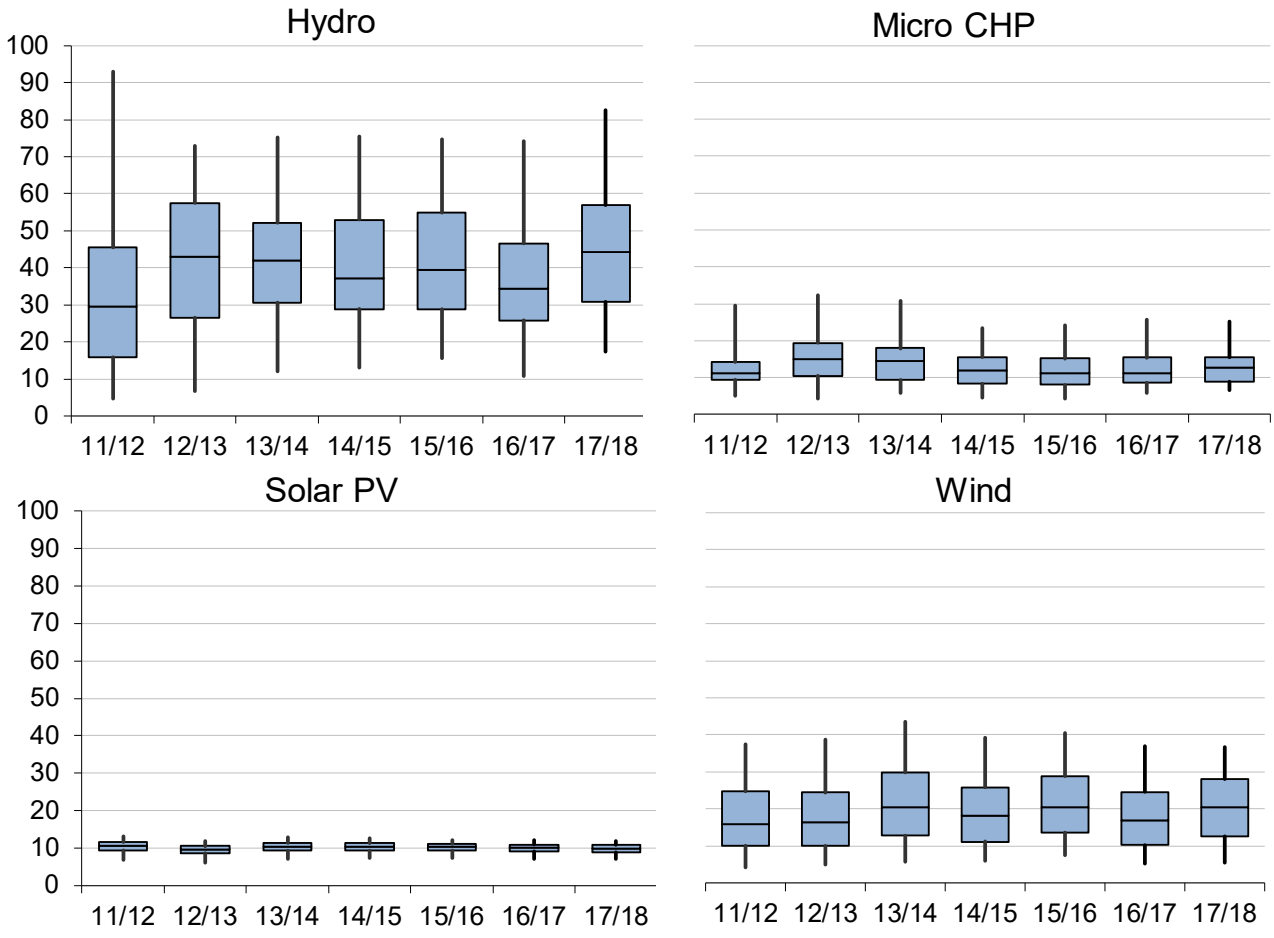
[5] Energy Trends section 7: weather, table 7.3: www.gov.uk/government/statistics/energy-trends-section-7-weather. Note that data for 2017/18 is provisional and subject to revision.

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
2017/18	9.8	4.1

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[6] and load factor for wind installations is less clear than between sun hours and solar load factors (see Table 4). For 2017/18 the median load factor increased to 20.3% compared to 17.0% in 2016/17. This increase reflects the increase in average wind speed (see Table 4).

There is a relationship between wind speed and wind load factors. However, wind speeds are measure at ground level which may vary with the wind speed at the level of the wind turbine. Furthermore, some wind directions are more favourable for wind generation and may vary from year to year. The average wind speed is for the whole of the UK however, wind speed varies by location. The locations of the wind sites that are included in the sample for this analysis can vary each year.

Table 4: Wind load factors and average wind speed

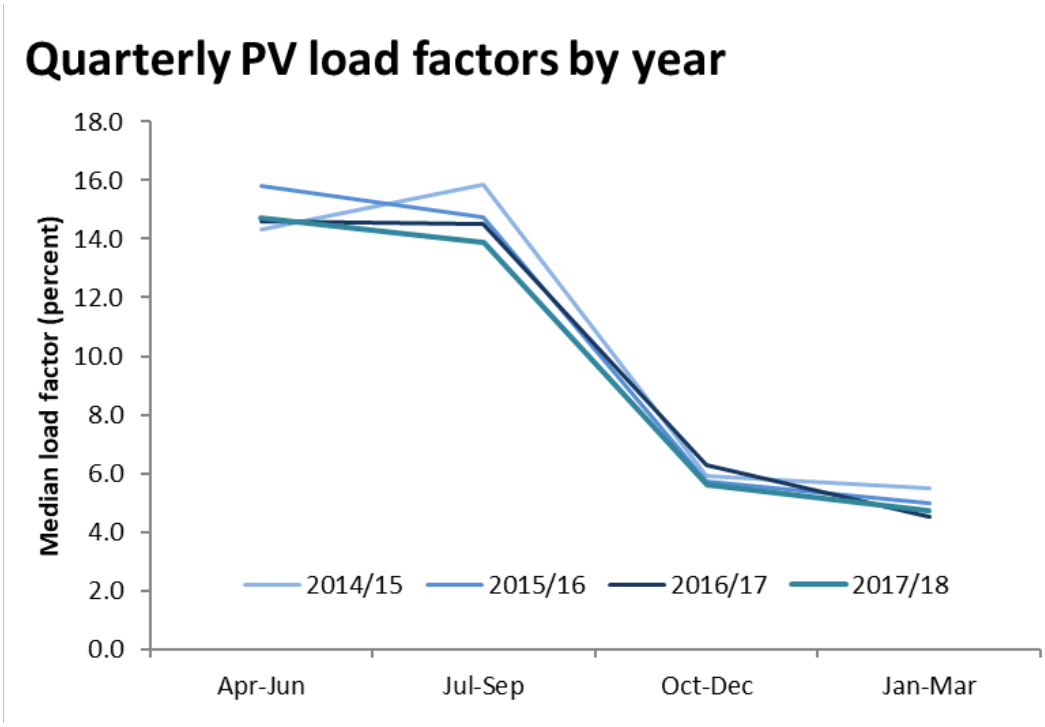
Year	Median load factor	Average wind speed (knots)
2011/12	15.9	9.2
2012/13	16.3	8.0
2013/14	20.5	9.3
2014/15	18.1	8.6
2015/16	20.3	9.2
2016/17	17.0	8.2
2017/18	20.3	8.8

Solar PV load factors

Quarterly load factors for Solar PV installations are available in the accompanying excel workbook and the last four years 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 low annual load factors seen in FIT year eight (2017/18) for Solar PV are driven by low sun levels and load factors in the summer quarter (Jul-Sep).

[6] 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 2017/18 are provisional and subject to revision.

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 seven and are updated with data from year eight in Table 4. Chart 3 highlights that the lowest load factors are seen in Scotland, while the highest are seen in the South West. For year eight (2017/18), the load factors are lower than in the preceding three years, reflecting the decrease in average daily sun hours. The reduction in 2017/18 could also be due to solar panels on average being older, there is evidence that solar panels become less efficient over time. 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 2-8

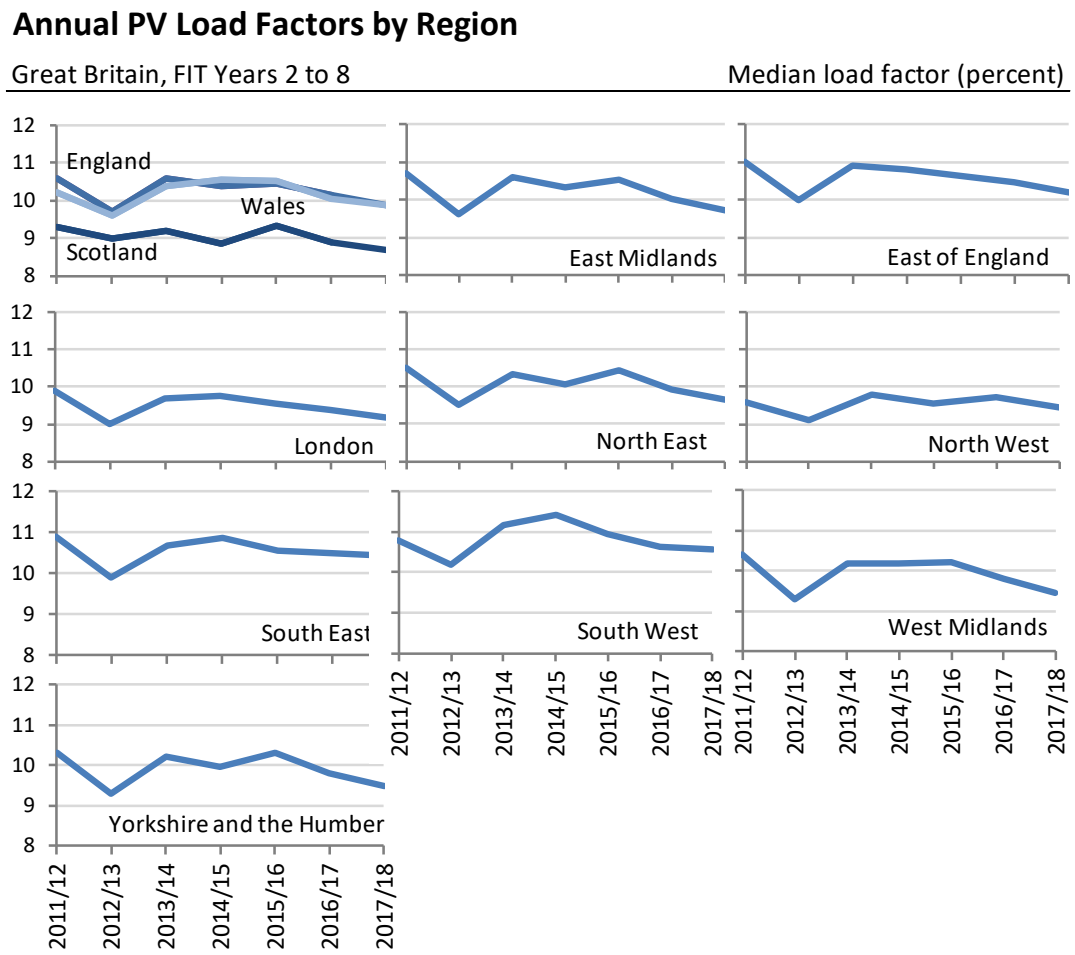


Table 5: Regional Solar PV load factors for FITs years 3-8

Region	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)		FIT Year 8 (2017/18)	
	Count	Median	Count	Median	Count	Median	Count	Median	Count	Median	Count	Median
East Midlands	7,520	9.6	12,936	10.6	18,735	10.3	13,489	10.5	11,548	10.0	19,023	9.7
East of England	10,521	10.0	16,306	10.9	21,247	10.8	16,917	10.6	14,308	10.5	22,240	10.2
London	3,283	9.0	4,117	9.7	4,996	9.8	3,813	9.6	3,240	9.4	4,852	9.2
North East	3,460	9.5	5,805	10.3	8,023	10.1	6,444	10.4	5,595	9.9	9,625	9.7
North West	8,867	9.1	13,024	9.8	17,360	9.5	13,689	9.7	11,546	9.5	19,736	9.0
South East	17,378	9.9	23,235	10.7	25,994	10.9	18,955	10.6	15,632	10.5	24,933	10.4
South West	24,445	10.2	31,965	11.2	36,938	11.4	29,331	11.0	25,715	10.6	36,357	10.6
West Midlands	7,139	9.3	11,118	10.2	15,312	10.2	12,013	10.2	10,219	9.8	13,946	9.5
Yorkshire and the Humber	7,292	9.3	11,299	10.2	18,507	9.9	15,058	10.3	12,826	9.8	19,339	9.5
England	**89,905**	**9.7**	**129,805**	**10.6**	**167,112**	**10.4**	**129,709**	**10.5**	**110,629**	**10.2**	**170,137**	**9.9**
Scotland	**7,722**	**9.0**	**11,531**	**9.2**	**11,363**	**8.9**	**6,802**	**9.3**	**5,731**	**8.9**	**11,036**	**8.7**
Wales	**9,882**	**9.6**	**13,643**	**10.4**	**15,100**	**10.5**	**11,614**	**10.5**	**9,946**	**10.0**	**14,598**	**9.9**

Regional Wind load factors

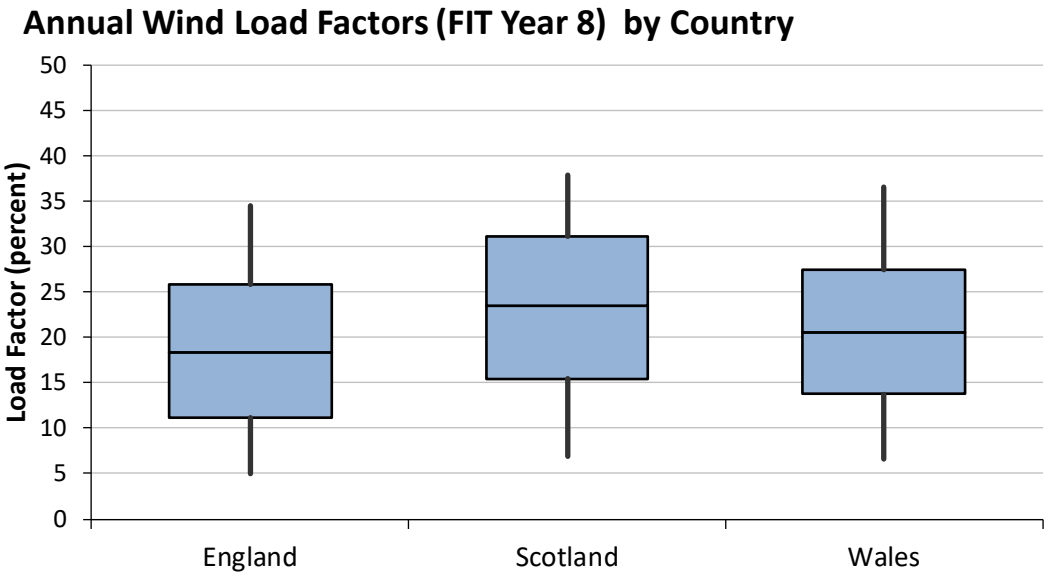
Similar to the regional solar load factors, we have also produced regional load factors for Wind schemes for FIT years five to eight; these are presented in Table 6. Data from London and the South East has been aggregated as there was a low number of installations within these regions with a valid load factor. Chart 4 summarises this data for England, Scotland and Wales, showing that the highest Wind load factors are found in Scotland.

Table 6: Regional Wind load factors for FITs years 5 to 8

Region	FIT Year 5 (2014/15)		FIT Year 6 (2015/16)		FIT Year 7 (2016/17)		FIT Year 8 (2017/18)	
	Count	Median	Count	Count	Count	Median	Count	Median
East Midlands	134	14.4	123	134	134	17.5	60	18.9
East of England	453	10.0	405	361	361	13.0	74	16.0
London and South East	30	14.8	23	18	18	12.1	16	8.0
North East	84	16.5	73	67	67	17.5	63	18.5
North West	133	19.0	137	129	129	23.6	90	18.8
South West	318	19.6	296	276	276	25.7	166	20.2
West Midlands	63	13.6	63	63	63	17.1	38	11.1
Yorkshire and the Humber	319	18.9	318	321	321	20.8	161	19.7
England	**1,534**	**14.8**	**1,438**	**1,369**	**1,369**	**18.2**	**671**	**18.3**
Scotland	**743**	**24.8**	**469**	**436**	**436**	**25.6**	**360**	**23.5**
Wales	**190**	**20.0**	**178**	**192**	**192**	**24.4**	**85**	**20.6**

Chart 4: Wind regional load factors for FITs year 8 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.



Andrew Smith and William Spry
FIT Statistics
Tel: 0207 215 5475
E-mail: fitstatistics@beis.gov.uk