# Feed-in Tariff load factor analysis

## Introduction

This article updates the Feed-in Tariff (FIT) load factor analysis presented in the December 2018 edition of Energy Trends[1] with data for FIT year nine (financial year 2018/19). We also present regional analysis of solar PV for the eight years that data has been published (FIT years two to nine) and wind for years five to nine. 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 electricity 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 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 quarterly updates on deployment levels and 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 nine (data from year one is not available as the number of installations running for the full year was very small).

The FIT scheme closed to new entrants at the end of March 2019.

## 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 nine data; previously produced statistics have not been

[1] The article published in December 2018 can be found at the following link: www.gov.uk/government/publications/energy-trends-december-2018-special-feature-articles
[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

revised. Whilst all efforts have been made to quality assure the data in this publication, the results are based on a sample.

Table 1 shows how many installations were registered on the Central Feed-in Tariff Register at the start of FIT year nine and how many installations had meter readings in March 2018 and 2019. 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 829,370 schemes registered for FiTs as of 1st April 2018, 22 per cent were found to have meter readings in both March 2018 and March 2019. Extreme load factor values were further excluded (as in previous years' analysis), accounting for around 11,533 (5.9%) 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. Micro CHP 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 9**

| Technology | Commissioned by 1st April 2018 | Generation Data Reported* | Valid load factor | % remaining in analysis |
|---|---|---|---|---|
| Anaerobic digestion | 417 | 127 | 111 | 27% |
| Hydro | 1,153 | 231 | 204 | 18% |
| Micro CHP | 490 | 40 | 21 | 4% |
| Photovoltaic | 819,816 | 192,979 | 181,693 | 22% |
| Wind | 7,494 | 1,997 | 1,812 | 24% |
| **All Technologies** | **829,370** | **195,374** | **183,841** | **22%** |

* Meter reading in March 2018 and March 2019.

## 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 nine), highlighting the large range present for Hydro compared to other technologies, whilst solar installations have the smallest range of load factors.

**Table 2: FIT Year 9 (2018/2019) load factors by technology**

| Technology | Count | Mean | Weighted mean | Percentile | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 5th | 25th | 50th (median) | 75th | 95th |
| Anaerobic digestion | 111 | 80.2 | 75.9 | 35.5 | 71.6 | 87.2 | 95.3 | 98.5 |
| Hydro | 204 | 38.6 | 36.4 | 17.1 | 28.3 | 37.1 | 46.4 | 66.1 |
| Micro CHP | 21 | 14.8 | 17.5 | 6.0 | 8.9 | 10.0 | 15.5 | 24.1 |
| Photovoltaic | 181,693 | 10.4 | 10.5 | 7.5 | 9.4 | 10.5 | 11.4 | 12.6 |
| Wind | 1,812 | 21.5 | 26.0 | 7.7 | 14.2 | 20.4 | 27.4 | 39.7 |

The median load factor for Solar PV in 2018/19 was the highest since 2011/12 at 10.5%. This increase can be attributed to an increase in average daily sun hours from 4.1 hours to 4.9 hours[5]. Load factors were at a similar level to 2011/12 despite sun hours being up. However, there was a much smaller sample in 2011/12 so comparisons should be made with caution. It is also possible

[5] Energy Trends section 7: weather, table 7.3: www.gov.uk/government/statistics/energy-trends-section-7-weather. Note that data for 2018/19 is provisional and subject to revision.

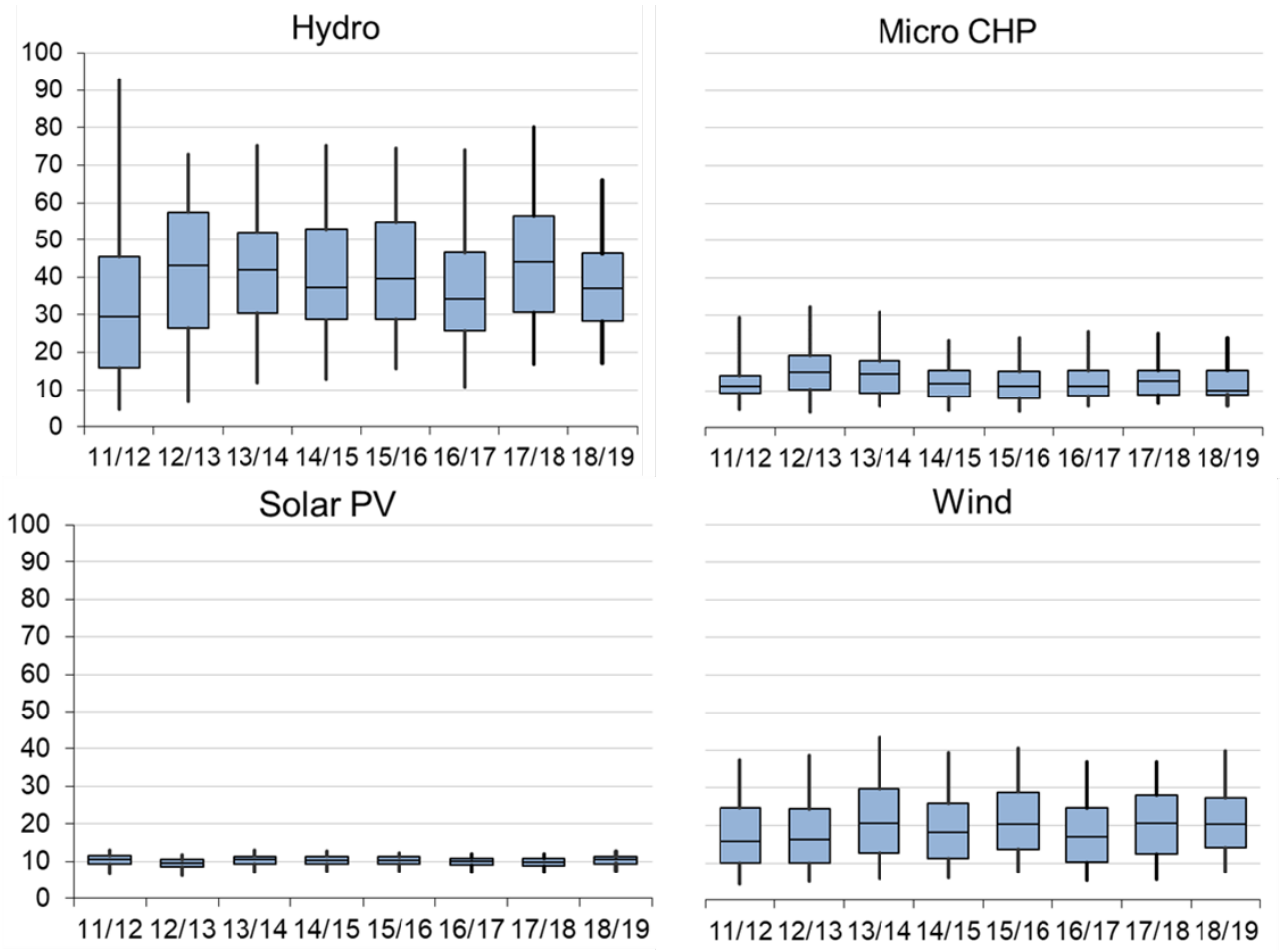
that the average age of solar panels was older in 2018/19 and there is some evidence that the efficiency of solar panels degrades over time.

**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 |
| 2018/19 | 10.5 | 4.9 |

**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 weaker than that observed between sun hours and solar load factors (see Table 4). For 2018/19 the median load factor decreased slightly to 20.4% compared to 20.5% in 2017/18. This decrease reflects the decrease in average wind speed (see Table 4). Load factors for wind vary much more than those for solar PV, Chart 1 (above) shows that there is a much wider spread between the lower and upper quartiles for wind but these ranges overlap from year to year. This may be because the wind farms that are on FITs are on average much smaller than major power producers and they may not be located in the optimum position for wind generation.

There is a relationship between wind speed and wind load factors. However, wind speeds are measured at ground level which may vary with the wind speed at the level of the wind turbine. The average wind speed quoted here is for the whole of the UK, however, wind speed varies by location.

**Table 4: Wind load factors and average wind speed**

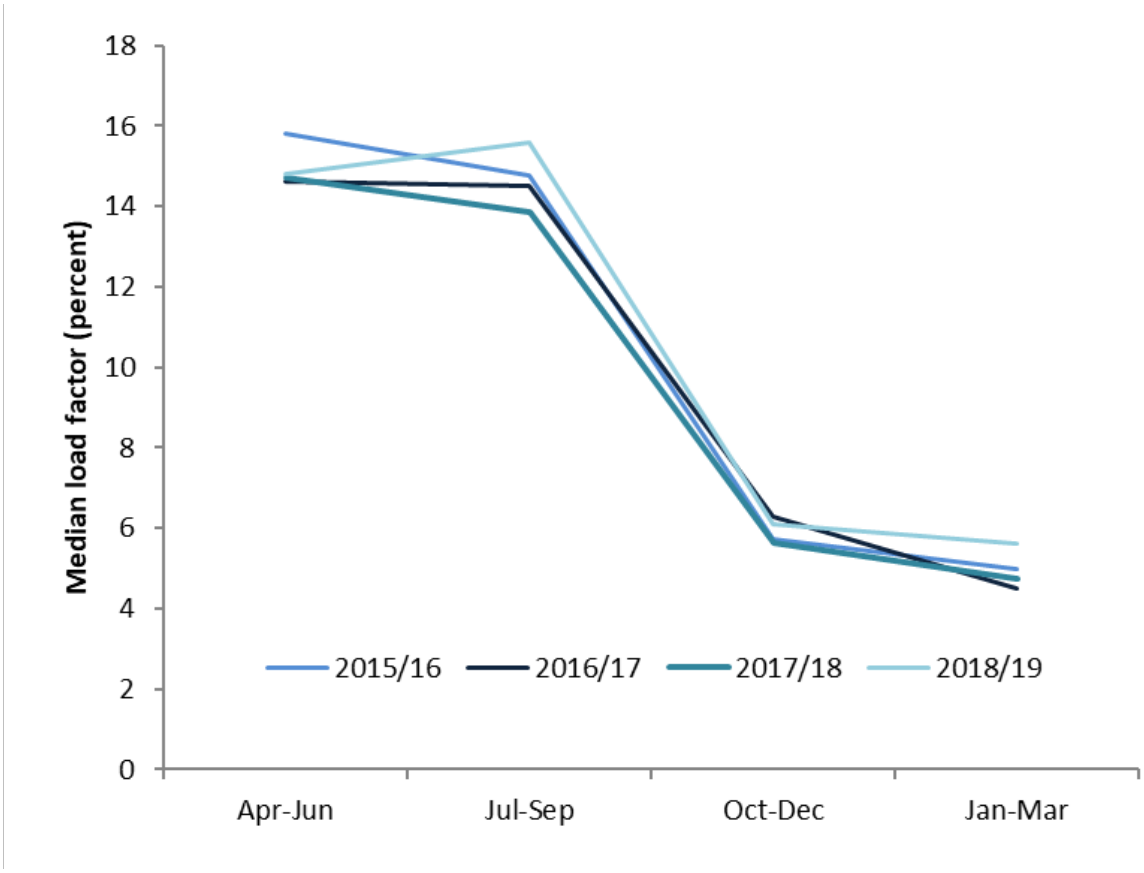
| Year | Median load factor | Average wind speed (knots) |
|---|---|---|
| 2011/12 | 15.9 | 9.2 |
| 2012/13 | 16.3 | 8.0 |
| 2013/14 | 20.5 | 9.3 |
| 2014/15 | 18.1 | 8.6 |
| 2015/16 | 20.3 | 9.2 |
| 2016/17 | 17.0 | 8.2 |
| 2017/18 | 20.5 | 8.8 |
| 2018/19 | 20.4 | 8.4 |

## 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 high annual load factors seen in FIT year nine (2018/19) for Solar PV are driven by high sun levels and load factors in all four quarters, most significantly 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 2018/19 are provisional and subject to revision.

**Chart 2: Quarterly Solar PV load factors by FIT year**




## Regional Solar PV load factors

Solar PV Factors for each region have been published for FIT years two to eight and are updated with data from year nine in Table 5. Chart 3 highlights that the lowest load factors are seen in Scotland, while the highest are seen in the South East. For year nine (2018/19), in each region, the load factors are higher than in the preceding two years, reflecting the increase in average daily sun hours. Furthermore, the load factors are the highest since records began in FIT year two for Scotland and six of the nine English regions. 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 2-9**

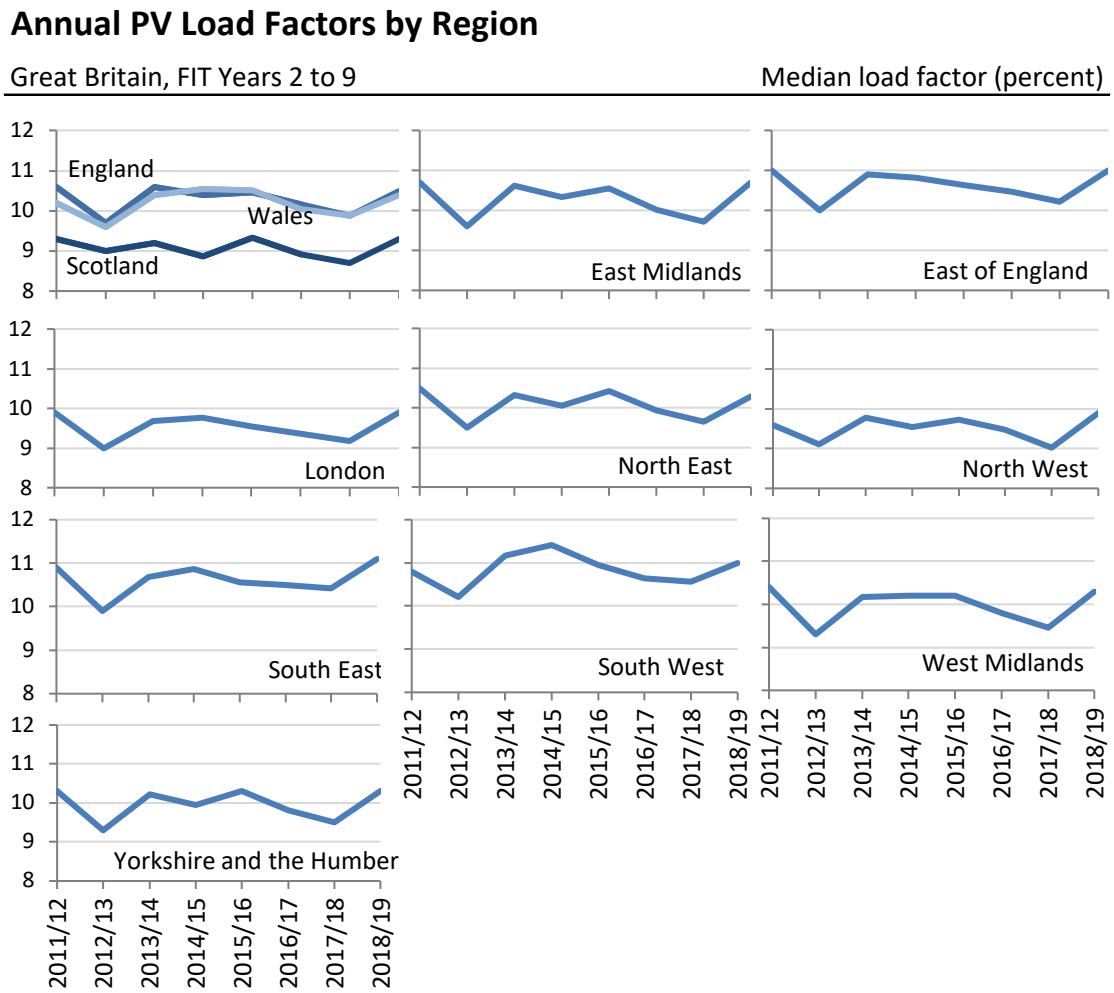


**Table 5: Regional Solar PV load factors for FITs years 4-9**

| Region | 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) | | FIT Year 9 (2018/19) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Count | Median | Count | Median | Count | Median | Count | Median | Count | Median | Count | Median |
| North East | 5,805 | 10.3 | 8,023 | 10.1 | 6,444 | 10.4 | 5,595 | 9.9 | 9,625 | 9.7 | 8,086 | 10.3 |
| North West | 13,024 | 9.8 | 17,360 | 9.5 | 13,689 | 9.7 | 11,546 | 9.5 | 19,736 | 9 | 21,398 | 9.9 |
| Yorkshire and the Humber | 11,299 | 10.2 | 18,507 | 9.9 | 15,058 | 10.3 | 12,826 | 9.8 | 19,339 | 9.5 | 15,866 | 10.3 |
| East Midlands | 12,936 | 10.6 | 18,735 | 10.3 | 13,489 | 10.5 | 11,548 | 10 | 19,023 | 9.7 | 16,041 | 10.7 |
| West Midlands | 11,118 | 10.2 | 15,312 | 10.2 | 12,013 | 10.2 | 10,219 | 9.8 | 13,946 | 9.5 | 11,843 | 10.3 |
| East of England | 16,306 | 10.9 | 21,247 | 10.8 | 16,917 | 10.6 | 14,308 | 10.5 | 22,240 | 10.2 | 26,783 | 11 |
| London | 4,117 | 9.7 | 4,996 | 9.8 | 3,813 | 9.6 | 3,240 | 9.4 | 4,852 | 9.2 | 4,027 | 9.9 |
| South East | 23,235 | 10.7 | 25,994 | 10.9 | 18,955 | 10.6 | 15,632 | 10.5 | 24,933 | 10.4 | 21,379 | 11.1 |
| South West | 31,965 | 11.2 | 36,938 | 11.4 | 29,331 | 11 | 25,715 | 10.6 | 36,357 | 10.6 | 32,044 | 11 |
| **England** | **129,805** | **10.6** | **167,112** | **10.4** | **129,709** | **10.5** | **110,629** | **10.2** | **170,137** | **9.9** | **157,467** | **10.5** |
| **Scotland** | **11,531** | **9.2** | **11,363** | **8.9** | **6,802** | **9.3** | **5,731** | **8.9** | **11,036** | **8.7** | **11,681** | **9.5** |
| **Wales** | **13,643** | **10.4** | **15,100** | **10.5** | **11,614** | **10.5** | **9,946** | **10.0** | **14,598** | **9.9** | **12,545** | **10.4** |

## Regional Wind load factors

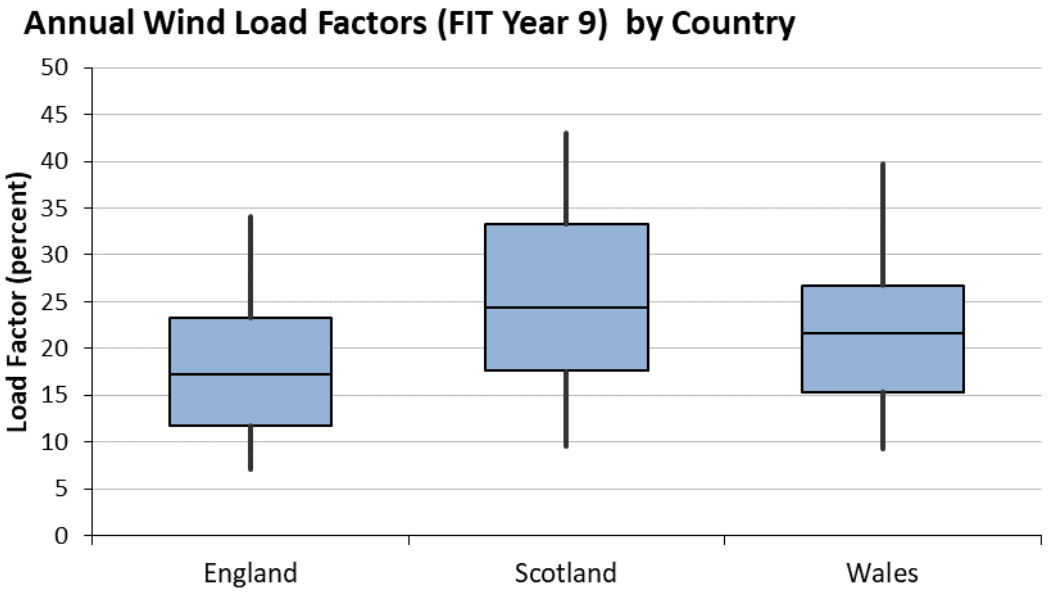
Regional load factors for Wind schemes for FIT years six to nine have also been produced; these are presented in Table 6. Data from London and the South East have been aggregated as there was a low number of installations within these regions with a valid load factor. Chart 4 summarises this data for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

### Table 6: Regional Wind load factors for FITs years 6 to 9

| Region | FIT Year 6 (2015/16) | | FIT Year 7 (2016/17) | | FIT Year 8 (2017/18) | | FIT Year 9 (2018/19) | |
|---|---|---|---|---|---|---|---|---|
| | Count | Median | Count | Median | Count | Median | Count | Median |
| North East | 73 | 17.5 | 67 | 14.2 | 63 | 18.5 | 60 | 17.8 |
| North West | 137 | 23.6 | 129 | 18.9 | 90 | 18.8 | 133 | 20.6 |
| Yorkshire and the Humber | 318 | 20.8 | 321 | 17 | 161 | 19.7 | 313 | 17.9 |
| East Midlands | 123 | 17.5 | 134 | 13.6 | 60 | 18.9 | 132 | 17 |
| West Midlands | 63 | 17.1 | 63 | 13.6 | 38 | 11.1 | 56 | 12.2 |
| East of England | 405 | 13 | 361 | 8.6 | 74 | 16 | 73 | 17.8 |
| London and South East | 23 | 12.1 | 18 | 10.2 | 16 | 8 | 9 | 14 |
| South West | 296 | 25.7 | 276 | 20.6 | 166 | 20.2 | 284 | 20.2 |
| **England** | **1,438** | **18.2** | **1,369** | **14.6** | **668** | **18.3** | **1,060** | **17.2** |
| **Scotland** | **469** | **25.6** | **436** | **24.0** | **360** | **23.5** | **546** | **24.4** |
| **Wales** | **178** | **24.4** | **192** | **20.4** | **85** | **20.6** | **206** | **21.6** |

### Chart 4: Wind regional load factors for FITs year 9 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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