Feed-in Tariff load factor analysis 2022/23

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Key headlines

Median load factors for solar photovoltaic (PV) increased slightly to 10.5 per cent in 2022/23, while hydro remained steady at 34.8 per cent. Weather conditions were the main driver, with this financial year being marginally sunnier and wetter.

The median load factor for wind was 16.8 per cent in 2022/23, a 0.9 percentage points fall with respect to 2021/22 despite a small rise in average wind speed. However, the higher wind speeds are reflected by a higher weighted mean.

Quarterly figures for wind and hydro have been added for the first time. The load factors follow a seasonal pattern due to weather conditions, with high load factors for hydro and wind being associated with wetter, windier autumn and winter months, and solar PV load factors being higher in spring and summer months.

South West and East of England had the highest median load factor for solar PV, while **Scotland had the highest wind load factor** this year. Wind load factors exhibit greater regional variability than solar's.

This article analyses load factors of small-scale renewable electricity generation installations accredited under the Feed-in Tariff (FiT) scheme[1]. For each financial year since 2011/12 (the second year of the FiT scheme), we provide an update on national load factors for all technologies, as well as regional load factors for solar PV and Wind installations, and quarterly national load factors for solar PV, Wind and Hydro schemes. Detailed tables are available as an Excel workbook, at this link (opens in a new window).

Background

Load factors are a measure of the efficiency of electricity generation. A load factor is the amount of electricity generated by a system over a certain period expressed as a proportion of its maximum possible output.

The Feed-in Tariff scheme was launched in April 2010[2]. It is managed by Ofgem. It is a financial support scheme for eligible low-carbon electricity technologies, aimed at small-scale installations. The following technologies are supported:

- Solar photovoltaic (up to 5 MW capacity)
- Anaerobic digestion (up to 5 MW capacity)
- Hydro (up to 5 MW capacity)
- Wind (up to 5 MW capacity)
- Micro Combined Heat & Power (Micro CHP, up to 2 kW capacity)

Some generators receive financial support for generating electricity and some for exporting electricity, depending on the tariff which they are on. 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. The FIT scheme closed to new entrants at the end of March 2019, though a grace period was allowed to a small number of installations for a short period after. Accredited generators continue to receive support for 20 years from the date they were commissioned (10 years for micro-CHP, 25 years for solar PV commissioned prior to August 2012).

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[1] The article published in December 2022 can be found at the following link (opens in a new window)
[2] More details here: www.ofgem.gov.uk/environmental-and-social-schemes/feed-tariffs-fit

Data cleansing

Table 1 shows how many installations were registered on the Central Feed-in Tariff Register at the start of FIT Year 13 and how many installations had valid meter readings; to be included in the analysis, each installation was required to have meter reading taken sufficiently close to April 1st, 2022, and a corresponding reading approximately one year later.

Of the 869,971 schemes registered for FiTs at the start of the financial year[3], 22 per cent were found to have sufficient meter readings for the annual analysis. Extreme load factor values were then excluded (as in previous years' analysis), accounting for around 4,000 (0.5 per cent) of installations. The column 'Valid load factor' in Table 1 indicates how many installations were included in the final annual analysis for each technology. Micro CHP statistics will no longer be included in this release, since the sample size approached zero within the past two years, likely a reflection of the end of FiT support for most schemes in this technology (see Introduction).

The headline coverage is always lower in the most recent survey wave, due to the absence of a final meter reading for many installations. In last year's publication we introduced a new method whereby closing readings for the previous year's analysis are added to the data set which increases the sample size for that year, making the results more robust. See the methodology annex in the December 2022 edition of this article[1] (link in note 1). Therefore we have revised the results for 2021/22 by supplementing the data with this year's data. This has added nearly 50,000 more installations with valid readings to the analysis.

Table 1: Installations included in analysis by technology – FIT Year 12

Technology	Commissioned by 31st March 2021	Generation Data Reported*	Valid load factor	% remaining in analysis
Anaerobic digestion	427	202	167	39%
Hydro	1,206	350	293	24%
Micro CHP	525	14	2	0%
Photovoltaic	860,252	189,774	186,068	22%
Wind	7,561	2,489	2,213	29%
All Technologies	**869,971**	**192,829**	**188,743**	**22%**

For this year's edition, we have revised the whole dataset back to FiT year 2 (2011/12) to ensure all figures are consistent with the current, more robust, methodology. This means that the sample size has increased for 2021/22 and for each year from 2011/12 to 2016/17. The data tables now also include full quarterly time series for wind and hydro load factors. Quarterly figures were only published for solar PV in previous editions of this report.

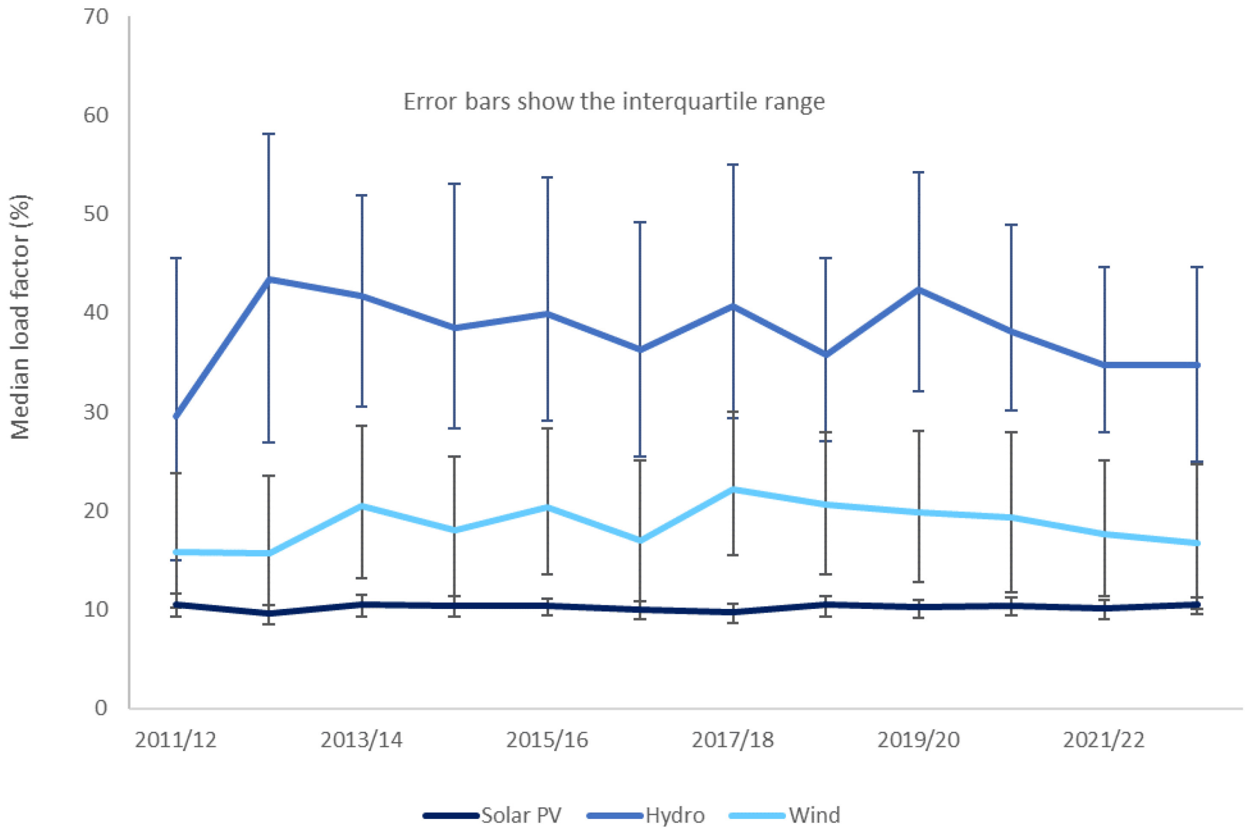
[3] Subject to further revision.

Results

Chart 1 below shows the annual load factors for the leading technologies (hydro, wind, and solar PV) over the FiT years. We present load factors on a line plot for each technology and year, displaying their median value and the interquartile ranges as a measure of dispersion around it.

The plot highlights the differences between the technologies: although primary renewables are all dependent on weather conditions, the distribution of load factors around their median repeats across the years and has a different spread for each technology. While load factors for solar PV are more concentrated, hydro and wind load factors exhibit a wider spread and a wider range of values can be observed. Changing sample sizes may also influence the distribution year on year; solar PV has the largest sample size each year.

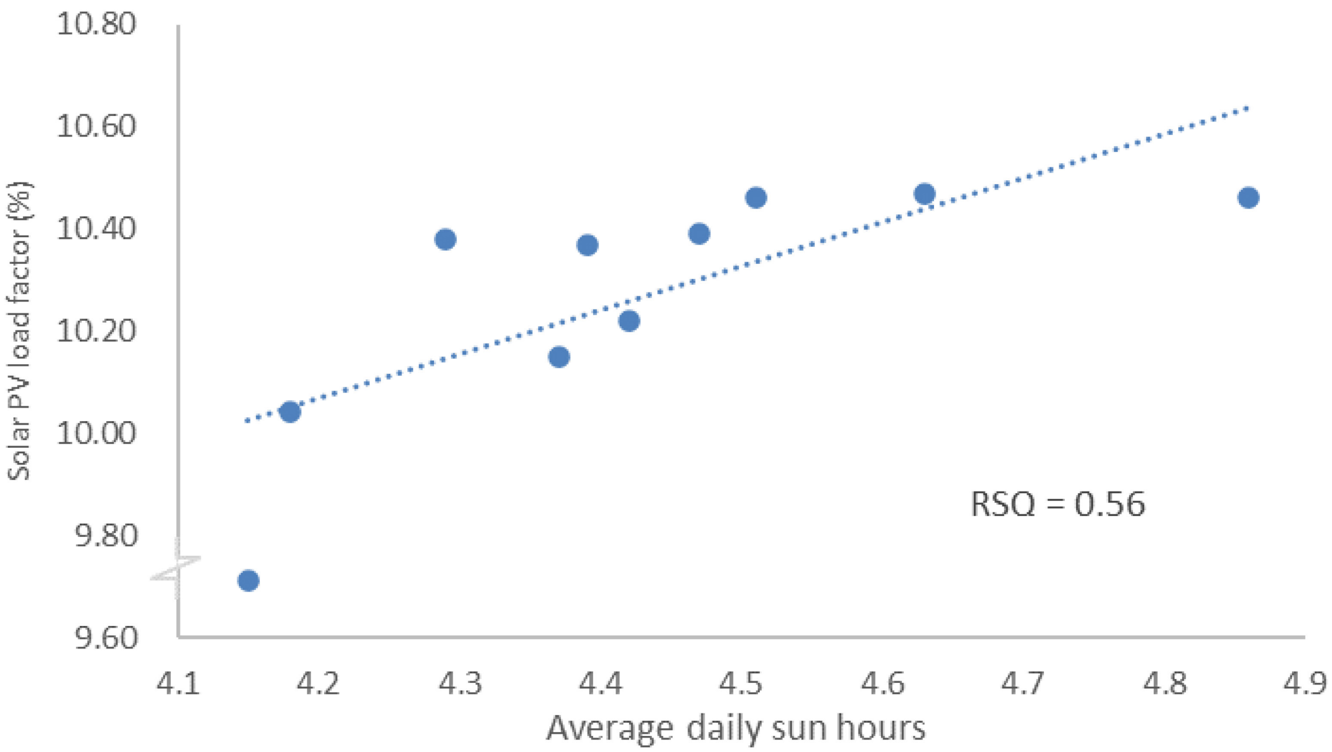
Chart 1: Hydro, Wind and Solar PV load factors, 2011/12-2022/23



The median load factor for solar PV in 2022/23 was 10.5 per cent, 0.3 percentage points higher than in 2021/22; this can be explained by the higher average sunlight hours reported for this period which were up by around 6 per cent on the year before. The weighted mean is systematically lower than the median, but the difference is small in relative terms; this suggests that the efficiency of solar PV installations is less dependent on their size than other technologies, although small scale installations (less than 50 kW) account for around two thirds of accredited capacity and may skew mean load factors towards the lower end.

The load factors for solar PV show a close relationship with average sunlight hours, with patterns repeating in the two series (see Chart 2 below). The clustered appearance of the boxplot indicates that Solar PV is not extremely sensitive to small changes in sunlight conditions, a feature also evident in the quarterly analysis.

Chart 2: Solar PV load factors and average sun hours, 2013/14-2022/23



In 2022/23, the median load factor for Wind was 16.8 per cent, decreasing by 0.9 percentage points since 2021/22. This is the lowest value reported since 2012/13, despite average wind speed increasing compared to last year. As in previous years, the weighted mean of the load factor for wind is notably higher than the median and tends to reflect trends in wind speed more accurately. The difference between the median and weighted mean generally reflects that larger wind farms are more efficient, and therefore skew the mean load factor towards higher values.

There is a relationship between annual wind speed and wind load factors, but it is weaker than the relationship between solar PV and sun hours. Load factors for wind vary more than those for solar PV throughout the year, with percentiles spreading further away from the median. It is also worth noting that in addition to being strongly seasonal, wind speeds can vary considerably by location and by height above the ground, making an accurate nationwide analysis more difficult to achieve.

The median load factor for hydro in 2022/23 was 34.8 per cent, a modest increase from 34.7 per cent the previous year and in line with an increase in average rainfall. Load factors for hydro tend to vary a lot within the sample, although the median value has remained stable over the years, broadly following average rainfall figures. With 2022/23 being a relatively dry year (rainfall was slightly below average), the current load factor appears particularly low when compared to wetter years, such as the 42.4 per cent measured in 2019/20.

Load factors for anaerobic digestion are highly variable due to a relatively small sample, however **the median load factor stands at 84.2 per cent in 2022/23**, which is consistent with the values observed in the past decade.

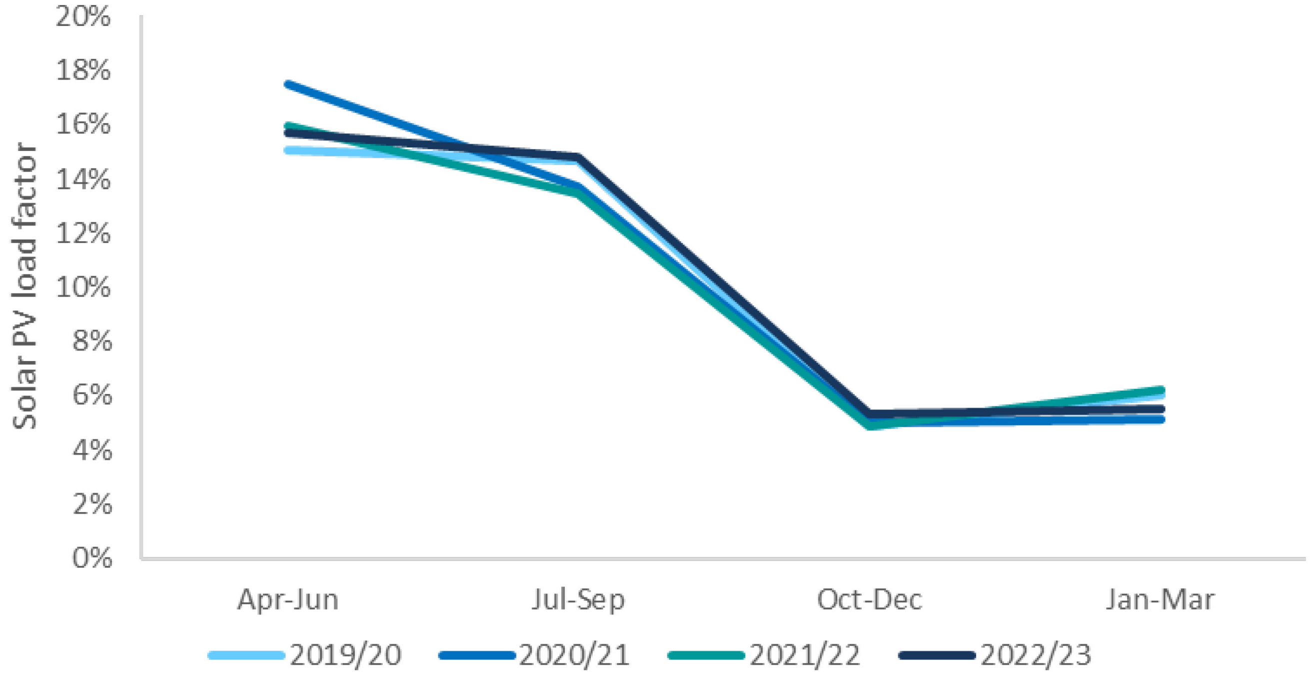
Quarterly load factors for primary renewables.

Primary renewables (hydro, solar PV, and wind) convert energy from natural elements and, as such, depend on their availability throughout the seasons. Therefore, their quarterly load factors have strong seasonal patterns.

Chart 3 below presents quarterly load factors for Solar PV within the last four years, plotted on the same axis. As expected, there is an association between sunnier seasons and higher load factors, with a nearly binary pattern between spring-summer and autumn-winter. Solar PV generation is boosted when the sun shines for longer, while it tends to wither in dimmer months.

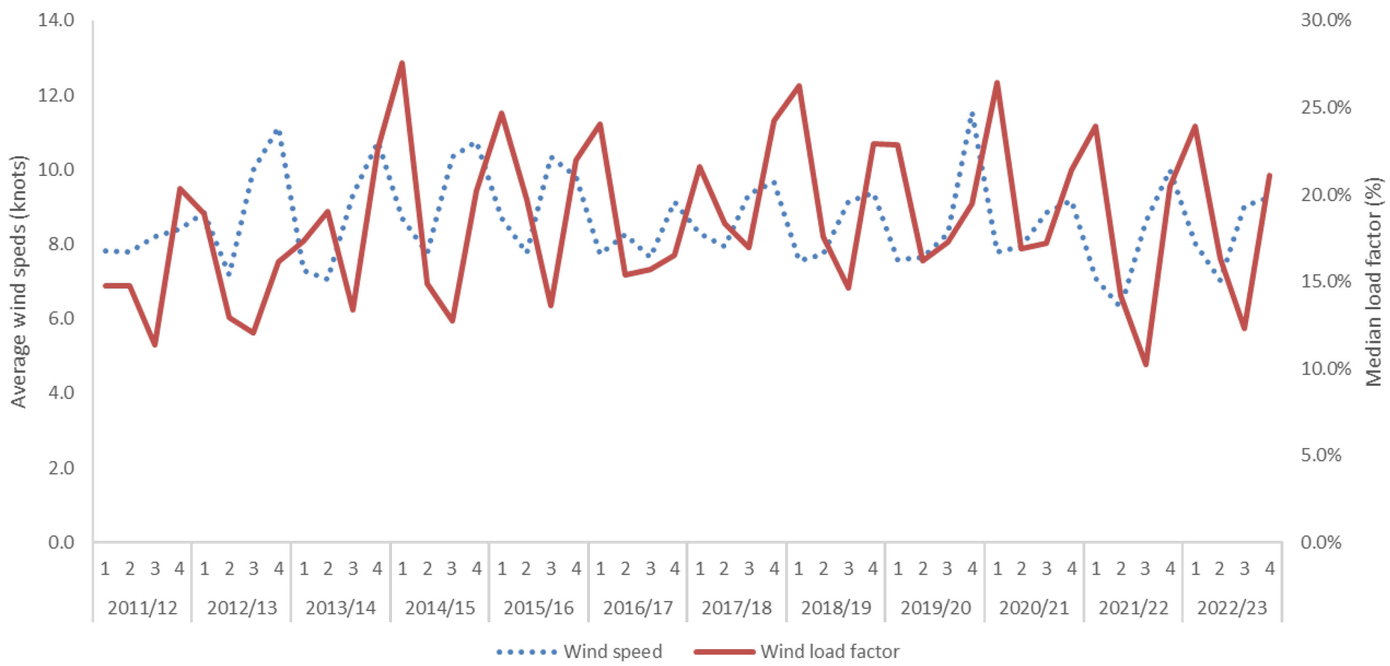
In 2022/23, the spring quarter (April-June) had the highest load factor of the year (15.7 per cent), which has often been the case over the previous ten years. The sun's irradiance is at its highest in June. The lowest load factor of 5.3 per cent was observed between October and December; this is nearly half a percentage point above the same period last year, following a slightly sunnier quarter this year.

Chart 3: Quarterly Solar PV load factors by FIT year



Wind load factors also follow a regular quarterly pattern. Chart 4 displays a line plot of wind load factors across the quarters since 2011 against average wind speed. Except for some discrepancies in the early years, load factors have mirrored wind speed quite closely, reaching their maximum during the winter months in most years.

Chart 4: Average wind load factors and wind speeds by quarter



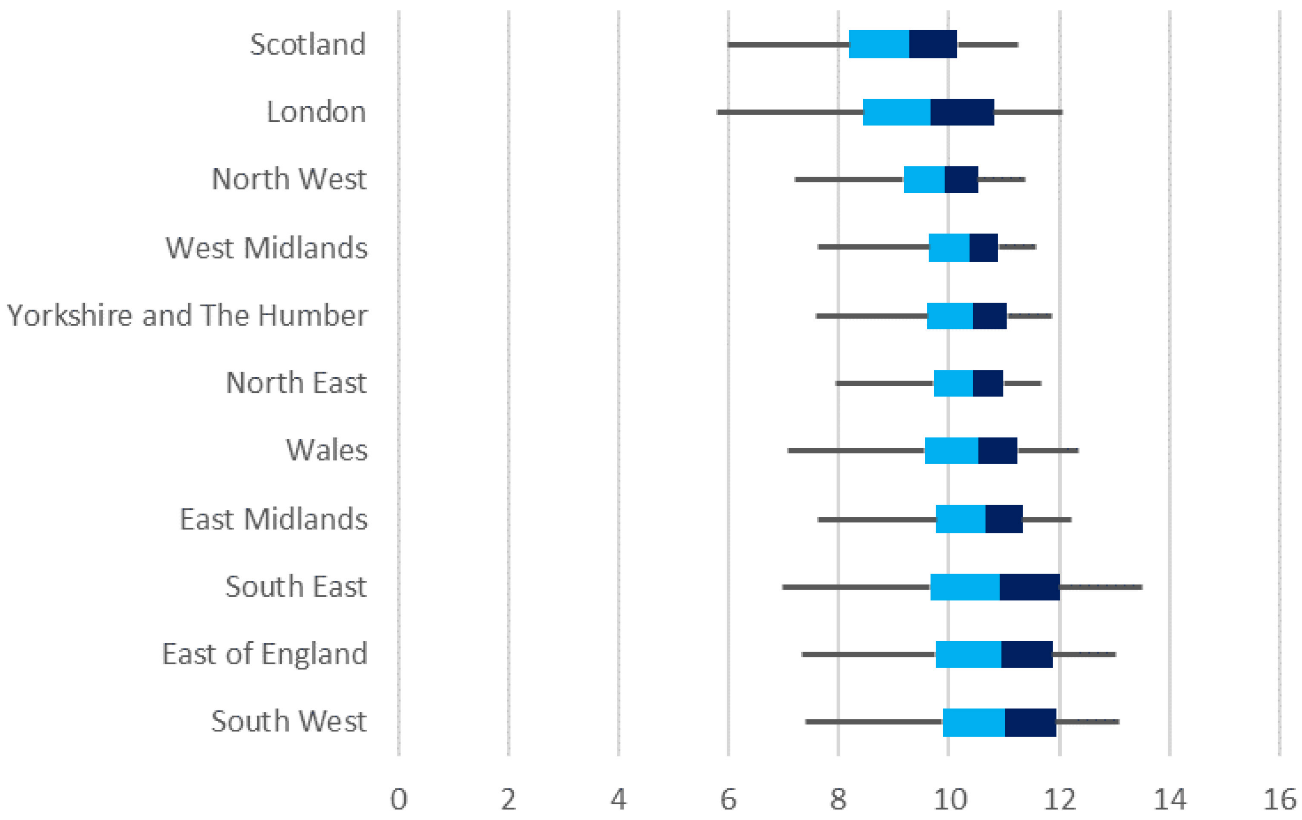
For hydro, wetter seasons are associated with higher load factors, though the relationship with rainfall is less precise than it is observed for wind and solar PV.

Regional Solar PV load factors

Chart 5 below displays the solar PV load factor for Scotland, Wales, and each region of England in Year 13. The median load factor varies across regions, but the load factors' distributions are similar from region to region.

In 2022/23, South West and East of England had the highest load factor at 11.0 per cent. Scotland had the lowest median load factor in 2022/23, with London and North West being the only other regions with a load factor below 10 per cent. London typically has one of the lowest regional load factors; this may be due to pollution, particles settling on the panels, or because panels are shaded by tall buildings nearby. When compared to 2021/22, median load factors increased in all regions except for modest decreases in North East and Scotland (0.2 and 0.1 percentage points respectively). London and East of England saw the largest increase in absolute terms (0.6 percentage points), likely a result of unusually low figures for last year.

Chart 5: Solar PV regional load factor for FiT Year 13 (2022/23).



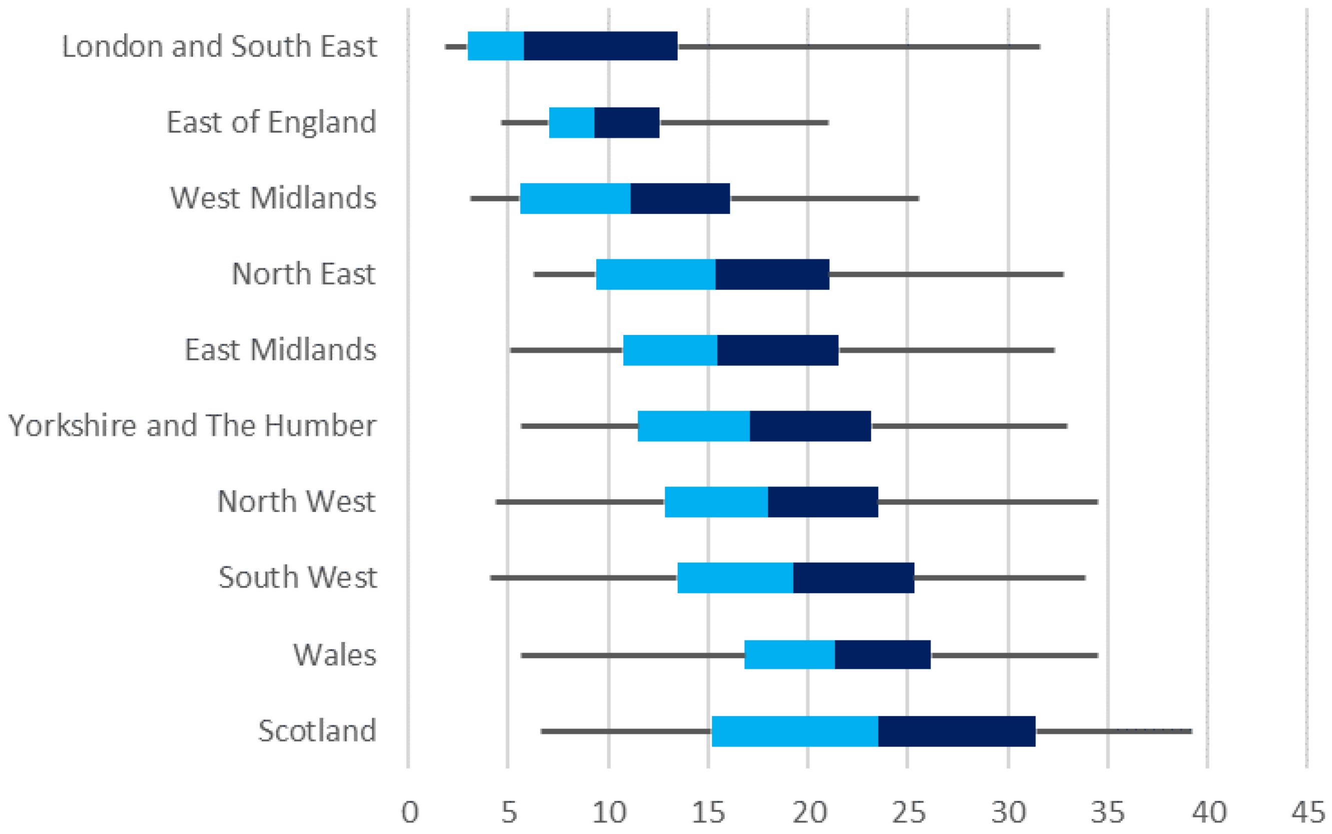
Regional Wind load factors

Chart 6 shows wind load factors in a box-and-whiskers plot for each region. Data from London and the South East are aggregated due to low number of installations with a valid load factor within these regions.

In the latest year, **Scotland had the highest Wind median load factor at 23.6 per cent**, followed by Wales and South West. When compared to last year, load factors have generally gone down in England, with the exception of North West and Yorkshire, but went up in Scotland and Wales (0.4 and 2.1 percentage points respectively).

Unlike solar PV, load factors for wind appear to follow different distributions across different regions, although the overall spreads are comparable. West-facing coastal regions tend to report higher load factors more frequently than inner and east-facing regions. This is likely due to prevailing winds coming from the South West. Moreover, apart from London and South East, regions with a lower median load factor are less likely to report extreme load factors. This suggests that wind load factors have a stronger geographic dependence than solar PV load factors.

Chart 6: Wind regional load factors for FITs year 13 (2022/23)



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