

## Renewable energy in 2017

### Introduction

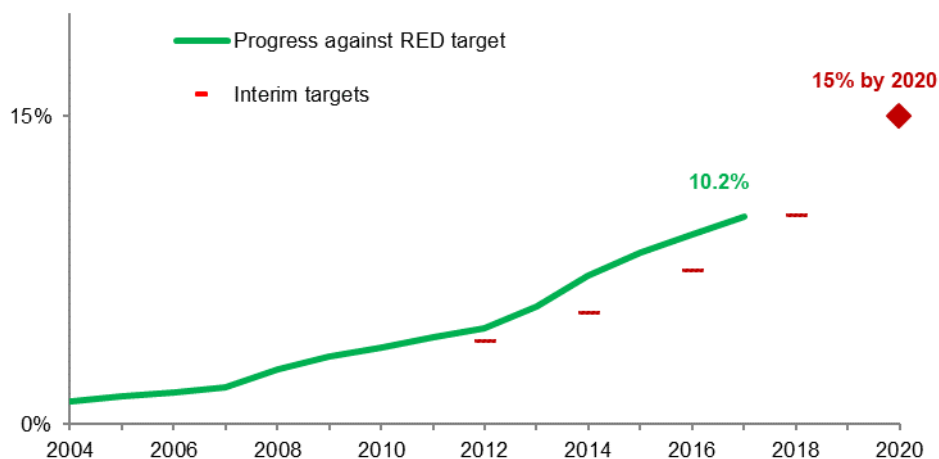
This article includes a first estimate of the UK's progress against the Renewable Energy Directive (RED) for 2017. It incorporates an update of the proportion of renewable electricity generation for 2017 previously published in the March 2018 issue of Energy Trends, and a first estimate of renewable heat generation. The first three sections describe trends in actual generation for electricity, heat, and renewable transport fuels in 2017. The subsequent sections relate to the methodology used to calculate progress against the Directive and UK progress for 2017. It also includes a brief comparison of member states' progress for 2016, the latest year for which data have been published by Eurostat.

### Key messages

*Progress against the Renewable Energy Directive (2009);*

- In 2017, renewable energy provisionally accounted for 10.2 per cent of final energy consumption, as measured using the 2009 Renewable Energy Directive (RED) methodology, an increase of 0.9 percentage points on 2016.
- The UK's third interim target is 7.5 per cent averaged over 2015 and 2016 and progress is now 8.8 per cent compared to 8.5 per cent as previously published in the June 2017 edition of Energy Trends. Chart 1 shows current progress and all targets;

**Chart 1: Progress against Renewable Energy Directive and UK targets**



- Renewable electricity accounted for 27.9 per cent of total generation (as measured using the RED methodology), an increase of 3.5 percentage points compared to 2016.
- Renewable heat accounted for 7.7 per cent of total heat consumption, an increase of 0.5 percentage points on 2016.
- Renewable energy for transport accounted for 4.6 per cent of total transport energy, 0.2 percentage points lower than in 2016.

*Trends in Generation;*

- Total renewable energy increased by 1,824 ktoe (9.9 per cent), from 18,392 in 2016 to 20,216 ktoe in 2017.
- Renewable electricity generation increased by 16.2 TWh (19 per cent) to 99.3 TWh in 2017.

- Electricity generation from wind (onshore and offshore) increased by 12.7 TWh (34 per cent) to 50.0 TWh, a record.
- Solar photovoltaic generation increased by 1.1 TWh (11 per cent) to 11.5 TWh in 2017.
- Generation from waste (biodegradable) increased by 0.6 TWh (24 per cent) to 3.4 TWh.

### Renewable electricity generation

In 2017, renewable electricity generation represented 69 per cent of total renewable energy (on fuel input basis; see table 1 associated with this article). **Total renewable generation** increased by 16.2 TWh (19 per cent) to 99.3 TWh in 2017. **Total wind generation** showed the largest increase in generation (in both absolute and percentage terms) by 12.7 TWh (34 per cent) to 50.0 TWh, the result of increased capacity and high wind speeds. Onshore wind showed a larger increase (8.2 TWh, 39 per cent) compared to offshore (4.5 TWh, 27 per cent), due to higher new capacity for onshore which went from 10.9 GW in 2016 to 12.8 GW in 2017. **Generation from hydro** increased by 0.5 TWh to 5.9 TWh; a small decrease in rainfall (in the main catchment areas) was offset by an increase in capacity for small scale generators which increased by 10 per cent to 0.4 GW. **Solar photovoltaic** generation increased by 11 per cent to 11.5 TWh with a corresponding increase in capacity by 7.3 per cent to 12.8 GW. **Onshore wave and tidal** showed the largest increase in percentage terms though from a small baseline. This is due to new capacity from four new test rigs installed during the year increasing capacity from 13.5 MW in 2016 to 18.4 MW in 2017.

In 2014, onshore wind was the leading technology in terms of capacity, however this switched to solar photovoltaic following large capacity increases in 2015 and 2016. This has now reverted to onshore wind in 2017 due to the large increase in onshore capacity, representing a 31.7 per cent share compared to 31.5 per cent for solar photovoltaic.

There were some small decreases in generation from co-firing and animal biomass though landfill gas generation fell by 0.4 TWh, or 8.9 per cent to 4.3 TWh, the result of falling gas abstraction efficiencies.

Table 1 shows electricity generation over the last three years by technology;

Table 1

Generation (TWh)	2015	2016	Percentage	
			2017	share in 2017
Onshore Wind	22.9	20.9	29.1	29.3%
Offshore Wind	17.4	16.4	20.9	21.1%
Shoreline wave/Tidal	0.0	0.0	0.0	0.0%
Solar photovoltaics	7.5	10.4	11.5	11.6%
Hydro Small scale	1.0	1.0	1.3	1.3%
Hydro Large scale	5.3	4.4	4.6	4.6%
Landfill gas	4.9	4.7	4.3	4.3%
Sewage sludge digestion	0.9	1.0	1.0	1.0%
Municipal solid waste combustion	2.6	2.7	3.4	3.4%
Co-firing with fossil fuels	0.2	0.1	0.1	0.1%
Animal Biomass	0.6	0.7	0.6	0.7%
Anaerobic Digestion	1.5	2.1	2.5	2.5%
Plant Biomass	18.6	18.8	20.1	20.2%
<b>Total generation</b>	<b>83.4</b>	<b>83.1</b>	<b>99.3</b>	<b>100.0%</b>

**Onshore wind continued to be the leading individual technology for the generation of electricity from renewable sources during 2017**, and its share further increased in 2017 due to capacity increases and wind speeds; in 2016, its share was 25 per cent and in 2017, 29 per cent.

### Heat production

Renewable heat generation accounted for 26 per cent of total renewable sources in 2017 (see the excel table published alongside this article), down from 27 per cent in 2016. The four categories of renewable heat production in the United Kingdom are the direct combustion of various forms of

bioenergy, heat pumps, active solar heating, and geothermal. In 2017, 79 per cent of renewable heat was from direct combustion. This is less than the 94 per cent reported for 2016 in the June 2017 edition of Energy Trends due to the inclusion for the first time of reversible air to air heat pumps following a BEIS led study<sup>1</sup>, inflating non-combustion heat generation. Table 2 shows the source mix.

Table 2

Heat generation (ktoe)	2015	2016	Percentage	
			2017	share in 2017
Landfill gas	13.6	13.6	13.6	0.3%
Sewage sludge digestion	73.1	72.1	84.2	1.6%
Wood combustion - domestic	1,918.3	2,053.5	2,039.4	39.1%
Wood combustion - industrial	318.7	319.1	319.1	6.1%
Animal Biomass	30.7	23.0	23.0	0.4%
Anaerobic digestion	118.9	269.8	298.9	5.7%
Plant Biomass	837.7	1,102.2	1,252.9	24.0%
Biodegradable energy from waste	66.7	69.3	93.8	1.8%
Active solar heating	50.7	51.2	52.0	1.0%
Deep geothermal	0.8	0.8	0.8	0.0%
Heat Pumps	1,007.1	1,065.5	1,044.4	20.0%
<b>Total</b>	<b>4,436.3</b>	<b>5,040.1</b>	<b>5,222.1</b>	<b>100.0%</b>

Despite the increase in heat pump generation, domestic wood consumption retains the highest share of renewable heat at 39 per cent, down from 50 per cent as reported for 2016 in the June 2017 edition of Energy Trends. Plant biomass represented 24 per cent of renewable heat and industrial wood 6.1 per cent. Heat pumps (mainly in the domestic sector) contributed 20 per cent compared to 4.6 per cent as reported in this article in 2017.

### Liquid biofuels for transport

Liquid biofuels for transport comprised around 4.9 per cent of total renewable sources. Two road transport fuels, biodiesel and bioethanol, are sold blended with diesel and petrol.

In 2017, 697 million litres (573 ktoe) of biodiesel and 752 million litres (424 ktoe) of bioethanol were consumed in 2017; by volume, biodiesel consumption was 1.4 per cent lower than in 2016, whilst bioethanol consumption was 0.8 per cent lower. During 2017, biodiesel accounted for 2.3 per cent of diesel, and bioethanol 4.5 per cent of motor spirit; the combined contribution of biodiesel and bioethanol was 3.1 per cent by volume, the same as in 2016. The Renewable Energy Directive introduced various sustainability criteria for transport biofuels; certain biofuels derived from waste products (for example, waste cooking oil) have extra weighting when monitoring progress against the transport component, but not the overall target, of the Directive.

### Progress against the Renewable Energy Directive

Progress against the RED is measured using a defined methodology. The key adjustments made to actual generation are as follows;

#### *Electricity Generation;*

Generation uses a normalisation approach for wind and hydro generation to negate the effects of variable wind speeds and rainfall from one year to the next. Normalised wind generation is calculated using the average load factor for the most recent five years and applying to the average of the start and end of year capacity. For Hydro, the load factor is the average of the past 15 years, applied to capacity at the end of the current year.

#### *Heat Generation;*

Net calorific values are used in the heat energy calculation which differs to DUKES which uses Gross Calorific Values. Additionally, heat energy generated by heat pumps includes only those heat pumps meeting the minimum Seasonal Performance Factor (SPF) of 2.5.

<sup>1</sup> [www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-the-contribution-of-reversible-air-to-air-heat-pumps-towards-the-renewable-energy-directive](http://www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-the-contribution-of-reversible-air-to-air-heat-pumps-towards-the-renewable-energy-directive)

### Renewable Energy for Transport

Some liquid biofuels, mostly those derived from waste products, are awarded double credits under the Renewable Transport Fuel Obligation scheme<sup>2</sup>. This applies to the transport specific target of 10 per cent and not in the overall progress calculation.

### Overall calculation adjustment

Final total energy consumption (i.e. the denominator) includes a cap on air transport fuel (6.18 per cent).

Table 3 shows the increasing share of renewable energy from electricity, heat and transport;

**Table 3: Progress against the 2009 Renewable Energy Directive**

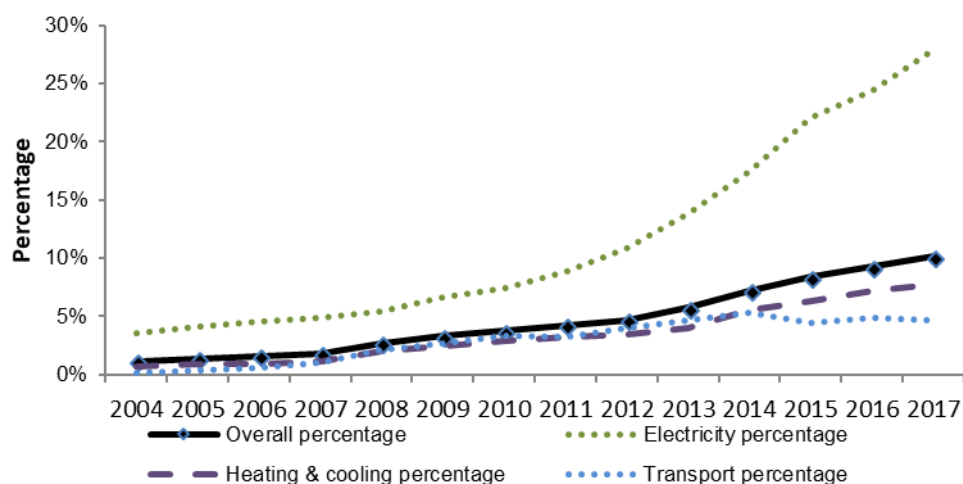
	2004	2010	2015	2016	2017
Percentage of electricity from renewable sources (normalised)	3.5%	7.4%	22.1%	24.4%	27.9%
Percentage of heating and cooling from renewable sources	0.7%	2.8%	6.3%	7.2%	7.7%
Percentage of transport energy from renewable sources	0.2%	3.3%	4.4%	4.8%	4.6%
Overall renewable consumption <sup>1,2</sup>	1.1%	3.8%	8.4%	9.2%	10.2%

<sup>1</sup> Measured as a percentage of capped gross final energy consumption using net calorific values

<sup>2</sup> Cannot be directly calculated from the three separate measures

The proportion of renewable electricity is, calculated on a RED basis, 27.9 per cent for 2017, 3.5 percentage points higher than in 2016 and 0.2 percentage points lower than the initial estimate published in the March 2018 edition of Energy Trends. Renewable heat also increased though to a lesser extent; from 7.2 per cent in 2016 to 7.7 per cent in 2017. The share of renewable energy in transport fell slightly, by 0.2 percentage point to 4.6 per cent.

### Chart 2: Progress against the Renewable Energy Directive



### Renewable electricity' share of generation (different measures)

In addition to the RED methodology for calculating renewable electricity's share of total generation, using normalisation; it is also calculated on an International Basis (actual generation as a percentage of total generation), and on a Renewables Obligation (RO) basis (generation supported by the Renewables Obligation as a percentage of electricity sales).

In 2017, the highest measure was on the International Basis at 29.3 per cent, reflecting the high wind speeds. The RED measure was lower, at 27.9 per cent due to the normalisation methodology averaging the weather effects over the preceding years. Table 4 shows a comparison of the three different measures:

<sup>2</sup> [www.gov.uk/guidance/renewable-transport-fuels-obligation](http://www.gov.uk/guidance/renewable-transport-fuels-obligation)

**Table 4**

	2004	2010	2015	2016	2017
International Basis <sup>1</sup>	3.6%	6.9%	24.6%	24.5%	29.3%
Renewable Obligation <sup>2</sup>	3.1%	7.2%	23.5%	22.8%	25.1%
2009 Renewable Energy Directive <sup>3</sup>	3.5%	7.4%	22.1%	24.4%	27.9%

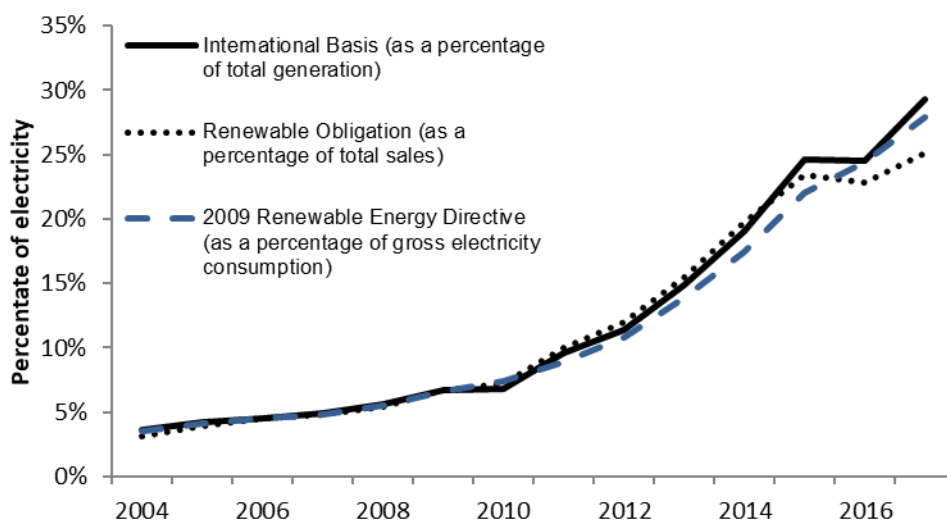
<sup>1</sup> All renewable electricity as a percentage of total UK electricity generation

<sup>2</sup> Measured as a percentage of UK electricity sales

<sup>3</sup> 2009 Renewable Energy Directive measured as a percentage of gross electricity consumption

Load factors in 2017 (see table ET 6.1) for wind and hydro generation were high compared to the previous year and to the long term mean due to high wind speeds (see tables ET 7.2 and ET 7.4 respectively for weather data). As weather effects are damped by the normalisation process, the proportion calculated on a RED basis will tend to diverge from the alternate measures; this is particularly pronounced between 2015 and 2017 due to fluctuating wind speeds during this period. Wind speeds were at record levels in 2015 but lower than the ten year mean for 2016, and reverting to the long term mean during 2017. Additionally, rainfall was particularly high during 2015. Chart 2 below shows this divergence;

**Chart 3: Growth in electricity generation from renewable sources since 2004**



### Member state comparison of progress against the Directive

As reported in the June 2017 edition of Energy Trends, the UK exceeded its third interim target; averaged over 2015 and 2016, at 8.8 per cent against its target of 7.5 per cent. The Fourth Progress Report was published in early 2018<sup>3</sup> and the fourth, including progress against the fourth interim target, is due to be published by Eurostat early in 2020.

Eurostat publishes data on how countries are progressing towards their RED (final and interim) targets. The latest comparative data relates to 2016<sup>4</sup> where progress was 17.0 per cent for all member states, a 0.3 percentage point increase on 2015, and requiring a 3.0 percentage increase to reach the 20 per cent target in 2020. Eurostat also publishes data for some non-member states including Iceland, Norway, Montenegro, The former Yugoslav Republic, Albania, and Serbia. In 2016, Iceland showed the highest proportion of renewables at 72.6 per cent, though of the member states, Sweden was the highest at 53.8 per cent. From 2015 to 2016, the UK increased its share by 0.8 percentage points, the fifth highest increase of member states; Denmark was the highest at 1.2 per centage points.

<sup>3</sup> <https://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports>

<sup>4</sup> <http://ec.europa.eu/eurostat/web/energy/data/shares>

In 2015, a third of the member states had exceeded their 2020 targets; Bulgaria, the Czech Republic, Denmark, Estonia, Croatia, Hungary, Italy, Lithuania, Romania, Finland and Sweden, though no additional member state met their target in 2016.

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