

Renewable electricity in Scotland, Wales, Northern Ireland and the regions of England in 2011

Background

This article updates that presented in the September 2011 edition of *Energy Trends* on the amount of electricity from renewable sources disaggregated below the national level. As before, it has been necessary to combine renewable sources into categories so that information about individual sites provided to AEA and the Department of Energy and Climate Change (DECC) in confidence is not disclosed.

As in previous years, a regional breakdown of non-FiTs micro-wind has not been included in the tables because, at present, they are estimated on a UK-wide basis that cannot readily be further sub-divided. Non-FiTs micro-wind in 2011 amounts to 20.4 MW of capacity and 24.7 GWh of generation (less than one third of one per cent of total wind capacity and generation). Otherwise, figures in tables 2 and 3 correspond to the totals shown in table 6.4 of the Digest of United Kingdom Energy Statistics 2012 (DUKES). Thus the data in this article cover all renewables, including renewables that are not eligible for the Renewables Obligation (RO) or Feed in Tariff (FIT), such as large-scale hydro commissioned before 1 April 2002. Offshore wind has been allocated to the region to which its output is connected¹.

What the figures show

Table 1 and chart 1 show that there were 2,288 non-PV sites in England generating electricity from renewable sources, with 1,494 non-PV sites in Scotland, 348 in Wales and 162 in Northern Ireland. In addition there were 174,988 PV sites reported for England with 15,438 for Wales and 12,808 for Scotland based on FITs data. PV uptake for Northern Ireland (204) was based on data from the Micro-generation Certification Scheme and the Renewables Obligation. No geographical information was available for a further 30,758 PV schemes.

In capacity terms, including PV, England for the first time had more (18 per cent) renewable electricity capacity than Scotland (table 2 and chart 3). This is because of England's considerable bioenergy resource (91 per cent of the UK's total bioenergy capacity), and results from the conversion of Tilbury B power station to dedicated biomass during 2011. Hydro accounted for 39 per cent of generation from renewables in Scotland (table 3 and chart 7). However, because bioenergy based capacity was used more intensively than hydro (which is subject to seasonal precipitation variation in the catchment areas) generation from renewable sources in England during 2011 was 27 per cent higher than generation in Scotland.

¹ With the exception of Robin Rigg which comes ashore at Seaton, Cumbria but whose generation is associated with Scotland

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Table 1: Number of sites generating electricity from renewable sources, 2011¹

	Hydro	Wind and wave ²	Landfill gas	Sewage gas	Other bioenergy ³	Total excluding PV	Solar PV	Total
England	175	1,425	378	162	148	2,288	174,988	177,276
East Midlands	21	144	43	15	15	238	18,870	19,108
East	5	247	70	14	18	354	23,383	23,737
North East	9	121	20	8	7	165	6,673	6,838
North West	31	175	63	25	22	316	16,614	16,930
London	-	18	1	4	6	29	5,628	5,657
South East	9	83	70	32	23	217	33,710	33,927
South West	74	269	39	19	14	415	36,844	37,259
West Midlands	10	78	30	21	23	162	14,128	14,290
Yorkshire and the Humber	16	290	42	24	20	392	19,138	19,530
Wales	91	209	23	15	10	348	15,438	15,786
Scotland	315	1,109	43	8	19	1,494	12,808	14,302
Northern Ireland	44	101	6	3	8	162	204	366
Other Sites							30,758	30,758
UK Total	625	2,844	450	188	185	4,292	234,196	238,488

Components may not add exactly to totals because of rounding.

For notes to Table 1 see below Table 3.

Table 2: Installed capacity of sites generating electricity from renewable sources, 2011¹

	Hydro	Wind and wave ²	Landfill gas	Sewage gas	Other bioenergy ⁴	Solar PV	MW Total
England	28.4	2,469.8	897.7	177.2	1,734.1	573.3	5,880.4
East Midlands	4.8	319.7	68.3	17.6	45.2	61.7	517.3
East	0.1	550.9	205.5	26.3	926.9	75.7	1,785.2
North East	7.1	156.5	42.3	15.6	71.1	20.2	312.7
North West	5.5	708.2	173.9	23.7	70.3	52.5	1,034.0
London	-	3.7	0.3	20.6	151.7	17.5	193.8
South East	0.1	467.6	168.6	27.4	255.6	105.9	1,025.2
South West	8.8	143.9	95.7	13.7	11.9	126.5	400.3
West Midlands	0.7	0.9	60.8	23.4	127.8	48.1	261.7
Yorkshire and the Humber	1.3	118.4	82.4	9.1	73.5	65.3	350.1
Wales	149.9	582.4	45.2	11.9	21.2	46.3	856.8
Scotland	1,489.2	3,016.0	113.1	8.2	142.3	41.2	4,810.1
Northern Ireland	8.2	402.8	10.7	0.2	4.9	0.7	427.6
Other Sites						314.3	314.3
Total	1,675.6	6,471.1	1,066.7	197.5	1,902.5	975.8	12,289.2
Micro wind turbines		20.4					20.4
UK Total	1,675.6	6,491.5	1,066.7	197.5	1,902.5	975.8	12,309.6
Co-firing ⁴					338.2		338.2

Table 3: Generation of electricity from renewable sources, 2011

	Hydro	Wind and wave ²	Landfill gas	Sewage gas	Other bioenergy ⁵	Solar PV	GWh Total
England	67.7	6,158.1	4,208.9	683.9	6,150.3	129.3	17,398.3
East Midlands	10.3	920.4	314.2	76.4	300.4	13.1	1,634.9
East	0.0	1,422.7	990.5	57.2	652.2	17.3	3,139.9
North East	22.7	323.1	181.4	61.1	335.5	3.4	927.3
North West	13.4	1,723.9	790.4	112.7	278.6	9.6	2,928.5
London	-	7.9	1.7	45.1	558.7	4.1	617.6
South East	0.1	1,270.2	836.6	114.8	781.6	25.3	3,028.7
South West	16.8	247.7	409.7	54.3	38.7	28.9	796.2
West Midlands	1.5	0.6	301.7	122.5	432.0	10.6	868.8
Yorkshire and the Humber	3.0	241.5	382.7	39.9	2,772.4	16.9	3,456.4
Wales	268.4	1,438.5	204.7	34.9	203.4	8.5	2,158.5
Scotland	5,331.8	6,984.3	506.5	35.3	862.6	7.6	13,728.1
Northern Ireland	18.5	892.6	59.1	0.8	22.4	0.4	993.8
Other Sites						106.1	106.1
Total	5,686.5	15,473.6	4,979.3	755.0	7,238.7	251.8	34,384.8
Micro wind turbines		24.7					24.7
UK Total	5,686.5	15,498.3	4,979.3	755.0	7,238.7	251.8	34,409.6

Components may not add exactly to totals because of rounding.

Notes to Tables 1 to 3

- Nil or less than half the final digit shown.

1 At the 31 December 2011.

2 Wind Offshore is allocated to regions/countries according to where the cabling comes ashore.

3 13 of these sites are sites that co-fire renewables with fossil fuels (see also note 4, below).

4 This is the proportion of non-fossil fuelled capacity used for co-firing of renewables based on the proportion of generation accounted for by the renewable source. This estimate has not been disaggregated into region values because to do so could disclose data that relate to individual companies.

5 Includes bioenergy sources co-fired with fossil fuels.

In England the number of sites (excluding PV) varies from 29 in London to 415 in the South West (table 1 and chart 2). The highest capacity in England (including PV) is in the East of England, followed by the North West and the South East (table 2 and chart 4). In the East of England, 52 per cent of this capacity is from other bioenergy (primarily one large bioenergy scheme) and 31 per cent from wind (mostly from three large offshore wind farms); in the North West, 68 per cent of capacity is from wind (more than half from two offshore wind farms). In the South East, 46 per cent of capacity is from wind and 25 percent from other bioenergy. The East of England has 19 per cent of the UK's landfill gas capacity, 13 per cent of the UK's sewage gas capacity and 12 per cent from other bioenergy. The North West (with 16 per cent of the UK's landfill gas capacity), and the South East (with 16 per cent of the UK's landfill gas capacity), are the other English regions with notably large shares. The East of England, North West and the South East regions together accounted for 53 per cent of UK generation from landfill gas.

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Chart 1: Number of sites by country¹

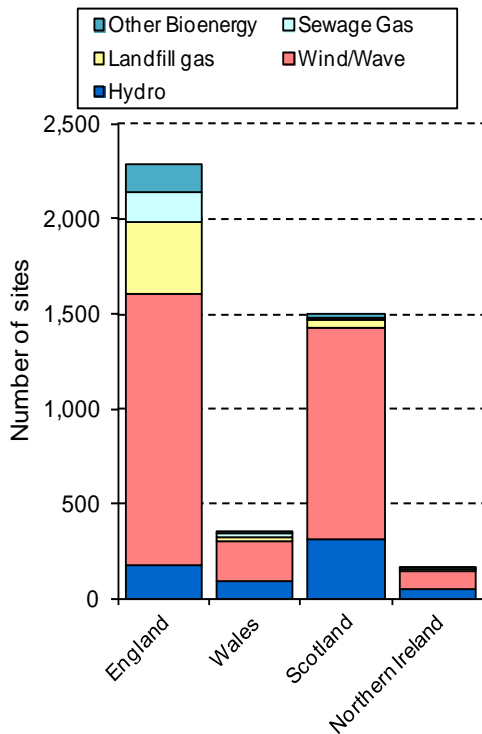
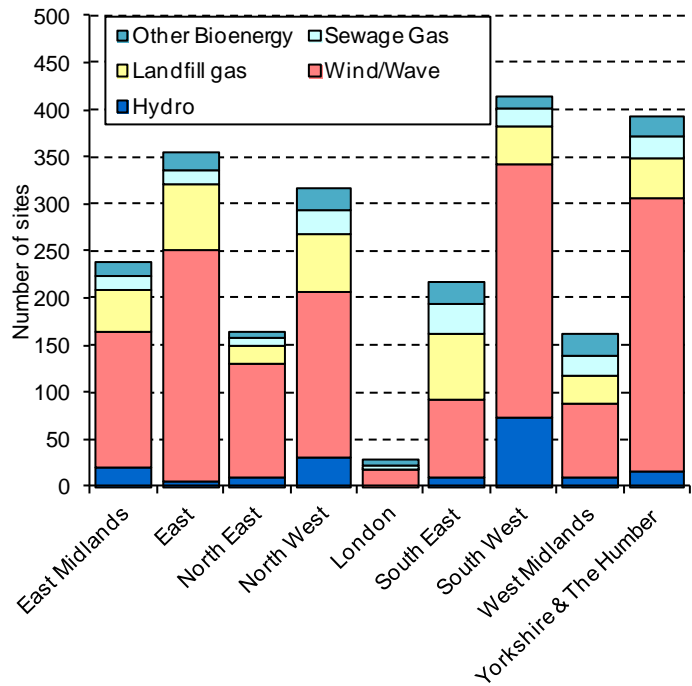


Chart 2: Number of sites by English region¹



¹ Excludes the large numbers of small Solar PV schemes as the inclusion of these would swamp all other technologies and misrepresent its overall contribution to UK renewables

In 2011, Scotland had 46 per cent of the UK’s wind capacity and produced 45 per cent of the output (tables 2 and 3; charts 5 and 9). The North West has the next largest (11 per cent of capacity and 11 per cent of generation) followed by Wales (9 per cent of the capacity and 9 per cent of the output) and the East of England (8 per cent of capacity and 9 per cent of generation) (tables 2 and 3; charts 3 to 10)².

² A map of wind farm installed capacities in the UK at the end of 2011 was published in the renewables chapter of the 2012 edition of the Digest of UK Energy Statistics, and is also available on the RESTATS web site (<https://restats.decc.gov.uk/>).

Chart 3: Renewable capacity by country

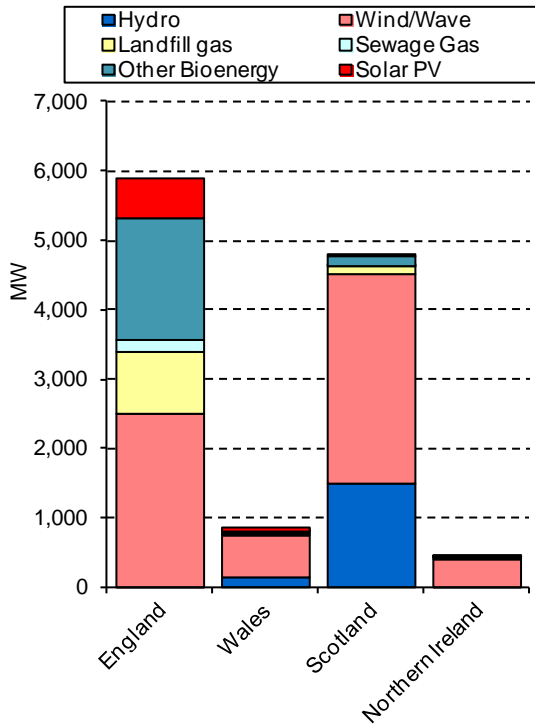


Chart 4: Renewable capacity by English region

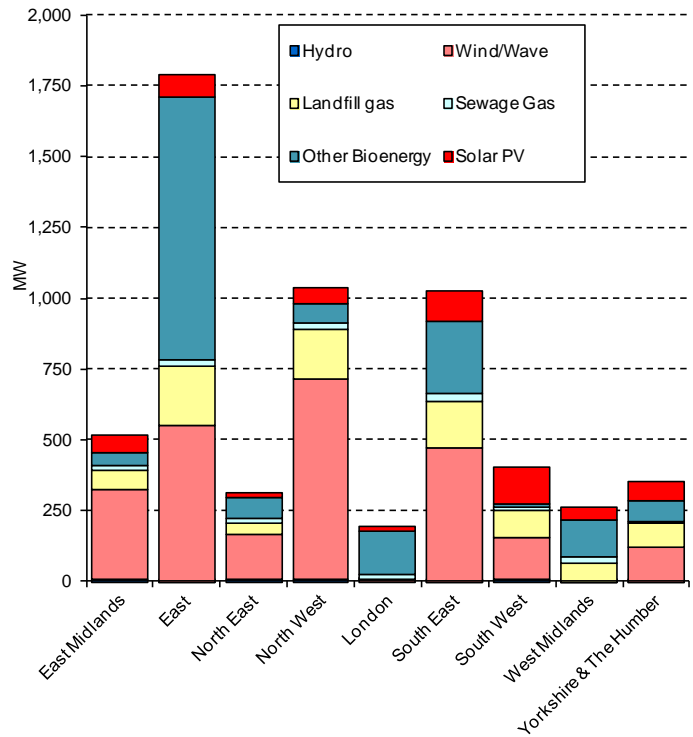


Chart 5: Wind capacity by country

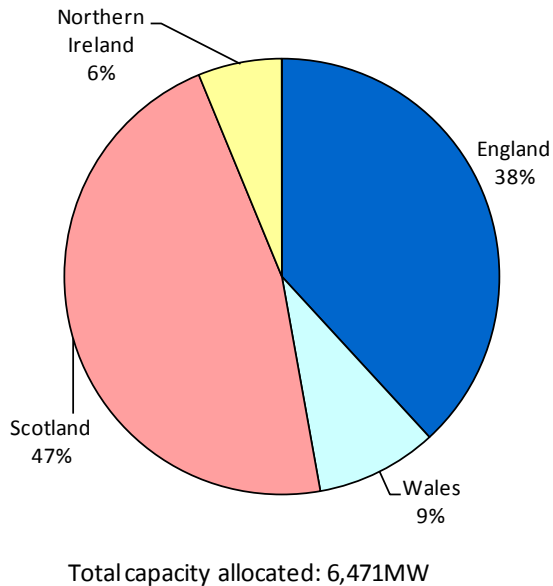


Chart 6: Wind capacity by English region

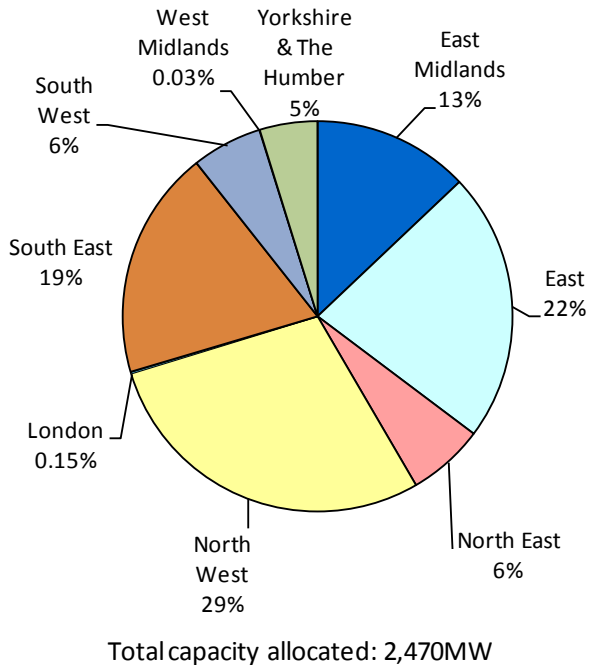


Chart 7: Renewable generation by country

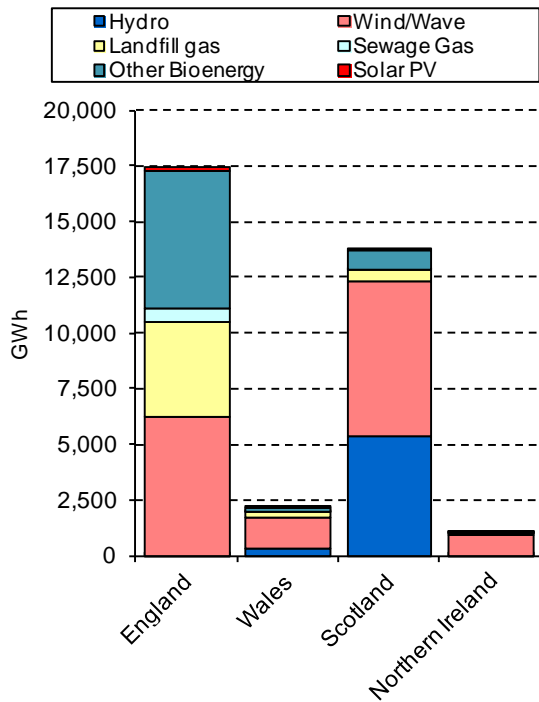


Chart 8: Renewable generation by English region

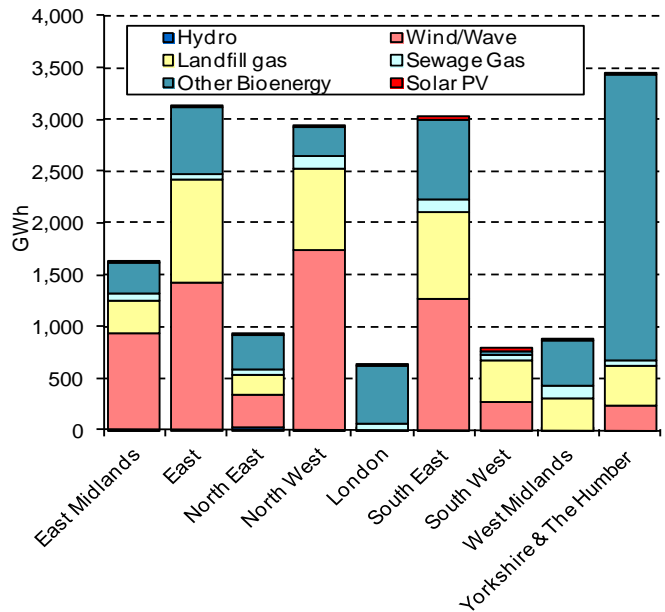


Chart 9: Wind generation by country

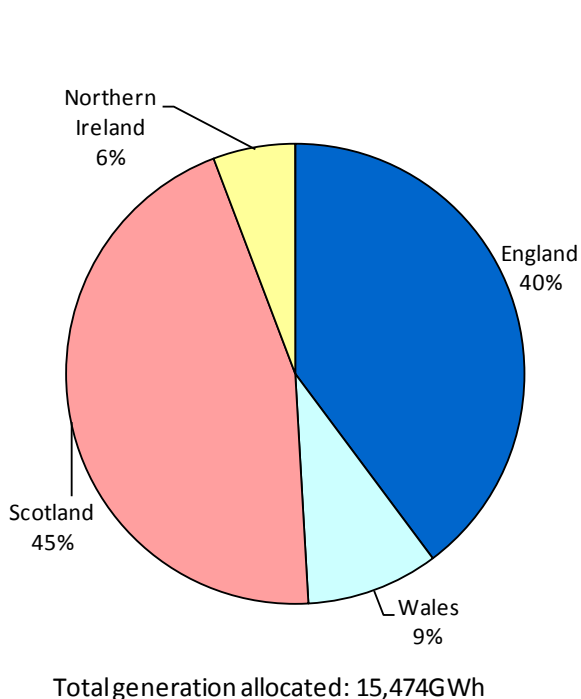
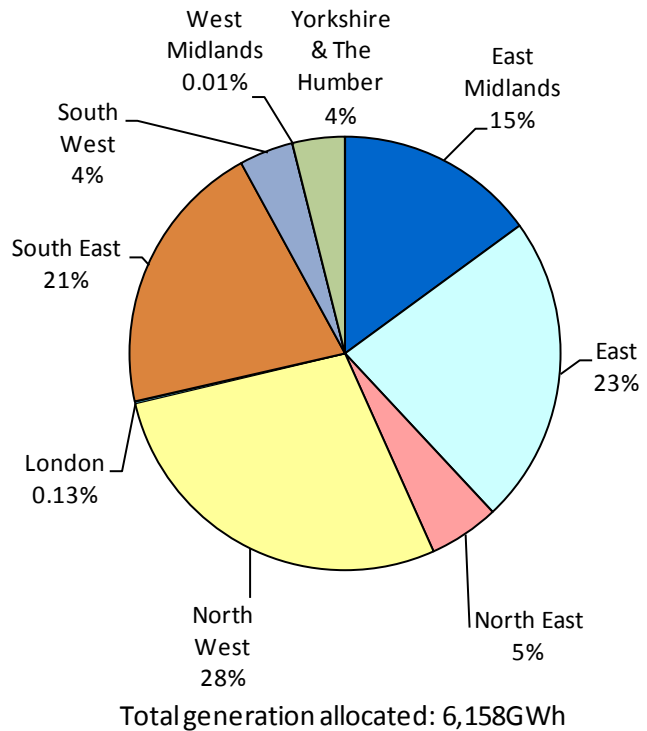


Chart 10: Wind generation by English region



Ninety-one per cent of the generation from sewage and 85 per cent of the generation from other bioenergy (including that used for co-firing) took place in England. The West Midlands (16 per cent), South East and North West (15 per cent each) and East Midlands (10 per cent) were the major sewage gas areas, whilst in the other bioenergy category, Yorkshire and the Humber (38 per cent) was the largest, followed by the South East (11 per cent) and the East of England (9 per cent) followed closely by the London (8 per cent). Excluding bioenergy sources used for co-firing (which cannot be allocated to regions – see note 4 to table 2), the East of England has the largest

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capacity to generate from bioenergy (49 per cent of the UK total) followed by the South East (13 per cent), London (8 per cent) and jointly West Midlands and Scotland (7 per cent).

In terms of total renewables generating capacity, the East of England (+1,090 MW), Scotland (+445 MW) and the North West (+420 MW) have shown considerable growth this year. This growth has primarily come from other bioenergy (+531 MW) and Wind (+192 MW) in the East of England, Wind in Scotland (+369 MW) and the North West (+329 MW), PV in the South West (+115 MW) and PV (+94 MW) and other biomass (+79 MW) in the South East.

Comparison with economic activity

Economic activity in each country or region can be measured in terms of Gross Value Added (GVA). Table 4 shows that Scotland still has the largest generating capacity from renewables in terms of capacity per unit of GVA and generation per unit of GVA. Looking at these two measures, on aggregate England was below the UK average, whilst Wales, Scotland and Northern Ireland were above. Among the English regions the East of England is highest in generating capacity per unit of GVA terms followed by the North West then the North East. In terms of Generation/GVA, Yorkshire and the Humber is the highest followed by the East of England, North West and North East.

Table 4: Density of renewables generation in different areas

	Electrical generating capacity from renewable sources kW/GVA (£million) ^{1,2}	Electricity generated from renewable sources kWh/GVA (£million) ¹
England	5.37	15,880
East Midlands	6.38	20,167
East	16.11	28,342
North East	7.62	22,595
North West	8.58	24,293
London	0.71	2,253
South East	5.49	16,208
South West	4.07	8,087
West Midlands	2.81	9,336
Yorkshire and the Humber	3.90	38,542
Wales	18.82	47,405
Scotland	45.55	130,014
Northern Ireland	15.18	35,289
UK total	9.39	26,888

1. GVA is gross value added in 2010 (workplace based) as published in *Regional, sub-regional and local Gross Value Added 2010, Summary table NUTS1 Regional GVA 2010* at:

www.ons.gov.uk/ons/rel/regional-accounts/regional-gross-value-added--income-approach-/december-2010/sbd-regional-gva-dec-2011.pdf

2. Excludes capacity attributable to co-firing of bioenergy which has not been allocated to regions (see footnote 4 to table 2).

Comparison with earlier years

As in the September 2011 article, DECC and AEA have compiled for each year from 2003 to 2010, the number, installed capacity and generation data comparable to that shown in Tables 1 to 3. These data are available for download as Excel spreadsheets from the following location: <https://restats.decc.gov.uk/cms/historic-regional-statistics/>. The *Energy Trends* articles in previous editions were snapshots of the position as seen at the time and so the headline data in those articles do not constitute a time series. This is because in each year there have been revisions due to an improved statistical base as well as later information on generation and capacity. In addition, non-biodegradable wastes were included in the figures prior to 2002, but the international definition of renewables being used both here and in the Digest of UK Energy Statistics excludes non-biodegradable wastes.

Between 2003 and 2011 there was a 225 per cent increase in generation from renewables in the UK, but faster rates of growth were recorded in Northern Ireland (853 per cent), Yorkshire and The Humber (431 per cent), South East (282 per cent), East Midlands (278 per cent), Scotland (269 per cent) and North East (260 per cent) (see charts 11 and 12). For the individual technology groups some very large increases are recorded in percentage terms because in 2003 there was very little use of some of the technologies in various regions.

Chart 11: Trends in generation from renewables by country

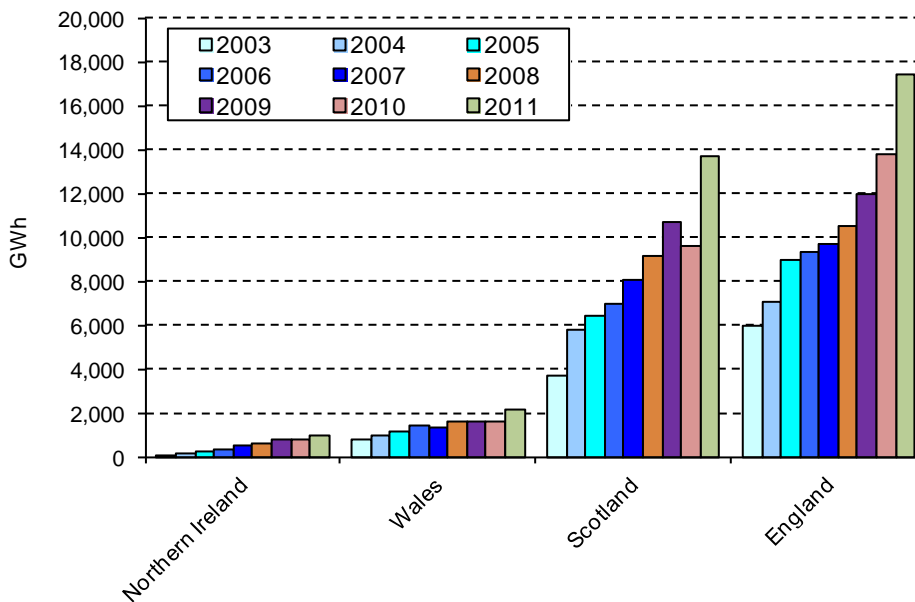
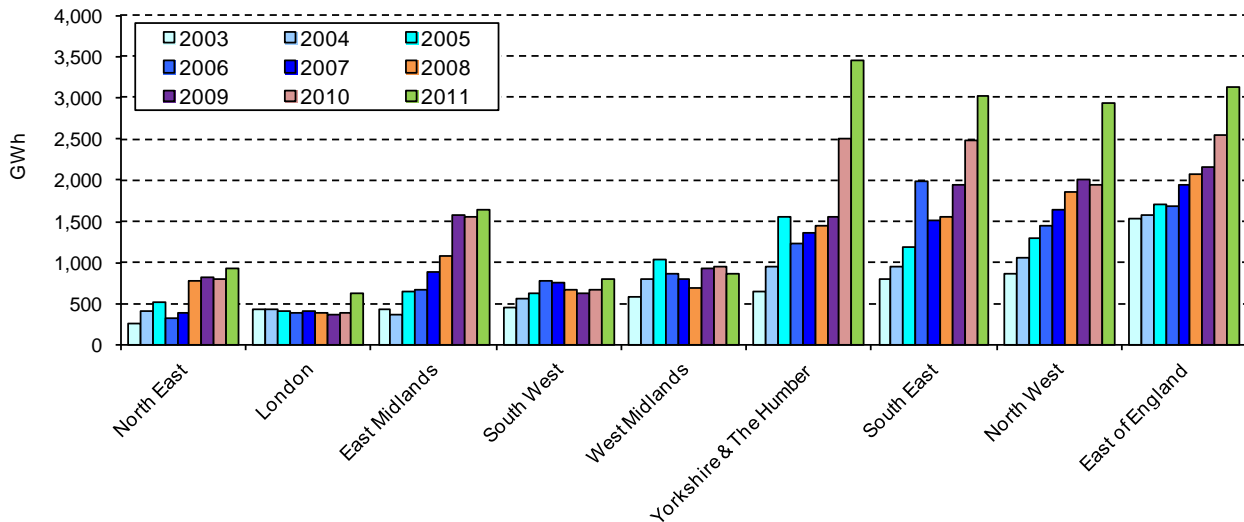


Chart 12: Trends in generation from renewables by English region



Load factors

Load factors for the various technologies have been calculated in Table 5 from data provided in Tables 2 and 3 of this article.

Table 5: Load factors, 2011

	Wind Offshore	Wind Onshore	Landfill gas	Sewage Gas	Other bioenergy (ex cofiring & sewage)	Hydro (large-scale)	Hydro (small-scale)	Hydro
England	37.2%	26.1%	54.7%	44.2%	31.0%	31.8%	27.1%	28.1%
East Midlands	37.5%	26.7%	51.9%	49.6%	47.3%		24.6%	24.6%
East of England	39.5%	25.8%	55.6%	27.0%	14.2%		0.3%	0.3%
North East	15.4%	24.2%	50.7%	44.7%	49.5%	31.8%	101.4%	38.8%
North West	41.5%	27.8%	52.2%	54.6%	29.9%		27.9%	27.9%
London		24.5%		25.1%	52.8%			
South East	31.7%	27.7%	57.7%	45.1%	40.8%		10.4%	10.4%
South West		26.2%	50.4%	45.7%	38.8%		22.5%	22.5%
West Midlands		14.5%	58.2%	59.6%	40.5%		25.8%	25.8%
Yorkshire and the Humber		24.4%	58.5%	49.7%	39.1%		26.9%	26.9%
Wales	34.6%	27.3%	51.3%	48.2%	68.2%	18.3%	32.1%	20.5%
Scotland	35.8%	27.6%	52.1%	49.4%	65.1%	40.9%	45.2%	41.4%
Northern Ireland		28.2%	64.6%	42.5%	47.7%		23.2%	23.2%
UK AVERAGE	36.8%	27.3%	54.4%	44.6%	35.0%	39.0%	40.6%	39.1%
MEDIAN	35.8%	26.5%	52.2%	47.0%	44.1%	31.8%	25.8%	24.6%

The load factors for hydro range from 0.3 per cent in the East of England (due to FiTs sites coming on line at the end of the year) to 41.4 per cent in Scotland, with mean and median values of 39.1 and 24.6 per cent, respectively. For landfill, the load factors vary from 50.4 per cent for South West to 64.6 per cent for Northern Ireland, with mean and median values of 54.4 and 52.2 per cent, respectively.

For offshore wind, load factors varied from 15.4 per cent in the North East to 41.5 per cent in the North West. The low load factor calculated for the North East is based on data from a 4MW experimental facility and, as such, is therefore unrepresentative of what might be expected for this technology in this region. For wind onshore, load factors varied from 14.5 per cent in the West Midlands to 28.2 per cent Northern Ireland This load factor measure does not take into account the

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impact of new schemes being constructed but not operating fully in the year. A better measurement of load factors is discussed on the following page.

The term “load factor on an unchanged configuration basis” describes the amount of electricity generated from schemes that have been operating throughout the whole of the calendar year with the same installed capacity configuration. It is calculated as follows:

$$\frac{\text{Electricity generated during the year (MWh)}}{\text{Installed capacity of schemes operating throughout the year with an unchanged capacity configuration (MW) x 8760 hours}}$$

In view of the interest shown nationally in this measure for onshore wind, regional average load factors on an unchanged configuration basis are also calculated; this approach has, for the first time this year, been extended to other renewable technologies. These data are only reported where the region contains three or more operational schemes. The England figure includes data from all English schemes regardless of how many were operational within each region of England.

Table 6: Regional load factors¹ on an unchanged configuration basis, 2011

	Wind Offshore	Wind Onshore	Landfill gas	Sewage gas	Other bioenergy (ex cofiring & sewage)	Hydro (large scale)	Hydro (small scale)	Hydro
England	34.9%	26.3%	59.0%	53.4%	64.6%	31.8%	34.5%	33.6%
East Midlands	37.5%	25.9%	56.6%	49.6%	62.1%		28.1%	28.1%
East of England	35.5%	26.4%	62.8%	64.0%	68.3%			
North East	15.4%	24.4%	51.7%	50.0%	48.9%		69.7%	36.9%
North West	38.9%	27.6%	53.9%	53.6%	50.4%		40.4%	40.4%
London		24.7%		31.0%	66.2%			
South East	31.7%	28.2%	62.8%	55.1%	63.5%			
South West		27.0%	51.6%	53.1%	55.8%		29.3%	29.3%
West Midlands			65.8%	60.3%	74.7%		27.3%	27.3%
Yorkshire and the Humber		25.1%	65.1%	52.9%	66.4%		32.1%	32.1%
Wales	34.6%	26.2%	56.6%	33.0%	55.0%	18.3%	34.3%	20.3%
Scotland	35.8%	27.4%	63.0%	57.7%	55.1%	44.0%	46.0%	44.1%
Northern Ireland		29.8%	66.8%		11.6%		40.5%	40.5%
UK AVERAGE	35.0%	27.2%	59.5%	53.5%	63.3%	41.5%	43.2%	41.7%
MEDIAN	35.5%	26.4%	62.8%	53.1%	59.0%	31.1%	34.3%	32.1%

¹ FITs data are excluded from all load factor on an unchanged configuration basis calculations because the fine detail about them (start dates, completeness of generation data, etc) is currently not available.

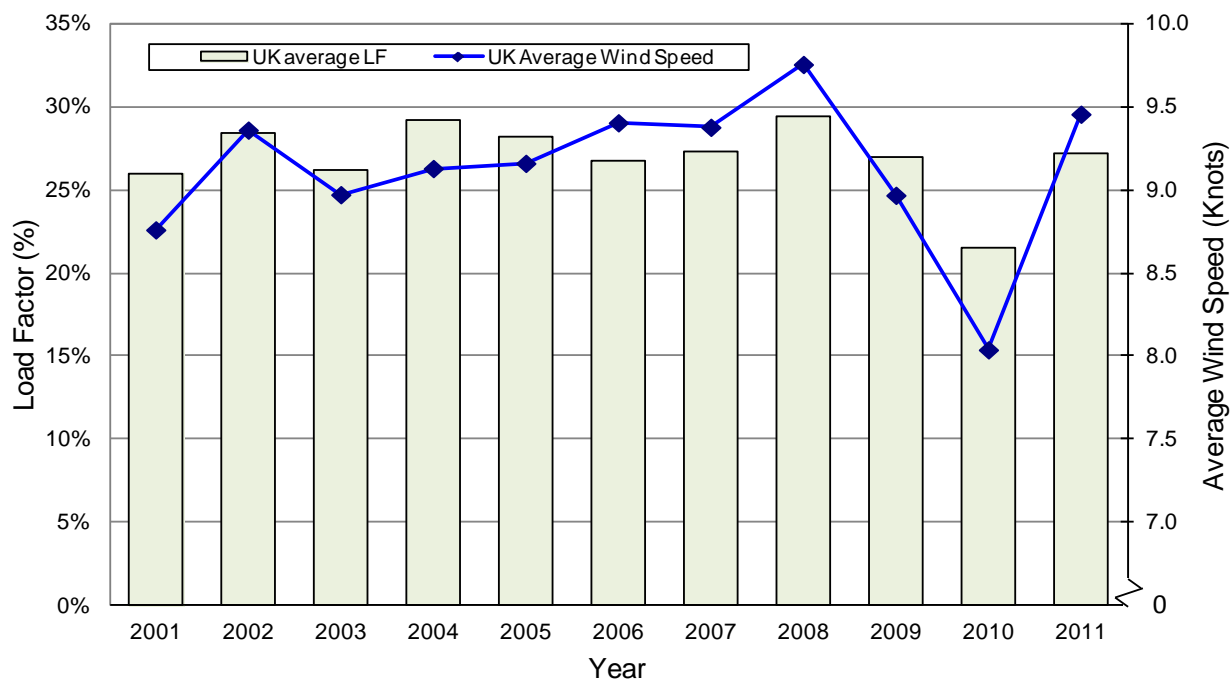
These data show that for onshore wind, the unchanged configuration load factors range from 24.4 per cent in the North East to 29.8 per cent in Northern Ireland with East of England and the South West occupying the median region at 26.7 per cent ³.

³ Regional wind speed data are aggregated according to wind electricity generating capacity. Further information on the methodology used is given. It is recognised that one of the shortcomings of the differences in the reporting periods for the data contained in the Digest of UK Energy Statistics and in this article (end of calendar year) and Ofgem’s finalised ROCs data (end of financial year), is that the finalised Ofgem figures are not available for use during the compilation process for the former analysis. The Digest and this article utilise ROCs data as reported in April 2012, when 2011 data were still provisional. In particular this can have an impact on the schemes included in the unchanged configuration definition as new data could include or remove particular schemes. This should be kept in mind if users wish to reanalyse these results.

Chart 13 shows the annual variation in load factor and wind speed. This uses a wind speed index⁴ that provides an indication of the mean wind speed relative to that of the UK long-term average.

Over the 11-year period from 2001 to 2011, 2008 was the windiest year with 2010 being the least windy year since 2003. Average wind speeds rose again in 2011 and were comparable with previous good years.

Chart 13: Annual variation in load factor on an unchanged configuration basis and wind speed



The unchanged configuration load factor ranges for other renewable energy technologies are as follows:

- Landfill gas: 66.8 per cent in Northern Ireland to 51.6 per cent in the South West compared with a UK figure of 59.5 per cent
- Sewage gas: 60.3 per cent in the West Midlands to 49.6 per cent in the East Midlands, with a UK figure of 53.5 per cent
- Hydro: 44.1 per cent in Scotland to 20.2 per cent in Wales with a UK figure of 41.7 per cent

Further information

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www.decc.gov.uk/en/content/cms/statistics/statistics.aspx

⁴ Based on data provided by the Meteorological Office. Regional wind speed data are aggregated according to wind electricity generating capacity. Further information on the methodology used is given in Energy Trends, September 2008, page 44: www.decc.gov.uk/en/content/cms/statistics/publications/trends/trends.aspx