

Renewable electricity in Scotland, Wales, Northern Ireland and the regions of England in 2009

Background

This article updates that presented in the September 2009 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. For the first time this year, however, sewage gas figures have been separated out from the 'Other biofuels' category.

Solar photovoltaics and micro-wind have not been included in the tables below because, at present, they are estimated on a UK-wide basis that cannot readily be broken down into regional components. In total, solar PV in 2009 amounts to 26.5 MWe capacity and 20.0 GWh of generation; micro-wind in 2009 amounts to 20.4 MWe capacity and 17.9 GWh of generation. Otherwise, figures in Tables 2 and 3 correspond to the totals shown in Table 7.4 of the Digest of United Kingdom Energy Statistics 2010 (DUKES). Thus the data in this article cover all renewables, including renewables that are not eligible for the Renewables Obligation such as large-scale hydro commissioned before 1 April 2002. Off-shore wind has been allocated to the region to which its output is connected.

What the figures show

Table 1 and Chart 1 show that there were 939 sites in England generating electricity from renewable sources, with 436 in Scotland, 143 in Wales and 130 in Northern Ireland. In capacity terms Scotland had the capacity to generate 24 per cent more electricity from renewable sources than England (Table 2 and Chart 3). This was because of Scotland's considerable hydro resources (89 per cent of the UK's total hydro capacity). Hydro accounted for 45 per cent of generation from renewables in Scotland (Table 3 and Chart 7). However, because biofuels based capacity was used more intensively than hydro (which is subject to seasonal variation in precipitation in the catchment areas) generation from renewable sources in England in 2009 was 12 per cent higher than generation in Scotland.

Table 1: Number of sites generating electricity from renewable sources, 2009¹

	Hydro	Wind and wave ²	Landfill gas	Sewage Gas	Other biofuels ³	Total
England	94	249	356	154	86	939
East Midlands	18	24	41	16	10	109
East of England	3	39	68	13	8	131
North East	3	41	17	8	5	74
North West	19	42	60	25	4	150
London	-	10	-	...	6	16
South East	5	18	67	28	15	133
South West	36	36	36	19	6	133
West Midlands	4	5	30	21	18	78
Yorkshire and the Humber	6	34	37	24	14	115
Wales	53	49	22	12	7	143
Scotland	208	164	40	8	16	436
Northern Ireland	45	74	3	3	5	130
UK Total	400	536	421	177	114	1,648

For notes to Tables 1 see below Table 3, overleaf.

Table 2: Installed capacity of sites generating electricity from renewable sources, 2009¹ **MWe**

	Hydro	Wind and wave ²	Landfill gas	Sewage Gas	Other biofuels ³	Total
England	28.2	1,447.9	823.6	121.1	655.8	3,076.5
East Midlands	5.5	300.0	64.0	8.2	38.4	416.0
East of England	0.3	357.1	198.5	20.7	103.0	679.6
North East	6.3	108.4	38.2	17.7	75.4	246.0
North West	5.9	357.2	163.1	17.4	29.3	572.8
London	-	3.7	-	23.7	90.0	117.4
South East	0.1	153.2	154.7	...	139.9	448.0
South West	8.4	61.5	85.9	9.8	6.9	172.6
West Midlands	0.6	0.6	55.0	18.4	113.9	188.5
Yorkshire and the Humber	1.0	106.3	64.1	5.1	59.0	235.6
Wales	148.8	532.6	45.4	8.5	18.0	753.3
Scotland	1,456.3	2,115.4	107.6	7.2	133.9	3,820.4
Northern Ireland	11.5	310.6	8.3	0.2	2.9	333.5
Total	1,644.8	4,406.5	984.9	137.0	810.6	7,983.6
Solar photovoltaics						26.5
Micro wind generation		20.4				20.4
UK Total	1,644.8	4,426.9	984.9	137.0	810.6	8,030.6
Co-firing ⁴						254.7

Table 3: Generation of electricity from renewable sources, 2009 **GWh**

	Hydro	Wind and wave ²	Landfill gas	Sewage Gas	Other biofuels ⁵	Total
England	83.5	3,064.5	4,161.7	539.7	4,143.7	11,993.2
East Midlands	17.3	797.6	328.1	69.6	381.5	1,594.0
East of England	0.6	500.9	1,029.9	67.6	538.4	2,137.4
North East	23.0	201.0	172.6	48.5	356.8	802.0
North West	16.3	904.1	756.6	99.7	231.2	2,007.9
London	-	6.1	-	...	381.0	387.2
South East	0.3	333.9	892.0	97.4	625.0	1,948.5
South West	21.1	123.4	404.1	42.3	41.8	632.7
West Midlands	1.6	0.1	299.4	95.4	528.6	925.1
Yorkshire and the Humber	3.2	197.4	279.1	19.2	1,059.5	1,558.5
Wales	266.2	904.6	234.2	6.0	198.9	1,609.9
Scotland	4,876.7	4,558.3	533.8	35.3	740.2	10,744.3
Northern Ireland	35.3	758.6	22.5	1.0	19.3	836.7
Total	5,261.6	9,286.0	4,952.2	582.1	5,102.1	25,184.0
Solar photovoltaics						20.0
Micro wind generation		17.9				17.9
UK Total	5,261.6	9,303.9	4,952.2	582.1	5,102.1	25,221.9

Notes to Tables 1 to 3

Components may not add exactly to totals because of rounding.

- Nil or less than half the final digit shown.

... Data cannot be shown because of the small number of sites providing information for these cells. Instead these data are combined with the Other Biofuels category

¹ At the end of December 2009.

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

³ 17 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 biofuels co-fired with fossil fuels.

In England the number of sites varies from 16 in London to 150 in the North West (Table 1 and Chart 2). In capacity terms the East of England continues to have the greatest ability to generate, followed by the North West, the South East and the East Midlands (Table 2 and Chart 4). In the East of England, 53 per cent of this capacity is from wind with almost two thirds of this from three large offshore wind farms. In the North West, 62 per cent of renewable sourced capacity is from wind (more than 50 per cent from two offshore wind farms) and in the South East, 34 per cent is from wind whilst in the East Midlands it is 72 per cent. The East of England region has 20 per cent of the UK’s landfill gas capacity and 13 per cent of the UK’s capacity to generate from sewage and other biofuels and wastes. The North West with 17 per cent of the UK’s landfill gas capacity, and the South East (with 16 per cent of the UK’s landfill gas capacity, 13 per cent of the UK’s sewage capacity and 15 per cent of the UK’s other biofuels and wastes capacity) are other English regions with notably large shares. The East of England, North West and the South East regions together accounted for 54 per cent of UK generation from landfill gas.

Chart 1: Number of sites by country

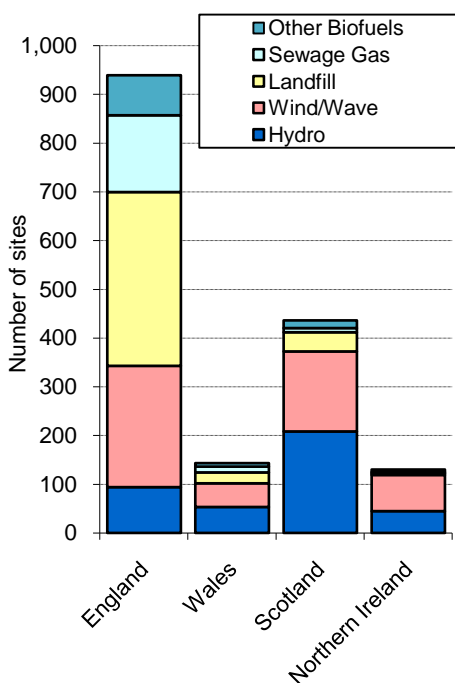
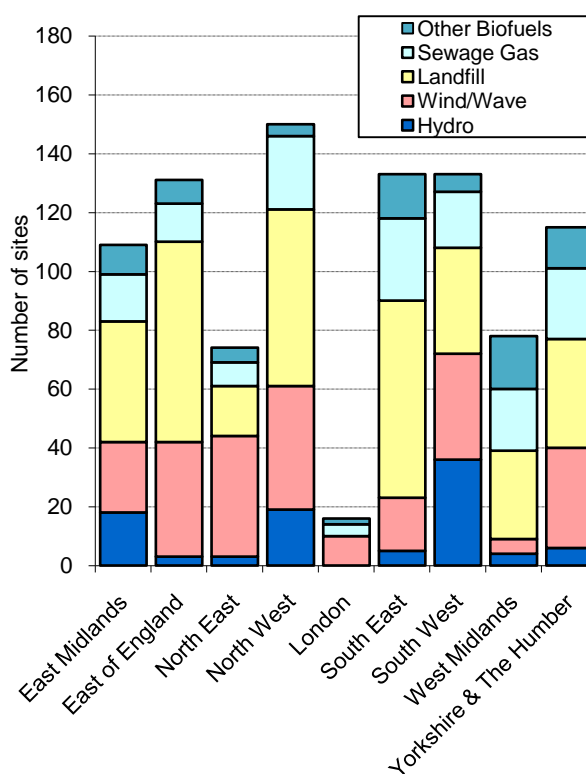


Chart 2: Number of sites by English region



In 2009, Scotland had 48 per cent of the capacity to generate from wind and produced 49 per cent of the output (Tables 2 and 3; Charts 5 and 9). Wales was the next largest (12 per cent of capacity and 10 per cent of generation) followed jointly by the East of England (8 per cent of the capacity but only 5 per cent of the output) and the North West of England (8 per cent of capacity and 10 per cent of generation)) (Tables 2 and 3; Charts 3 to 10)¹.

¹ A map of wind farm installed capacities in the UK at the end of 2009 was published in the renewables chapter of the 2010 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

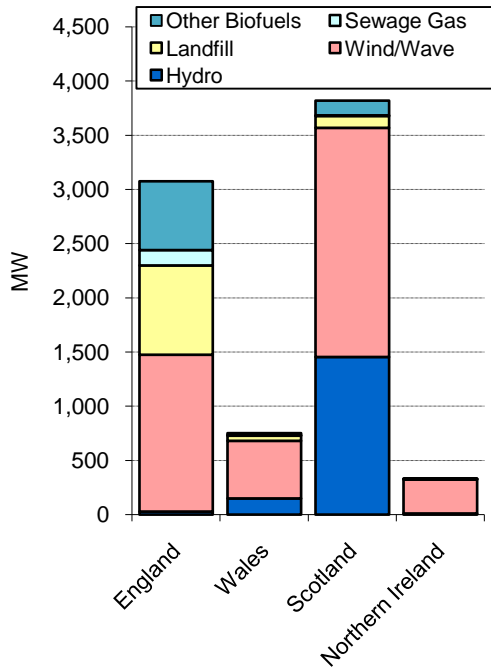


Chart 4: Renewable capacity by English region

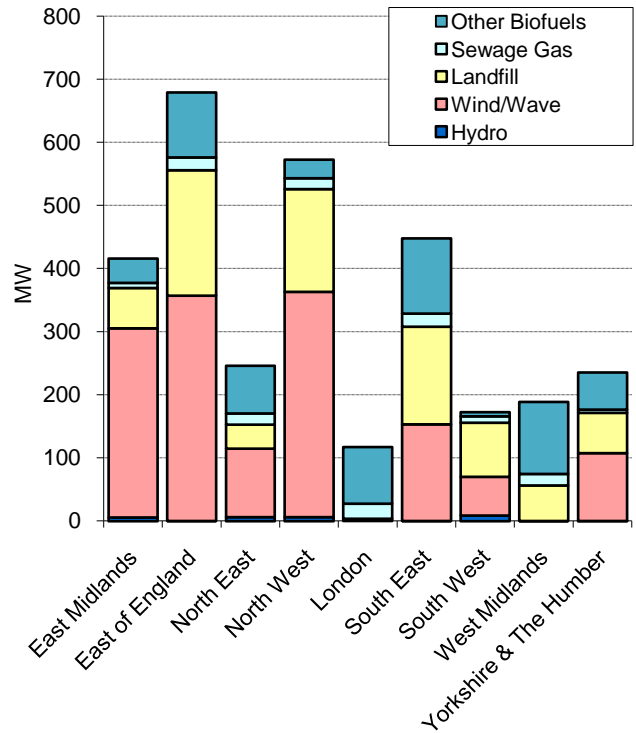


Chart 5: Wind capacity by country

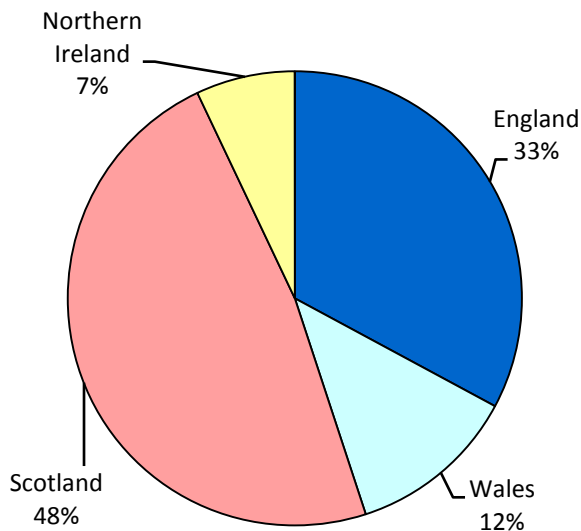
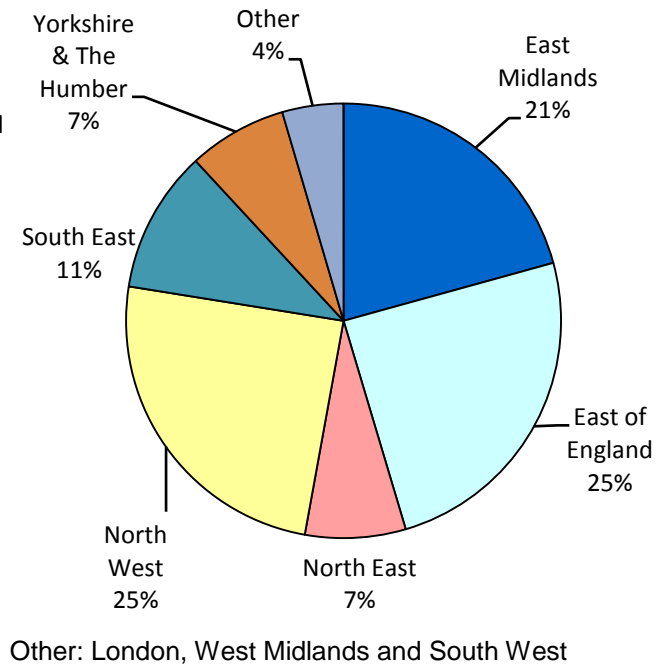


Chart 6: Wind capacity by English region



Ninety-three per cent of the generation from sewage and 81 per cent of the generation from other biofuels (including biofuels used for co-firing) took place in England. The North West (16 per cent), South East (15 per cent) and West Midlands (15 per cent) were the major sewage gas areas, whilst in the other biofuels category, Yorkshire and the Humber (21 per cent) was the largest, followed by the South East (12 per cent) and the East of England (11 per cent) followed closely by the West Midlands (10 per cent). Excluding biofuels used for co-firing, (which cannot be allocated to regions – see note 3 to Table 2), Scotland, together with the South East, both have the largest capacities to generate from biofuels (15 per cent each of the UK total) followed by the West Midlands (14 per cent), East of England (13 per cent) and London (12 per cent).

In terms of total renewables generating capacity, Scotland (+482 MWe), East of England (+192 MWe), Wales (+179 MWe), Northern Ireland (+103 MWe), the North East (+78 MWe) and South East (+73 MWe) have shown considerable growth this year. This growth has primarily come from wind; Scotland (+407 MWe), East of England (+171 MWe), Wales (+157 MWe), Northern Ireland (+95 MWe), North East (+53 MWe) and in the South East (+60 MWe).

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 not only has the largest generating capacity from renewables, it is the largest 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 and Northern Ireland (as well as Scotland) were above. Among the English regions the East of England is highest in generating capacity per unit of GVA terms followed by North East then the East Midlands. In terms of Generation/GVA, East Midlands is followed closely by the North East and the East of England, Yorkshire and the Humber and the North West. Note that co-firing capacity has not been allocated to individual regions.

Table 4: Density of renewables generation in different areas

	Electrical generating capacity from renewable sources kWe/GVA (£million) ^{1,2}	Electricity generated from renewable sources kWh/GVA (£million) ¹
England	2.84	11,090
East of England	6.09	19,160
North East	6.01	19,602
East Midlands	5.20	19,930
North West	4.75	16,635
Humber (Y/H)	2.64	17,487
South East	2.46	10,721
West Midlands	1.99	9,790
South West	1.76	6,466
London	0.44	1,461
Wales	16.52	35,297
Scotland	36.80	103,496
Northern Ireland	11.61	29,118
UK total	6.34	19,994

1. GVA is provisional gross value added in 2008 (workplace based) as published in table 1.6 at

www.statistics.gov.uk/downloads/theme_economy/CRC2008ALL.pdf

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

Chart 7: Renewable generation by country

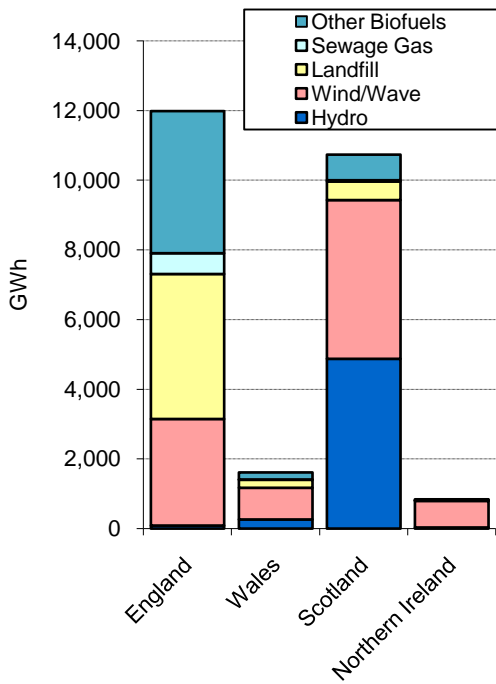


Chart 8: Renewable generation by English region

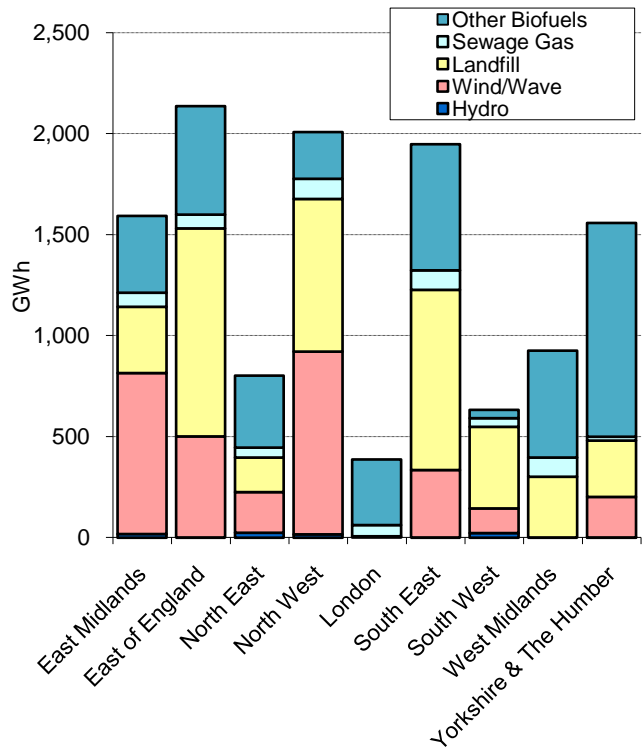


Chart 9: Wind generation by country

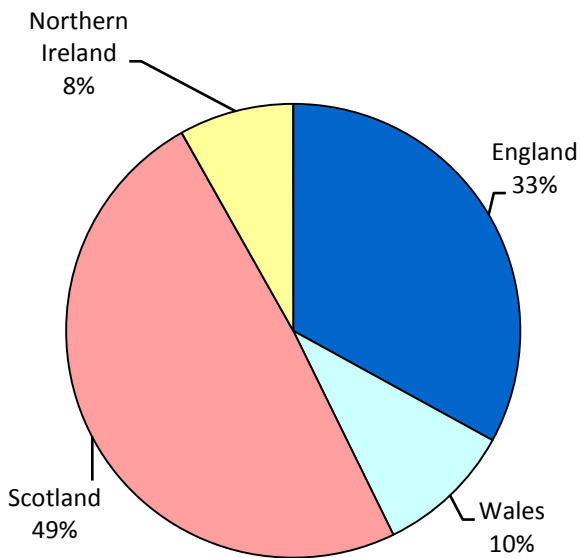
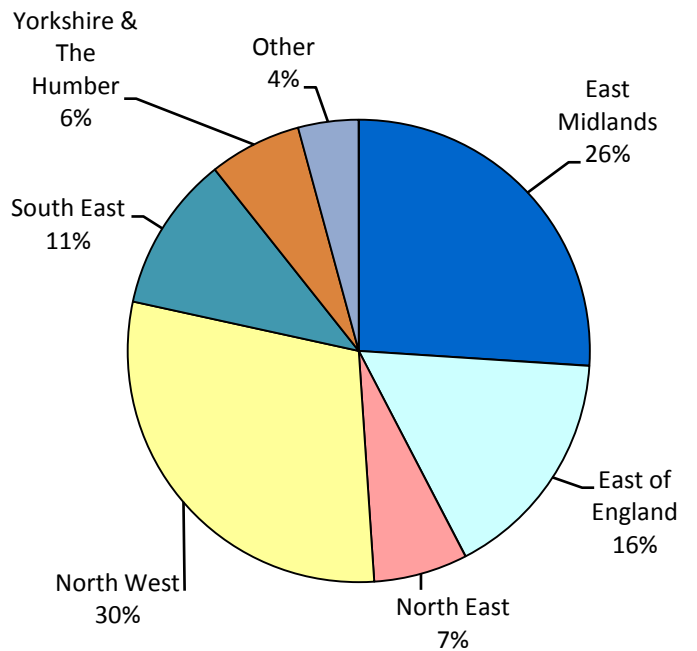


Chart 10: Wind generation by English region



Other: London, West Midlands, South West

Comparison with earlier years

As in the September 2009 article, DECC and AEA have compiled for each year from 2003 to 2008, installed capacity and generation data comparable to that shown in Tables 2 and 3. These data are now 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 for 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 2009 there was a 138 per cent increase in generation from renewables in the UK, but faster rates of growth were recorded in Northern Ireland (702 per cent), East Midlands (268 per cent), North East (211 per cent), Scotland (188 per cent), South East (146 per cent) and Yorkshire and The Humber (139 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. For example wind generation in the East Midlands in 2009 was over 500 times its low level in 2003. In Northern Ireland the substantial growth was from low levels in 2003 for wind, hydro and biofuels.

The South East became the leading English region in generation from renewables in 2006 not only through the expansion in offshore wind, but also through increased co-firing of biomass with fossil fuels at two of its power stations. At the same time a reduction in the co-firing of biomass led to generation from renewables in Yorkshire and the Humber and in the North East and the West Midlands showing a fall between 2005 and 2006. However, in 2007 a reduction in the co-firing of biomass in the South East saw that region's generation from renewables fall back behind the East of England and North West regions. 2009 saw further reductions in co-firing which resulted in the decreases in generation for the South West. Further rapid increases are foreseen in future for key coastal regions where new offshore wind capacity comes on stream.

Chart 11: Trends in generation from renewables by country

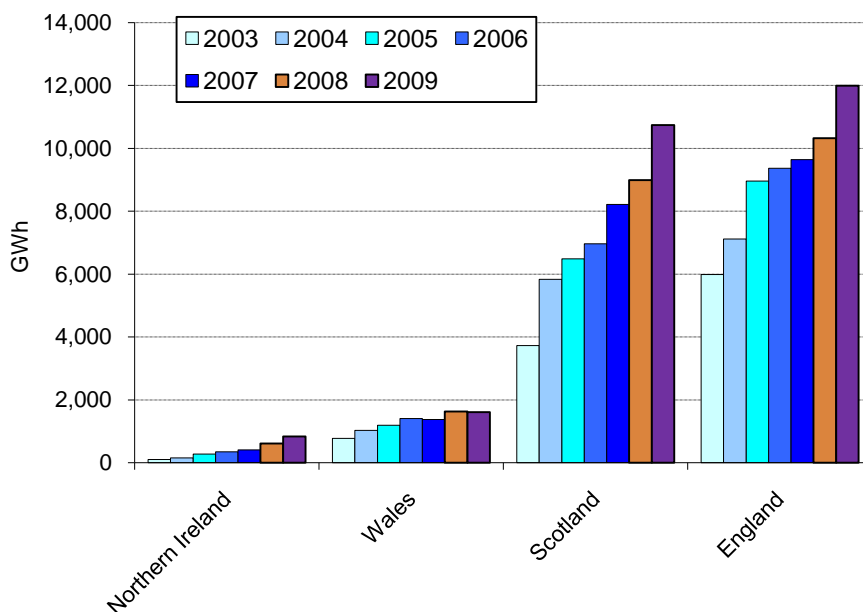
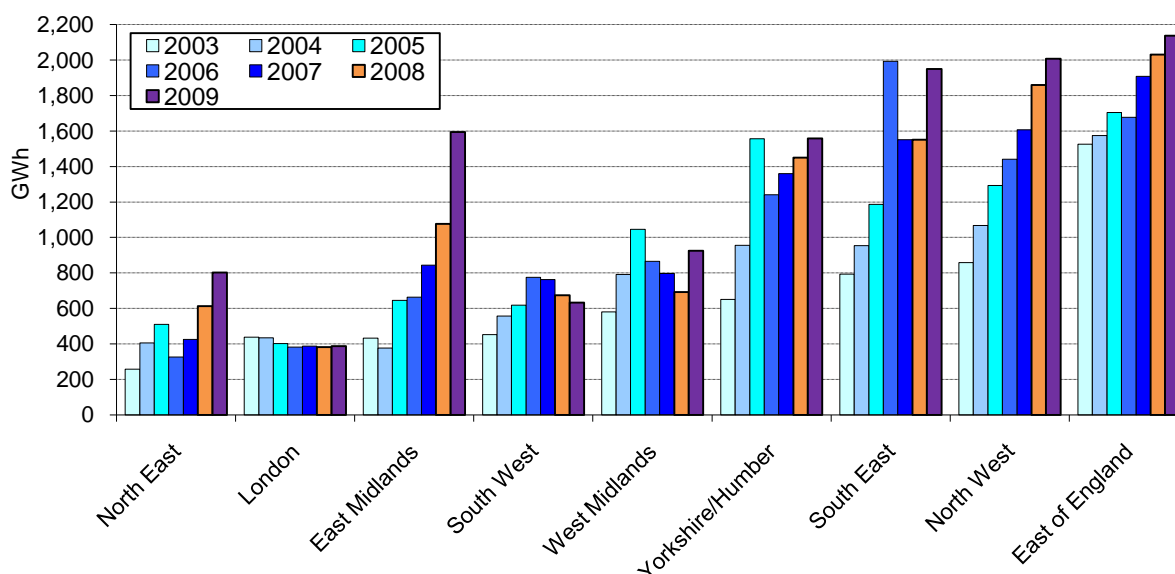


Chart 12: Trends in generation from renewables by English region



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, 2009

	Hydro	Wind and wave	Landfill gas	Sewage Gas	Other biofuels (ex cofiring & sewage)
England	34.3%	27.6%	59.6%	49.3%	46.6%
East Midlands	36.4%	30.7%	60.0%	97.0% ¹	43.0%
East of England	17.1%	21.0%	60.9%	41.2%	61.1%
North East	41.9%	28.6%	56.6%	31.3%	48.4%
North West	32.9%	29.5%	53.4%	67.4%	27.6%
London	-	19.0%	-	27.0%	41.4%
South East	30.8%	30.9%	67.7%	53.4%	51.6%
South West	28.6%	22.9%	57.6%	49.6%	47.7%
West Midlands	31.1%	- ²	65.4%	60.2%	37.6%
Yorkshire and the Humber	40.7%	27.7%	51.1%	55.3%	45.7%
Wales	20.5%	22.7%	60.1%	8.5% ³	107.8% ⁴
Scotland	38.4%	27.2%	60.4%	59.5%	63.5%
Northern Ireland	35.0%	32.9%	58.3%	52.8%	78.4%
MEAN	36.7%	27.2%	59.7%	47.6%	50.0%
MEDIAN	32.9%	27.7%	60.0%	53.1%	48.1%

1 This was due to some anomalies with the ROCs generation data provided for a small number of schemes, that resulted in abnormally high load factors for these schemes. AEA will be working with Ofgem to resolve these issues over the coming months.

2 West Midlands has only a few small wind schemes, and load factors would be disclosive.

3 This unusually low figure is due to a large installed capacity that was burning little sewage gas during the year.

4 As a result of one large new project beginning operation near the start of the reporting year, the standard method for load factor calculation as used in DUKES based on averaging the installed capacities between the start and the end of the year was pushed beyond its normal limits and resulted in load factors > 100%.

The load factors for hydro range from 17.1 per cent in the East of England to 41.9 per cent in the North East, with mean and median values of 36.7 and 32.9 per cent, respectively. For landfill, the load factors vary from 51.1 per cent for Yorkshire and the Humber to 67.7 per cent for the South East, with mean and median values of 59.7 and 60.0 per cent, respectively.

For wind, based combined on offshore and onshore capacities and generation, load factors varied from 19.0 per cent in London to 32.9 per cent in Northern Ireland. This load factor measure does not take into account the effect of different scheme sizes that are especially significant in hydro and wind. A better measurement of load factors for wind is discussed below.

The term “load factor on an unchanged configuration basis” describes the amount of electricity generated from wind farms compared with the amount that such turbines would have generated had they been available for the whole of the calendar year and running continually and at maximum output throughout the calendar year. It is calculated as follows:

$$\frac{\text{Electricity generated during the year (kWh)}}{(\text{Installed capacity of wind farms operating throughout the year with an unchanged configuration (kW)}) \times 8760 \text{ hours}}$$

In view of the interest shown nationally in this data for on-shore wind, regional average load factors on an unchanged configuration basis are also calculated. These data are only reported where the region contains 3 or more operational wind farms. The England figure includes data from all English wind farms regardless of how many operational wind farms were in each region within England.

	Load Factor	Number of Schemes
Wind Offshore	33.7%	7
Wind Onshore (UK total)	26.9%	184
England	23.9%	81
East Midlands	25.7%	8
Eastern	23.9%	14
London	-	-
North East	21.9%	16
North West	26.3%	21
South East (incl London)	18.3%	4
South West	24.1%	9
Yorkshire & Humberside	22.9%	9
Wales	24.8%	21
Scotland	27.9%	62
Northern Ireland	30.3%	20

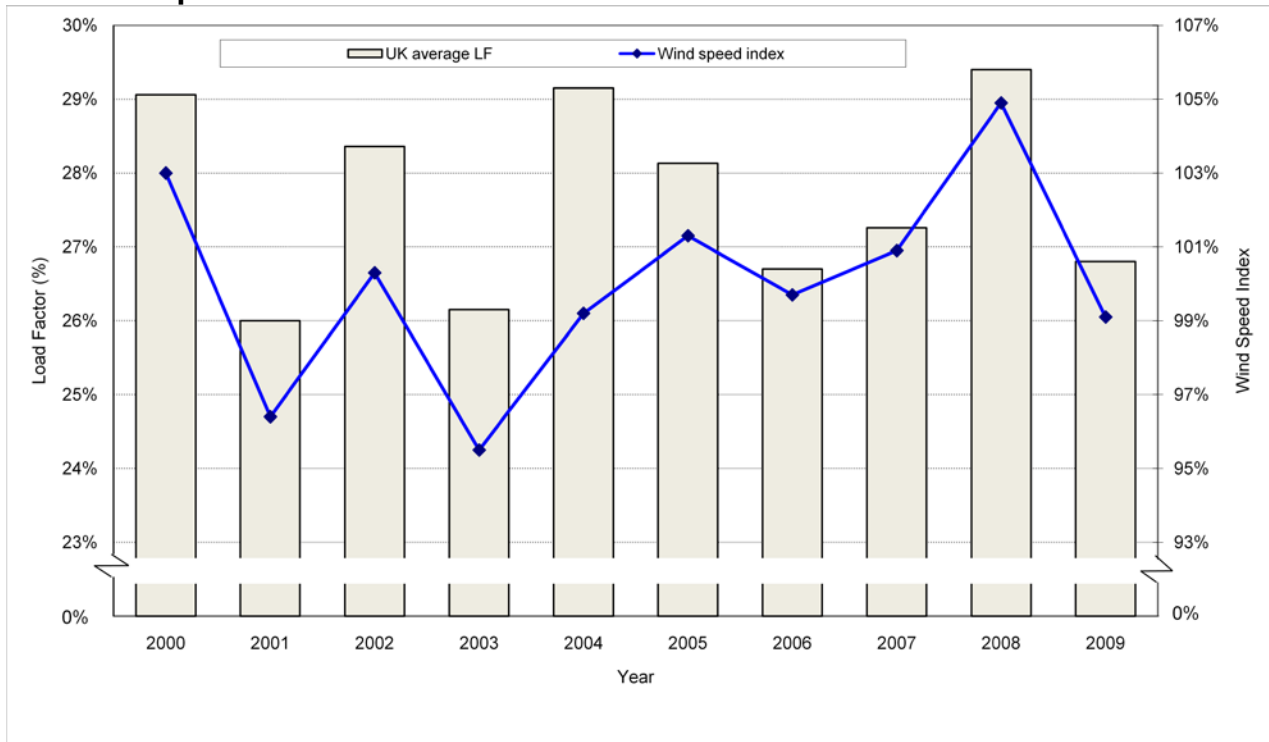
These data show that for onshore wind, the load factor ranges from 18.3 per cent in the South East to 30.3 per cent in Northern Ireland with Wales in the median region at 24.8 per cent.

Chart 13 also shows the annual variation in load factor and wind speed. This uses a wind speed index² that provides an indication of the mean wind speed relative to that of the long-term average across the UK. This wind speed index is calculated from a sample of 13 meteorological stations that have sufficient data quality in terms of consistency, accuracy and exposure and a long term, 10-year record.

Over the 10-year period from 2000 to 2009, 2008 was the windiest year with 2001 and 2003 jointly sharing the position as being the least windy. 2009 has been the least windiest year since 2003.

² GH UK 2010 Wind Speed Index, Garrad Hassan and Partners Ltd (www.gi-garradhassan.com)

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



Further information

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