

Combined Heat and Power in Scotland, Wales, Northern Ireland and the regions of England in 2012

Background

Combined Heat and Power (CHP) is the simultaneous generation of usable heat and power (usually electricity) in a single process. CHP data for the UK as a whole are updated annually and published in the Digest of United Kingdom Energy Statistics (DUKES), the latest edition of which was published in July 2013. This article updates statistics published in the September 2012 edition of Energy Trends and provides a breakdown of CHP in the Devolved Administrations and English regions¹ in 2012.

The data presented originates from a CHP database maintained by Ricardo-AEA on behalf of DECC. Data relating to the overwhelming majority of CHP electrical capacity (about 99 per cent of total capacity) is received annually from the reliable sources of the Combined Heat and Power Quality Assurance (CHPQA) programme, the Iron and Steel Statistics Bureau (ISSB) and from Ofgem's Renewable Obligations Certificates (ROCs) returns. Other sources of data used include the sales databases of the Combined Heat and Power association (CHPA) and a survey of anaerobic digestion sites. Data from CHP schemes not covered by the above are extrapolated from historic data. There is an ongoing data proving exercise in respect of these schemes.

In the 2013 edition of DUKES, 'mothballed' schemes were removed from the statistics for the first time. Schemes are mothballed when operators decide to discontinue operation. In previous editions, the capacity of these schemes was retained in the statistics on the basis that these schemes are still able to operate. The removal of these mothballed schemes resulted in the removal of 117 schemes with a capacity of 101 MWe. These removals have been applied to all previous years where the schemes were marked as mothballed.

After allowing for the removal of mothballed schemes, between 2011 and 2012 there was a net increase of 135 in the number of CHP schemes in the database (154 new schemes and the removal of 19 schemes) and a net increase of 166 MWe in capacity. Good Quality CHP² capacity in the UK increased from 5,970 MWe (revised 2011 figure) to 6,136 MWe in 2012.

Regional Trends³

Table 1 shows an overview of CHP plant data broken down between the English regions and Devolved Administrations. CHP capacity utilisation can be expressed by the Load Factor (L.F). The L.F is the actual generation as a proportion of the theoretical maximum power that can be generated for a given total installed capacity (TPC). The power output that is actually generated is the total power output (TPO). For 2012, the TPC was 9,355 MWe and the TPO was 43,714 GWh, giving a L.F. of 53.3 per cent, compared to 57.8 per cent in 2011.

Higher L.F. values tend to be found in industrial uses where the demand for heat extends over a greater proportion of the year than for space heating applications (where the heat demanded from the CHP is mostly confined to the heating season).

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1. Similar articles on CHP have appeared in previous Energy Trends publications from 2001 to 2012. The figures within any one article are a snapshot of the position as seen at the time and therefore figures between articles do not constitute a time series.
 2. Good Quality CHP denotes schemes that have been certified as being highly efficient through the UK's CHP Quality Assurance (CHPQA) programme.
 3. Note: The figures for previous years are revised on an annual basis to account for late information submitted after the publication date of the article. This is to ensure that the true trends are captured in the data. The figures herein therefore supersede the previous articles published.

Table 1: Overview of CHP schemes in 2012

	Number of schemes	Electrical capacity (QPC)* MWe	Electrical Capacity (TPC) MWe	Heat capacity MWth	Fuel used* GWh	Electricity generated (QPO)* GWh	Total Electricity Generated (TPO) GWh	Heat generated GWh	Load Factor ** (%)
England	1,640	5,367	8,159	18,858	84,406	19,780	38,392	39,328	53.7%
East Midlands	97	228	415	734	4,465	1,008	1,144	1,949	31.5%
Eastern	133	290	290	824	5,292	1,218	1,248	1,906	49.1%
London	255	153	245	835	2,792	448	991	1,527	46.1%
North East	104	834	928	2,206	13,592	2,406	3,511	7,173	43.2%
North West	259	745	848	3,924	16,409	3,220	3,882	9,423	52.2%
South East	329	1,006	2,292	5,401	18,387	4,470	9,927	8,407	49.4%
South West	128	81	81	218	1,424	346	357	612	50.6%
West Midlands	163	104	171	565	1,904	438	601	762	40.1%
Yorkshire/Humberside	172	1,925	2,889	4,151	20,141	6,224	16,732	7,569	66.1%
Scotland	118	500	628	2,714	12,551	2,439	3,332	6,569	60.5%
Wales	111	214	512	1,118	5,229	926	1,767	2,751	39.4%
Northern Ireland	60	55	55	148	995	215	223	487	46.4%
UK Total	1,929	6,136	9,355	22,837	103,181	23,360	43,714	49,134	53.3%

*This represents Good Quality CHP capacity, Good Quality CHP power output and the fuel associated with the Good Quality CHP outputs.

** These load factors are based on the total power output (TPO) and total power capacity (TPC) of the CHP (for partially and fully qualified schemes). This gives the true utilisation of the power generating plant.

Tables 2 and 2B show a comparison of the number of schemes, electrical capacity, electricity generated and heat generated in the regions for the period 2010 to 2012. During this time, the total number of schemes increased from 1,460 to 1,929, while capacity increased from 5,970 MWe to 6,136 MWe. The number of schemes increased in all regions over the period 2010 to 2012. Over this period, the electrical capacity increased in all regions except in the North East and North West regions.

Table 2: Number and electrical capacity of CHP schemes, 2010 to 2012

	Number of schemes			Electrical capacity (MWe)		
	2010	2011	2012	2010	2011	2012
England	1,240	1,518	1,640	5,213	5,210	5,367
East Midlands	72	93	97	222	229	228
Eastern	115	131	133	272	289	290
London	147	198	255	124	141	153
North East	67	96	104	899	828	834
North West	204	251	259	783	743	745
South East	276	313	329	880	885	1,006
South West	99	116	128	66	73	81
West Midlands	126	155	163	101	103	104
Yorkshire/Humberside	134	165	172	1,864	1,920	1,925
Scotland	87	114	118	491	495	500
Wales	82	104	111	199	212	214
Northern Ireland	51	58	60	47	53	55
UK Total	1,460	1,794	1,929	5,950	5,970	6,136

Table 2B: Electricity and heat generated, 2010 to 2012

	Electricity Generated (GWh)			Heat Generated (GWh)		
	2010	2011	2012	2010	2011	2012
England	22,937	19,000	19,780	38,600	38,208	39,328
East Midlands	1,227	1,040	1,008	1,812	2,081	1,949
Eastern	1,232	1,230	1,218	1,788	1,824	1,906
London	453	411	448	1,562	1,493	1,527
North East	3,257	2,208	2,406	6,566	6,268	7,173
North West	3,593	3,150	3,220	9,419	9,583	9,423
South East	4,206	3,903	4,470	8,425	8,327	8,407
South West	248	312	346	526	597	612
West Midlands	433	416	438	708	734	762
Yorkshire/Humberside	8,289	6,331	6,224	7,794	7,302	7,569
Scotland	2,809	2,661	2,439	6,796	6,658	6,569
Wales	882	931	926	2,433	2,863	2,751
Northern Ireland	140	174	215	438	454	487
UK Total	26,768	22,766	23,360	48,267	48,183	49,134

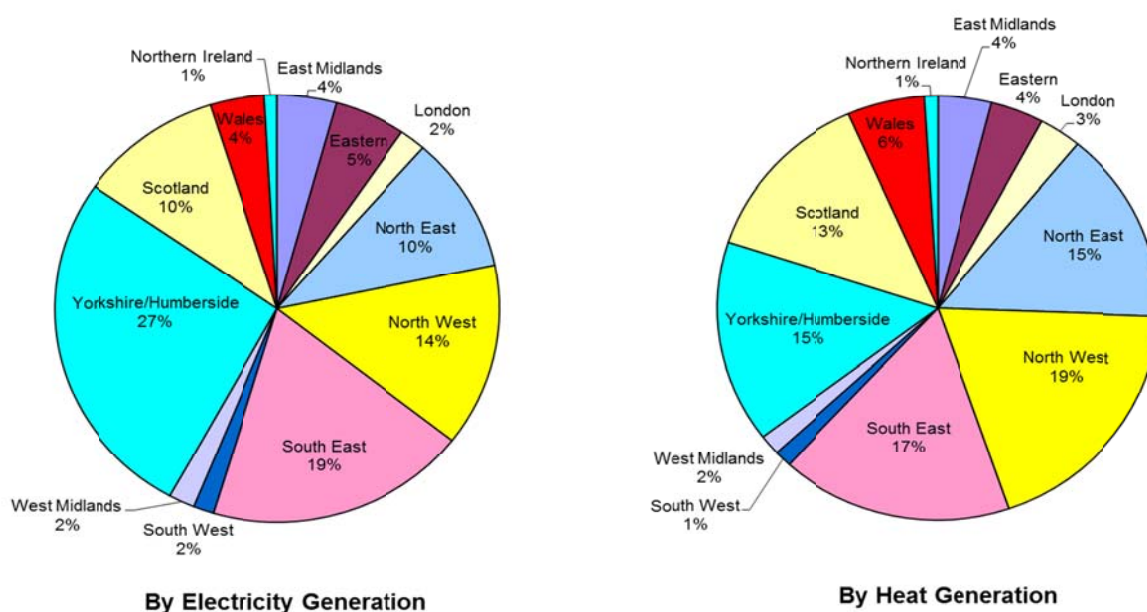
The region with the highest proportion of the UK's capacity was the Yorkshire and Humberside region with a 31 per cent share, but only 8.9 per cent of the total number of schemes, indicating the large capacities of schemes in this region.

Chart 1 shows the distribution of electricity and heat generation from CHP in 2012 across the English regions and the Devolved Administrations. The largest contribution to electricity generation remains that of the Yorkshire and the Humber region (27 per cent), followed by the South East (19

per cent), the North West (14 per cent) and the North East and Scotland (10 per cent). Although this ranking is the same as in 2011, there has been an appreciable decrease in the total share of electricity generation falling within the Yorkshire and the Humber region and an increase for the South East region. This is a reflection of the relatively larger increase in electrical capacity in the South East region (14 per cent) compared to little change in the Yorkshire and Humber region.

The region with the greatest share of heat generation in 2012 was the North West (19 per cent), followed by the South East (17 per cent) and then Yorkshire and Humberside and the North East (15 per cent).

Chart 1: CHP generation by area in 2012



Importance of CHP in the Regional Economies

Chart 1 portrays only a limited picture as it does not account for the varying size of each region. To allow for this, CHP heat capacity and electrical capacity have been compared with the level of economic activity in each region as measured by Gross Value Added (in £ million) in Table 3. Chart 2 maps the heat capacity per unit of GVA for the different regions.

When comparing the heat capacities presented in Table 3 with earlier versions of this table, it should be noted that these figures are based on a revision to the way in which heat capacities are worked out for each CHP scheme⁴. This has produced a reordering of the regions in terms of Heat Capacity per unit of GVA. CHP continues to be a very important part of the economies of the North East, Yorkshire/Humber and North West regions, as evidenced by the large heat capacities per unit of GVA in these regions. This is due to the prominence of the chemicals and oil refining sectors in these regions.

4. See Chapter 7 para 7.44, Digest of United Kingdom Energy Statistics, 2013.

Table 3: Density of CHP in different areas, ordered by heat capacity

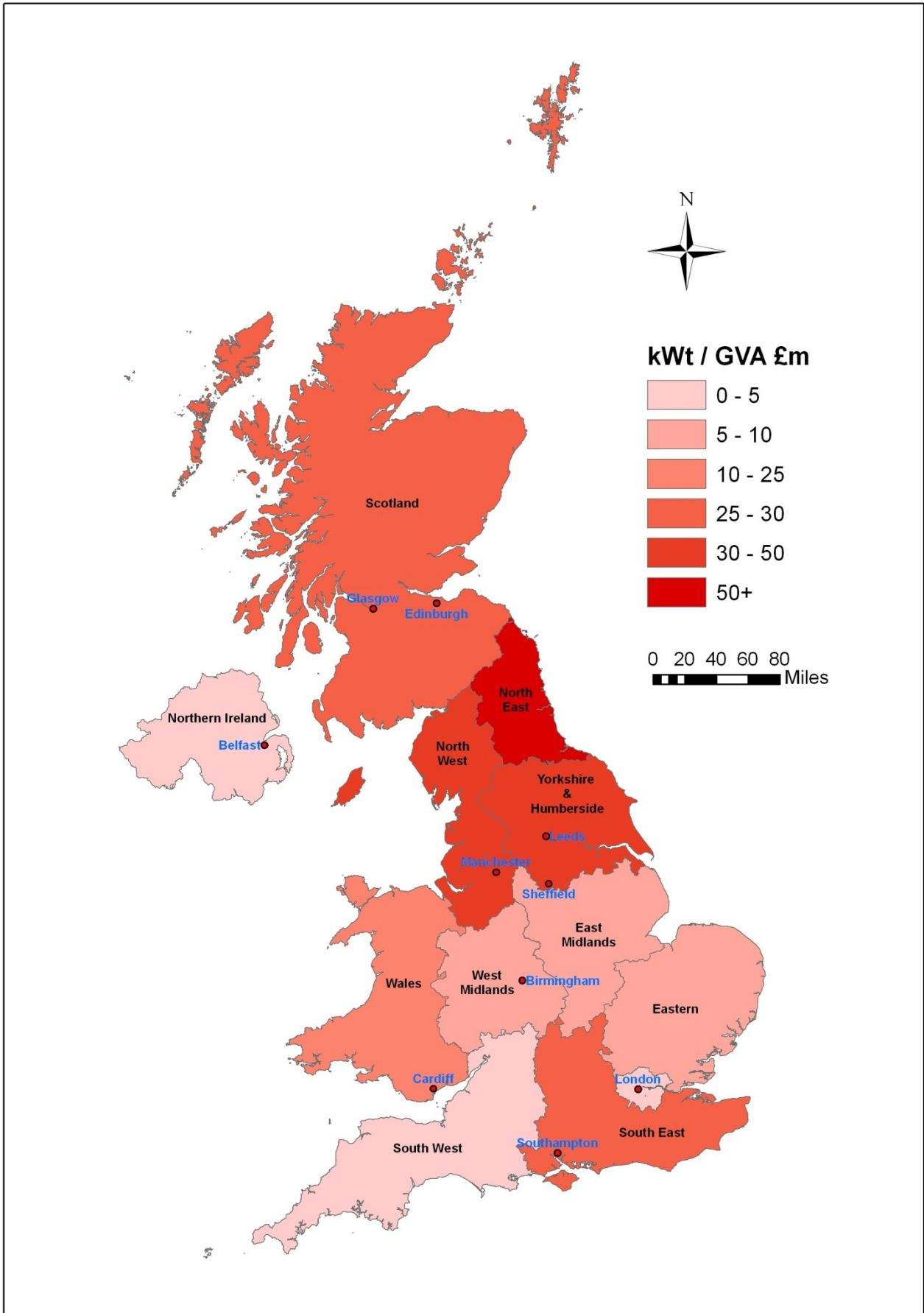
	Heat capacity kWt/GVA (£million)*	Electrical capacity kWe/GVA (£million)*
North East	53.04	20.06
Yorkshire/Humber	45.59	21.14
North West	31.67	6.01
South East	28.08	5.23
Scotland	25.10	4.63
Wales	23.61	4.52
England	16.76	4.77
East Midlands	9.00	2.80
Eastern	7.22	2.54
West Midlands	5.89	1.09
Northern Ireland	4.94	1.84
London	2.95	0.54
South West	2.15	0.80
UK total	17.03	4.58

*GVA is provisional gross value added in 2011 (workplace based)⁵

The distribution of CHP capacity across the regions and economic sectors is summarised in Table 4, which shows the proportion of total CHP capacity in a particular economic sector in each region. More than half of all CHP capacity in the oil refineries and oil and gas terminals sector can be found in the Yorkshire and Humber region and over 80 per cent of capacity in the chemicals sector is to be found in three regions: North East, Yorkshire/Humber and the North West. More than half of the capacity in the Paper, Publishing and Printing sector is located in the South East region.

5. www.ons.gov.uk/ons/dcp171778_291684.pdf (Regional Gross Value Added (Income Approach), December 2012).

Chart 2: Map of CHP density in terms of heat capacity and gross value added



Technology type and size

Tables 5 and 6 show the regional split of installed electrical capacity (that qualifies as Good Quality CHP capacity) by prime mover type and by size range, respectively. In a number of regions, disaggregation of the data by prime mover type or size category could result in the disclosure of confidential information and so, for these areas, only totals are shown. The following conclusions can be drawn from the tables:

- Gas turbines, whether on their own or as part of Combined Cycle Gas Turbines (CCGT), continue to dominate the CHP market. In 2012, CCGT accounted for over 70 per cent of total CHP capacity but less than 3 per cent of the total number of CHP schemes.
- The North East and North West regions continue to be the regions with the most significant presence of steam turbine-based CHP plant. These regions have correspondingly high heat to power ratios (H:P > 2.9).
- As CCGT CHP plant has the lowest heat to power ratios of all the CHP technologies, the large proportion of total CCGT capacity in the Yorkshire/Humber region (40 per cent of the total) explains why that region has the lowest heat to power ratio of all regions (H:P = 1.21). Yorkshire/Humber region generated over 26 per cent of all CHP power but only about 15 per cent of all of the heat.

Table 5: CHP electrical capacity (MWe) by area and prime mover in 2012

	Gas Turbines*	Steam Turbines	Reciprocating Engines	Total
England	4,280	291	796	5,367
East Midlands	146	46	35	228
Eastern		209	82	290
London		56	97	153
North East		763	72	834
North West	511	130	104	745
South East		819	187	1,006
South West		23	57	81
West Midlands		27	77	104
Yorkshire/Humberside	1814	26	84	1,925
Scotland	406	45	49	500
Wales		177	37	214
Northern Ireland		14	40	55
UK Total	4,827	387	922	6,136

*Includes combined cycle gas turbines

Special feature - CHP

The CHP market is dominated by large-scale (>10MWe) plant, with almost 82 per cent of all installed capacity in this size range. The regional distribution of CHP by capacity tranche is given in Table 6.

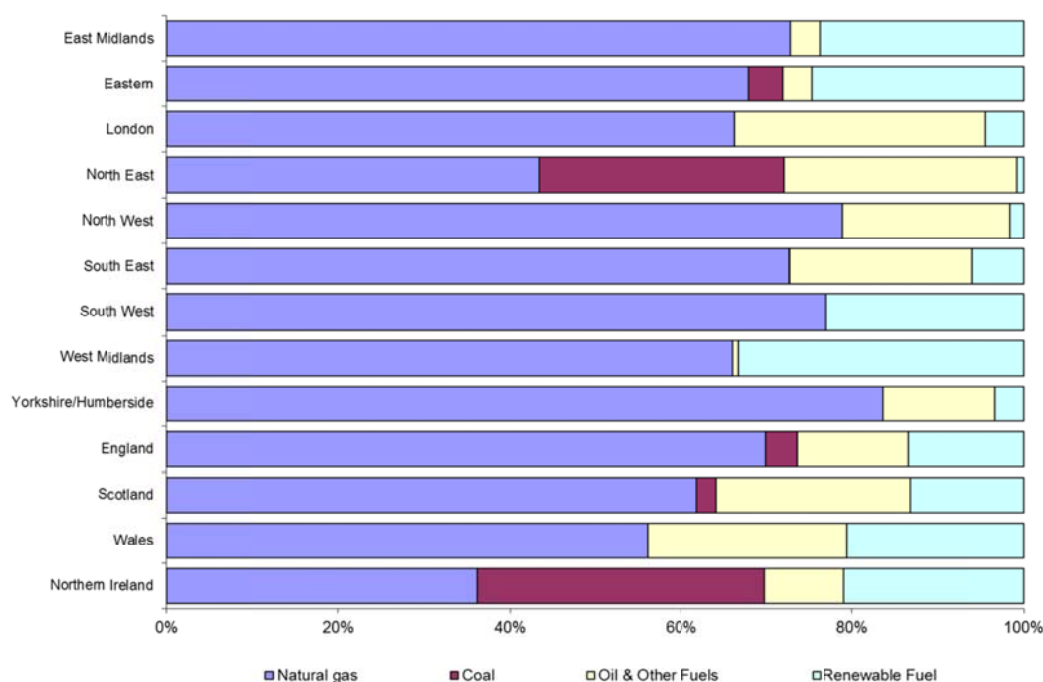
Table 6: CHP electrical capacity (MWe) by area and size in 2012

	Less than 100 kWe	100 kWe but less than 1 MWe	1 MWe but less than 10 MWe	10 MWe and greater	Total
England	28	219	710	4,410	5,367
East Midlands	2	14	24	189	228
Eastern	2	21	70	198	290
London	5	34	115		153
North East	2	8	54	770	834
North West	4	34	109	598	745
South East	5	48	953		1,006
South West	2	19	59	0	81
West Midlands	3	21	80	0	104
Yorkshire/Humberside	4	20	81	1,820	1,925
Scotland	1	15	61	423	500
Wales	2	14	198		214
Northern Ireland	1	8	46		55
UK Total	32	256	836	5,012	6,136

The fuel mix

The proportion of coal, gas, renewable fuels and 'oil and other fuels' (comprising oil products, refinery gases, blast furnace gas and other industrial wastes) in the fuel mix for each region is shown in Chart 3.

Chart 3: Proportion of different fuels in the fuel mix for CHP in 2012 for each region



Natural gas represented about 69 per cent of all fuel burned in CHP in 2012, and was more than half of all fuel burned in CHP in every region except Northern Ireland and the North East. Natural gas consumption in Northern Ireland has been historically low, due to the relatively limited extent of the gas grid in that region. However, the share of natural gas consumption has increased over the years in Northern Ireland, from 18.1 per cent in 2010 (revised) to 36.2 per cent in 2012.

Coal continues to play a minor role overall, with about 5 per cent of fuel burned in CHP being coal. Coal is a very minor part of the fuel mix in all regions except Northern Ireland (33 per cent) and the North East (28 per cent). The proportion of coal consumption in the North East was higher in 2012 than in 2011. This was due to an increase in the share of coal consumption at one large scheme.

The share of total renewable fuel use in CHP plant rose from 7.0 per cent in 2011 (revised) to 8.3 per cent in 2012. In 2012 the largest share of renewable fuel input was in the West Midlands region, where renewables accounted for 33 per cent of total fuel used in the region, followed by the Eastern region (25 per cent), East Midlands (24 per cent), South West (23 per cent) and Northern Ireland (21 per cent). Since 2010 all regions have shown an increase in renewable CHP capacity. In 2012 the region with the largest renewable capacity was Scotland, followed by the East Midlands and then the South East⁶.

Summary

The Yorkshire and the Humber region continues to be the region of the UK with the greatest level of installed capacity and electricity generation, accounting for 31 per cent of all capacity and 27 per cent of all electricity generated. Other regions with high levels of CHP capacity are the South East, North East and the North West regions where there is a significant presence of heat intensive industry, such as oil refining, chemicals production and paper and printing. About 88 per cent of all refinery CHP capacity is located in the regions of Yorkshire and the Humber, the South East and Scotland, while about 81 per cent of CHP capacity at chemical works is located in the three regions of the North East, the North West and Yorkshire and Humber. About 58% of the paper and printing CHP capacity, on the other hand, is located in the South East.

CHP plays a very noticeable role in the economies of the North East and Yorkshire and Humber regions, as evidenced by heat and electrical capacities per unit of GVA that are very much higher than in any other region. This is a result of the high concentration of oil refining and chemical industries in these regions which are large users of CHP heat.

The region with the highest proportion of renewable fuel use is the West Midlands, followed by the Eastern region, East Midlands and the South West.

For further information on UK CHP statistics, please contact:

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6. Capacity is calculated according to the proportion of fuel inputs to the CHP that are renewable. Many renewable CHP schemes use a mixture of renewable and non-renewable fuels. Therefore, a scheme of 5 MWe capacity using a 50:50 mixture of natural gas and biogas is deemed to have a renewable capacity of 2.5 MWe.