International comparisons of energy efficiency indicators

Introduction

A helpful way to measure the performance of UK energy efficiency is to compare its energy intensity in different sectors the economy relative to other countries. This article presents indicators for each of the main energy consuming sectors based on data published by the ODYSSEE European energy efficiency indicators project[1]. These indicators are designed to make meaningful comparisons between countries; however care must be taken when making comparisons regarding efficiency due to differences in the types of energy uses in different countries, and differences in heating demand, building type and the structure of industry that cannot be fully controlled for.

Data in this article are taken from the ODYSSEE database unless otherwise noted. The ODYSSEE project is a European Commission supported project made up of partners from EU Member States together with Norway to produce detailed energy efficiency indicators for European countries. The majority of countries have data covering at least 2000 to 2014. However, in some cases where a country does not have 2014 data available yet the most recent data available has been used. This will is noted as a footnote where applicable. If a country is not displayed on a cross-European chart, it is because that country has not reported data for that indicator at the time of writing.

It is useful to make comparisons to countries that are similar to the UK both in climate and economic factors for example France & Germany. It is noticeable in a number of the indicators shown that the EU members prior to 2004 (EU15), which includes the UK, often show a different level when compared to more recent members. Therefore, throughout the charts in this article EU15 countries will be presented with an amber border.

This article provides a brief overview of energy efficiency in each major sector. All energy figures are presented in net calorific values (NCV)[2], and so are not directly comparable with other data in Energy Trends and the Digest of UK Energy Statistics.

Domestic

The indicator in Chart 1 shows average energy consumption per dwelling, adjusted for climatic differences across the EU. This indicator uses climate corrected data, which enables better comparisons to be made across countries by adjusting some key energy uses (e.g. heating demand) based on modelled variation both over time and to standard EU climate; for instance a household that lives in a country with a cooler climate may use more energy to heat their home than a household living in a warm climate.

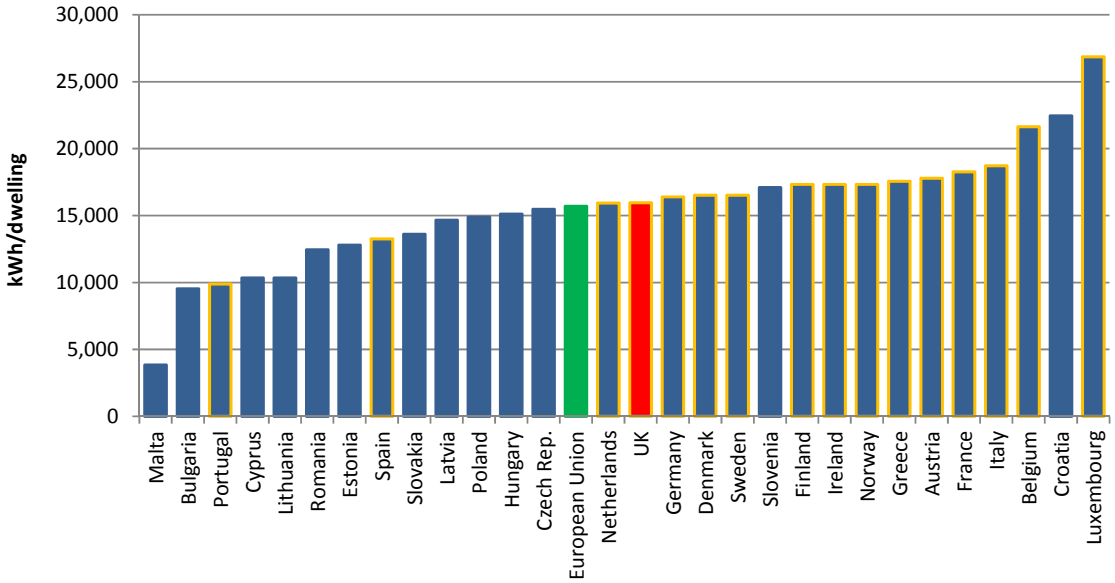
In 2014, UK average consumption per dwelling when adjusted to the EU climate[3] was 16,000 kWh per dwelling, 2 per cent higher than the EU average of 15,700 kWh per dwelling. In 2014, UK average consumption per dwelling was 5 per cent less than Germany and 13 per cent less than France after climate adjustment. Despite the climate adjustment the lowest consumers appear to favour southern European countries and non EU15 countries.

[1] www.odyssee-mure.eu/

[2] www.gov.uk/government/statistics/dukes-calorific-values

[3] Temperature correction of a country's energy consumption data adjusted for difference in temperature compared to the average EU climate.

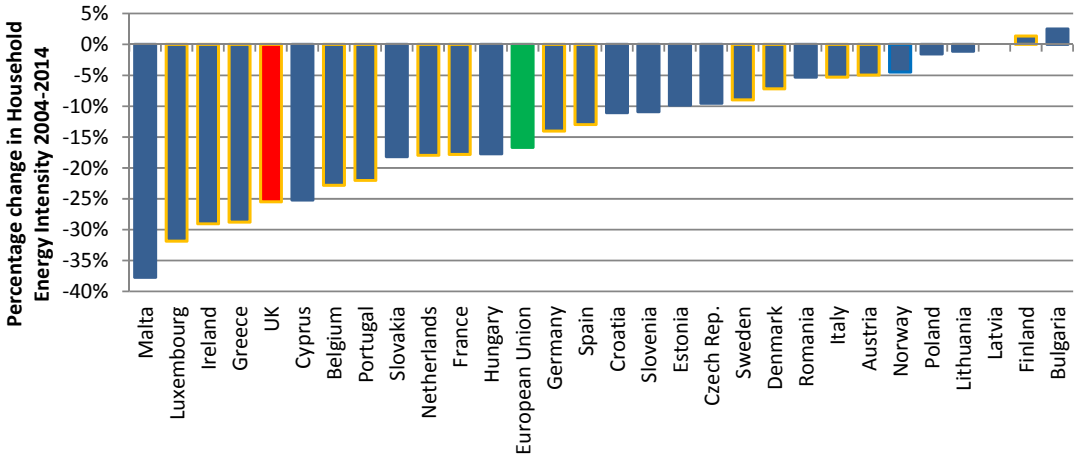
Chart 1: Domestic energy consumption per dwelling adjusted to the EU climate, 2014[4]



Source: ODYSSEE

Overall, UK energy consumption per dwelling after climate correction saw the fifth largest fall of 25 per cent between 2004 and 2014. By comparison, the EU average fell by 17 per cent over the same period, with energy consumption per dwelling falling in all EU countries except Bulgaria, Finland.

Chart 2: Change in domestic energy consumption per dwelling adjusted to the EU climate from 2004 to 2014[6]



Source: ODYSSEE

[4] Note: Data for Romania are from 2001-11, Malta from 2002-12 and Portugal from 2003-13.

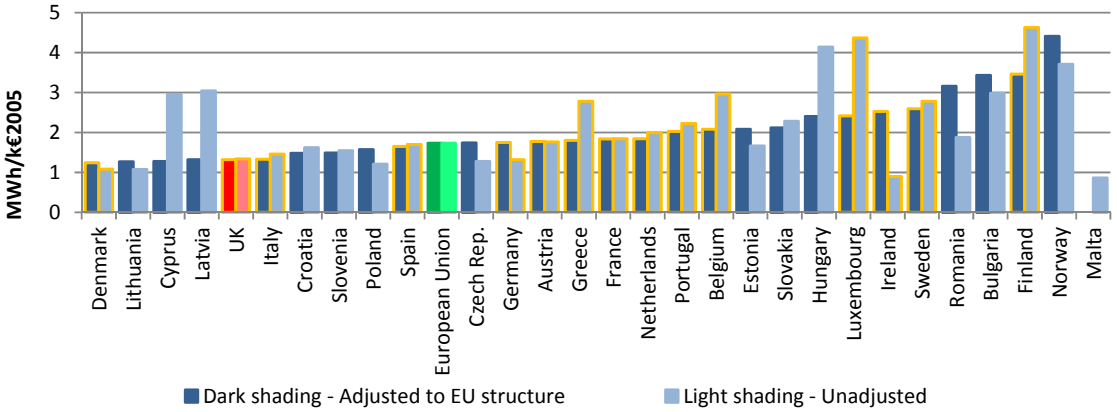
Manufacturing

Manufacturing intensity can either be measured relative to the gross value added (GVA) to the gross domestic product of the sector or to the amount of production.

The UK has the eighth lowest raw overall manufacturing intensity relative to GVA in Europe, 23 per cent below the EU average.[5,6]

A key issue in determining the energy intensity of manufacturing is the share of each manufacturing sub-sector within the industry of each country. In 2014, UK energy intensity was 1 per cent lower once adjusted to the EU standard share of each sub-sector, reflecting that the structure of UK manufacturing is slightly more energy intensive than the EU average. After adjusting for EU structure, the UK has the fifth lowest manufacturing energy intensity in Europe, 24 per cent below the EU average, 25 per cent less than Germany and 28 per cent less than France relative to gross value added.[5,6]

Chart 3: Manufacturing energy consumption per unit of GVA 2014 for unadjusted data and adjusted to EU structure (PPP adjusted).[7]



Source: ODYSSEE

Since 2004, UK manufacturing energy intensity has fallen by 23 per cent. When data are adjusted for EU structure, UK manufacturing intensity fell by 29 per cent. The EU as a whole has reduced its manufacturing energy intensity by 24 per cent in the same period, which is 5 percentage points worse than the UK after adjustments. Between 2004 and 2014, the GVA of the UK's manufacturing industry fell by 3 per cent[8], and in 2014 manufacturing only accounted for 10 per cent of the UK's GVA.[9]

[5] Purchasing power parity (PPP) is an alternative to using market exchange rates. The purchasing power of a currency refers to the quantity of the currency needed to purchase a given unit of a good, or common basket of goods and services.

[6] Data for manufacturing intensity at the EU structure has not been reported for Malta. Manufacturing intensity data adjusted at EU structure is calculated by taking actual sub-sectoral intensities of the country and the share of each branch in the value added of manufacturing of the EU. Data for Romania are for 2011, Malta, Luxembourg and Hungary for 2012 and Portugal for 2013.

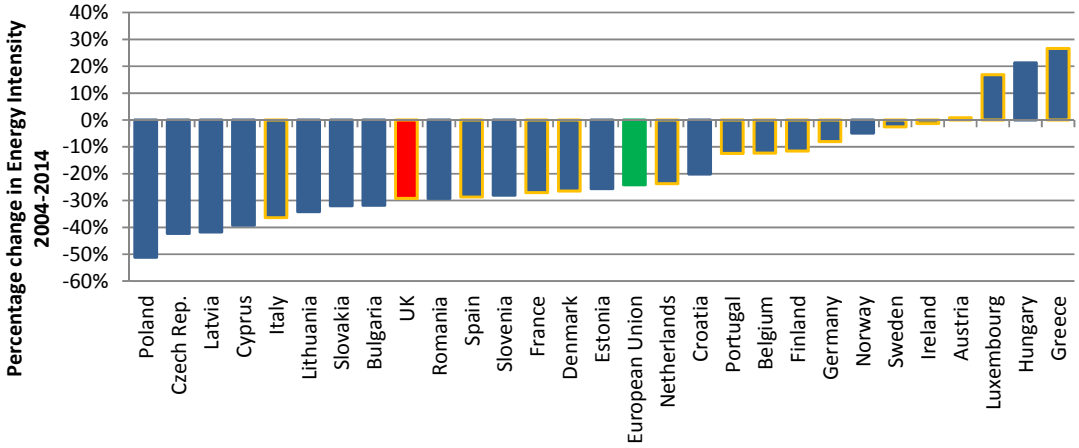
[7] Countries ordered by increasing EU structure adjusted intensity (dark blue).

[8] www.ons.gov.uk/file?uri=/economy/grossdomesticproductgdp/datasets/ukquarterlynationalaccountsdatatables/current/ukquarterlynationalaccountsdatatablesq32016.xls

[9] www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedincomeapproach

When the energy intensity of industry has been adjusted for EU structure the UK has made the ninth largest reduction in the EU, and the second largest reduction in manufacturing energy intensity out of countries in the EU 15 (Chart 4).

Chart 4: Change in manufacturing energy consumption per unit of GVA, 2004-2014 (PPP adjusted at EU structure).[10]



Source: ODYSSEE

While it is important to compare the broad indicator of manufacturing intensity, it is also interesting to compare relative efficiencies of manufacturing sub-sectors across countries. Care should be taken whilst making international comparisons of manufacturing because the type and quality of products produced varies between countries. For example in the steel industry, energy intensity will vary depending on the share of coke that is manufactured on-site compared to the share that is purchased.

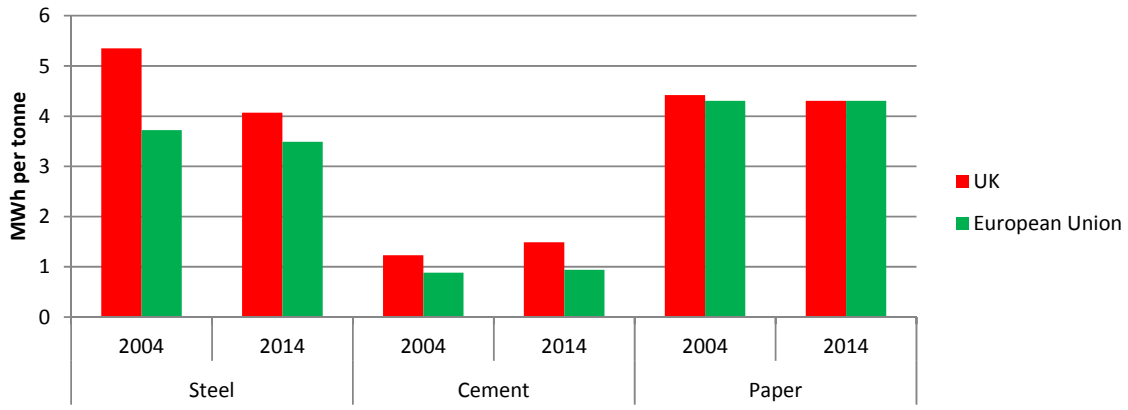
Energy intensity in the cement, steel and paper sectors are measured by energy consumption by physical output (tonnes). Using this measure for these energy intensive sectors the UK is generally shown to be more energy intensive than the EU as a whole.

In 2014, the UK was 58 per cent more energy intensive than the EU in cement and by 17 per cent in steel. There was no difference in the energy intensity of paper manufacturing between the UK and EU average. Between 2004 and 2014 the UK's energy intensity in cement increased by 21 per cent with an increase of 7 per cent across the EU as a whole. The UK's energy intensity in steel decreased by 24 per cent over the same time period and for paper manufacturing decreased by 3 per cent.

UK output of the cement sector fell 23 per cent between 2004 and 2014, whilst the paper sector fell 29 per cent and the steel sector rose 5 per cent over the same time period.

[10] Note: Manufacturing intensity data adjusted at EU structure is calculated by taking actual sub-sectoral intensities of the country and the share of each branch in the value added of manufacturing of the EU. Data for Romania are for 2011, Malta, Luxembourg and Hungary for 2012 and Portugal for 2013.

Chart 5: Energy intensity by manufacturing sector, UK and EU, 2004 and 2014



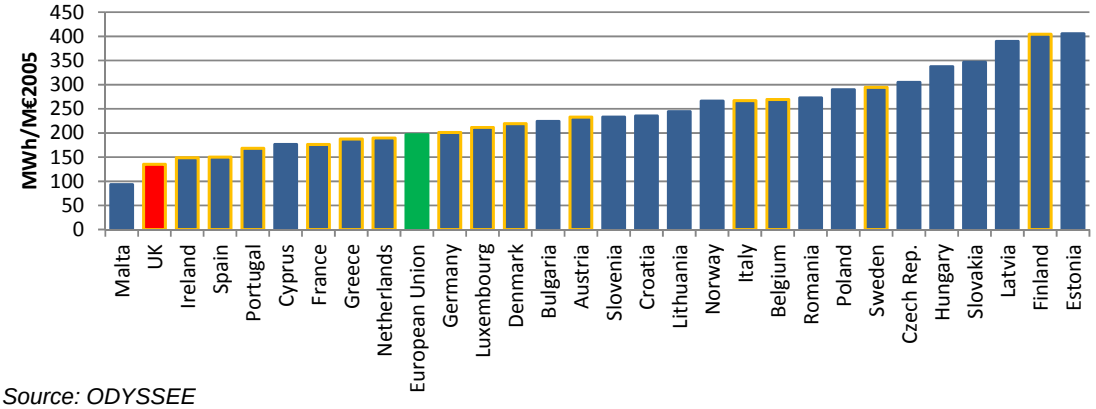
Source: ODYSSEE

Commercial and Public Sector Services

The UK has the second least energy intensive service sector in the EU as measured by energy consumption per unit of GVA, shown in Chart 6. The UK performs particularly well on this indicator due to the high-value professional services that generate high GVA for relatively low energy use. UK service sector energy consumption per unit of GVA on a climate and PPP adjusted basis was 31 per cent lower than the EU average, 23 per cent lower than France and 33 per cent lower than Germany in 2014. The UK service sector is the dominant sector of the UK economy, contributing 80 per cent of GDP output in 2014.[11]

Between 2004 and 2014, the UK's service sector energy consumption remained stable, but with an increase in GVA, intensity fell by 22 per cent compared to a fall of 9 per cent in the EU as a whole.

Chart 6: Service Sector energy consumption per unit of GVA, 2014 (Climate and PPP adjusted)[12]



Source: ODYSSEE

[11] www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedincomeapproach

[12] Note: Data for Romania are for 2011, Malta are 2012 and Sweden are 2013.

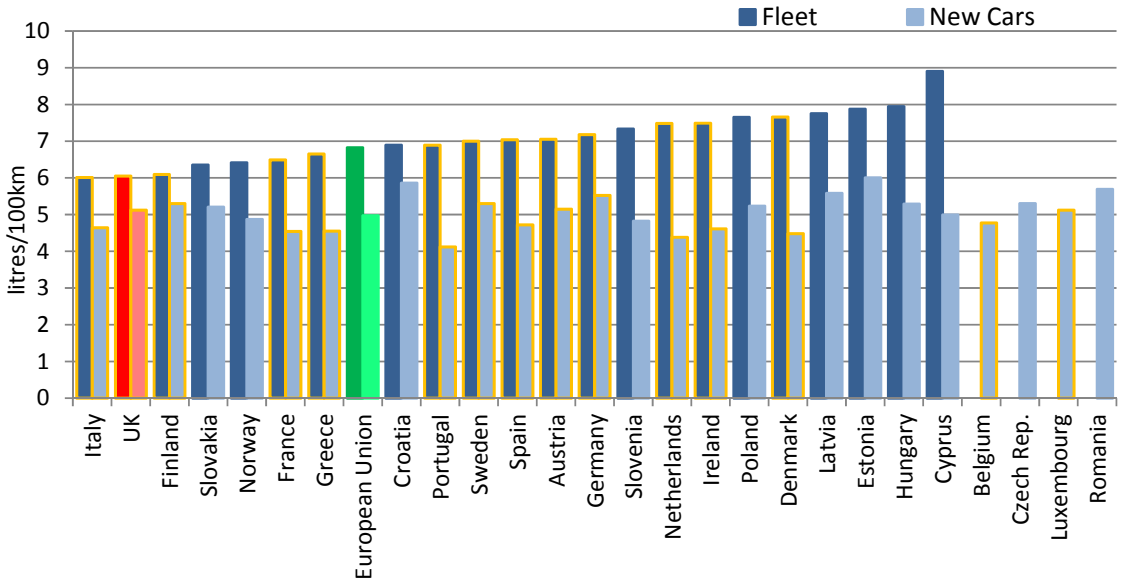
Transport

The energy efficiency of vehicles is measured by the amount of fuel needed to cover 100km. Newer vehicles tend to be more energy efficient, so new cars and the vehicle fleet as a whole are considered separately. For the vehicle fleet as a whole, the UK has the second lowest energy intensity of 6.05 litres/100km (equivalent to 47 miles per gallon), which is 11 per cent below the EU average[13]. The UK new car consumption rate is 5.12 litres/100km (equivalent to 55 miles per gallon), comparable to the EU average of 4.97 litre/100km. the data would imply that UK drivers have more energy intensive vehicles e.g. larger vehicles but a more modern fleet. In the UK the average age of cars since 1st registration was 7.9 years in 2014[14].

In the UK energy consumption for new cars decreased by 26 per cent between 2004 and 2014. For the car fleet as a whole consumption fell by 17 per cent, between 2003 and 2013. This is compared to an EU average of 23 per cent for new cars and 10 per cent for all cars.

Diesel is a more efficient fuel than petrol, and the share of the whole fleet in the UK propelled by diesel was 36 per cent in 2014, which is double the share from 2004.[15]

Chart 7: Specific consumption of litres/100 km for new cars and total fleet, 2014[16]



Source: ODYSSEE

The UK has the eighth lowest percentage share of public transport in total land passenger transport, accounting for 15 per cent of all traffic. This has increased 3 percentage points from 12 per cent in 2004. The EU average remained stable at 18 per cent of public transport in total land passenger from 2004 to 2014.

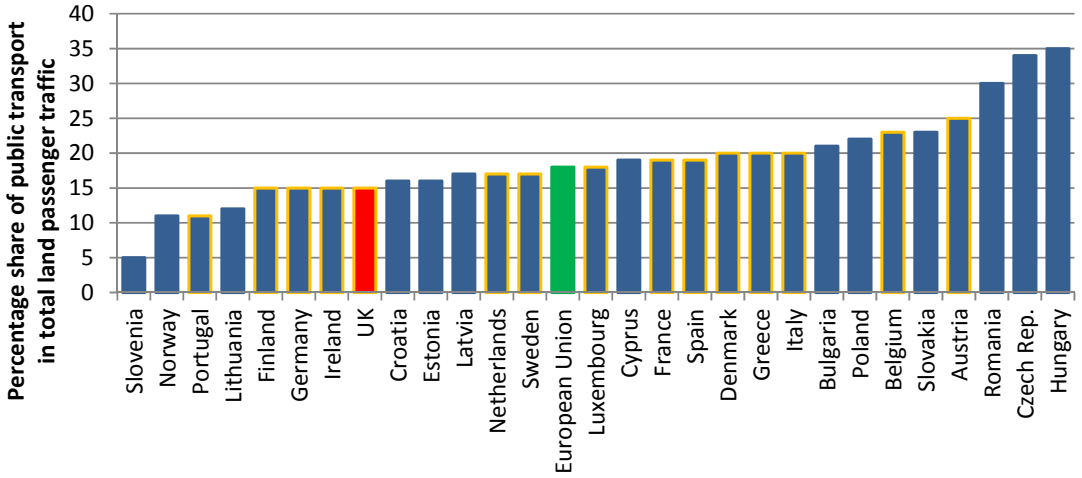
[13] UK figure is from 2013 for total fleet figures.

[14] Department for Transport Road Traffic Survey - www.gov.uk/government/uploads/system/uploads/attachment_data/file/184161/veh0211.xls

[15] Department for Transport Table VEH0203: www.gov.uk/government/uploads/system/uploads/attachment_data/file/301636/veh0203.xls

[16] Note: Data for total fleet consumption in the UK are for 2013, for Portugal and Finland data are for 2012, for Hungary and Slovakia data are for 2010. For new cars data for Romania are for 2011.

Chart 8: Percentage share of public transport in total land passenger transport, 2014[17]



Source: ODYSSEE

Conclusion

Energy consumption in the UK has reduced in each main sector over the 10 years between 2004 and 2014.

In the domestic sector, the UK was more energy intensive in 2014 than the EU average, but there has been a greater reduction in domestic energy intensity in the 10 years between 2004 and 2014 in the UK (26 per cent) compared to the EU (17 per cent).

After adjusting for structural changes within manufacturing, the UK energy intensity fell by 29 per cent from 2004 to 2014. The energy intensity of manufacturing in the cement sector has increased from 2004 to 2014, however the energy intensity of manufacturing in the steel sector reduced over the same time period, most likely due to the 5 per cent increase in output for this sector in the UK.

Improvements in energy intensity in the service sector have meant that while this sector has increased its GVA by 20 per cent between 2004 and 2014, energy intensity has been reduced by 22 per cent.

In transport, the intensity of the car fleet as a whole has reduced by 17 per cent in the UK compared to 10 per cent in the EU. In the UK the percentage of the fleet fuelled by diesel more than doubled between 2004 and 2014, and average time since first registration is just 7.9 years. Faster replacement of the car stock leads to a more energy efficient fleet, contributing to the fact that UK average energy consumption for the entire car fleet is the second lowest in the EU.

The UK compares favourably for energy intensity of the manufacturing and services sectors to countries such as Germany and France, which have similar climates and economic factors. In other sectors such as energy consumption in households and transport, UK energy intensities are at similar levels to France and Germany. Between 2004 and 2014 the UK saw larger reductions in energy intensities than both France and Germany in manufacturing, services and households.

[17] Note: Data for Belgium, Ireland and Slovakia are for 2013. Data for Portugal are for 2012.

For further information on International Energy Efficiency statistics, please contact:

Sam Rushbrook
BEIS
Tel: 0300 068 6131
E-mail: Sam.Rushbrook@beis.gov.uk

Stephen Oxley
BEIS
Tel: 0300 068 5025
E-mail: Stephen.Oxley@beis.gov.uk