DEPARTMENT OF ENERGY & CLIMATE CHANGE

Energy Efficiency Deployment Office

Energy Efficiency Deployment Office

Evidence Brief

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Introduction to EEDO

Just like any other resource fundamental to modern society, energy should be used as effectively as possible and, if this is achieved, the social, economic and environmental benefits can be significant. The remit of the Energy Efficiency Deployment Office (EEDO) is to facilitate greater energy efficiency in the future UK economy so we might realise these benefits.

Why energy efficiency matters

Energy costs are a significant input cost for the economy and greater energy efficiency can lead to greater energy productivity and, potentially, growth. This is especially true in the current economic climate where higher fossil fuel prices have put additional pressures on energy consumers, whether they are households or businesses. The less spent on meeting demand for energy services the more finance can be allocated to other priorities. In the case of households, this can boost disposable income and improve welfare.

Energy efficiency will also contribute to delivering our legally binding carbon targets [1], [2] and other associated environmental objectives, such as those for air quality and the deployment of renewables. A reduction in future demand would also have a positive on energy security given that the UK would become less reliant on imported fossil fuels. Furthermore, less overall demand will, in the long term, reduce the scale and cost of energy infrastructure and, therefore, the cost to the consumer.

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[1] Climate Change Act, 2008, http://www.legislation.gov.uk/ukpga/2008/27/contents

[2] The Carbon Plan: Delivering our low carbon future, DECC, December 2011, www.decc.gov.uk/en/content/cms/tackling/carbon_plan/carbon_plan.aspx

The Energy Efficiency Deployment Office

DECC’s 2011 Delivery Review announced that:

“A new office for national energy efficiency should be established within DECC to provide a wider energy efficiency strategy based on evidence and analysis, strong programme management and a joined up view of the offer to the customer.”

Formed as the Energy Efficiency Deployment Office (EEDO) this Directorate consists of a central strategy and delivery team alongside the analytical expertise of DECC’s climate change economists, consumer insight specialists and statisticians.

EEDO will continue to support the delivery of our existing energy efficiency policies by further developing our evidence base, ensuring effective delivery, and by bringing coherence of the Government’s ‘offer’ to the consumer. The Office will also develop a far-reaching energy efficiency strategy that will identify where there is further energy efficiency potential across the economy and develop a plan for delivering it.

We consider the key energy efficiency ‘sectors’ to be domestic, non-domestic buildings, industry, electricity generation, services (not including buildings), and transport. While we already have a good energy efficiency evidence base we aim to strengthen this by further developing our understanding of each of these sectors, identifying where we consider there is energy efficiency potential and collaborating with leading industry experts, colleagues across Government and in the Devolved Administrations to identify ways in which that potential can be realised. We published an eight week Call for Evidence on 8 February 2012 in support of this.

EEDO is at the centre of a new drive by Government to improve the way we use energy across the UK.

EEDO's objectives

EEDO’s high-level objectives are:

- to develop a national energy efficiency strategy;
- to be the centre of Government expertise on energy efficiency; and
- to support and challenge the development and delivery of major energy efficiency programmes across Government, ensuring a joined up 'offer' to the consumer.

Why an 'Evidence Brief?'

As EEDO improves the central evidence that it holds it will set out and update the information on our internet site. This will provide general access to the statistics that we have developed and help inform those interested in energy efficiency and its potential for the UK.

If you have any comments or thoughts on this initial contribution, please contact us at eedostrategy@decc.gsi.gov.uk.

Headline statistics

Ten Key Statistics [i]

Macro

1. UK energy consumption was at about the same levels in 1970 and 2010, but over this period GDP more than doubled. This means that energy intensity (energy consumption per unit of GDP) in the UK has halved since 1970.

2. Energy intensity of the UK economy in 2009 was 35 per cent below the EU average and 42 per cent below that of the United States, but 14 per cent higher than Japan. This indicates the UK is more energy efficient than the EU average and United States but not as energy efficient as Japan.

Households

3. Between 2000 and 2009, energy consumption per UK household fell by 17 per cent. This was mainly driven by a reduction in household consumption for space heating.

4. Had no improvements been made in home insulation and more efficient heating systems since 1970, household energy consumption would have almost doubled.

5. The average new home built in England requires about half as much energy per square meter as the average existing home.

6. Two thirds of the 2050 UK housing stock are expected to have been homes built before 2009.

Industry

7. Total industrial energy consumption fell by 56 per cent between 1970 and 2010. This was associated with a 67 per cent reduction in energy intensity over the same period. This was due to an average of 3 per cent reduction per annum in 1970s, 5 per cent in 1980s, 2 per cent in the 1990s and less than 1 per cent in the 2000s.

Services

8. Total service sector energy consumption was at about the same levels in 2010 and 1970. Energy intensity in the sector fell by 64 per cent between 1970 and 2010.

Transport

9. Energy consumption in the transport sector doubled between 1970 and 2010.

Energy Production

10. In 2010, 24 per cent of UK primary energy demand was lost through energy generation, transformation and distribution losses.

In order to gauge how energy efficient the UK economy is and to identify potential future savings, EEDO must draw upon a range of evidence

Energy Use

Energy use by sector

Figure: 1.1 UK final energy consumption by sector [3]

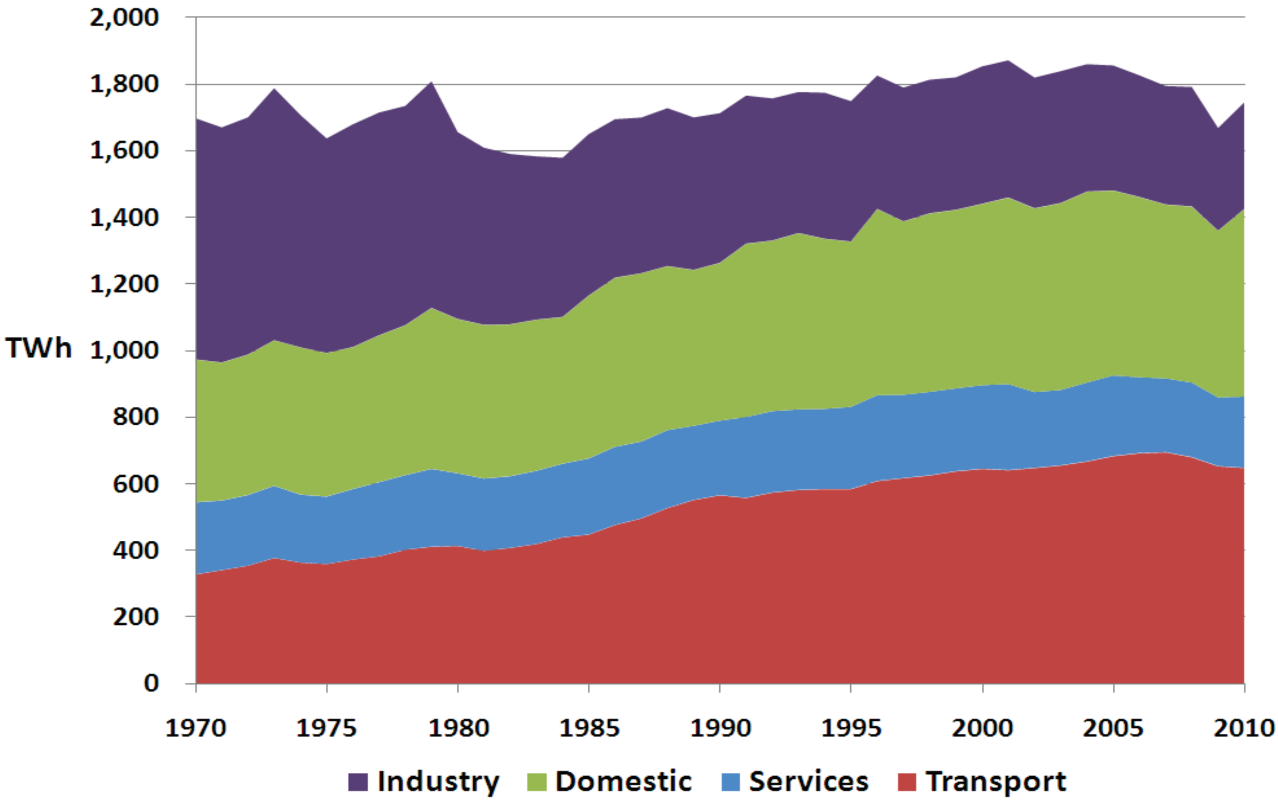

Figure 1.1. shows that UK final energy consumption was 3 per cent higher in 2010 than 1970.

Final consumption in industry was 56 per cent lower in 2010 than in 1970. Industry accounted for 18 per cent of final consumption in 2010 compared to 43 per cent in 1970.

Final consumption in the domestic sector was 31 per cent higher in 2010 than in 1970. The domestic sector accounted for 32 per cent of final consumption in 2010 compared with 25 per cent in 1970.

[3] DUKES table 1.1.5. Final energy consumption is defined as energy consumption by the final user, i.e. consumption which is not being used for transformation into other forms of energy.

Final consumption in the services sector was 1 per cent lower in 2010 than in 1970. The services sector accounted for 12 per cent of final consumption in 2010 compared with 13 per cent in 1970.

Final transport consumption in 2010 was double that in 1970. Transport accounted for 37 per cent of final consumption in 2010 compared to 19 per cent in 1970.

Energy use by fuel

Figure: 1.2 UK final energy consumption by energy source [4]

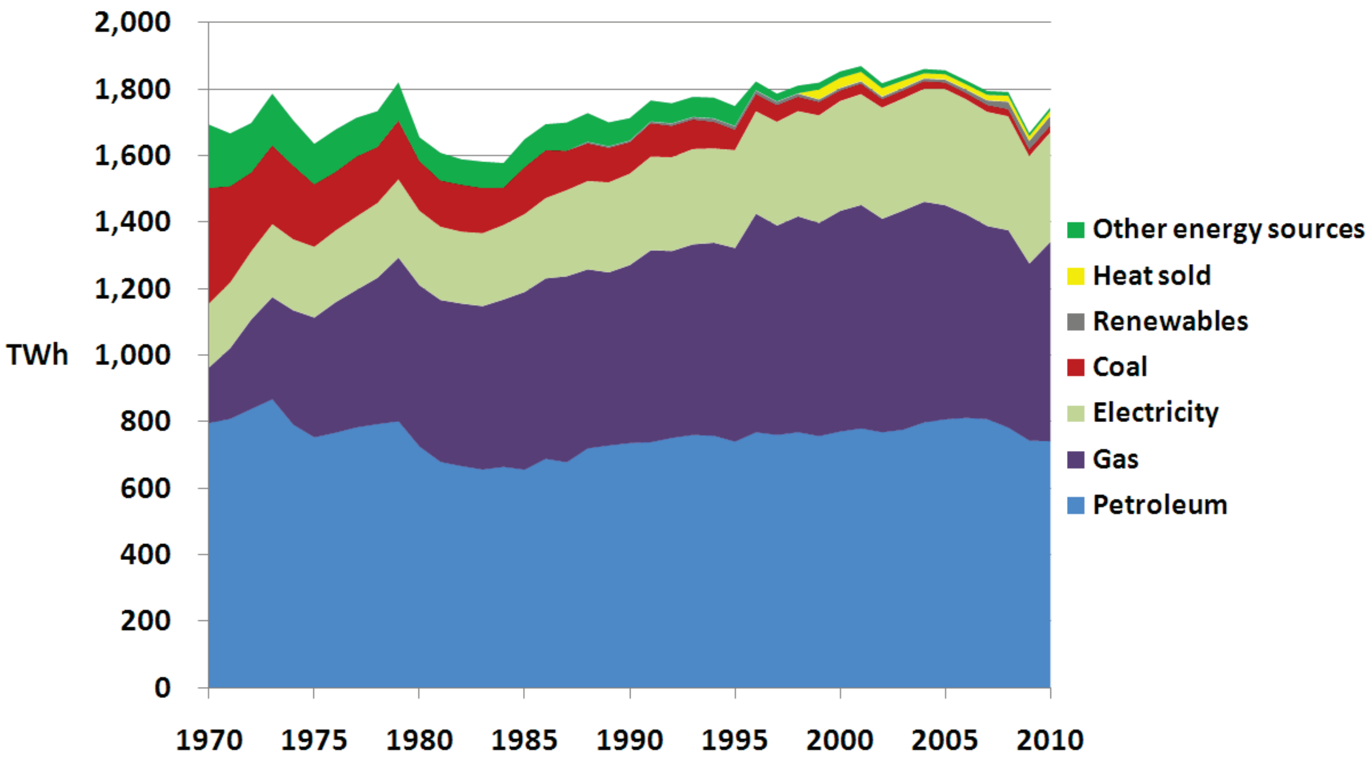

Figure 1.2 shows that use of petroleum accounted for 43 per cent of UK final energy consumption in 2010. The use of gas and electricity made up 34 and 19 per cent of final consumption respectively.

The final consumption of petroleum in 2010 was at a similar level to 1970.

The final consumption of gas in 2010 was about three times higher than in 1970.

The final consumption of electricity in 2010 was about 70 per cent higher than in 1970.

[4] DUKES table 1.1.5, gas consists of natural gas and town gas.

Energy use by fuel and sector

Figure: 1.3 UK final energy consumption by energy source and sector, 2010 [5]

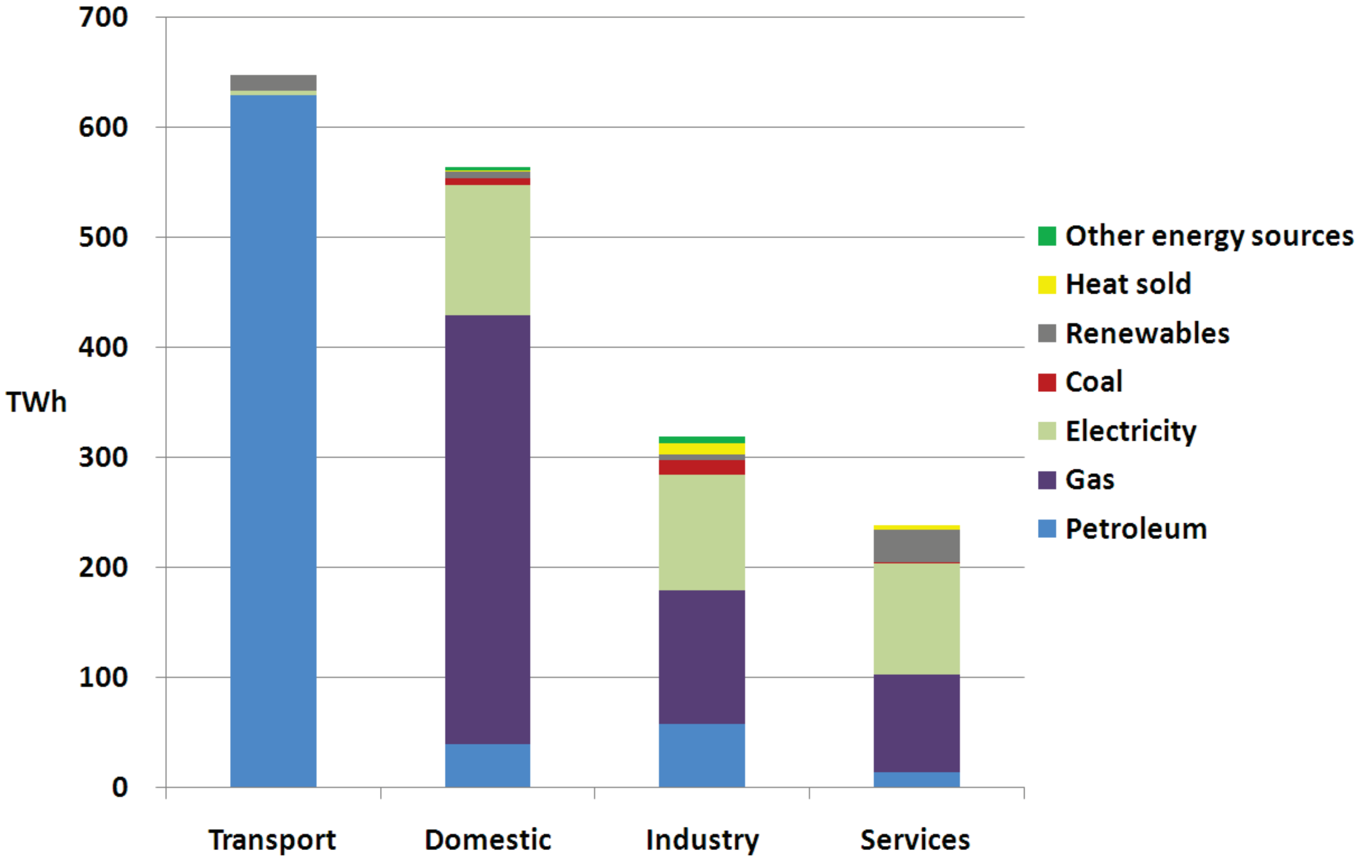

Figure 1.3 shows that in 2010 the transport sector final energy consumption was dominated by petroleum and accounted for 85 per cent of petroleum use.

The domestic, industry and services sectors used approximately equal amounts of electricity in 2010.

In 2010, the domestic, industry and services sectors accounted for 65, 20 and 15 per cent of gas use respectively.

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[5] DUKES table 1.1.5, gas consists of natural gas and town gas.

Energy use by application and sector

Figure: 1.4 UK final energy consumption by application, 2009 [6]

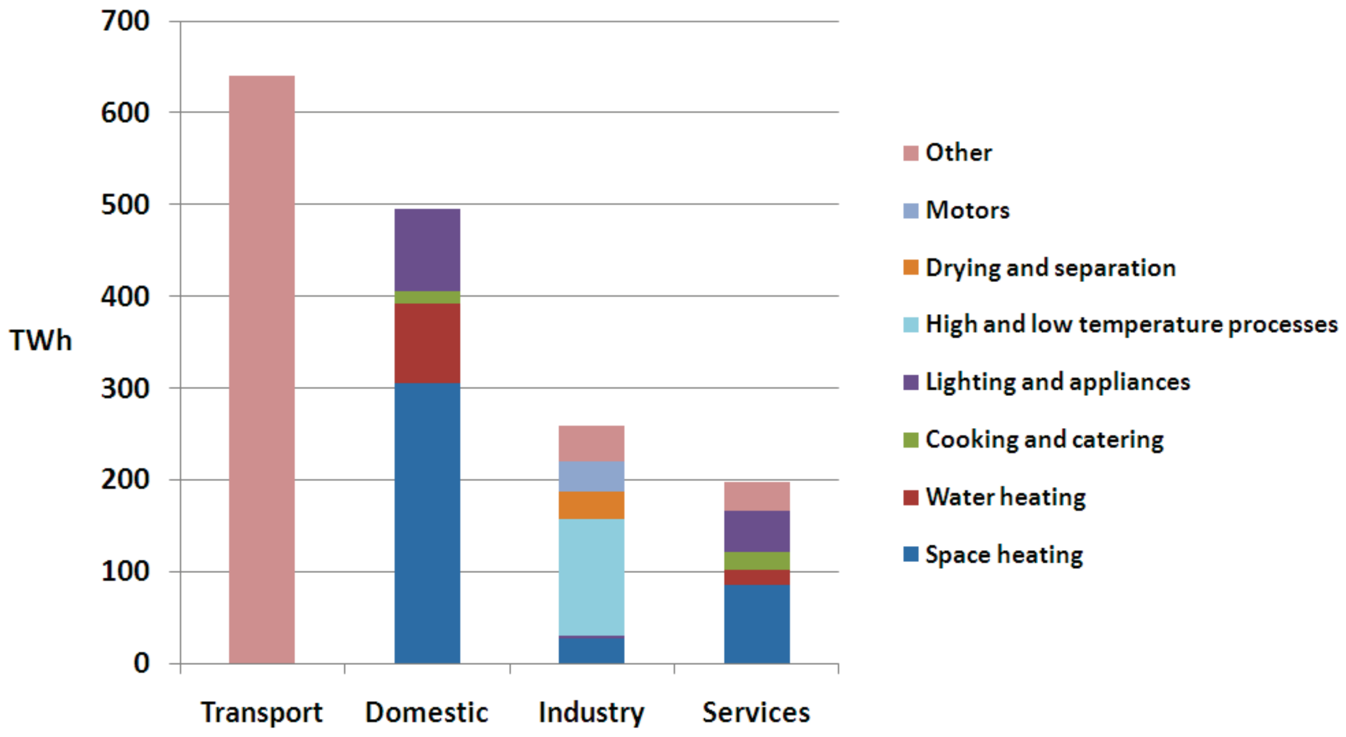

Figure 1.4 shows that in 2009, space heating accounted for 62 per cent of final energy consumption in the domestic sector and 43 per cent in the services sector.

High and low temperature processes accounted for 49 per cent of final consumption in industry in 2009. [7]

[6] ECUK table 1.14, based on BRE modelling. Final energy consumption by application in transport has not been modelled.

[7] Low temperature processes (which includes process heating and distillation in the chemicals sector; baking and separation processes in food and drink; pressing and drying processes in paper manufacture; and washing, scouring , dyeing and drying in the textiles industry) contributed towards 30 per cent of total energy consumption. High temperature processes (which include coke ovens, blast furnaces and other furnaces, kilns and glass tanks) contributed a further 19 per cent.

International Comparisons

Energy intensity – by GDP

Figure: 2.1 Primary energy consumption per unit of GDP, 2009 [8]

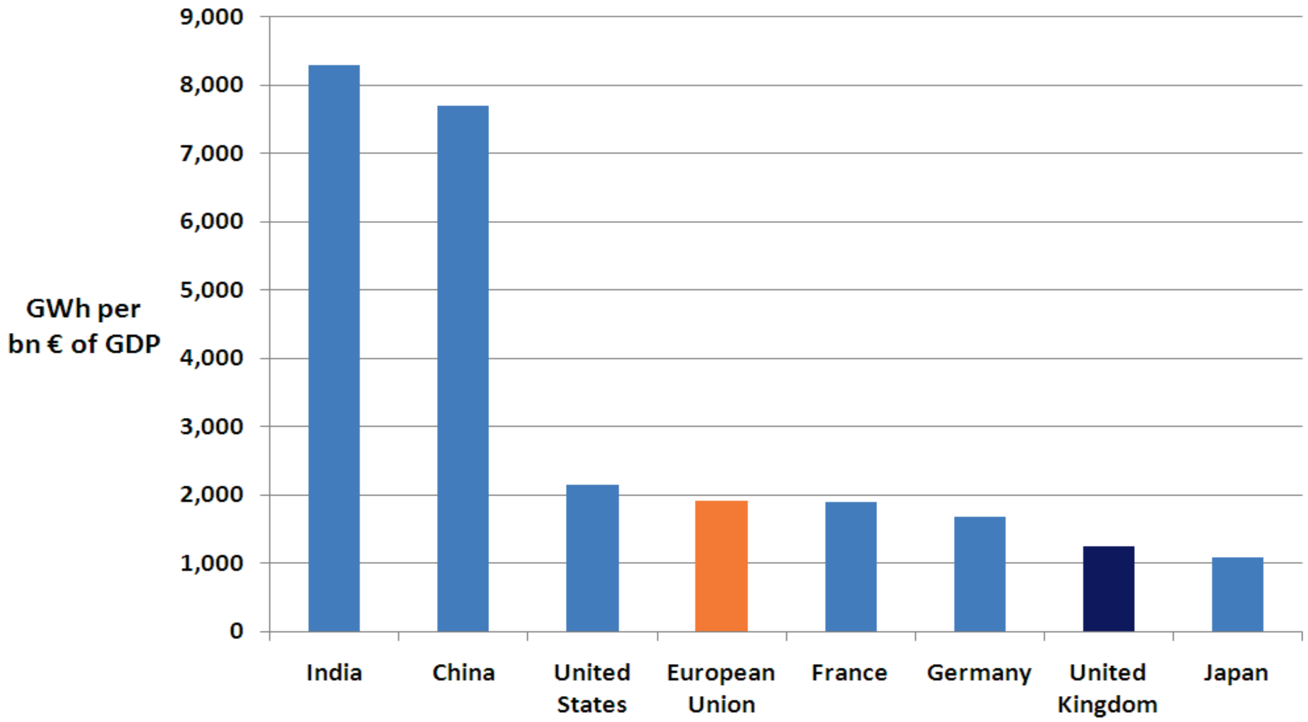

Figure 2.1 shows that in 2009, UK primary energy consumption per unit of GDP was less than Germany, France and the EU average consumption per unit of GDP.

In 2009, Japan had about double the primary consumption of the UK and three times the GDP.

China had about twelve times the primary consumption of the UK and double the GDP, whereas India had about three times the primary consumption of the UK and half the GDP.

[8] ODYSSEE and IEA indicators. The typical value of the euro in 2000 was used to compare GDP between countries.

Figure: 2.2 Primary energy consumption per unit of GDP, 1991-2009 [9]

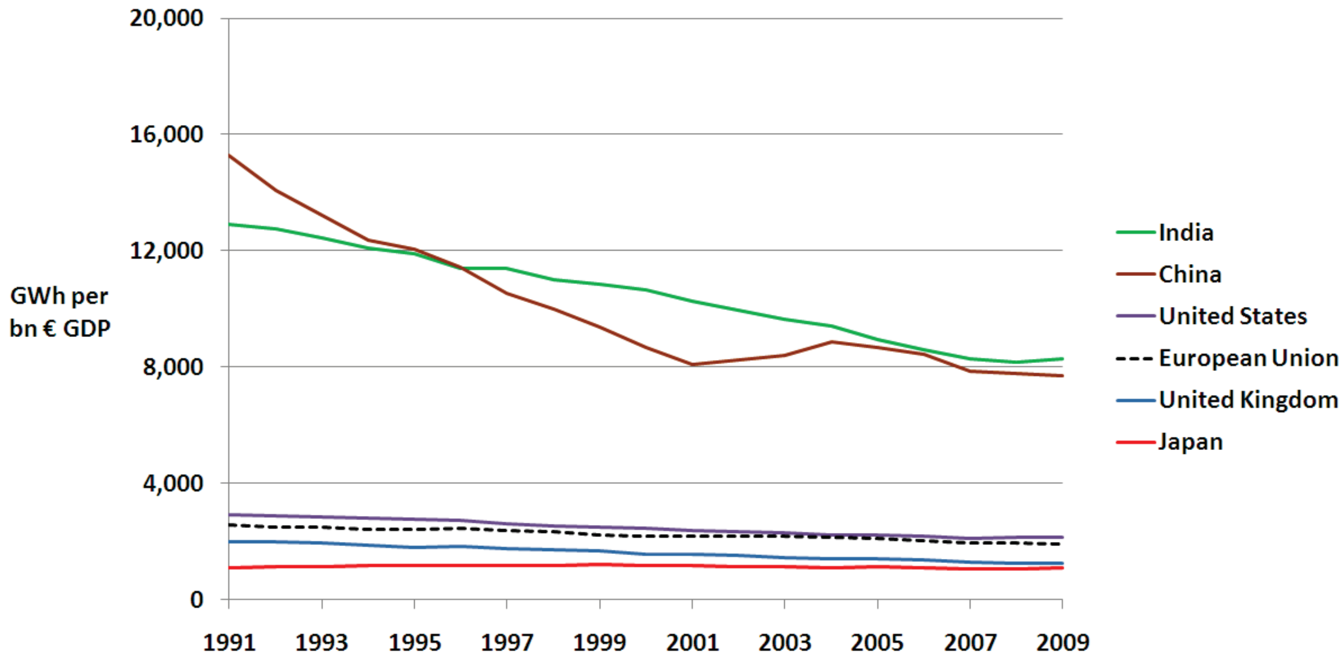

Figure 2.2 shows that UK primary energy consumption per unit of GDP was 38 per cent lower in 2009 than 1991.

Primary consumption per unit of GDP in China was half as much in 2009 than 1991, and in India it was 36 per cent lower in 2009 than 1991.

Primary energy consumption per unit of GDP was at about the same level in 2009 and 1991 for Japan, but over this period it fell by about 25 per cent for both the US and EU.

[9] ODYSSEE and IEA indicators. The typical value of the euro in 2000 was used to compare GDP between countries.

Energy intensity - by head of population

Figure: 2.3 Primary energy consumption per person, 2009 [10]

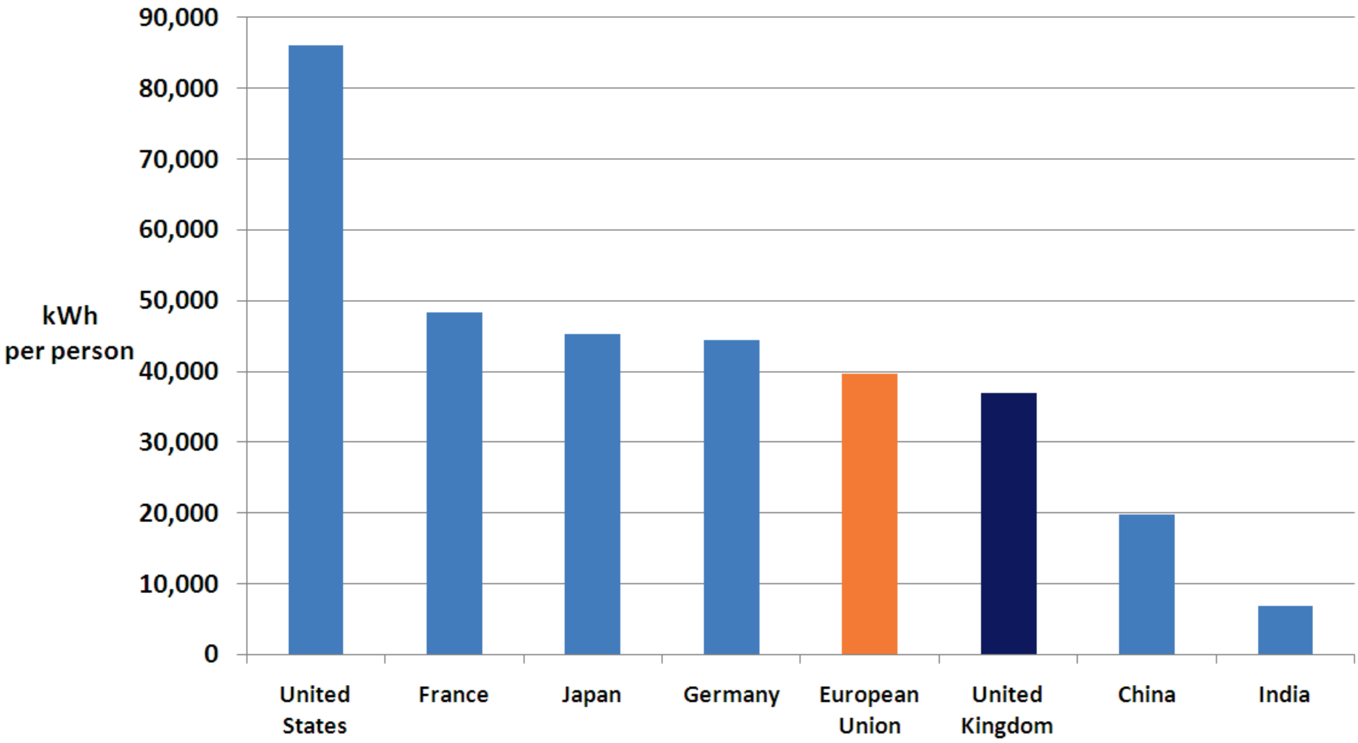

Figure 2.1 shows that in 2009, UK primary energy consumption per person was less than half US consumption per person and less than Germany, France and the EU average consumption per person.

In 2009 China had about 20 times the population of the UK and 12 times the primary consumption, whereas India had about 20 times the population of the UK and 3 times the primary consumption.

[10] ODYSSEE and IEA indicators.

Figure: 2.4 Primary energy consumption per person, 1995-2009 [11]

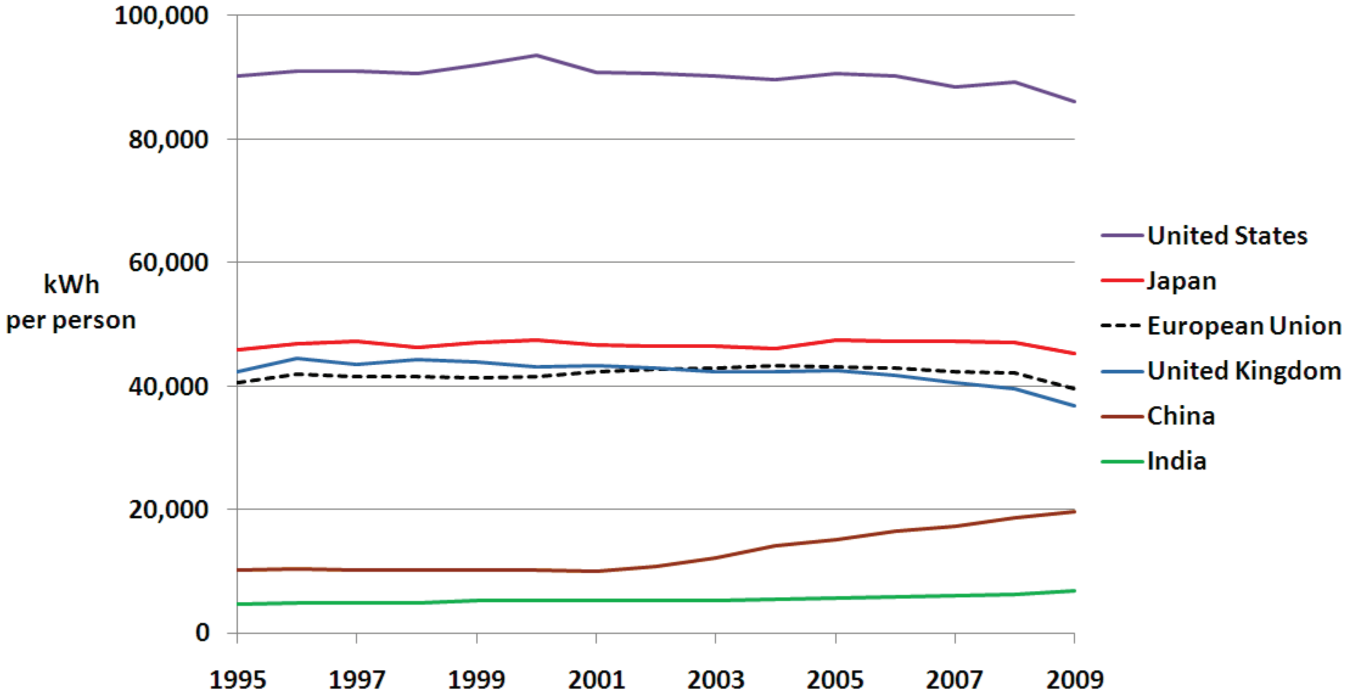

Figure 2.4 shows that UK primary energy consumption per person was about 10 per cent lower in 2009 than 1995.

Primary consumption per person in China was almost twice as high in 2009 than 1995, and in India it was about 40 per cent higher in 2009 than 1995.

Primary energy consumption per person was at about the same level in 2009 and 1995 for the US, the EU and Japan.

[11] ODYSSEE and IEA indicators.

EU - Energy consumption per household

Figure: 2.5 Household energy consumption per occupied dwelling, climate adjusted, 2008 [12]

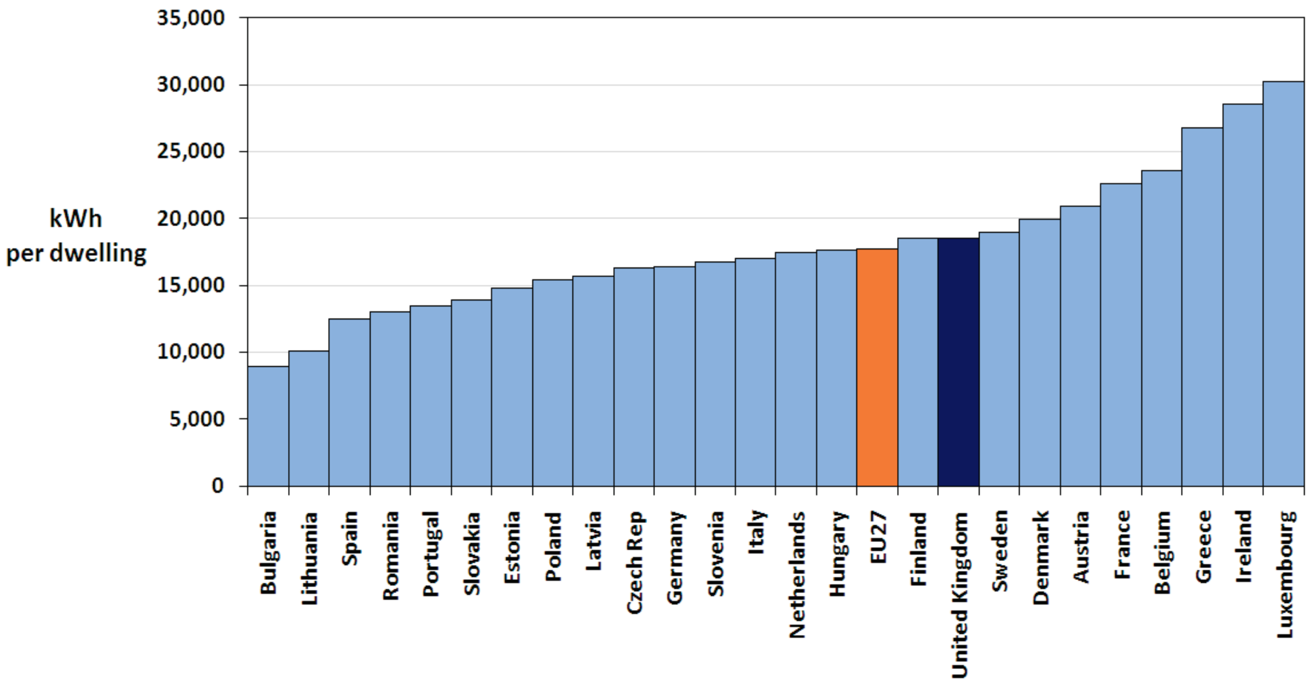

Figure 2.5 shows that once climate adjustment is taken into account, UK consumption per occupied dwelling is 5 per cent higher than the EU average.

The order of the countries in chart 2.5 is highly correlated with the GDP per capita of the country. [13] Countries with lower GDP per capita have lower household energy consumption on a climate corrected basis. Out of the 10 countries with lowest consumption per household, 9 of these have GDP per capita in 2008 below €20,000. The EU27 average was over €25,000.

[12] European Energy Efficiency - Analysis of ODYSSEE Indicators
http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/en_effic_stats/en_effic_stats.aspx

To enable better comparisons to be made between countries an additional indicator is used of consumption that has been adjusted to the average EU climate, based on the requirement for space heating in each country, based in turn on the national climate of each country. Unless stated otherwise, consumption figures are not climate adjusted.

[13] epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/

Energy efficiency potential

Domestic

Table: 1.1 Home insulation levels and impact in Great Britain, October 2011 [14]

<table>
<tr><th>Domestic Energy Efficiency Measures</th><th>Percentage of Households with Measure Installed (GB)</th><th>Energy Savings per household per annum (kWh)</th><th>Estimated Bill Savings per household per annum (£)</th></tr>
<tr><td>Cavity Wall Insulation</td><td>59</td><td>2,320</td><td>100</td></tr>
<tr><td>Loft Insulation (from 100mm)</td><td rowspan="2">59
(at least 125mm)</td><td>420</td><td>20</td></tr>
<tr><td>Loft Insulation (from empty)</td><td>2,880</td><td>130</td></tr>
</table>

Table 1.1 shows that in October 2011, 41% of households in Great Britain with cavity walls did not have them insulated.

If all these households had cavity wall insulation installed, this would save enough energy to meet the needs of about a quarter of households in London per year (about 830,000 households), saving about £83m in consumer gas bills.

In October 2011, only 1 per cent of households in Great Britain with solid walls had solid wall insulation.

[14] Statistical Release: Estimates of home insulation levels in Great Britain - October 2011

Savings estimated from National Energy Efficiency Data-framework (NEED) and BRE modelling. http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/en_effic_stats/en_effic_stats.aspx

Level of insulation applies to percentage of households suitable for measure in question and savings expressed are median savings. Measures for installing loft insulation apply to installing or topping up to a depth of 270mm.

Figure: 3.1 Energy saving effect energy efficiency measures in UK homes [15]

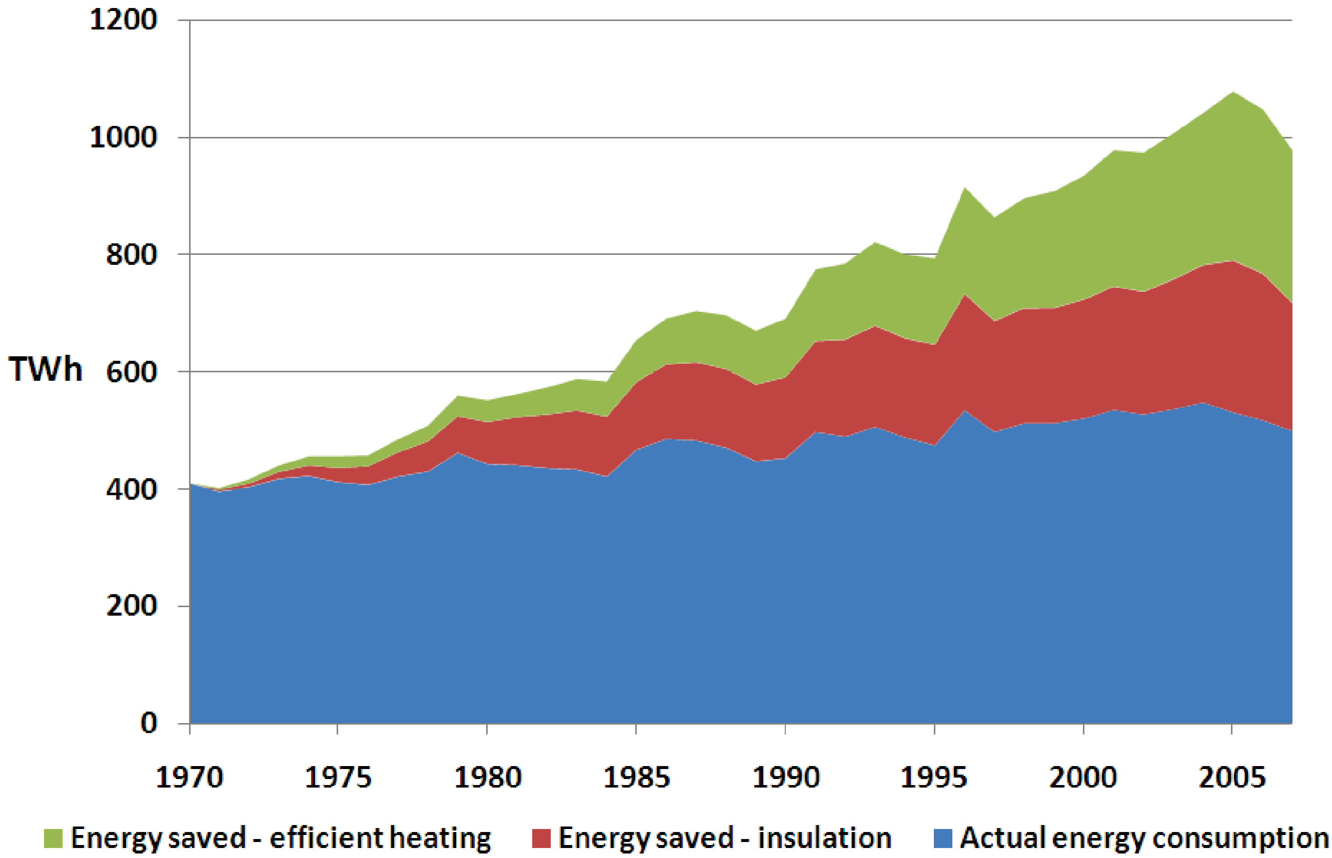

Figure 3.1 shows that UK household energy consumption increased by 22 per cent between 1970 and 2007. The Building Research Establishment (BRE) model estimates that if no new insulation and no new efficient heating measures had been installed since 1970, it would have almost doubled.

[15] ECUK table 3.18, based on BRE modelling.

Energy losses in generation

Figure: 3.2 UK primary energy demand 2010 [16]

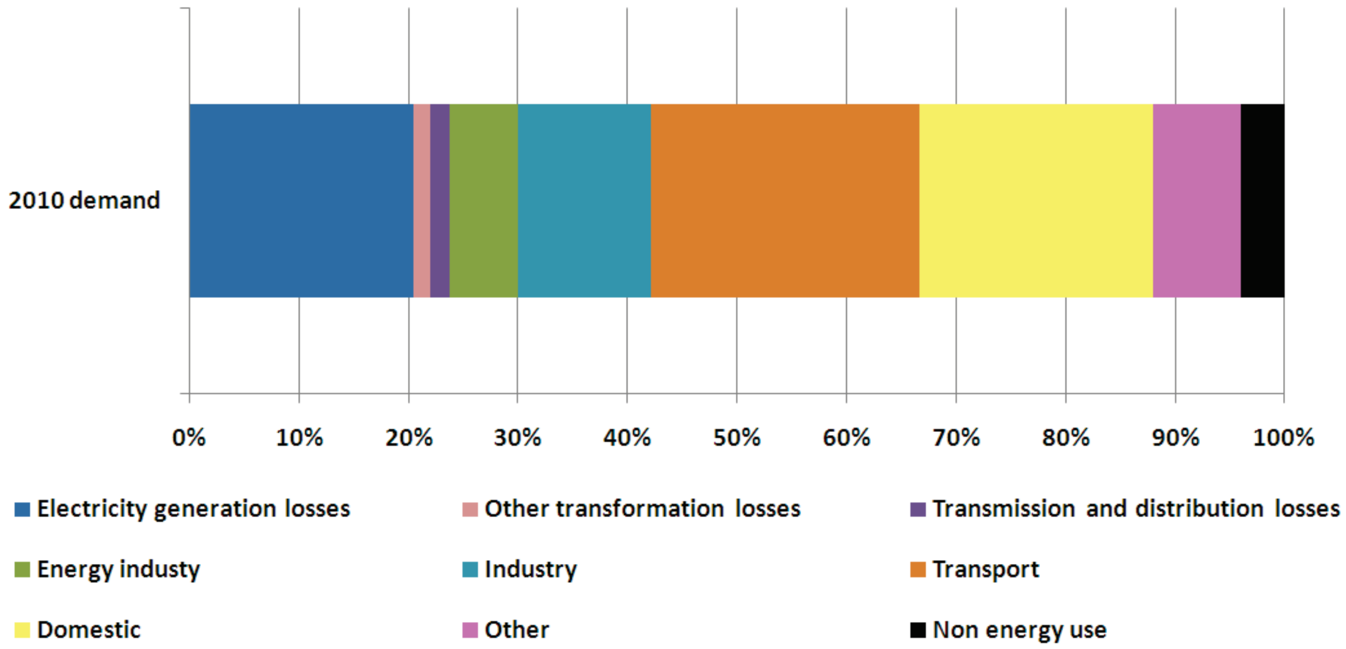

Figure 3.2 shows that 24 per cent of primary energy demand was lost through electricity generation, other transformation, and transmission and distribution losses in 2010.[17]

This is similar to all the energy used by homes in the UK in one year, or equivalently, more than ten times the electricity produced by all UK nuclear power plants in 2010.[18]

[16] DUKES table 1.1

[17] Electricity generation losses are the losses involved with transforming a primary energy source (such as natural gas) into electricity. Other transformation losses cover the losses associated with transforming a primary energy source into another energy source (not electricity, e.g. processing crude oil to produce petrol). Electricity and gas have transmission and distribution losses.

[18] DUKES table 5.1

Definitions and indicators

The Energy Efficiency Deployment Office (EEDO) has a remit to consider and analyse energy efficiency across the UK economy. Fundamental to the success of this is to define what we mean by energy efficiency and how this can be measured.

Definitions

Efficiency is the relationship between inputs and outputs. Energy efficiency on a technical level is the relationship between the energy consumed and the output produced by that energy, often called “energy services”, for example the number of miles travelled for a gallon of fuel. Increasing energy efficiency means using either less energy to get the same level of energy services, or using the same energy to get a higher level of energy services

The total amount of energy services enjoyed can be proxied by the size of the economy, measured in GDP. Reductions in the energy intensity of the economy suggest an improvement in energy efficiency. However, this measure is imperfect because changes to the structure of the economy (for instance de-industrialisation) can also serve to reduce energy intensity but do not reflect improvements in energy efficiency. Therefore **looking at micro-indicators of energy efficiency within individual sectors of the economy** provides additional insights.

The **energy intensity** of the energy sector is ratio of primary to final energy consumption. Energy intensity in the industrial and services sector can be measured by the ratio of energy inputs to economic output to, and in the transport sector by a measure of distance travelled to energy consumed.

In the domestic sector, the benefit produced by energy is the measured not by units of output, but in the benefit that is received from the energy in enabling activity, which is modelled by energy services. Household energy intensity is the relationship between household income and energy services.

Energy efficiency indicators

DECC's Energy Sector Indicators [19] publication provides a range of indicators with a chapter specifically on energy use and efficiency.

Whole economy efficiency

Figure 4.1: Primary and final energy consumption [20], [21], GDP and energy intensity

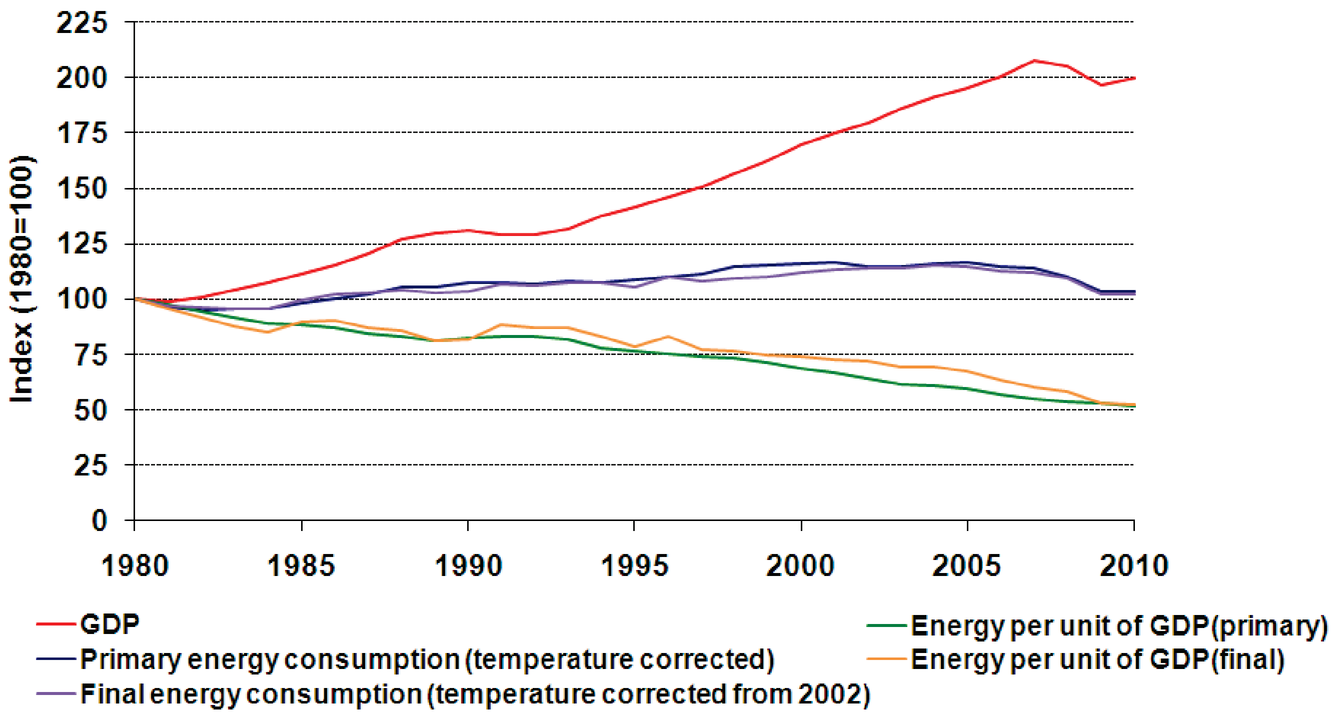

Figure 4.1 shows that following the recent recession, both primary and final energy consumption are at a similar level in 2010 as in 1980 and that over the same period GDP has doubled, so that energy intensity (energy per unit of GDP) has halved.

[19] www.decc.gov.uk/en/content/cms/statistics/publications/indicators/indicators.aspx

[20] Energy consumption data has been weather corrected from 2002 onwards.

[21] Excludes energy used for non-energy purposes (e.g. lubricants)

Energy efficiency by sector

An alternative method of measuring energy efficiency is energy intensity – the energy used per unit of activity. This is effectively the inverse of energy productivity. Figure 4.2 shows the trends energy intensity indicators for the main UK final energy sectors.

Figure: 4.2 Energy Intensity Indicators by sector[22]

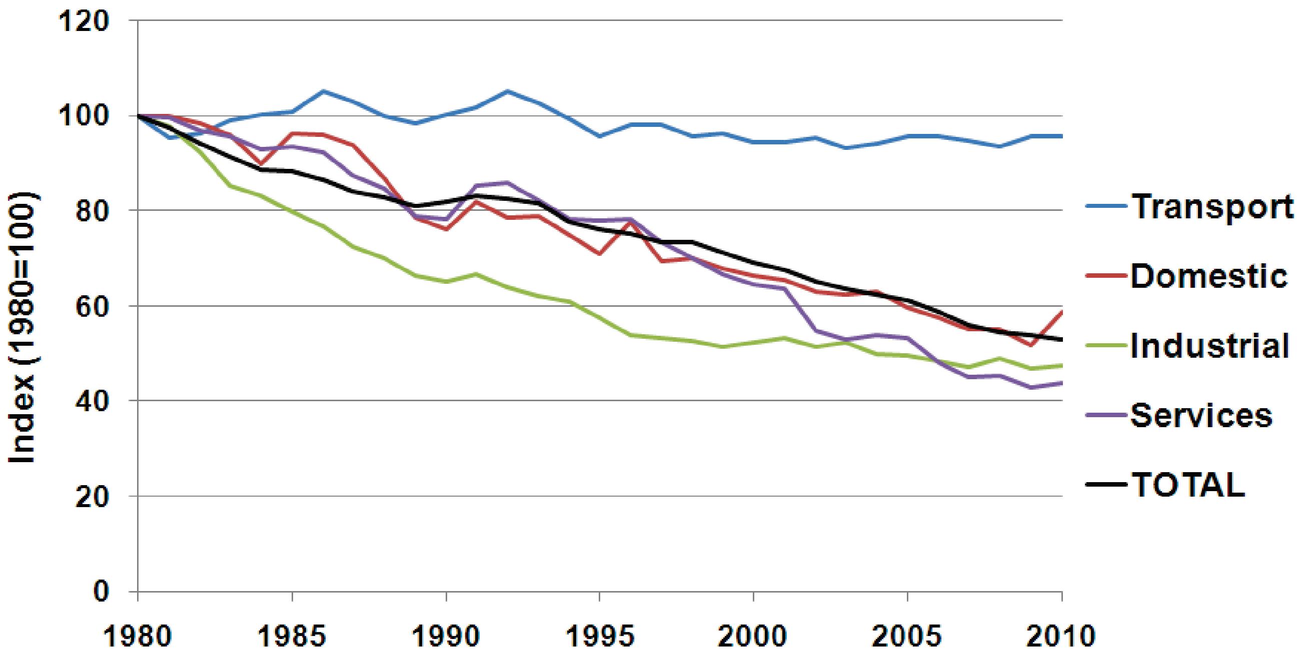

Figure 4.2 shows that the energy intensity of the UK economy has fallen by 47 per cent between 1980 and 2010.

The services sector has shown the greatest reduction in energy intensity over this period (56 per cent) closely followed by industry (52 per cent) which made significant progress during the 1980s.

Domestic energy intensity has closely followed the total and fluctuates due to short term effects such as temperature.

The energy intensity of transport has fallen by just 4 per cent between 1980 and 2010.

[22] ECUK table 1.12. TOTAL - final energy consumption per GDP, Transport energy consumption per passenger km and per tonne-km of freight, Domestic energy consumption per real household disposable income, Industrial energy consumption per unit of output & Services energy consumption per GVA.

Domestic energy efficiency

Figure 4.3 Domestic energy consumption, consumption per household and energy service demand

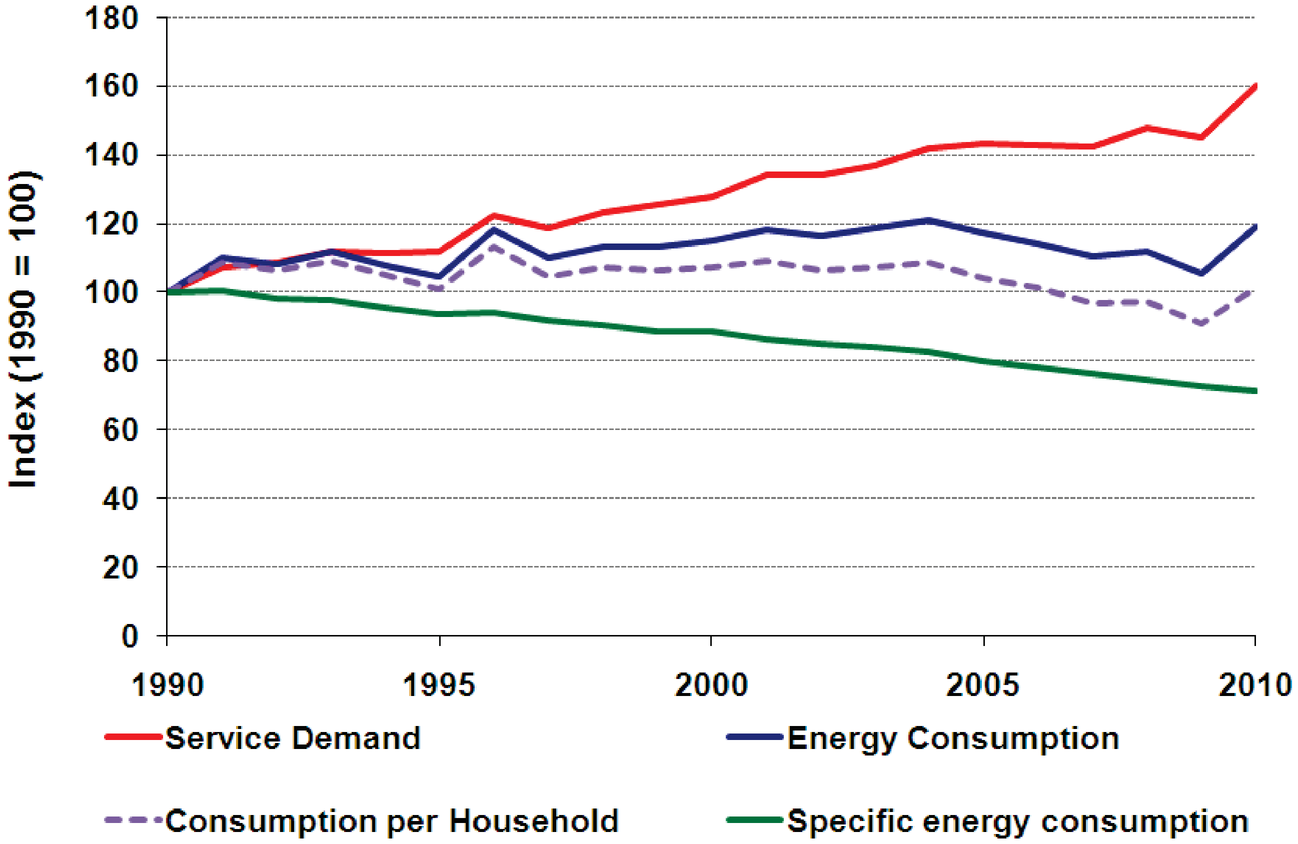

Figure 4.3 shows that energy consumption per household has been broadly flat between 1990 and 2004 but then fell until 2009. Energy consumption per household was 11 per cent higher in 2010 compared to 2009 partly due to the cold weather in 2010.

Service demand [23] is an indicator which captures the benefits of energy use. The indicator models energy usage, which is affected by external and internal temperatures achieved and the number of households. Additional output from lighting and appliances will also increase service demand.

Specific energy consumption is defined as service demand per unit of energy consumption. It gives a very good indication of technical energy efficiency and accounts for improvements in building standards, the efficiency of heating systems, lights and appliances.

While service demand is modelled to have risen by 60 per cent since 1990, energy consumption has only risen by 19 per cent, driving a reduction in specific energy consumption of nearly 30 per cent.

[23] Energy service demand has been modelled by the Building Research Establishment (BRE).

The impact of energy efficiency policies

Each year DECC publishes updated energy projections (UEPs), analysing and projecting future energy use and greenhouse gas emissions in the UK. These projections are used to inform energy policy and associated analytical work across government departments. The impact in terms of carbon dioxide equivalent is available in Annex G of the latest energy and emissions projections.[24]

Further Policy Development

EEDO's work will be conducted within the context of those mechanisms that are already in place, or are being implemented, and how they align with the barriers that have been identified. Any further action by Government to encourage energy efficiency within the economy will need to account for these existing mechanisms, avoid unnecessary complexity, and comply with the principles of better regulation.

[24] www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx

[i] References for Ten Key Statistics

1. Digest of UK Energy Statistics (DUKES) table 1.1.4
www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/total/total.aspx

Macro energy intensity is defined as unit of primary energy consumption per unit of GDP. Primary energy consumption is defined as the consumption of primary energy sources, i.e. sources which are not created through the transformation of other energy sources.

Here primary energy consumption has been temperature corrected. The temperature corrected series indicates what annual consumption might have been if the average temperature during the year had been the same as the average for the years 1971 to 2000. Unless stated otherwise, consumption figures are not temperature corrected.

2. ODYSEE and International Energy Agency (IEA) indicators.

ODYSSEE is part of a project coordinated by French Environment and Energy Management Agency (ADEME) and supported under the Intelligent Energy Europe Programme of the European Commission. This project gathers representatives such as energy Agencies from the 27 EU Member States and it aims at monitoring energy efficiency trends and policy measures in Europe.

3. ODYSSEE indicators. Climate adjusted (see footnote 12 for definition of climate adjusted).

Energy Consumption in the UK (ECUK) table 3.7.

4. ECUK table 3.18, based on Building Research Establishment (BRE) modelling.
http://www.decc.gov.uk/en/content/cms/statistics/publications/ecuk/ecuk.aspx

5. The average energy efficiency rating for new homes built in England is on the border of Energy Performance Certificate (EPC) band B and band C compared to the average home which is band E

http://www.communities.gov.uk/publications/corporate/statistics/codesustainablesapq32011

English Housing Survey 2009:
http://www.communities.gov.uk/housing/housingresearch/housingsurveys/englishhousingsurvey/

6. 2009 Low Carbon Transition Plan (DECC), modelled.

http://www.decc.gov.uk/assets/decc/white%20papers/uk%20low%20carbon%20transition%20plan%20wp09/1_20090724153238_e_@@_lowcarbontransitionplan.pdf

7. DUKES table 1.1.5.

ECUK table 4.5. Energy intensity in industry is defined as energy consumption per unit of production.

8. DUKES table 1.1.5

ECUK table 5.4a. Energy intensity in services is defined as energy consumption per unit of Gross Value Added.

9. DUKES table 1.1.5

10. DUKES table 1.1

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