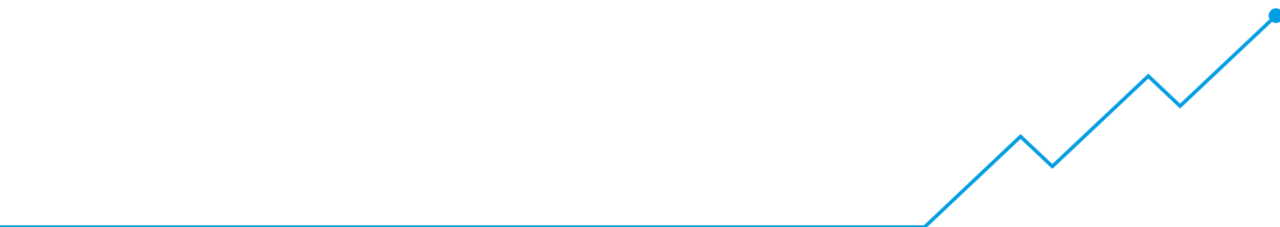




Department for  
Business, Energy  
& Industrial Strategy

# ENERGY CONSUMPTION IN THE UK



July 2016

# Energy Consumption in the UK (2016)

Overall energy consumption in the UK since 1970

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# Introduction

## Background

This report provides an overview of the trends and some key drivers that have influenced energy consumption in the UK since 1970. Analysis is based on the data presented as part of this publication.

There are five sections in this report which focus on the following key sectors; Overall Energy, Transport, Domestic, Industry, and services. There is also a set of tables providing the data on which the report is based. This includes a title page with a list of tables and a summary showing how this year's table numbers compare to those used in the 2015 publication. Some of the tables have been discontinued as they are published by other government departments and others have been combined into one table to reduce the number of tables to be navigated. Where tables have been discontinued, links have been included to the relevant source

There is also a separate user guide which includes an overview of the content of each sector and an explanation of technical concepts, and vocabulary. .

The user guide can be found from the following link;

<https://www.gov.uk/government/statistics/energy-consumption-in-the-uk>

### Key terms

- **Final energy consumption (end use)** – this refers to energy consumed by final end users after transformation, as opposed to primary energy consumption which is energy in its original state.
- **Primary energy equivalents** - this is the amount of the fuel used directly for consumption in a sector prior to any loss of energy via conversion or transformation process. Therefore, the primary energy equivalent estimates will include any losses incurred during the transformation process and energy used by the energy industry, and will be larger than final energy consumption estimates.
- **Non-energy use** – this category includes the consumption of petroleum, natural gas and manufactured fuels which have not been used directly to provide energy and are therefore excluded from this analysis. This category includes use for chemical feedstock, solvents, lubricants and road making material.
- **Tonne of oil equivalent (toe)** – this is a common unit of energy measurement which enables different fuels to be directly compared and aggregated. One tonne of oil equivalent represents the energy generated by burning one metric tonne of crude oil. Quantities in this report are generally quoted in thousand tonnes of oil equivalent (ktoe).
- **Temperature corrected consumption** – this measures energy consumption adjusted to remove the impact of temperature variations year on year to identify underlying trends. Details of the methodology used to calculate this can be found in the June 2011 and September 2011 editions of Energy Trends;  
<http://webarchive.nationalarchives.gov.uk/20130109092117/http://www.decc.gov.uk/en/content/cms/statistics/publications/trends/trends.aspx>
- **Energy intensity** – the amount of energy required to produce one unit of output. A reduction in intensity could imply an improvement in energy efficiency.

# Overall Energy

## Overall Final Energy Consumption

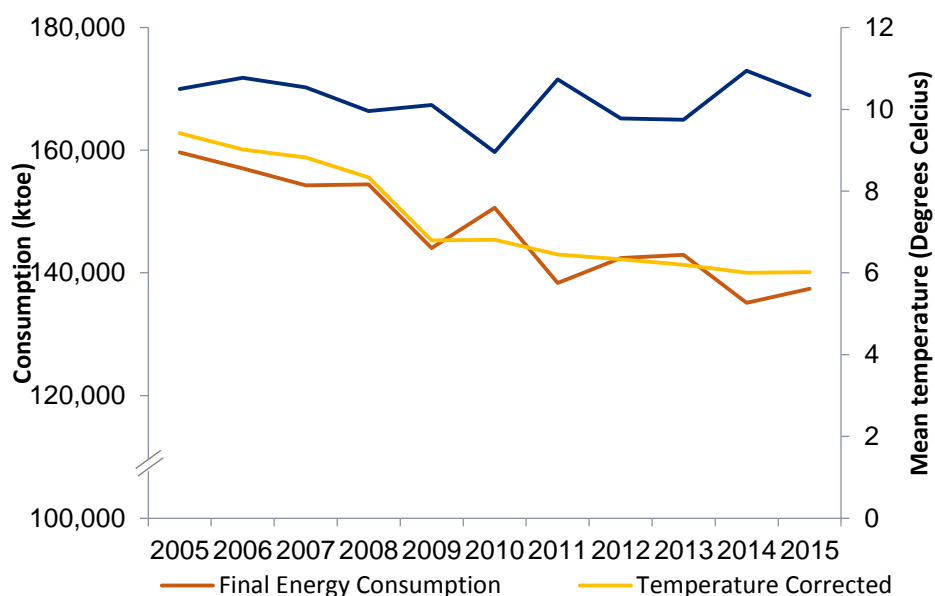
- Final energy consumption increased by 2,291 ktoe (1.7 per cent) in 2015 to 137,430 ktoe
- The majority of the increase was due to gas which increased by 1,481 ktoe (3.7 per cent)
- The domestic sector saw the biggest increase in both absolute and percentage terms; by 1,391 ktoe (3.6 per cent)
- The transport sector accounted for the largest share of final consumption at 40 per cent in 2015
- On a temperature corrected basis (see key terms), consumption increased by just 123 ktoe (0.1 per cent) with petroleum being the primary driver of this increase

Final energy consumption in 2015 was 2,291 ktoe (1.7 per cent) higher than in 2014, reflecting a lower mean temperature for the year. The majority of this increase was from natural gas, a key fuel in providing space heating and hot water. A decrease in coal consumption largely offset an increase in petroleum consumption. The domestic sector showed the biggest increase in both absolute and percentage terms; this sector is the most responsive to fluctuations in temperatures as a bigger proportion of household consumption is for space and water heating.

On a temperature corrected basis, consumption was 123 ktoe (0.1 per cent) higher in 2015 with the majority of the increase being petroleum use in the transport sector. As this measure excludes weather effects, the difference reflects a combination of changes in demand and energy efficiency.

Chart 1.01 below shows the trend in final consumption both on a temperature corrected basis and actual consumption from 2005.

**Chart 1.01: Final energy consumption, actual and temperature corrected**



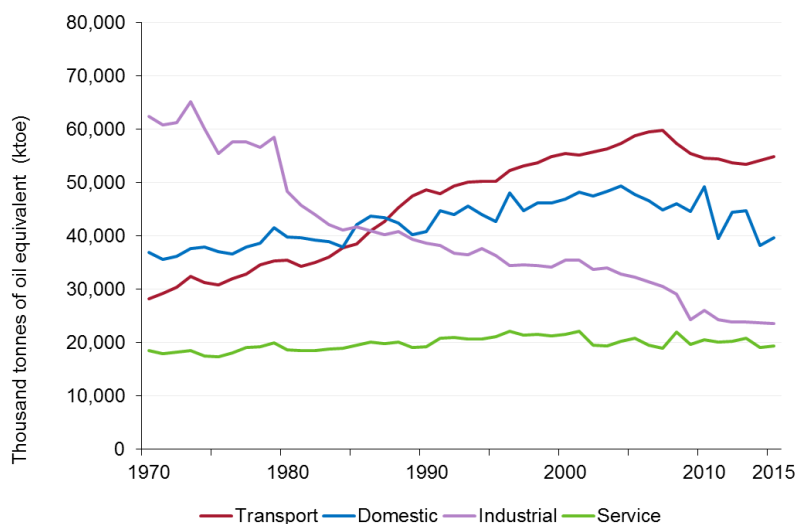
Source; BEIS ECUK Table 1.01

Over the last ten years, consumption has decreased by 14 per cent on both an actual and temperature corrected basis. During this period, actual consumption has increased or decreased year on year depending on average temperature changes. However, on a temperature corrected basis, just two years have seen increases; 2010 and 2015.

## Consumption by sector

Chart 1.02 below shows how each sector's share of final consumption has changed since 1970.

**Chart 1.02: Final Energy Consumption by Sector**



Source; BEIS ECUK Table 1.01

Transportation accounted for the largest proportion of final consumption in 2015 at 40 per cent, followed by the domestic sector (29 per cent), industry (17 per cent) and the service sector (14 per cent). Between 1970 and 1984, the industrial sector accounted for the largest share of consumption and in 1985, the domestic sector surpassed industry. Transportation then became the biggest consumer in 1988 and has maintained its dominant share since. A shift in economic activity away from heavy, energy intensive industries accounts for the decrease in the industry sector's share, whilst increasing mobility and rates of car ownership account for a large proportion of the increase in transportation. These effects are discussed in further detail within the sections for each sector.

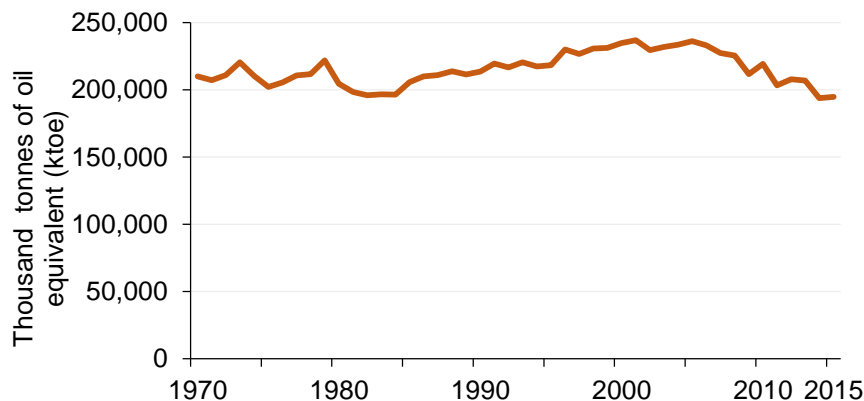
### Fuel mix (in primary energy equivalents)

This section focusses on primary energy equivalents, i.e. it the energy value of the source fuel rather than final consumption. For example, electricity generated by a gas fired power station will include the energy value of the input gas rather than the electricity output. Electricity includes only primary generation from nuclear power plants and renewable technologies such as wind and solar.

Chart 1.03 below shows the long term trend for consumption in primary energy equivalents.



**Chart 1.03: Total consumption in primary energy equivalents**

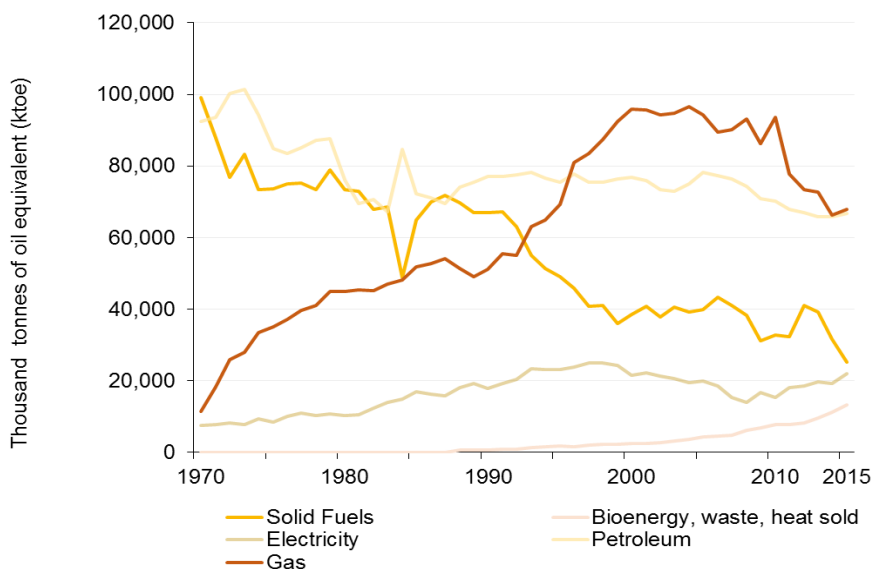


Source; BEIS ECUK Table 1.09

Consumption increased from 1970, peaking in 2001 at 236,856 ktoe. Since then, primary energy consumption has fallen by 41,078 ktoe (18 per cent) to 2015.

Chart 1.04 below shows the changing mix of fuel sources on a primary energy basis (i.e. taking into account the fuel input prior to any transformation process) and total consumption in ktoe.

**Chart 1.04: Final energy consumption in primary energy equivalents by fuel type**



Source; BEIS ECUK Table 1.10

In 1970, solid fuels<sup>1</sup> and petroleum dominated the fuel mix accounting for 47 per cent and 44 per cent respectively. As solid fuel's share decreased sharply in 1984 during the miners' strike, use of petroleum spiked due to substitution for low coal production. Solid fuels' share recovered to 1987 before steadily declining to a 16 per cent share in 1999. During this period, North Sea Gas increased its share from just 5 per cent in 1970 to a maximum of 43 per cent in 2010. Electricity's share also increased during this period, and more recently, renewables share has increased from 1 per cent in 1999 to 6.8 per cent in 2015, the result of various drives to reduce reliance on fossil fuels and production of greenhouse gasses<sup>2</sup>.

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<sup>1</sup> Solid fuels include coal, manufactured solid fuels, benzole, tars, coke, oven gas and blast furnace gas. Wood and wood waste is included in renewable fuels and waste.

<sup>2</sup> For more information on renewable energy, BEIS' renewable statistics home page; <https://www.gov.uk/government/collections/renewables-statistics>

# Transport

## Final Energy Consumption in transport

### Key terms

- **Train kilometres** – the number of kilometres a train travels. There is a separate measure for freight and passenger trains and this is used to compare trends between the two categories. However, this does not relate directly to fuel consumption as it doesn't take into account factors such as the weight being transported which will impact on fuel consumption.
- **Passenger kilometres** – this measure accounts for the number of passengers in addition to the distance travelled and is an indicator of energy intensity, i.e. the amount of energy consumed per unit output.
- **Freight moved** – takes into account the weight of freight moved in addition to the number of kilometres transported, measured in tonne kilometres.

- Final energy consumption in the transport sector increased by 684 ktoe (1.3 per cent) between 2014 and 2015 to 54,810 ktoe; the second year of positive growth following the economic slowdown
- Transport is the largest consuming sector representing 40 per cent of total energy consumption in 2015
- The majority of the increase was due to road transport which increased by 559 ktoe (1.4 per cent) to 40,521 ktoe in 2015
- Air transport increased by 154 ktoe (1.2 per cent) whilst rail and water transport both fell by 17 ktoe (1.6 per cent) and 12 ktoe (1.8 per cent) respectively
- Energy intensity<sup>3</sup> fell by 0.9 million tonnes of oil equivalent from 2013 to 2014 (the latest year for which data are available)

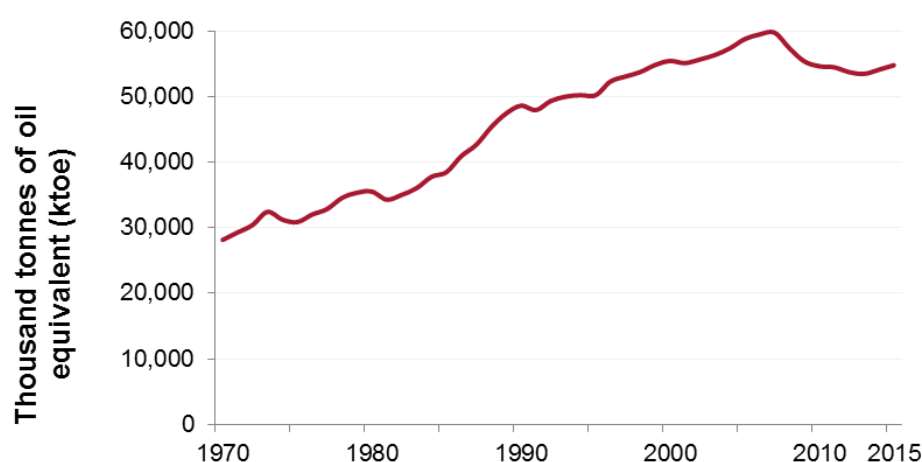
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<sup>3</sup> Energy intensity is defined as energy consumption per unit output.

- The domestic sector accounted for 66 per cent of transport consumption in 2014 (the latest year for which data are available) whilst the industrial sector accounted for 21 per cent and services, 14 per cent<sup>4</sup>

Negative growth in the transport sector tends to coincide with recessions such as during the mid 1970s, 1980, 1991, and 2008 to 2009. Chart 2.01 below shows the long term trends;

**Chart 2.01: Total consumption in the transport sector**



Source; BEIS ECUK Table 2.01

Following previous recessions, transport consumption generally recovered in the year following the recession, however growth didn't turn positive again until 2014 following the 2008 to 2009 recession.

## Road transport

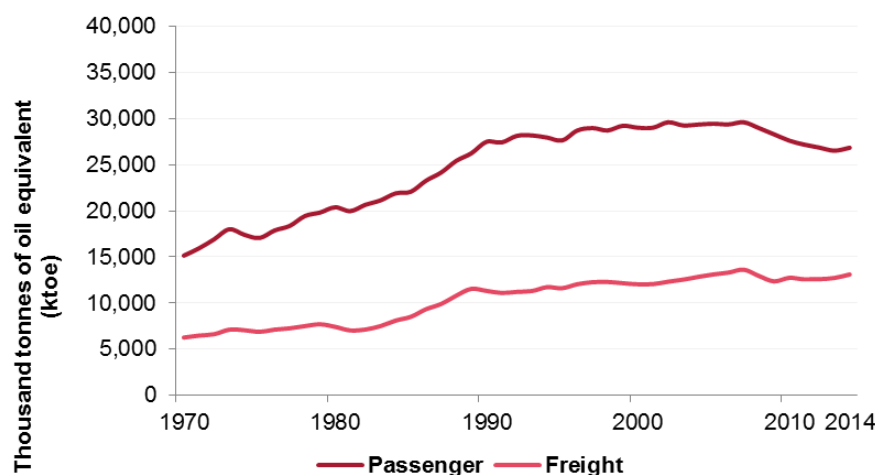
- Road transport consumption increased by 1.4 per cent from 2014 to 40,521 ktoe in 2015
- Road transport accounted for the largest share of transport consumption representing 74 per cent of transport consumption in 2015

Chart 2.02 below shows road transport consumption<sup>5</sup> from 1970 to 2014<sup>6</sup> split by passenger transport and freight;

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<sup>4</sup> Source; table 2.03

**Chart 2.02: Road transport consumption split by passenger and freight**



Source; BEIS ECUK Table 2.01

Consumption in **passenger transport** showed steady growth between 1970 and 1990, increasing by an average of 2.8 per cent per annum. Although the proportion of households with one car or van remained stable during this period (44 per cent in 1971 compared with 45 per cent in 1989-1991<sup>7</sup>), the proportion with access to two cars or vans increased from 8 per cent in 1981 to 22 per cent in 1989-1991. Growth then remained fairly stable until it peaked at 29,622 ktoe in 2007, the year prior to the recession. Growth in consumption turned positive again in 2014 (the split for 2015 is not yet available).

Drivers of energy consumption in passenger road transport can be split into two key factors;

- Output – a measure of demand in passenger kilometres (see key terms on page 10), and
- Intensity – a measure of energy consumed per passenger kilometre which can vary with structural changes and vehicle efficiency

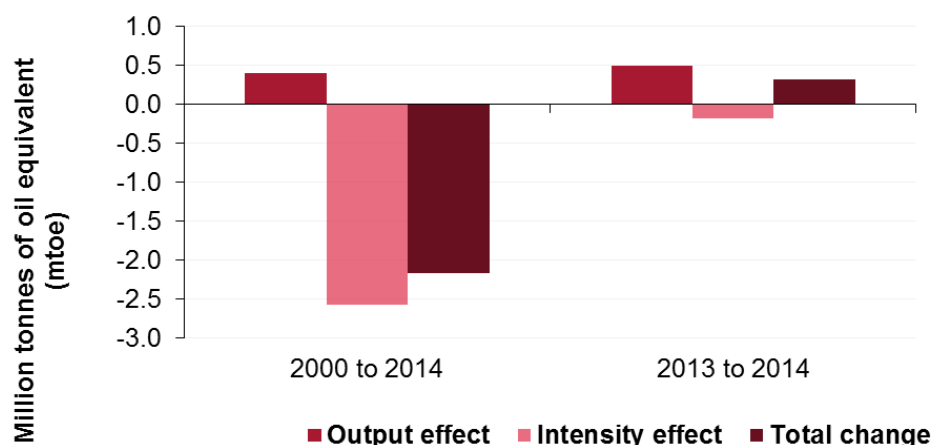
Chart 2.03 below shows how these factors have affected road transport consumption between 2000 and 2014 and also over the shorter term, 2013 to 2014.

<sup>5</sup> Excluding electricity which represented just 0.01 per cent of consumption in transport for 2014

<sup>6</sup> 2014 is the latest year for which data are available.

<sup>7</sup> Source Department for Transport National Travel Survey vehicles table NTS0205;  
<https://www.gov.uk/government/statistics/transport-statistics-great-britain-2015>

**Chart 2.03: Output and intensity factors affecting passenger road transport**



Source; BEIS ECUK Table 2.04

Between 2000 and 2014, the effect on consumption due to a modest increase in demand (from 694 billion passenger kilometres in 2000 to 704 billion passenger kilometres in 2014<sup>8</sup>) was more than offset by a reduction in energy intensity, i.e. increasing efficiencies and positive structural changes.

From 2013 to 2014, a bigger proportion of the total change in consumption was due to an increase in demand (from 691 billion passenger kilometres in 2013 compared to 704 in 2014) with the intensity effect being more muted.

Growth in **freight transport** consumption was modest from 1970 to 1981 averaging just 1.1 per cent per annum. Growth then increased from 1982 to 1989 averaging 6.4 per cent per annum. This was the result of increasing volumes of freight being transported by road; in 1981, 94 billion tonne kilometres were moved<sup>10</sup> compared to 138 billion tonne kilometres in 1989. Consumption for freight transport peaked in 2007, the same year as passenger transport. However, unlike passenger transport which saw 6 years of negative growth following the recession, freight transport turned positive after just two years (although 2011 saw negative growth of 2.1 per cent).

Chart 2.04 below shows the impact of output factors (billion tonne kilometres moved) compared with intensity effects for 2013 to 2014 and over the longer term 2000 to 2014.

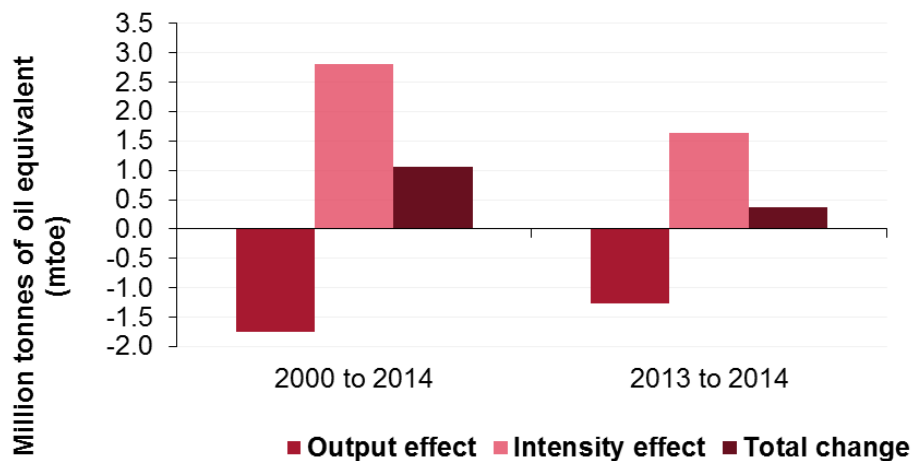
<sup>8</sup> Transport Statistics GB table TSGB0101. Source Department for Transport statistics; <https://www.gov.uk/government/statistical-data-sets/tsgb01-modal-comparisons>

<sup>9</sup> Note these statistics are for Great Britain only

<sup>10</sup> Sourced from table TSGB0401; <https://www.gov.uk/government/statistical-data-sets/tsgb04-freight>

Over both time periods, demand decreased (159 billion tonne kilometres in 2000, 151 in 2013 compared with 136 in 2014).

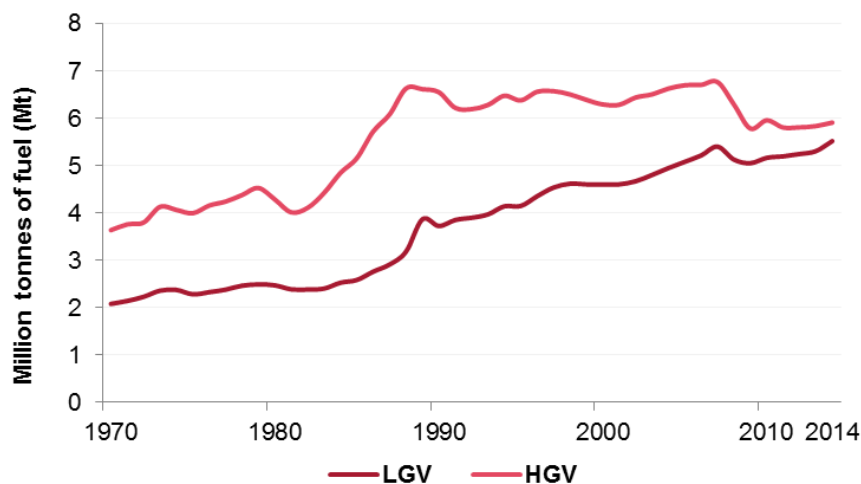
**Chart 2.04: Output and intensity factors affecting freight road transport**



Source; BEIS ECUK Table 2.04

Chart 2.05 below shows freight transport consumption (in million tonnes of fuel) split by Heavy and Light Goods Vehicles (HGV and LGV respectively).

**Chart 2.05: Fuel consumption by HGVs and LGVs in million tonnes**



Source; BEIS ECUK Table 2.04

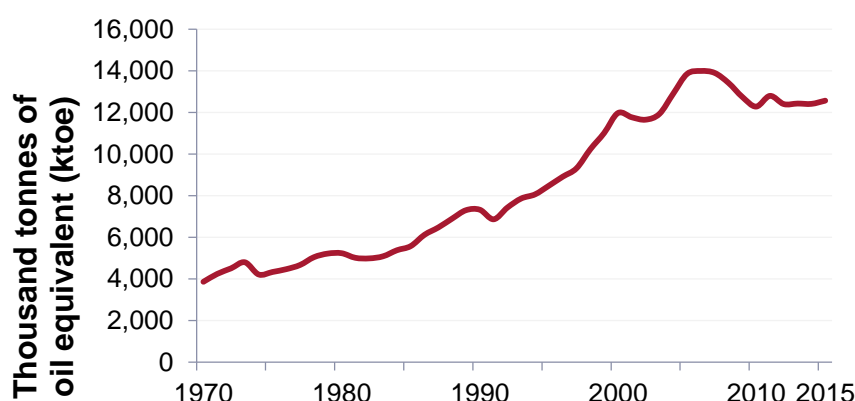
Historically, HGV consumption has been higher than for LGVs; in 1970, HGV consumption was 1.7 times that for LGVs but this margin has decreased over the years and although HGV consumption is still higher than LGV the factor has decreased to just 1.1.

### Air transport

- Consumption in air transport increased by 1.2 per cent in 2015 to 12,573 ktoe, largely due to increased passenger numbers
- Total passengers to and from the UK increased by 9.4%<sup>11</sup>
- Consumption remains 11 per cent below its peak of 13,999 ktoe in 2006
- Air transport accounted for 23 per cent of total transport consumption in 2015
- International travel accounts for approximately 90 per cent of fuel consumption used in aviation with 5 per cent for domestic use and 5 per cent military use<sup>12</sup>

Over the longer term, consumption in air transport has more than trebled; chart 2.06 below shows the long term trend;

**Chart 2.06: Total consumption in air transport**



Source; BEIS ECUK Table 2.01

Short term fluctuations in air passenger numbers are generally caused by a number of factors such as currency exchange rates, weather, government policy, economic (such as the recessions in the mid 1970s, 1981, 1991, and 2008 to 2009), and political conditions in the UK and abroad, in addition to special events<sup>13</sup>. Some of these special events are

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<sup>11</sup> Source; tables 2.07 and 3.07 Office for National Statistics (ONS) Travel Trends statistics 2015; <http://www.ons.gov.uk/peoplepopulationandcommunity/leisureandtourism/articles/traveltrends/2015#understanding-overseas-travel-and-tourism-statistics>

<sup>12</sup> Source DUKES 2016 Chapter 3, paragraph 3.70;

<https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes#2015>

<sup>13</sup> ONS Travel Trends 2015



analysed in a 50<sup>th</sup> anniversary release of The Office for National Statistics' (ONS) Travel Trends Survey<sup>14</sup>. Some special events caused a short term interruption to growth such as the terrorist attacks of September 2001, whereas others have caused a structural shift in travel behaviour such as the introduction of low cost airlines.

A summary of some of the main events is below;

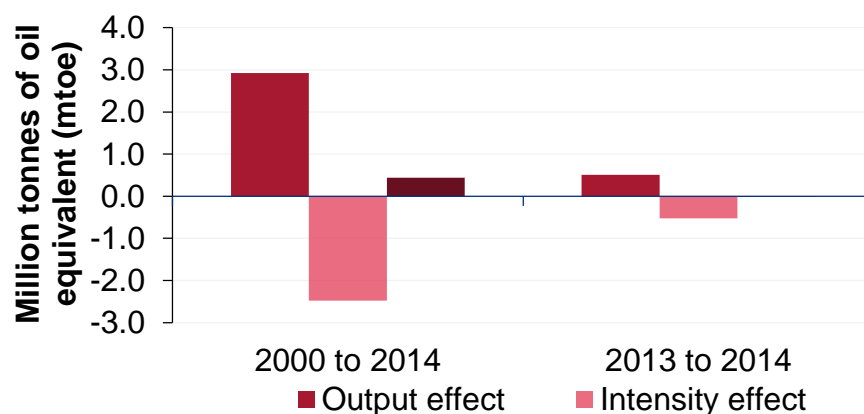
- From the 1970s, more holidays were being taken and there was an increase in the number of affordable package holidays. Low cost airlines also made a debut with the introduction of the "Skytrain"
- During the 1990s, several UK regional airports underwent substantial development increasing the volume of passengers travelling through them. This period saw high growth in energy consumption in air transport averaging 5.1 per cent per annum
- The terrorist attacks of September 2001 contributed to negative growth during the early 2000s. Growth then picked up again due to a growing economy and the increase in the use of online booking systems.
- The global economic recession started in late 2007 affecting business travel in particular and with several years of slow or negative growth, energy in air transport is still 11 per cent below its peak in 2006

Chart 2.07 below shows the effect on energy consumption in the air transport sector split by output and intensity effects for the periods 2000 to 2014 and also 2013 to 2014 (demand data are not yet available for 2015).

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<sup>14</sup> ONS Travel Trends 2010;  
<http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/rel/ott/travel-trends/2010/index.html>

**Chart 2.07: Output and intensity factors affecting air transport**



Source; BEIS ECUK Table 2.04

Over both the longer and shorter time periods, passenger numbers increased, which would have increased energy consumption by the amount indicated as “output effect”, had there been no improvements in energy intensity (a combination of improved fuel efficiency and / or the density of passengers per aeroplane). The intensity effect considerably reduced energy consumption between 2000 and 2014, but over the shorter term, between 2013 and 2014, the output and intensity effects virtually offset each other; consumption was just 0.1 per cent lower in 2014 compared to 2013.

## Rail transport

Whilst passenger train kilometres and freight kilometres (see key terms section on page 10) provide useful measures for changes in energy intensity for passenger rail travel and freight transport, it does not provide a useful comparator for comparing trends between passenger and freight transport. Energy consumption in transport depends on weight hauled and this varies considerably between transporting passengers and freight. Train kilometres provides a more useful metric for estimating the split between the two modes as both are measured in the same unit; kilometres.

- Energy consumption in rail transport decreased by 1.6 per cent from 2014 to 1,049 ktoe in 2015 despite a 2.6 per cent increase in passenger kilometres<sup>15</sup>
- Freight moved (in tonne kilometres) fell by 13 per cent from 2014 to 2015

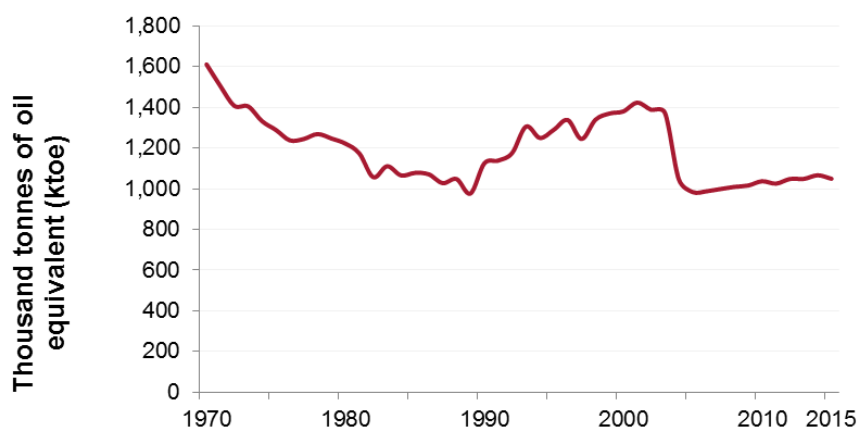
<sup>15</sup> Source; Office of Rail Regulation Statistics tables 12.13 (passenger) and 13.25 (freight); <http://orr.gov.uk/statistics/published-stats/statistical-releases>

- Passenger trains accounted for 93 per cent of all kilometres travelled by trains. Freight train kilometres accounted for the remainder
- Rail transport accounted for 1.9 per cent of energy consumption in the transport sector

Some of the decrease in consumption can be accounted for by the decrease in freight moved, though because the majority of rail transport is passenger, it is likely that some of the decrease will have been due to other factors such as improved efficiencies.

Chart 2.08 below shows the longer term trend for energy consumption by rail transport;

**Chart 2.08: Energy consumption in rail transport**



Source; BEIS ECUK Table 2.01

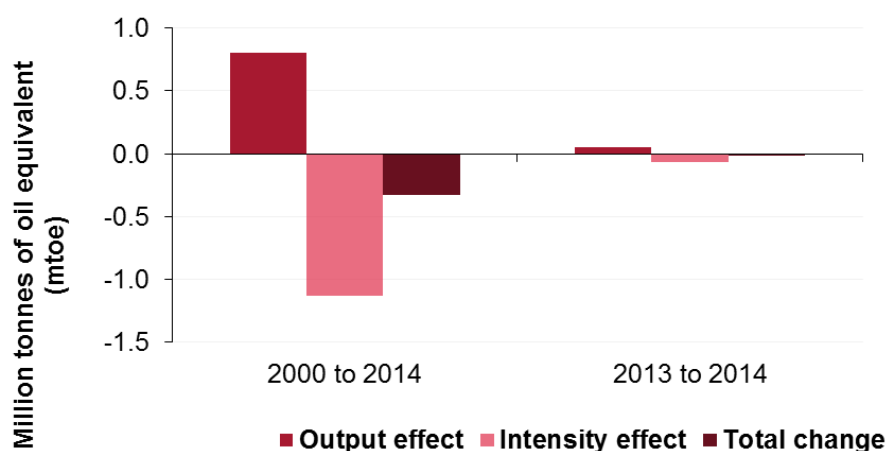
Energy consumption in rail transportation fell from a peak of 1,611 ktoe in 1970 to a minimum of 977 ktoe in 1989. This period coincided with a rapid increase in car ownership, particularly second car ownership (see road passenger section). A period of positive growth then resumed until 2001. This period of growth coincided with the privatisation of the railways in 1994 to 1995<sup>16</sup>. A step change occurred between 2003 and 2004 due to a change in methodology; up until 2003, electricity consumption in transport included use for both traction and services such as lighting within train stations. In order to be consistent with the European Union Renewable Energy Directive methodology, only electricity used for traction was included in transport consumption from 2004 onwards with other uses being re-classified to the services sector.

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<sup>16</sup> Source; Office of Rail Regulation Statistics;  
<http://orr.gov.uk/statistics/published-stats/statistical-releases>

In rail transport, as the majority of rail transport is passengers, output effects are measured using passenger kilometres. Chart 2.09 below shows the impact of output effects compared to intensity effects for the two periods, 2000 to 2014 and 2013 to 2014. Energy intensity effects include more energy efficient trains and / or an increase in the number of passengers travelling in each train.

**Chart 2.09: Output and intensity factors affecting rail transport**



Source; BEIS ECUK Table 2.04

Between 2013 and 2014, an increase in passenger kilometres had a positive impact in terms of consumption. However, this was offset to a great extent by improvements in efficiency; total consumption was just 2 per cent higher in 2014. Over the longer term (2000 to 2014), the impact of increasing passenger kilometres was more than offset by improvements in energy intensity. During this period, consumption fell by 23 per cent.

## Water transport

Fuel for water transport includes fuel sourced from inland bunkers, i.e. fuel oil and gas/diesel oil delivered, other than under international bunker contracts, for fishing vessels, UK oil and gas exploration and production, coastal and inland shipping and for use in ports and harbours<sup>17</sup>.

- Fuel consumed by water transport fell by 1.8 per cent from 2014 to 667 ktoe in 2015
- Water transport accounted for 1.2 per cent of consumption in the transport sector as a whole

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<sup>17</sup> Source DUKES 2016 Chapter 3, paragraph 3.72;  
<https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes#2015>

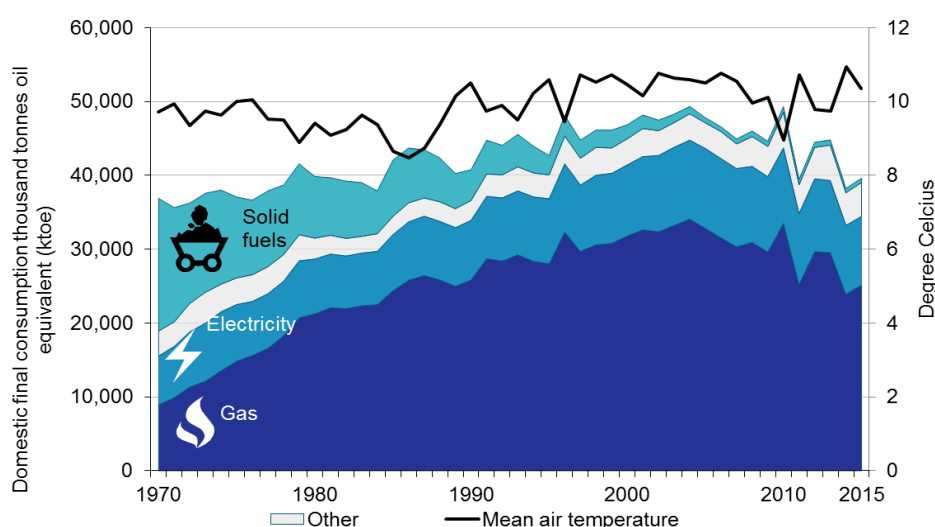
# Domestic

- Since 2014, final energy consumption in the domestic sector increased by 1,391 ktoe (3.6 per cent) to 39,623 ktoe in 2015 largely due to lower mean temperatures; in 2015, the average temperature was 10.3 degree Celsius, 0.6 degrees lower than in 2014
- The majority of the increase was gas consumption which was 1,231 ktoe (5.1 per cent) higher reflecting additional heating requirements
- On a temperature corrected basis, final consumption was 433 ktoe (1.0 per cent) lower
- In 2015, the domestic sector accounted for 29 per cent of total final energy consumption
- Average gas consumption (see table 3.03) increased by 4.5 per cent to 12,962 kWh
- Average electricity consumption fell by 2.1 per cent to 3,938 KWh in 2015

The domestic sector is the most susceptible to temperature fluctuations of the four sectors as space and water heating account for in the region of 80 per cent of final energy consumption. In addition, the majority of space and water heating are provided by gas resulting in gas consumption in the domestic sector being the most responsive to temperature variations.

Chart 3.01 below shows the long term trend in domestic consumption showing the contribution by each fuel type. It also shows mean air temperature (right hand axis).

**Chart 3.01: Final consumption by fuel compared to mean air temperature**



Note; "Other" includes petroleum, bioenergy, and heat soldSource; BEIS ECUK Table 3.01

Whilst overall consumption has fluctuated since 1970, consumption is just 7 per cent higher in 2015 compared to 1970. Short term changes in consumption have generally shown the effects of mean air temperature fluctuations year on year. For example, the peaks occurring in 1979, 1996, and 2010 were all colder than the years preceding and following. Correspondingly, troughs have occurred such as in 2011 when the mean temperature was 10.7 degrees celsius, 1.7 degrees warmer than in 2010 when temperatures were lower than usual for that period.

The fuel mix has changed significantly since 1970 when 49 per cent of final energy consumption was provided by solid fuels and 24 per cent gas. With declining coal production (particularly from 1989 onwards), combined with North Sea gas coming on line, this share had fallen to just 2 per cent by 2004, by which time natural gas comprised 69 per cent. The balance between the two fuels has remained fairly constant since then with solid fuels accounting for an average of 1.6 per cent and gas 66 per cent.

In addition to weather factors, domestic fuel consumption is dominated by a number of other factors;

- Household characteristics; the number of households, disposable income and energy prices
- Efficiency measures such as installing a more efficient boiler and improving home insulation (for example adding cavity wall insulation, and double glazing), and the age of the housing stock (older homes tend to have poorer insulation properties)
- In the case of electricity consumption, the number and usage of appliances along with appliance efficiencies

On a temperature corrected basis (only available from 2002) final energy consumption has fallen steadily; from 52,229 ktoe in 2002 to 42,328 ktoe in 2015, a fall of 19 per cent. This effect is likely to be due to a combination of all the above factors and the following section discusses each one in turn.

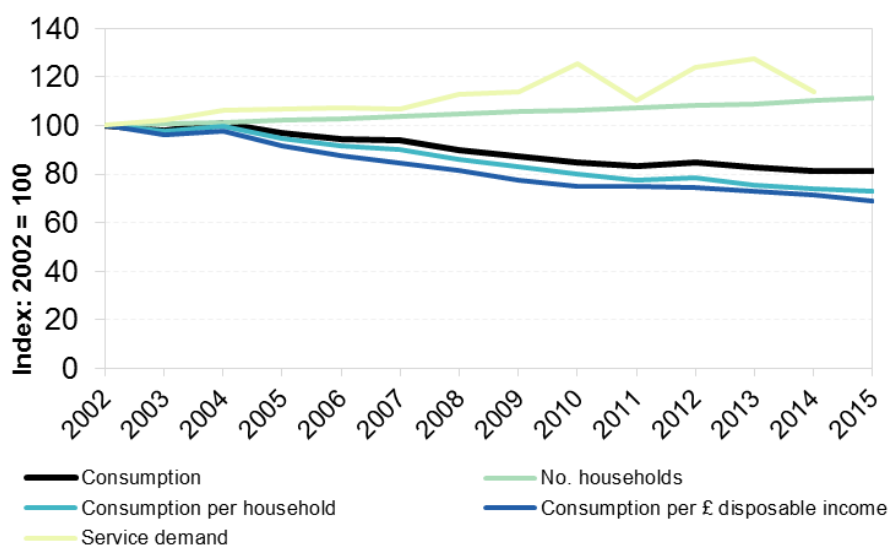
## Household characteristics

- Consumption per household increased between 2014 and 2015 by 2.6 per cent
- Consumption per person increased by 2.8 per cent from 2014 to

The number of households in the UK has grown steadily since 1970 from 18.8 million to 27.5 million in 2015, an increase of 46 per cent. During this time, the population has also risen, although to a lesser extent - by 17 per cent - resulting in a reduction in the number of residents per household. A household with fewer occupants will generally result in lower

consumption per household, but an increasing number of households will tend to increase consumption as a whole. An additional factor to be considered is the level of comfort required, i.e. the expectation of what is considered to be a reasonable level of warmth, which varies over time. This has increased over recent years resulting in additional energy demand. Chart 3.02 below shows, on an indexed basis the effects of these factors and how they may have influenced consumption.

**Chart 3.02: Factors impacting on domestic consumption**

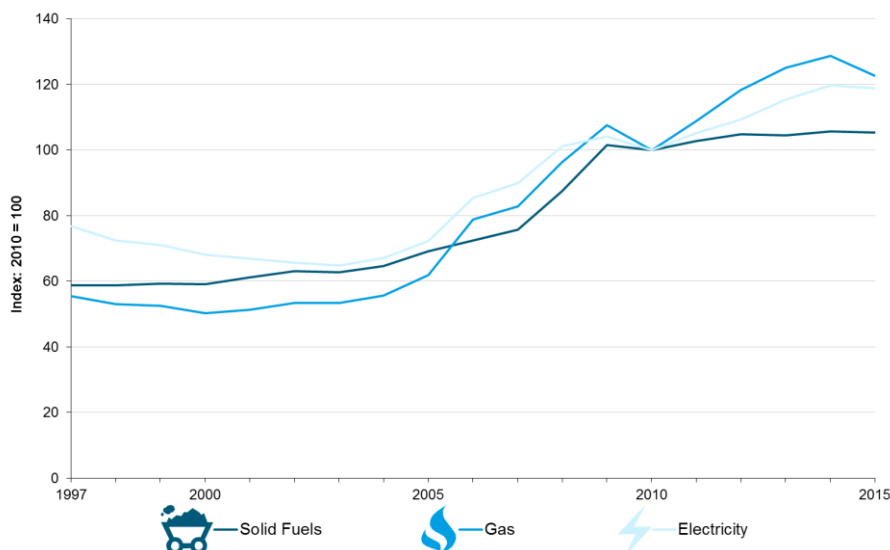


Source; BEIS ECUK Tables 3.01 3.04, and 3.05

The factors displaying a downward trend on consumption are; consumption per household and consumption per unit of disposable income. Upward pressures are the increasing number of households and also the service demand.

Chart 3.03 below shows the consumer price index for the domestic sector over the same period for gas and electricity, the two key fuels used in households;

**Chart 3.03: Consumer Price Index for gas and electricity**



Source; BEIS Domestic energy price indices, QEP 2.1.1 and 2.1.2

<https://www.gov.uk/government/statistical-data-sets/monthly-domestic-energy-price-statics>

Since 2002, gas and electricity prices have more than doubled over the period (though there was a decrease in 2015). It is likely that this significant increase in fuel prices, combined with the economic downturn will have had a negative impact on consumption as consumers became more conscious of their household budgets. In Wave 17<sup>18</sup> (March 2016) of The Public Attitudes Tracker<sup>19</sup> 28 per cent of households were worried or very worried about paying for their energy bills, more than for any other household bill; food, transport and housing costs.

## Energy Efficiency Measures

The UK housing stock is old relative to most European countries with many houses dating from the Victorian era. As a result, many houses have poor insulation with properties resulting in additional consumption to maintain a given level of comfort. However, as older housing stock is gradually replaced with newer, more energy efficient homes, this will tend to lower consumption. This is a long term trend; houses built prior to 1918 represented 25

<sup>18</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/519488/PAT\\_Wave\\_17\\_Summary\\_of\\_key\\_findings.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/519488/PAT_Wave_17_Summary_of_key_findings.pdf)

<sup>19</sup> A survey conducted by BEIS to understand and monitor public attitudes to the department's main business activities



per cent of the housing stock in 1970 compared to 16 per cent built prior to 1919<sup>20</sup> in 2014 (the latest year for which data are available).

There have been some key changes to various characteristics in households which have put downward pressure on consumption; in 1976, 87 per cent of households had a hot water tank of which 74 per cent were insulated. With the increasing prevalence of more energy efficient boilers such as combination and condensing boilers, which do not require a tank, the proportion of households with a hot water tank had declined to around half of households and of these 99 per cent were insulated (table 3.21). Installing a condensing boiler can reduce consumption by 8.3 per cent<sup>21</sup>.

Installed **double glazing** is another measure which has increased dramatically; in 1983, just 9.5 per cent of households had double glazing in 80 per cent of the property<sup>20</sup>. By 2008, 71 per cent of homes had double glazing throughout and by 2013 the proportion was 80 per cent (table 3.22). Rates of **cavity wall insulation**, which can reduce consumption by 8.4 per cent<sup>20</sup>, have also increased considerably since 1976 when just 3.8 per cent of homes known to have cavity walls had insulation compared to 73 per cent in 2015. This upward trend is still continuing; between 2014 and 2015, the proportion of properties with cavity wall insulation increased by 1.6 percentage points. For those homes without wall cavities, **solid wall insulation**, which can reduce consumption by 16 per cent<sup>20</sup>, is an alternative to improving energy efficiency. Although the number of homes with solid wall insulation has increased since 2008 when 67,000 homes were known to have had solid wall insulation compared to 334,000 homes in 2015, the proportion of UK homes with this type of insulation is still relatively small at 4 per cent. Rates of **loft insulation**, which can reduce consumption by 2.1 per cent, have increased to the point where the majority of homes with a loft have insulation installed (98 per cent).

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<sup>20</sup> There was a break in the series between 2000 and 2001 for the classification of date of construction. Source; table 3.14

<sup>21</sup> Source; National Energy Efficiency Data Framework;  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/532535/National\\_Energy\\_Efficiency\\_Data-Framework\\_NEED\\_Main\\_Report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/532535/National_Energy_Efficiency_Data-Framework_NEED_Main_Report.pdf)

## Electrical appliance consumption

### Key electrical appliances

- Lighting appliances include lightbulbs in the following categories; standard, halogen, fluorescent strip lighting, energy saving lightbulbs, and light emitting diodes (LEDs).
- Cold appliances; chest freezers, fridge-freezers, refrigerators, and upright freezers.
- Wet appliances; washing machines, washer-dryers, dishwashers, and tumble dryers.
- Consumer electronics; televisions, set top boxes, DVD/VCRs, games consoles, and power supply units.
- Home computing; desktop computers, laptops, monitors, printers, and multifunction devices.
- Cooking appliances; electric ovens, electric hobs, microwaves, and kettles.

- Electricity consumption fell marginally by 0.2 per cent between 2014 and 2015 to 9,300 ktoe
- Lighting and appliances account for approximately two thirds of electricity consumption

Over the longer term, domestic electricity consumption increased to a peak of 10,809ktoe in 2005 then began decreasing, despite the continuing increase in the number of electrical appliances owned by households. Table 3.01 below shows the average number of appliances per household;

**Table 3.011; Average number of appliances per household**

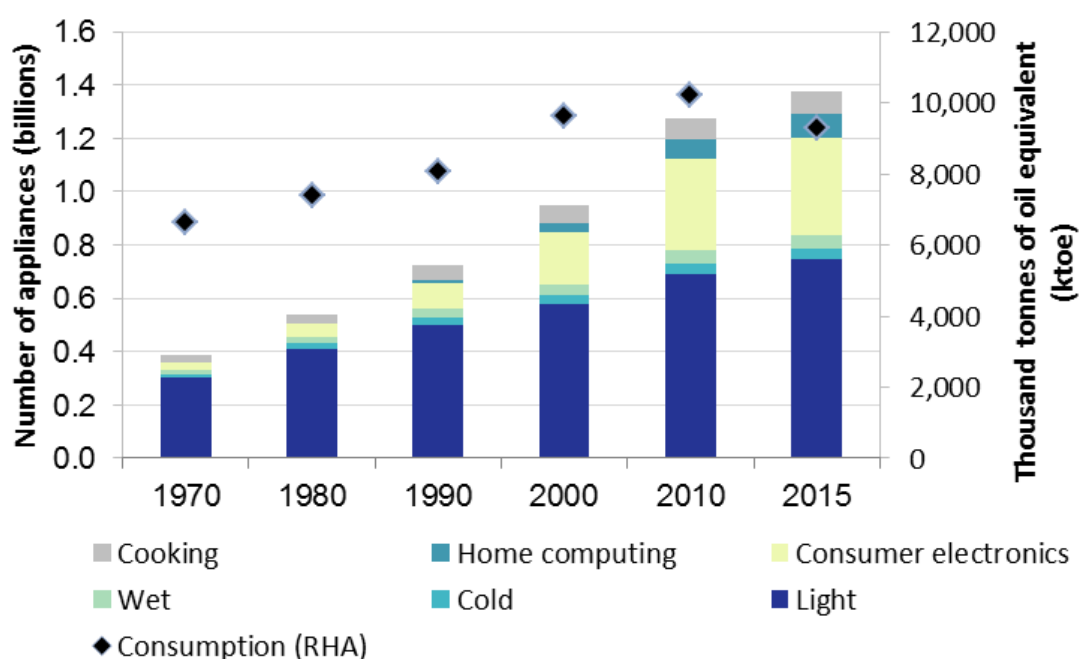
Average number of appliances per household						
Year	Lighting	Cold Appliances	Wet Appliances	Consumer electronics	Home computing	Cooking
1970	16	1	1	2	0	1
1980	20	1	1	2	0	2
1990	22	1	1	4	1	2
2000	24	1	2	8	1	3
2010	26	2	2	13	3	3
2015	27	2	2	13	3	3

Source; BEIS ECUK Table 3.12

The average number of appliances per household has increased for all appliance types but the most dramatic increase is for consumer electronics which has increased from an average of 2 appliances in 1970 to 13 in 2015.

Chart 3.04 below shows electricity consumption (right hand axis) together with the number of appliances;

**Chart 3.04: Total number of electrical appliances owned by households and total domestic electricity consumption (right hand axis)**



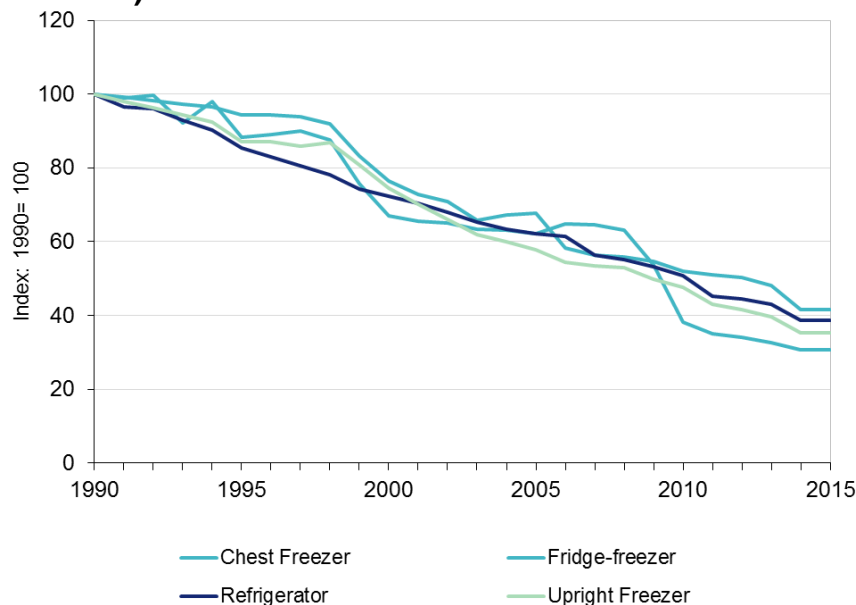
Source; BEIS ECUK table 3.01

The growth in consumer appliances is particularly notable from the mid 1990s, particularly for consumer electronics and lighting.

The recent decrease in electricity consumption (despite the increasing number of appliances) can be partially explained by increasing efficiencies.

Average consumption for **new cold appliances** has decreased dramatically since 1990 for all appliance types (Chart 3.05) particularly for chest freezers which saw notable improvements between 2008 and 2010 when average consumption fell by 39 per cent over the two year period. There were also notable improvements in average consumption during the late 1990s for all freezer types. Improvements in refrigerator consumption were more stable over the period (1990 to 2015) but all types of cold appliance improved by between 58 per cent (fridge-freezers) and 69 per cent for chest freezers.

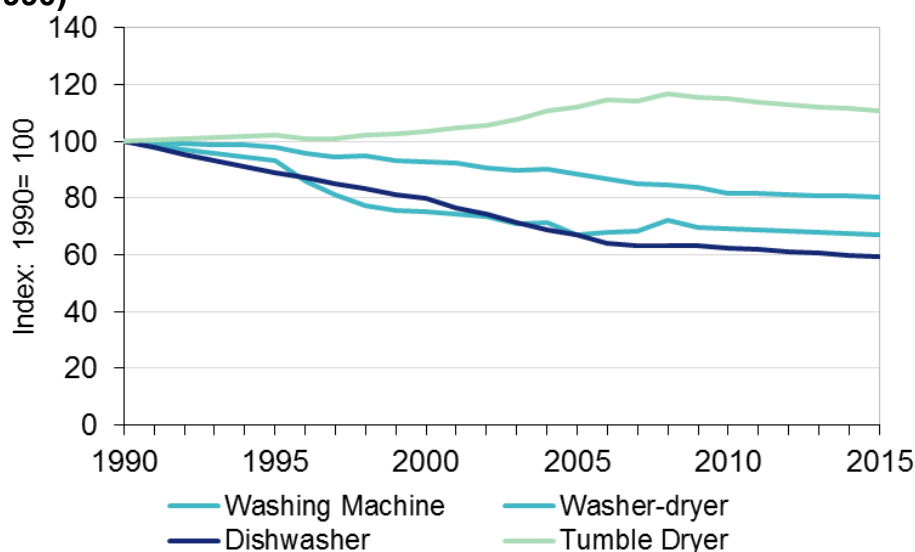
**Chart 3.05: Average energy consumption of new cold appliances 1990 to 2015 (index 1990)**



Source; BEIS ECUK Table 3.09

Improvements in average consumption for wet appliances were less dramatic compared to cold appliances with an increase of 11 per cent for tumble dryers, reflecting bigger demand. Average consumption for dishwashers fell most significantly, by 41 per cent between 1990 and 2015, washing machines by 33 per cent, and washer dryers by 20 per cent over the same period.

**Chart 3.06: Average energy consumption of new wet appliances 1990 to 2015 (index 1990)**



Source; BEIS ECUK Table 3.09

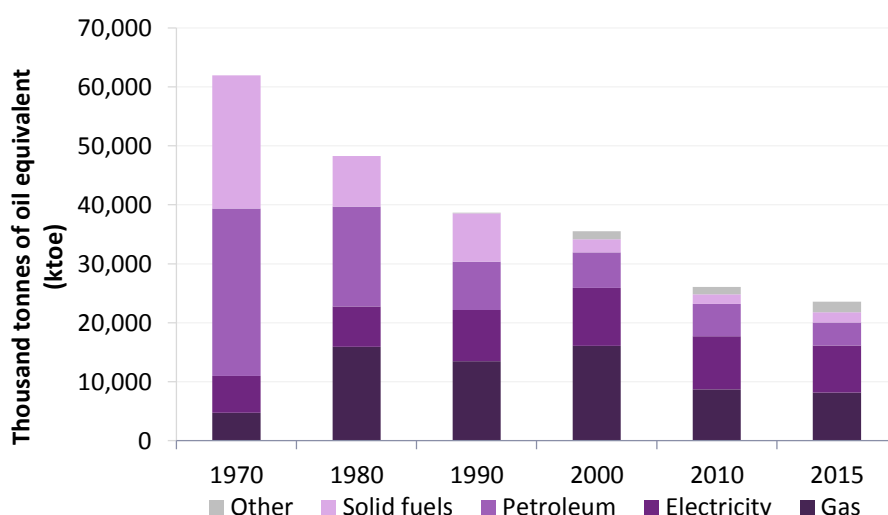
# Industry Sector

- Final consumption in the industry sector fell by 124 ktoe (0.5 per cent) between 2014 and 2015 to 23,594, the lowest level since 1970
- In 2015, the industry sector accounted for 17 per cent of total final energy consumption
- The sub-sectors with the largest decreases were mineral products, by 109 ktoe (3.8 per cent); iron and steel, by 96 ktoe (7.1 per cent); and mechanical engineering, by 62 ktoe (5.6 per cent)
- Sub-sectors showing an increase are; vehicles, by 46 ktoe (4.6 per cent); chemicals, by 44 ktoe (1.5 per cent); and electrical and instrument engineering, by 19 ktoe (2.7 per cent)
- Energy intensity fell by 1.5 per cent between 2014 and 2015

Chart 4.01 below shows **total final consumption in the industry sector since 1970**.

The general fall in consumption reflects the shift away from heavy industry to more energy light industries such as within the service sector (see section 5).

**Chart 4.01: Total industrial consumption by fuel mix**



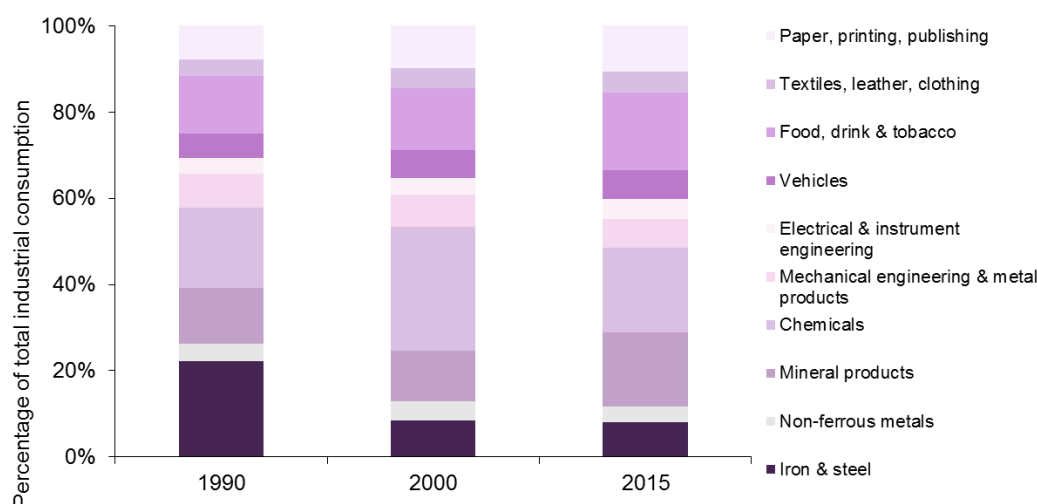
Source; BEIS ECUK Table 4.01

Note: Other includes heat sold and bioenergy. Renewable electricity is included in electricity  
Solid fuels include coal, coal, manufactured solid fuels, benzole, tars, coke, oven gas and blast furnace gas.  
Wood and wood waste is included in renewable fuels and waste

**The fuel mix used in industry** has changed over the period reflecting the shift away from solid fuels and petroleum to gas and, more recently, an increasing proportion of demand is being satisfied by bioenergy. In 1970, 82 per cent of consumption was provided by solid fuels and petroleum. By 2015, this had fallen to 24 per cent with gas and electricity accounting for 35 per cent and 34 per cent respectively.

**Consumption by sub-sector** has also changed over the long term. In 1990, the heavy industry sub-sectors; iron & steel, non-ferrous metals, mineral products, and chemicals, together accounted for 56 per cent of industrial final consumption compared to 47 per cent in 2015. Chart 4.02 below shows the mix between the subsectors;

**Chart 4.02: Industrial consumption by sub-sector, 1990, 2000, and 2015**



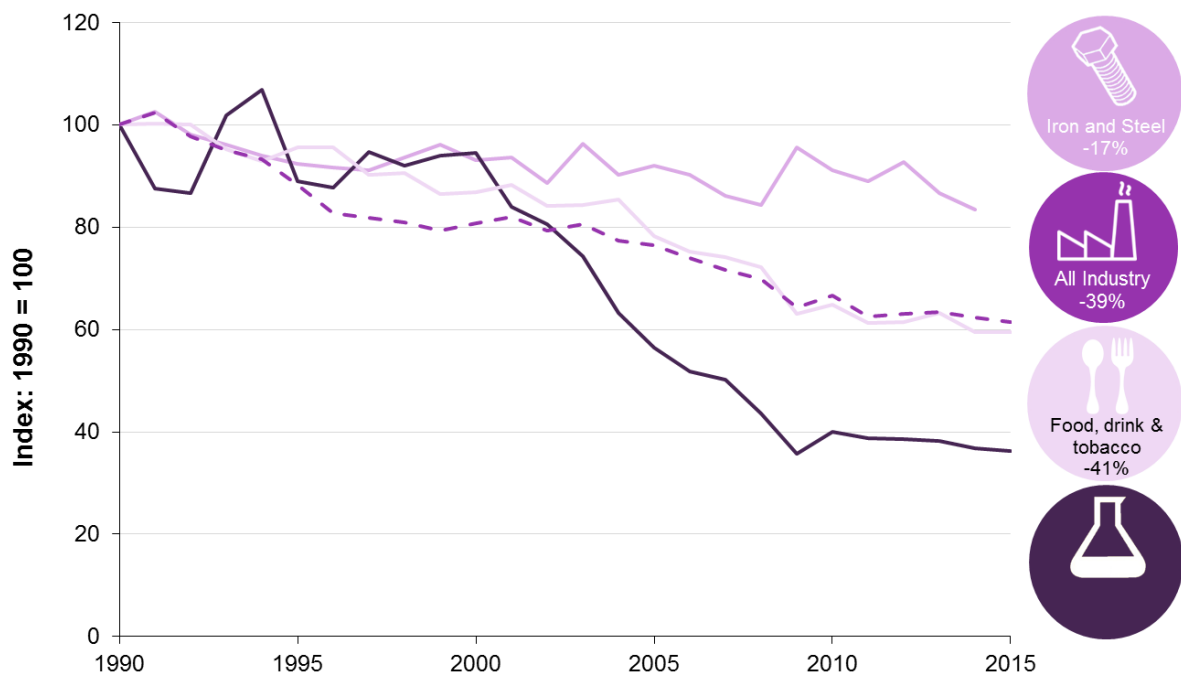
Source: Table 4.02

*Note the above chart excludes other industry and unclassified. Unclassified has accounted for an increasing proportion since 1990 so may give a slightly distorted picture of the changing share of sub-sectors*

The sectors showing an increasing share are food, drink, & tobacco (4.4 percentage points since 1990), paper, printing, & publishing (2.7 percentage points), and vehicles (a 1.0 percentage point increase).

Across the industry sector as a whole, **energy intensity** (energy consumed per unit output) has decreased by 38 per cent between 1990 and 2015 (the latest year for which data are available) with the chemicals industry improving by a significant proportion (64 per cent) reflecting a structural change within the industry. Chart 4.03 below shows the trend for three key sectors; Iron & steel, chemicals, and food, drink & tobacco.

**Chart 4.03; Energy intensity for the industry sector and three key sub-sectors**

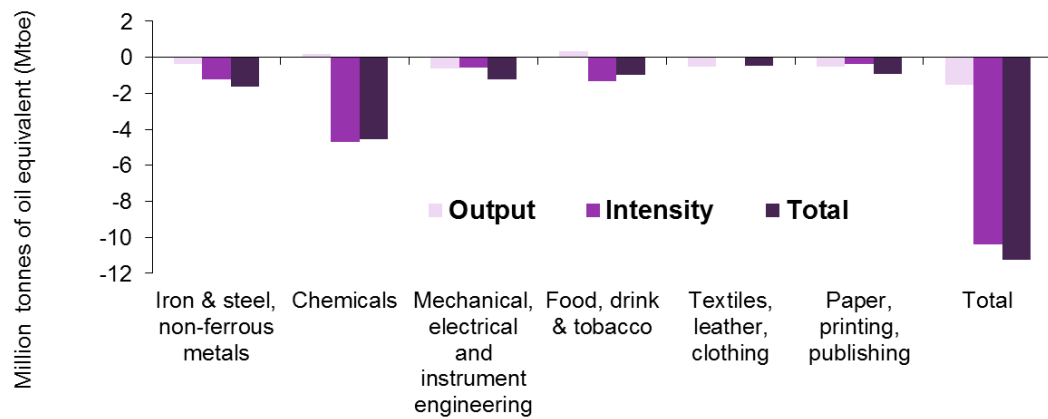


Source; BEIS ECUK Table 4.08

Note; 2014 is the latest year for which data are available for the iron and steel sector.

Comparing output changes and energy intensity from 2000 to 2015, chart 4.04 shows that all sub-sectors' consumption fell and most were due to a combination of a fall in output and improvements in intensity. The exceptions were the chemicals and food, drink and tobacco sub-sectors which both saw an increase in output effects but the improvement in intensity consumption resulted in an overall decrease.

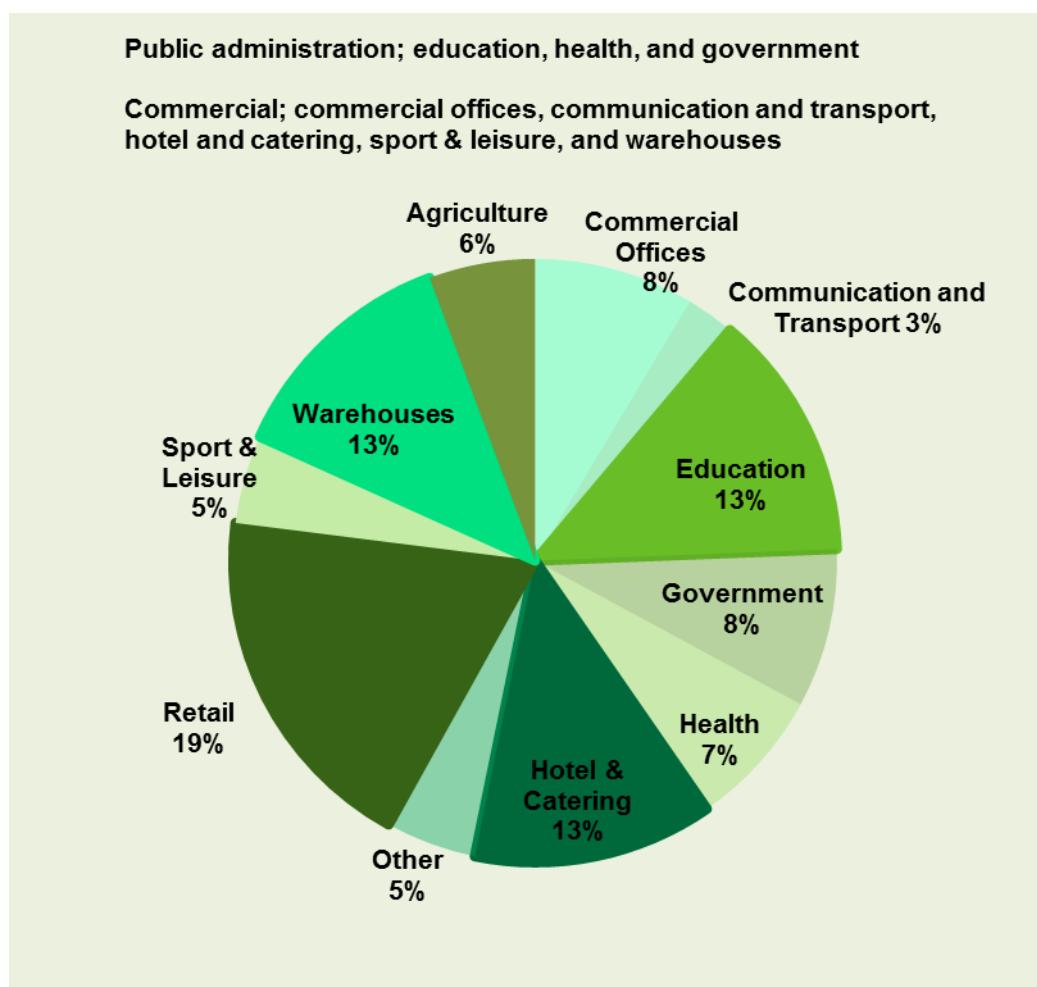
Chart 4.04: Output and Intensity effects for industry subsectors 2000 to 2015



Source; BEIS ECUK Table 4.07



## Services Sector

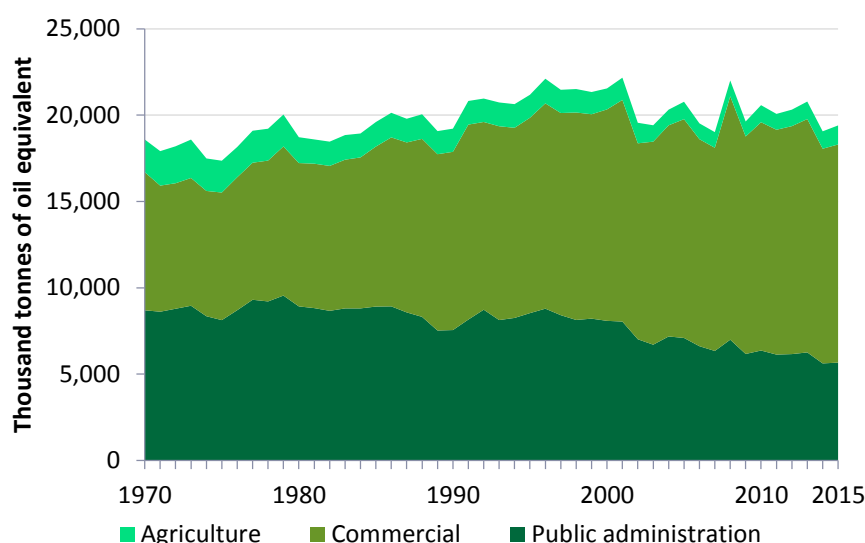


- Consumption increased by 341 ktoe (1.8 per cent) between 2014 and 2015 to 19,403
- The majority of the increase was from gas (154 ktoe) and petroleum (117 ktoe)
- The service sector accounted for 14 per cent of total final consumption in 2015
- The commercial sector accounted for 65 per cent of services consumption in 2015, public administration 29 per cent, and the agriculture sector 5.7 per cent
- Energy intensity fell by 1.8 per cent between 2014 and 2015

Over the longer term, **final consumption in the services sector** has fluctuated but the underlying trend has been relatively stable since 1970 (chart 5.01); consumption in 2015 was just 4.4 per cent higher than in 1970 despite a 63 per cent increase in the number of

employees (from 1978, the earliest year for which employee data are available). Floor space dedicated to the services sector also increased though only a shorter time series is available<sup>22</sup>; floor area in retail increased by 8.0 per cent from 2000 to 2012 and office space by 17 per cent. The shift away from an industry intensive economy to a services based economy, putting upward pressure on consumption in this sector, has been accompanied by an improvement in energy intensity which fell by 67 per cent (excluding agriculture) from 1970.

**Chart 5.01: Energy consumption in the services sector**



Source; Tables 5.01, 5.02, 5.03, and 5.04

Consumption peaked in 2001 and has since fallen by 13 per cent.

There has also been a shift in the share of consumption by the three key sectors; in 1970, public administration accounted for 47 per cent of services in consumption and the commercial sector 43 per cent. By 2015, public administration consumed 29 per cent and commercial's share had increased to 65 per cent. Agricultural's share decreased between 1970 and 2015 from 10 per cent to 5.7 per cent.

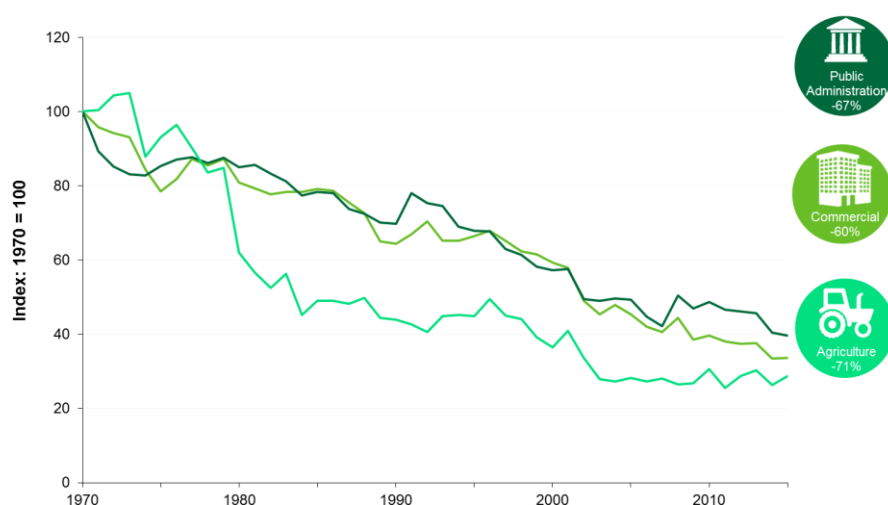
**Energy intensity in the services sector<sup>23</sup>** has improved since 1970 and has fallen by 67 per cent in public administration and by 60 per cent in the commercial sector. The largest

<sup>22</sup> Source; table 5.01. Valuation Office Agency experimental statistics covering England and Wales only

<sup>23</sup> Energy intensity in the services sector is the energy required to produce a unit of output. Output is measured using ONS GVA statistics which measures the contribution to the economy of each individual producer, industry, or sector in the UK.

gain was within agriculture which fell by 71 per cent; gains were particularly noticeable in the late 1970s and early 1980s. Over this period, intensity improvements in the public administration sector were steadier but were greater in public administration (a 67 per cent improvement) compared to the commercial sector (a 60 per cent improvement).

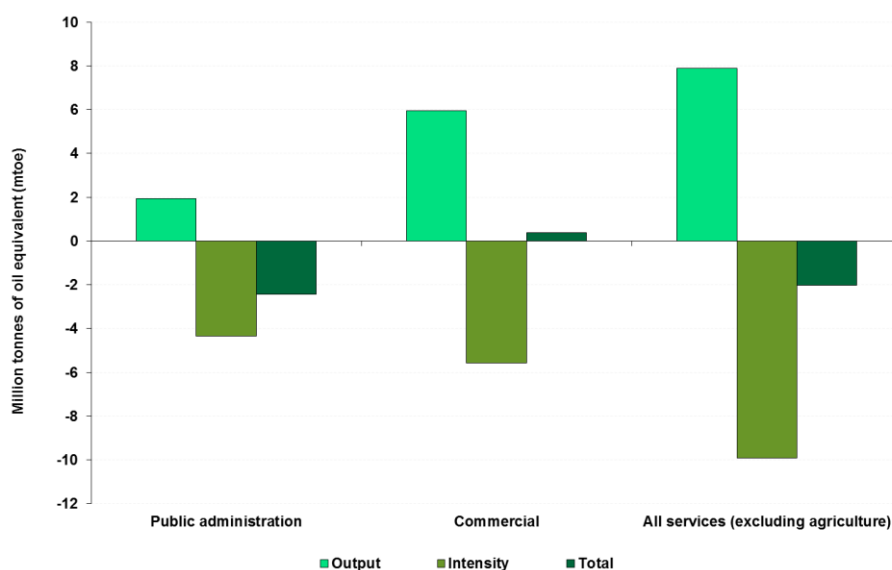
**Chart 5.02: Energy Intensity in the services sector**



Source; BEIS ECUK Tables 5.01, 5.02, 5.03, and 5.04

Chart 5.03 shows the effect of output changes in the services sector compared with intensity effects between 2000 and 2015.

**Chart 5.03: Output and intensity effects in services between 2000 and 2015**

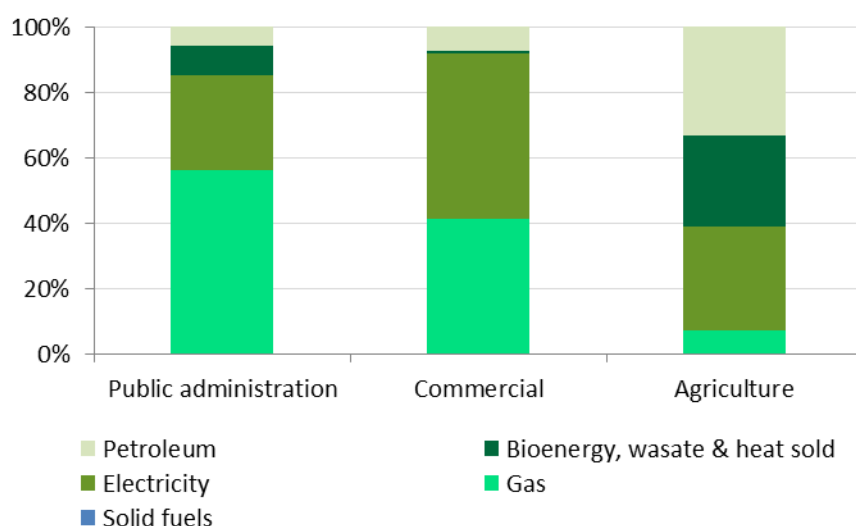


Source; BEIS ECUK Table 5.05

Increased output within public administration would have increased energy consumption by 1.9 Mtoe (34 per cent) had there been no change in energy intensity. However, this was more than offset by a 4.3 Mtoe (77 per cent) reduction in energy intensity. For the commercial sector, consumption due to output increases would have been 6.0 Mtoe (48 per cent) higher but this was largely offset (though not totally) by a 5.6 Mtoe (45 per cent) improvement in energy intensity.

Whilst the **fuel mix** in the services sector as a whole reflects the long term trend of increasing use of gas and lower solid fuel consumption, the pattern varies most notably in the agricultural sector where activity is less focussed on heating and lighting compared to office space. Chart 5.04 shows the fuel mix for 2015.

**Chart 5.04: Fuel mix for public administration, commercial, and agriculture for 2015**



Source; BEIS ECUK Tables 5.02, 5.03, 5.04

In the public sector, gas provides the largest proportion of fuel requirements at 56 per cent compared to the commercial sector where electricity is the main fuel accounting for 51 per cent of consumption. Just 6.9 per cent of fuel in agriculture is provided by gas; 33 per cent is petroleum, 32 per cent electricity, and 28 per cent is bioenergy and heat sold. This reflects activities in that sector where petroleum is required to fuel farm machinery and bioenergy is often produced and consumed on site. The majority of final consumption of

animal and plant based biomass<sup>24</sup> is used within agricultural sector which accounts for 75 per cent and 68 per cent respectively.

### Building Energy Efficiency Survey (BEES)

This project was undertaken by The Department of Business, Energy, and Industrial Strategy to improve and update evidence of how energy is used within non-domestic premises across England and Wales. The forthcoming results will be available via the following link;

<https://www.gov.uk/government/publications/building-energy-efficiency-survey-bees>

However, high level summary results have been included in this edition of ECUK; see table 5.05a. This table replaces 5.05 for 2015 and due to different levels of disaggregation for sub-sectors and fuel sources; it is not consistent with the historical series.

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<sup>24</sup> Although the majority of plant based biomass demand is used to generate electricity, this refers to final consumption. See table 6.1 in DUKES for additional details

## Annex A: Related BEIS publications

### The Digest of UK Energy Statistics (DUKES)

Much of the data contained in ECUK are based on estimates from DUKES. DUKES is an annual publication which includes tables, charts and commentary covering all the major aspects of energy. It provides a detailed and comprehensive picture of fuel production and consumption during the last three years. DUKES 2016 is published alongside ECUK and relates to 2015 data.

[www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes](http://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes)

### Energy Trends

A quarterly publication including tables, charts and commentary covering all major aspects of energy. It provides a comprehensive picture of energy production and use.

[www.gov.uk/government/collections/energy-trends](http://www.gov.uk/government/collections/energy-trends)

### Sub-national consumption statistics

The sub-national data contain estimates at regional, local authority and MSOA/LSOA (for electricity and gas consumption statistics) geographies. However, it is worth noting that the data are not comparable with DUKES and ECUK due to differing data sources.

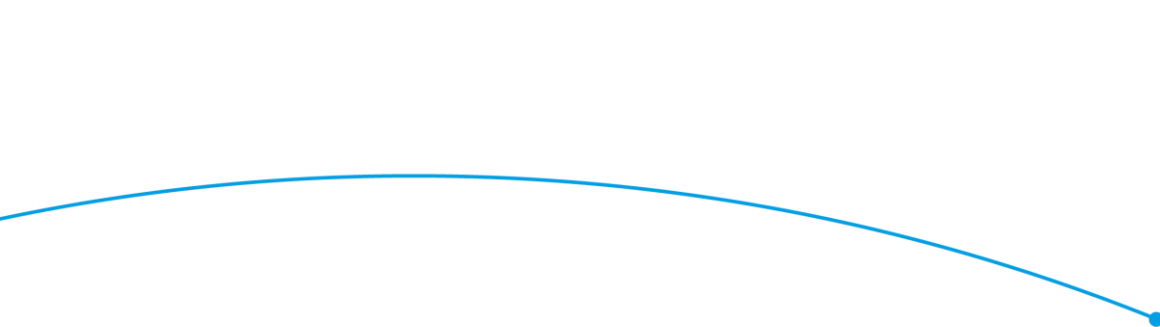
A full summary of the sub-national consumption datasets available, along with links to relevant datasets is available from the following link:

<https://www.gov.uk/government/collections/sub-national-electricity-consumption-data>

### National Energy Efficiency Data Framework (NEED)

The National Energy Efficiency Data-Framework (NEED) was set up by BEIS to provide a better understanding of energy use and energy efficiency in domestic and non-domestic buildings in Great Britain. The data framework matches gas and electricity consumption data with information on energy efficiency measures installed in homes. It also includes data about property attributes and household characteristics.

[www.gov.uk/government/collections/national-energy-efficiency-data-need-framework](http://www.gov.uk/government/collections/national-energy-efficiency-data-need-framework)



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