Great Britain's housing energy fact file

Authors: Jason Palmer, Ian Cooper

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Authors: Jason Palmer, Ian Cooper
Researchers: Martin Hughes,
Vicky Cheng, Amy Tillson (CAR)
Phil Summerton, Ragini Madan (CE)
Les Shorrock, Janet Utley (BRE)

The Housing Energy Fact File aims to draw together most of the important data about energy use in homes in Great Britain since 1970. It is intended for policy-makers, researchers, and interested members of the public.

Prepared under contract to DECC by Cambridge Architectural Research, Cambridge Econometrics and Eclipse, with data provided by BRE. The views expressed are not necessarily DECC's. September 2011.

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1. Introduction and policy context

Introduction

The energy used in homes accounts for more than a quarter of energy use and carbon dioxide emissions in Great Britain. More energy is used in housing than either road transport or industry (Graph 1a), and housing represents a major opportunity to cut energy use and CO_2 emissions.

Much of Britain's housing was built before the links between energy use and climate change were understood. Much of it was also built when there were very different expectations of thermal comfort.

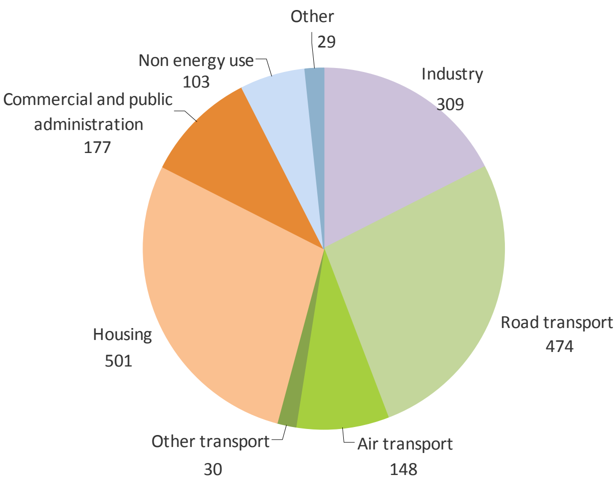
Britain's homes, and how they are used, has changed enormously since 1970.

To put it simply, most families in 1970 lived in homes that would be cold by modern standards in winter – as cool as 12°C on average (see Table 6m, Appendix 1). There may have been ice on the insides of the windows, and nearly everyone accepted the need to wear thick clothes at home in winter.

Few homes had central heating, and many families used coal for heating. Added to this, few families owned the household appliances everyone takes for granted today.

The way energy is used in homes today is very different. Nearly all homes have central heating, usually fuelled by natural gas, and most households have fridges, freezers and washing machines. Many households also own dishwashers, tumble dryers, PCs and games consoles.

The *Housing Energy Fact File* aims to draw together most of the important data about energy use in homes in Great Britain since 1970. As well as describing the current situation, it also shows changes over the last 40 years. It is intended for policy-makers, researchers, and interested members of the public. (More detailed information about homes in England is available on DECC's website, in the *Cambridge Housing Energy Tool,* see http://tinyurl.com/EnergyStatsUK.)



Graph 1a: Final energy consumption by sector 2009 (UK, TWh)

The Fact File is one in a series of reports stretching back to the early 1970s, previously prepared for the Government by the Building Research Establishment. This report was a collaborative endeavour, prepared by Cambridge Architectural Research, Cambridge Econometrics and Eclipse, using data provided by BRE, with input from Loughborough University.

This report supports informed decisions about how to reduce energy use and CO_2 emissions from homes. These decisions are not only the territory of governments and policy-makers, but all of us, in day-to-day decisions about how homes are used and improved.

Policy context

The policy landscape for housing is changing fast. However, housing policies take place in the broader context of legislation on renewables and on greenhouse gases. The EU Renewable Energy Directive requires the UK to obtain 15% of all energy from renewable sources by 2020.

The 2008 Climate Change Act requires:

- a 34% cut in 1990 greenhouse gas emissions* by 2020, and
- at least an 80% cut in emissions by 2050.

** CO_2 is the most important greenhouse gas from housing, and the one most closely related to energy use in homes.*

Housing is responsible for a quarter of the UK's greenhouse gas emissions, so it would be impossible to meet the 2050 objective without changing emissions from homes.

The Government intends to "drive down demand [for energy across the economy], increase efficiency and reduce wasted energy" [1]. DECC's Business Plan for 2011-2015 lays out plans to establish low carbon technologies including renewable power, a new generation of nuclear power and clean fossil fuels using carbon capture and storage[1].

The Government aims to "reduce energy use by households, businesses and the public sector and to help protect the fuel poor"[2]. It is also working to reform the electricity market to encourage low carbon investment[3].

The Government plans to build renewable energy systems across the UK to ensure that at least 15% of energy comes from renewable sources by 2020[1].

The Government is also working to improve the information available to householders, researchers and policy-makers about energy use in homes. DECC is supporting smart meters, which help householders to see how much energy they are using. The Department also set up the National Energy Efficiency Data frameworks[4] to understand more about energy use and the impact of energy efficiency measures.

The Government is supporting smart meters and the National Energy Efficiency Data frameworks (NEED). These will provide more information about how households use energy.

To meet the Government objective of cutting greenhouse gas emissions by four-fifths by 2050, households will have to think carefully about how energy is used in homes. Homes will need a transformation in energy-efficiency, and at the same time make much greater use of low carbon technologies.

2. Energy use trends 1970-2008

Total energy use in housing gives some clues about energy efficiency, but it is only part of the story. For one thing, it says nothing about how the housing stock has grown, or how energy is used in homes.

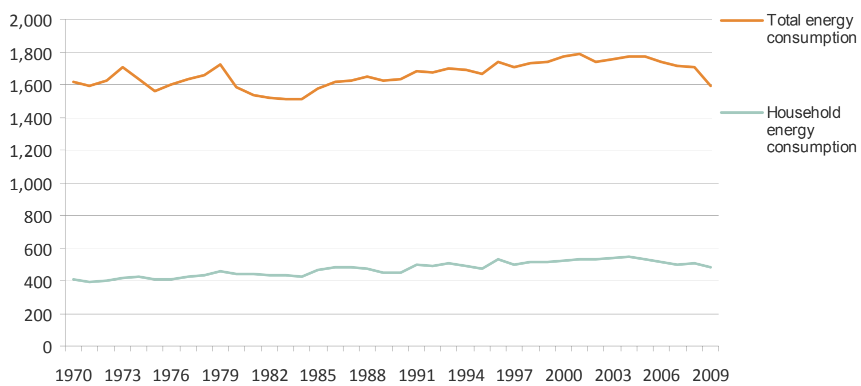
Similarly, the total use of energy hides variations in carbon emissions, because different fuels lead to greater, or lower CO_2 emissions. Nor does this aggregate information say anything about energy spending – because each fuel has a different price, which can vary independently.

Nevertheless, total fuel use is a simple barometer of whether more, or less, energy is used in all British homes over time. It is a good place to start to get an overview of housing energy.

Housing energy is nearly a third of total energy use, and its share is rising over time.

Energy use in homes is just under a third of total energy use in Britain, up from a quarter in 1970. The headline graph below shows that housing energy (the blue line) crept up gradually until 2004, but has fallen by nearly a tenth since then.

The orange line on the graph shows all energy used: transport, industry, public sector use and housing. (All of the sources and references for the graphs in the Fact File are in Appendix 1, and the data is available here: www.carltd.com/FactFile.)



Graph 2a: Final energy use for housing and all sectors (GB, TWh)

Total energy use in Britain rose and fell during the 40 years covered in the graph. However, it finished the period a little below the level of use in 1970: 1,600 terawatt hours, TWh. (A terawatt hour is a million million Watt hours, 10^{12} Wh – equivalent to leaving on a small hairdryer in every home in Britain, continuously, for 1.6 days.)

Energy use in housing rose by 17% from 1970 to 2009 – an average increase of 0.4% per year. However, the number of homes also increased by two-fifths, and average household size has fallen (see Chapter 4). This means that average energy use per home has fallen: from 22,235 to 18,639 kWh.

Overall energy use in homes has risen since 1970, but use per household has fallen by getting on for a fifth.

3. Carbon emissions and energy generation trends

Almost all energy use results in CO_2 emissions, which contribute to climate change.

Carbon dioxide emissions and energy use are inextricable. Nearly all use of energy results in increased CO_2 emissions somewhere – even nuclear electricity and renewable power require energy (and emit CO_2) to build generating capacity and, for nuclear, in extracting and refining uranium.

However, the carbon-efficiency of electricity generation has improved since 1970 – largely through switching from coal to gas in power stations. (This section focuses purely on CO_2 and excludes other greenhouse gases.)

This section of the Fact File charts how CO_2 emissions and energy prices have changed over time. There are two key points raised:

- Carbon dioxide emissions from housing have fallen since 1970, but have remained broadly stable since 1995. This was despite increases in the number of homes and changing expectations about energy use in the home.
- As to the cost of energy in the home, the cost per unit of electricity, solid fuel and oil have increased in real terms, while gas costs per unit have fallen somewhat over the last 40 years. Rising costs for electricity hit poorer households with electric heating the hardest.

Carbon emissions

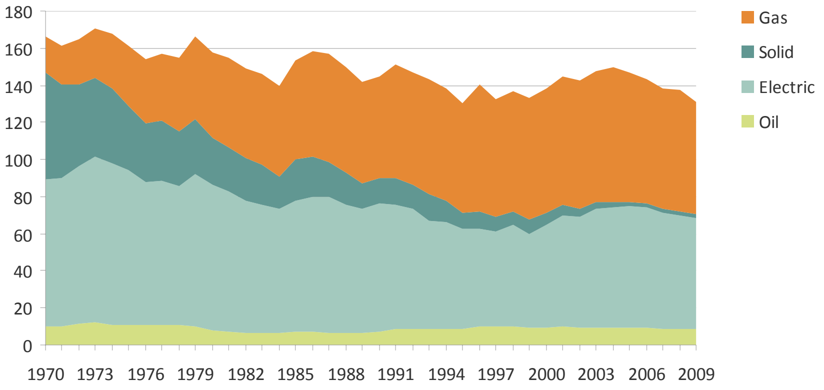
There are many more British homes today than there were in 1970: towards 26 million now, compared to just over 18 million at the start of the period. Inevitably, this puts upward pressure on carbon emissions.

Added to this, significant changes in heating systems, comfort expectations, insulation and use of appliances have transformed carbon emissions from housing. However, some changes (like greater use of appliances) have worked against other changes aimed at saving energy and CO_2 (like better insulation).

Overall there has been a broad downward trend in CO_2 emissions from housing (see graph below). However, the trajectory has not been straight – and unsurprisingly, cold, prolonged winters lead to higher CO_2 emissions. (These figures are derived from the energy use data in Graph 7a, Chapter 7.)

Gas use has more than trebled since 1970, while solid fuel use has fallen away from more than a third of housing CO_2 in 1970 to less than 2% today. Carbon emissions from electricity, meanwhile, have fallen by nearly a quarter since 1970.

However, electricity's share of total household CO_2 emissions has remained fairly stable, at between two-fifths and half of carbon emissions from housing (see graph below).



Graph 3a: CO_2 emissions from housing energy (million tonnes)

CO_2 emissions from oil use in homes have also fallen, by about a tenth since 1970. Again, they remain a similar proportion of overall carbon emissions from housing.

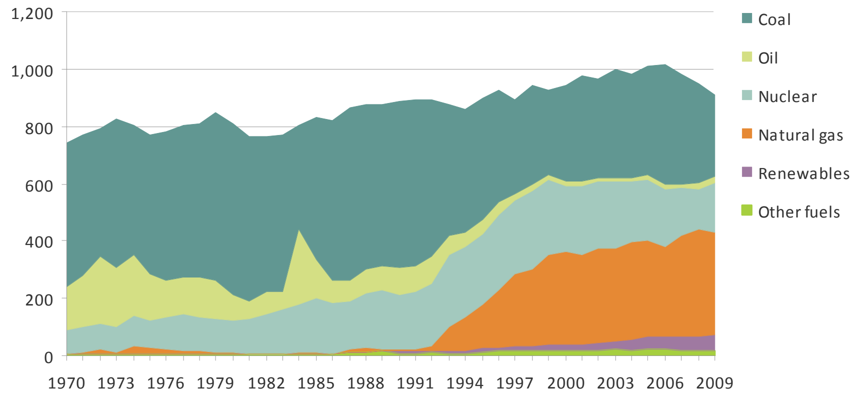
Electricity generation

Electricity generation in Britain has changed considerably since 1970. The changes have come mainly as a result of different prices for the input fuels used in power generation, but also because of the availability of North Sea gas, electricity sector privatisation, and growth in nuclear power.

These changes alter the economics and the environmental impact of electricity use – in the home and beyond. Notably, coal has fallen steeply as an input into power generation (see graph next page).

Coal is a high carbon fuel, which leads to high emissions of CO_2 per unit of electricity from a coal-fired power station. It is also quite polluting, and burning coal results in relatively high nitrous and sulphurous emissions. Nitrous oxide is a very potent greenhouse gas (300 times more potent than CO_2). Sulphurous emissions have a cooling effect on the climate but they contribute to acid rain.

We now use much less coal to generate electricity, which means that CO_2 emissions per unit of electricity have fallen dramatically.



Graph 3b: Energy content of fuel input for UK electricity generation (TWh)

Coal-fired power has been mainly displaced by electricity generated from natural gas and, to a lesser extent, by nuclear power. While two-thirds of the country's power came from coal in 1970, this has fallen to under a third today.

Oil has declined even more rapidly in the electricity generating mix: from just over a fifth of Britain's electricity to 2% now. (There was a big increase in oil use for power generation during the miners' strike in 1984-5.)

Coal and oil have witnessed a steep fall in their share of the power generation mix. Two-fifths of our electricity now comes from gas.

The share of electricity coming from nuclear power almost doubled over the period – from just over 10% to just under 20%. However, nuclear power peaked in 1998, when it generated towards a third of Britain's power, and the decline since then looks set to continue unless the nuclear power stations now reaching the end of their lives are replaced.

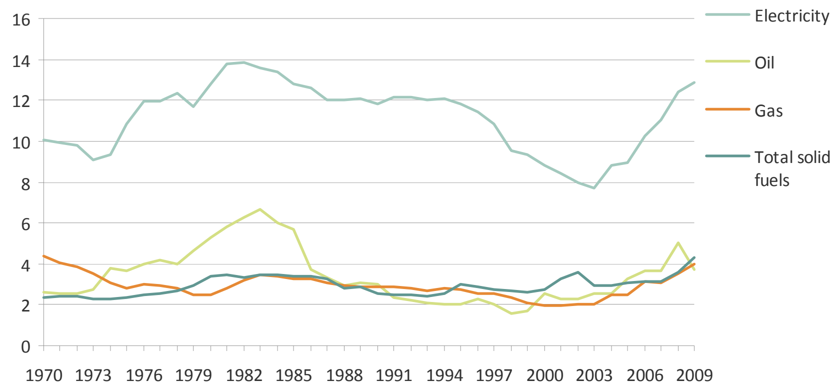
Natural gas was used to produce a tiny fraction of power in 1970. But today, as a result of the 'dash for gas' in the 1990s, it generates nearly two-fifths of the country's electricity.

The proportion of power coming from other sources (principally gas from coke ovens and blast furnaces, chemical and refuse waste, and renewables) has grown from almost nothing to 2%.

Energy prices

Household spending on energy is directly affected by the price of different fuels. Fuel prices have changed significantly since the 1970s, even when inflation is removed from price figures, as shown in the graph on the next page.

The real price of electricity has increased by over a quarter since 1970, and the rise since 2003 was much steeper: a jump of two-thirds in only six years. This is significant because electricity is three or four times more expensive per kWh than other forms of energy. The prices of gas and solid fuels tended to be more stable.



Graph 3c: Average UK household fuel prices (p/kWh, 2009 prices)

Heating oil closed the period about 40% more expensive in real terms than it was in 1970. However, the most volatile time for oil costs was in the 1970s and 80s, when the price increased by more than 150%, and then slipped back to the same cost in real terms.

Gas prices were remarkably stable in real terms throughout the four decades in the graph. They finished the period about 10% lower than they were at the beginning.

The price of solid fuels, including coal, coke and breeze, rose gradually during the period, finishing nearly 90% more expensive in real terms. (This is probably less significant than price changes for electricity and gas because far fewer homes now use solid fuel heating.)

The demand for energy is usually reckoned to be 'inelastic' in the short term (i.e. energy use doesn't change much straight away when prices go up) but 'elastic' in the long term (i.e. a few years after price rises households are able to make changes to save energy).

However, low-income households, who spend proportionately more of their incomes on energy, are hit much harder by energy cost rises. Their demand for energy tends to be more elastic than wealthier households, meaning that they tend to use less if prices rise (see also[5]).

Low-income households spend proportionately more on energy, and lack resources to improve energy efficiency. They are forced to use less energy if prices rise.

In the long term, all households may act to reduce electricity use as a result of higher real costs of power. Savings could come from low energy lights and appliances, and possibly reduced use of conventional (resistance) electric heating.

Savings in electricity use may also come from EU policies, such as the EU's draft regulation on standby on appliances being limited to 1 Watt[6], and the phase-out of ordinary incandescent bulbs[7].

4. The housing stock, households and bills

Great Britain's housing stock changes very slowly. There are now getting on for 26 million dwellings in England, Scotland and Wales[8], but only around 180,000 new homes are built each year, and far fewer homes are demolished.

(The Department of Communities and Local Government defines a dwelling as 'a self-contained unit of accommodation'. A household is defined as 'one person or a group of people who have the accommodation as their only or main residence and either share at least one meal a day, or share the living room'[9].)

The total number of dwellings changes very slowly over time: the average growth in numbers of dwellings from 2000 to 2009 was only 190,000 – well under 1% per year.

Similarly, existing homes undergo improvements over time, but historically the rate of improvement has been very slow. More recently, CERT has accelerated the rate of upgrades, and especially of cavity wall insulation, and loft insulation – see Graph 6j in Chapter 6.

Historically Britain's housing stock has changed very slowly, but now unparalleled improvements to energy-efficiency are needed to meet climate change objectives.

Britain has now embarked on an ambitious strategy to accelerate the rate of housing energy-efficiency improvements. This, coupled with work to decarbonise energy supply, will allow progress towards climate change objectives in the housing sector.

This section of the Fact File explains the current situation in terms of different types and ages of homes, who owns them, and how they are spread around the country. It also provides information about household spending on energy and how this relates to household incomes.

In summary, there are five main trends emerging from the data:

- the number of households is increasing at a rate of 0.85% a year, and average household size is falling
- the concentration of households is shifting – slowly – away from the North, towards the South West, Midlands and South
- flats and detached homes are now more common, and together these make up more than a third of the stock
- there has been a significant change in home ownership since 1970 – nine million more homes now belong to the household living there, and local authorities now own four million fewer homes than they did in 1970

- energy bills have fallen in relation to total household spending – from 6% in 1970 to 4% today.

Population and households

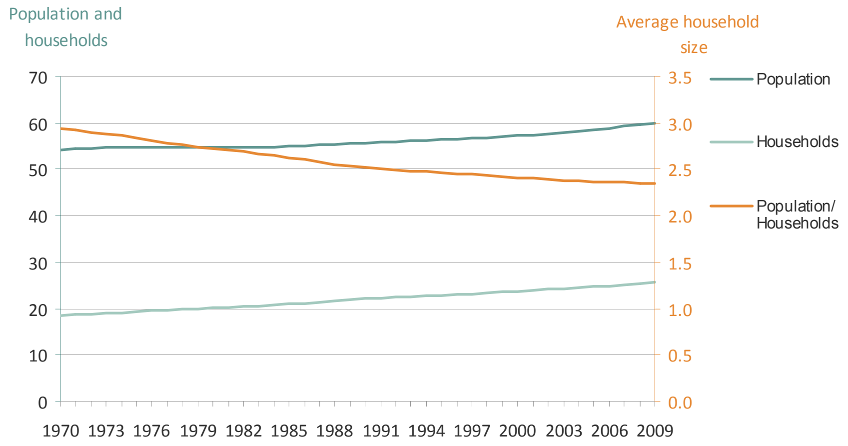
It is a truism that buildings do not use energy – people do. However, people do not actually want to use energy – it is services like light and comfort they really seek.

Nevertheless, it comes as no surprise that energy use in homes is strongly affected by both the population and the number of households. Hot water use and use of some appliances (kettles, hair driers, washing machines) increase in proportion to household size.

However, heating energy (which is the biggest slice of energy use in homes) usually correlates more strongly to the size of dwellings, and household size makes little difference to heating.

There also seems to be a minimum level of energy use in homes, which applies regardless of the household size. For example, households nearly always run a fridge or fridge-freezer, some electronic appliances, minimum heating and hot water whether they live alone or in large families.

The graph below shows how Britain's population, and the number of households, have changed since 1970. (As before, all of the sources and references for these graphs are in Appendix 1.)



Graph 4a: Population and households (millions)

The population rose very slowly, from 54.1 million in 1970 to 60 million in 2009 – an average 0.27% increase every year. However, the number of households grew more rapidly over the period, from 18.0 million in 1970 to 25.6 million in 2009. The average yearly increase in household numbers was 0.85% (note that this is a steeper rise than from 2000 to 2009).

The rising number of households reflects a trend for smaller households, with more people living alone and in small families. This inevitably has

The number of people in a home, and the home's floor area, both influence energy use. However, dwellings seem to have a minimum annual energy use that is not related to the number of occupants or floor area.

How people use energy in their homes is usually more significant in shaping consumption than either household size or the size of the dwelling.

implications both for the provision of appropriate housing and for energy use in homes.

Without improving the energy-efficiency of homes, or the ways people use energy at home, growth in household numbers and smaller average household size would lead to higher per capita energy use.

Demographic trends – particularly increasing numbers of pensioners – and changing working patterns may affect energy use.

There are also demographic trends affecting how energy is used, and how much. An ageing population with more pensioners, and more flexible working practices – which make people more likely to work from home – mean an increased proportion of dwellings are heated between 9am and 5pm on weekdays.

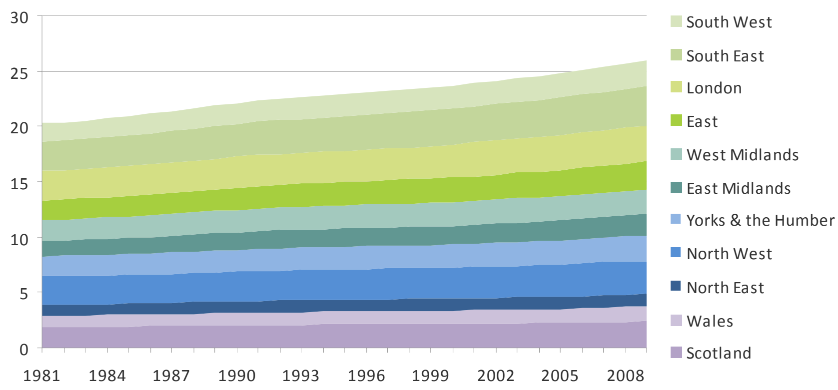
This inevitably increases heating energy use in the home, and probably also the use of lighting and appliances.

Geographical profile of homes

Some parts of Great Britain have much harsher winters than others. There is also higher rainfall and stronger wind in some parts of the country.

Typically, Scotland and the North of England are colder in winter, while the South and especially the South West are usually milder. Wales and the west coast and upland areas see most of the rain, while it is significantly drier in the East.

This all translates into different heating requirements for homes in different regions. We have divided households into the nine government office regions in England, one for Scotland and one for Wales, in the graph below.



Graph 4b: Number of households by region (millions)

The number of households has risen in all regions since 1981 (the first year data is available). On average for Britain as a whole, there are now over a quarter more homes than there were in 1981.

However, the expansion was not shared evenly throughout the country. The fastest-growing regions in terms of new households were the South West and the East (both nearly 38%).

The North East and North West grew much more slowly – only 14.5% and nearly 16%, respectively. Scotland's households grew by a quarter, while Wales's grew by 28%. Overall the concentration of households is shifting – slowly – away from the North, towards the South West, Midlands and South.

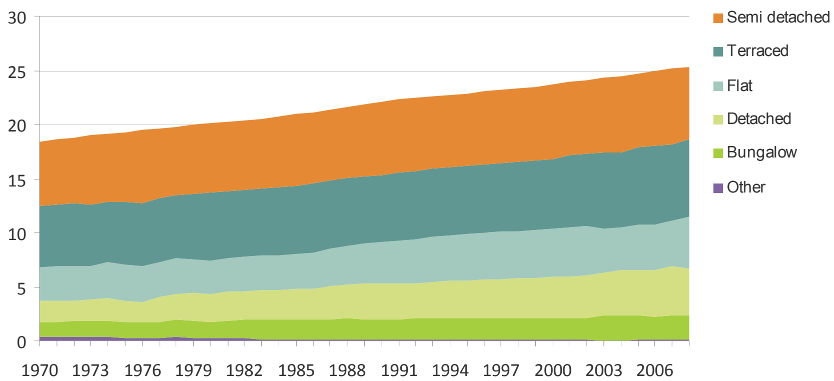
The concentration of housing is shifting – very slowly – towards the South West, Midlands and South, where it is milder.

Type profile of homes

'House type' refers to whether dwellings are semi-detached, terraced houses, detached houses, flats or bungalows. Unsurprisingly, the housing mix changes slowly over time – due to new house building and some demolition of dwellings.

However, over nearly 40 years the change is quite pronounced (see graph below*). While semi-detached and terraced houses have always been the most common house types (each representing just under a third of the housing stock throughout the period), flats and detached houses have become more common. (Flats are now 19% of the housing stock, and detached houses are 17%.)

** We should note here that there were significant changes in data collection methods between 2002 and 2003, when the English House Condition survey replaced surveys carried out by GfK. This means that there are inevitably some discontinuities within the data series. The changes are described in more detail in Appendix 2.*



Graph 4c: Housing stock distribution by type (millions)

This is significant in energy terms because heating energy is related to external wall area and window area. Flats tend to have less external wall area compared to their floor area (so have less heat loss in winter), while detached houses typically have more external wall and more windows than equivalent homes of other types.

The heating energy effects of proportionately more flats and detached houses probably offset each other. A bias towards higher glazing ratios (larger windows compared to walls) in many modern flats may undermine some of the benefit of lower wall to floor ratios in modern flats.

Some house types also tend to be larger (e.g. detached houses) or smaller (e.g. flats) than an average home. Since heating energy is correlated to floor area, this means that the doubling in the number of detached homes would increase heating energy unless other factors affecting heating changed.

Different house types also imply differences in lighting energy use – linked to window areas and how 'deep' the homes are.

Age profile of homes

The age of a dwelling usually affects its energy efficiency, and older homes typically have poorer insulation than modern homes.

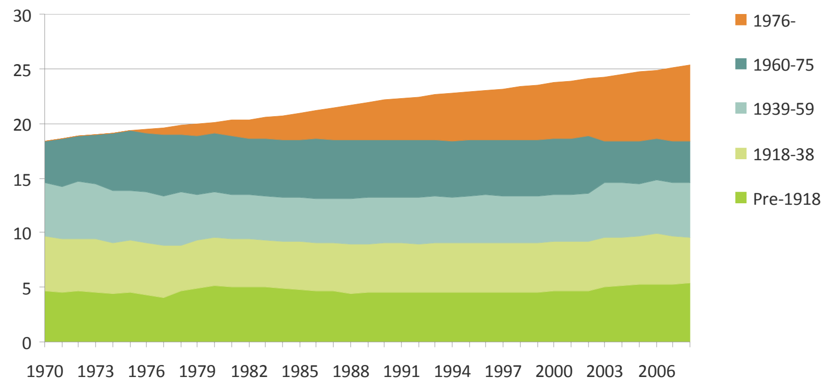
Two of the most important determinants of heating energy use are insulation and the efficiency of heating systems. Both are related to a home's age. Broadly, older homes have inferior insulation and if they have solid walls they are more difficult to bring up to modern standards of insulation.

(Even if they have improved insulation in the loft over time and added double-glazing, older homes tend to have poorer thermal performance than new homes overall. First, because it is unusual to retrofit underfloor insulation and to insulate solid walls, and second because even older homes with cavity wall insulation added do not match current standards for new homes in the Building Regulations.)

Heating systems are usually much easier to change than wall or floor insulation, and they nearly always have much shorter service lives than the homes they heat. This means that although a home's original heating depends on when it was built (along with other factors, like access to a gas main), the current heating system in most homes is not the original one.

(This does not mean that older homes tend to have heating systems as efficient as those in new homes, and there is a time lag in heating upgrades.)

Because the demolition rate for housing is so low, the number of existing homes for all periods stays almost the same (see graph below). The real change in the age profile of housing is, unsurprisingly, the increasing number of more recent homes dating from 1976.



Graph 4d: Housing stock distribution by age (millions)

In 1970, homes were divided fairly evenly between the four age bands (broadly, pre-war, inter-war, post-war and 1960s). Around 190,000 new homes were built each year on average from 2000 to 2009 (160,000 in England[10], 23,000 in Scotland[11], and 8,000 in Wales[12]).

This means that the pre-1976 age bands now each represent a smaller share of total housing: about a fifth each. 'Modern' homes built since 1976 now make up just over a quarter of the stock.

The dip in the number of 1960s-70s homes shown in the graph in 2003, and the spike in the 1940s-50s homes, is probably due to the change in housing survey that took place that year, and not a spate of demolitions and sub-divisions of the earlier homes.

The Building Regulations addressed energy conservation from 1965, and the controls on energy became ever stricter in every revision of Part L of the Regulations. This means that, in theory, modern homes should be more energy-efficient than older ones.

Almost all 21st Century homes have better insulation and more efficient heating systems than homes from earlier periods. This means that the increased proportion of modern homes in the stock should, by itself, lead to better average energy efficiency and lower carbon emissions per home.

Nearly all modern homes have better energy efficiency than older ones – largely because the Building Regulations force developers to make the homes they build more efficient.

This path is likely to continue in future – as the Building Regulations continue to get stricter, and as modern homes make up an ever-larger share of the stock. However, electricity use is not included in the Regulations (this would be very difficult because electricity use depends on what appliances people use and how). And electricity use is growing, see next chapter.

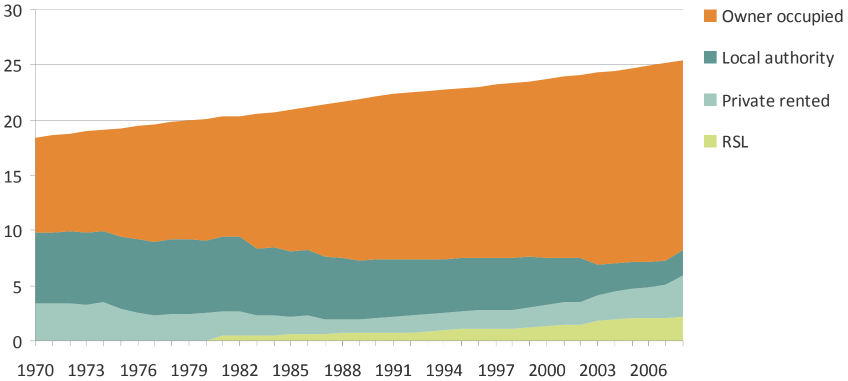
Home ownership

It is not immediately obvious why home ownership should affect energy use. However, historically housing belonging to some groups (e.g. local authorities or Registered Social Landlords – RSLs) has been much more likely to get energy-efficiency improvements[13].

Conversely, private rented homes are less well insulated[15]. (In part this is because the landlords who would pay for improvements do not get the benefits in improved comfort or lower bills.)

This means that, overall, you would expect housing belonging to local authorities and RSLs to have above-average energy performance, followed by owner-occupied homes, followed by below-average energy performance for privately rented homes.

Changes in the ownership structure of British homes have been quite pronounced in the past 40 years – a more dramatic change than the changes in housing type or age (see Graph 4e). There are now many more owner-occupied homes, and far fewer local authority-owned homes.



Graph 4e: Housing stock distribution by tenure (millions)

In 1970, less than half of all homes were owned by their occupants, whereas by 2008 nearly 70% belonged to the people living there. There was an even starker change in local authority ownership, and while councils owned more than a third of homes in 1970, this had fallen to less than a tenth by 2008.

Some responsibility for providing social housing switched to RSLs from the early 1980s, and their share of British housing rose from nothing in 1980 to nine per cent of the stock by 2008.

The impact of these changes on energy efficiency is complex, with some changes pushing in one direction and others pushing in another. The rise in home ownership means that many households have more of a stake in their homes, so they are more likely to maintain them.

If window seals fail, or a door gets damaged, homeowners may be more likely to replace them quickly.

However, energy efficiency improvements have historically come second to concerns about the quality of homeowners' accommodation: people who own their own homes are probably more likely to invest in better kitchens or bathrooms than in wall insulation or a more efficient boiler. Further, poorer people who own their own homes may find it much harder to raise the money for energy-efficiency improvements than local authorities or RSLs.

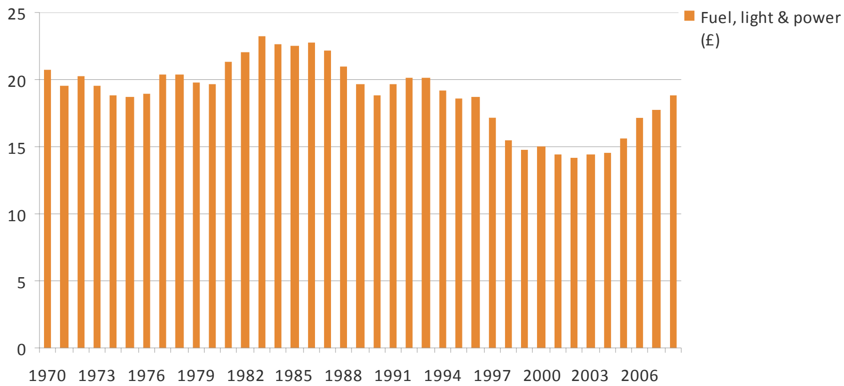
Fewer council-owned properties make it harder to carry out wholesale improvements to a whole street or estate, because of fragmented ownership.

Fewer homes owned by local authorities (and the smaller share of social housing generally) makes it more difficult to carry out wholesale improvements to a whole street or estate – because ownership is fragmented, and a single big project may need the agreement of many different owners.

The number of private rented homes fell markedly from 1970 to 1988, but it recovered more recently, and there are now more private rented homes than there were in 1970. This is probably due partly to the fashion for 'buy-to-let' investments and mortgages.

Household spending on energy

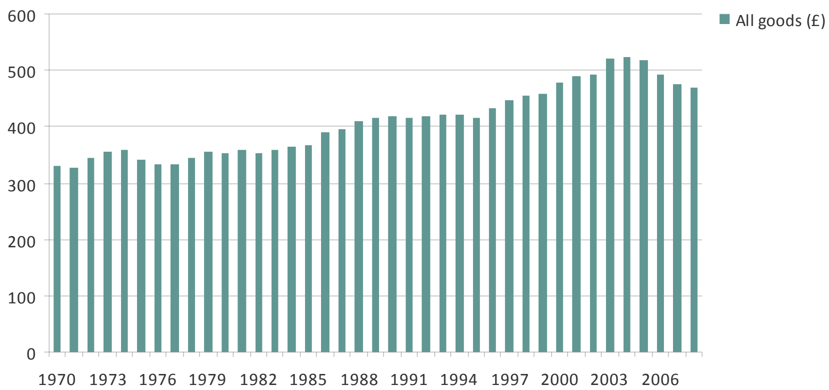
Spending on energy has varied quite a lot since 1970, and average weekly spending on heating, lighting and power reported in the Living Costs and Food Survey [14] was a tenth lower in 2009 than in 1970 (normalised to 2009 prices, see graph below).



Graph 4f: Average weekly expenditure on fuel, light and power (£/wk, 2009 prices)

Energy costs have fallen in relation to total household spending – from 6% in 1970 to 4% in 2008.

Further, the graph below shows that total weekly spending by households has also risen over the period – by two-fifths. This means that energy costs have fallen as a proportion of total household spending: from more than 6% on average in 1970 to 4% in 2008. From 2001 to 2004 (a period of low energy cost) it was even lower: less than 3% of total expenditure.



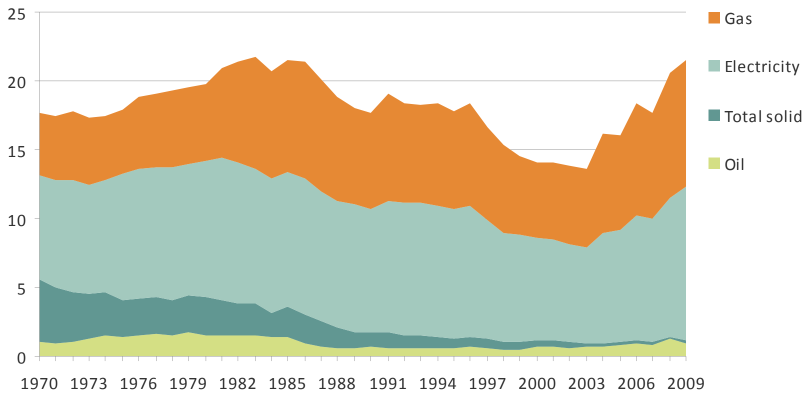
Graph 4g: Average weekly expenditure on all goods (£/wk, 2009 prices)

Energy costs per household are inevitably affected by household size. As average household size has fallen, the burden of paying for energy bills falls on fewer people – so the energy cost per head increases even as energy cost per household falls.

For example, in 1970 total household spending on energy was £319 million per week, averaged over the year, in 2009 prices (see Appendix, Tables 4a and 4h). This cost was borne by a population of 54 million – i.e. an average energy cost per person of £5.91 a week.

Whereas, in 2009, total household spending on energy was £556 million per week. The population in 2009 had grown to 60 million, so the average energy cost per person was £9.27 a week. (This increase incorporates both an increase in the use of heating/appliances – see below – and the effect of smaller households.)

Household energy costs are also affected by the proportion of energy coming from different fuels. Spending on gas per household has more than doubled since 1970, while spending on electricity has gone up by nearly half – see graph below. Conversely, expenditure on coal is only a twentieth of its level in 1970.



Graph 4h: UK Weekly energy expenditure by fuel (£/HH, 2009 prices)

(Note that these figures, from the Digest of UK Energy Statistics, do not exactly match total energy spend figures from the Living Costs and Food Survey reported above, although the trends are consistent.)

Part of the change in energy spend is a result of changes to the housing stock and how homes are used, and part of it is due to changing energy prices (in pence per unit). Energy prices are probably more significant in short-term changes.

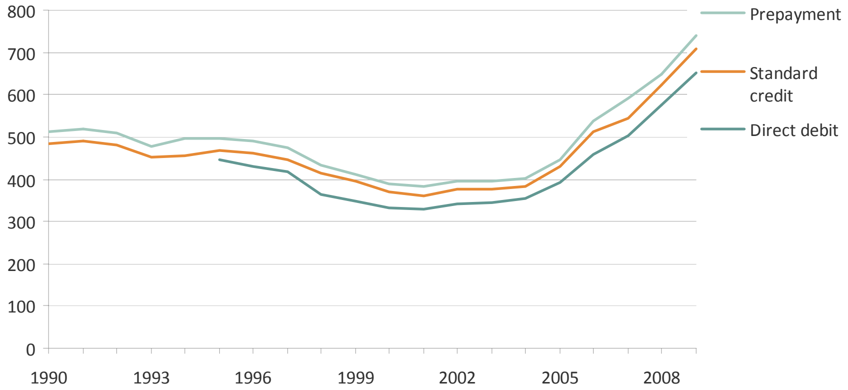
Gas bills

Gas bills have increased steeply since 2004 – even excluding the effect of inflation.

Gas is now the main fuel used for heating British homes. Its price is therefore important – both in charting energy costs relative to incomes and total household spending, and particularly in questions about fuel poverty.

Precise prices for gas vary according to the method of payment, and discounts are offered to households that pay for their gas using direct debit (see Graph 4i below).

Overall average gas bills have risen in real terms since 1990. The graph shows all prices adjusted to 2009 values, so removing the effect of inflation. Excluding inflation, then, gas bills have increased by nearly half to an average of £708 per year.



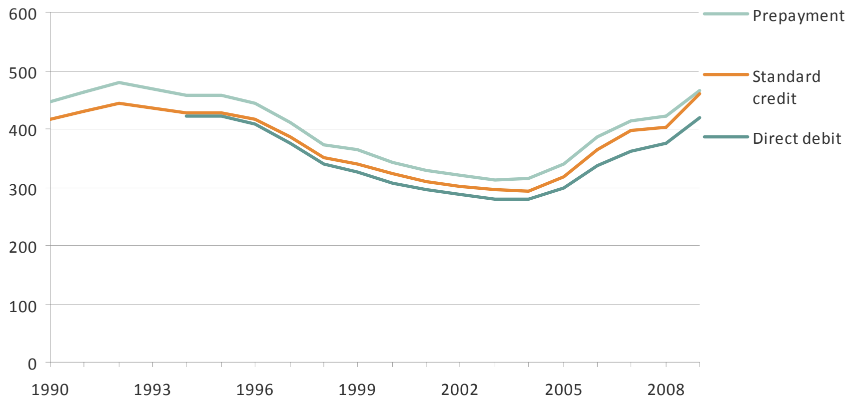
Graph 4i: Average annual gas bill (£, 2009 prices)

Electricity bills

Again, discounts are offered to electricity customers who pay using direct debit, while households using prepayment meters pay more for their electricity (see graph below).

As for gas, there was a downward trend in prices until 2004, but then electricity prices rose, and by 2009 the average electricity bill was more than 10% higher – £458 per year. (Households with electric heating face bills that are much higher than this, on average.)

Electricity bills too have risen significantly since 2004.



Graph 4j: Average annual UK electricity bill (£, 2009 prices)

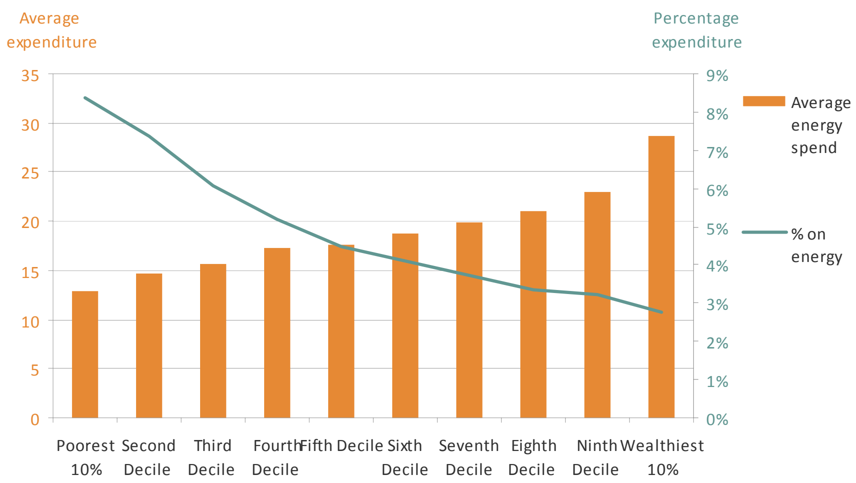
Household incomes

Intuitively, you might expect energy spending to be loosely related to income, with wealthier households living in larger, warmer homes, with more appliances and spending more money on energy. Is it true, though, that the richer you are the more you spend on energy?

The graph below shows how much different households spent on energy each week in 2008. Households are divided into ten 'deciles', with the poorest 10% on the left and the richest 10% on the right.

Wealthier families spend more on energy than poorer ones, but a smaller fraction of their income.

You can see that it is true that wealthier households do spend more on energy each week than poorer ones. Each successive band of income spends more than the one before it on energy, on average, in pounds per week. (The wealthiest 10% also spend significantly more on average – £5.70 a week – than the next 10% of incomes.)



Graph 4k: Average UK weekly expenditure on fuel, light & power, & income (£/wk/hh) 2008

** Averaging in the data means that the graph suggests no-one spends more than 10% of their income on energy. This is not true – in fact around 4 million people do, see Chapter 6.*

However, as a fraction of income, every successive band of income spends a smaller proportion of earnings on energy. On average, while the poorest 10% spend 8.4% on energy*, the wealthiest 10% of households devote just 2.7% of their spending to energy in the home.

Again, the explanation for this pattern of spending is complicated. You would expect people on low incomes to be much more careful about their energy use than richer households. However, poorer households are also more likely to live in poorly-insulated homes, and less likely to be able to improve their homes' energy efficiency.

Conversely, wealthier households may be more prone to ignoring 'avoidable' energy use (like heating unused rooms, or leaving unnecessary lights on). But they probably also have more money to invest in insulation, efficient heating, lights and appliances, and/or renewable energy systems.

This data is crude, and the reality is that there is limited understanding of how income and poverty affect energy use in homes. Better survey data would help to unpack the links between income and energy use, and this field is ripe for more research

.

5. How much energy is used in homes?

This chapter of the Fact File shows estimates of how energy use in homes breaks down into different so-called 'final uses'. Most of the data has been modelled, although there is also a section presenting actual weather data over the past 40 years. To summarise, there are five important points to draw from the data:

- winters in Britain were a little milder from 1988 to 2007 than they were at the beginning of the period
- energy used for heating homes has increased by two-fifths since 1970, although it has fallen since 2004
- less energy is used now for water heating and cooking in homes than it was 40 years ago
- more energy is now used for lights and appliances in homes than it was in 1970
- average SAP ratings (a standardised way to assess housing energy efficiency) have improved every decade, and the average SAP rating for a British home is 51.6.

Energy use and weather

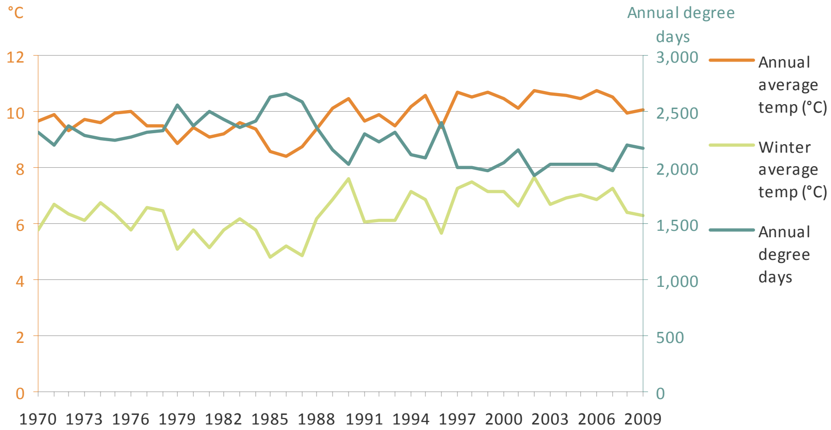
Average winter temperature is one of the most important determinants of energy use in homes.

The difference in temperature between outside and inside homes in winter is the single most important factor shaping energy use at home. If it is very cold outside and householders choose to heat their home to 25°C, their home will inevitably use much more heating energy than if it were mild outside and the home were only heated to 18°C.

The average winter temperature for the year is one of the simpler ways to summarise past weather data. The graph below shows how average winter temperature (the pale green line) varies from year to year. ('Winter' is defined as January to March and October to December.)

On average, winters since 1988 have been milder than those at the start of the period – one or two degrees centigrade milder. The average winter temperature hides some complexity in how external temperature changes over time (for example, it does not show very cold periods in the evening, when people are at home and heating their homes).

Nevertheless, the graph shows particularly cold winters in 1985 and 1987, and particularly mild ones in 1990 and 2002. You would expect above-average energy use and CO_2 emissions in 1985 and 1987, and below-average figures in 1990 and 2002.



Graph 5a: Average UK air temperatures

'Degree days' give another measure of how mild or cold it is in winter. (A degree day is defined here as the number of days mean temperature is below 15.5°C, times the temperature difference. This figure allows you to normalise space heating energy use or CO_2 emissions between years with different weather.)

You can see from the graph that degree days are almost a mirror image of average winter temperature. Cold winters have many more degree days than mild ones.

Again, you would expect years with many degree days to coincide with years of high energy use and CO_2 emissions from housing. Degree days can also be used to standardise energy use and CO_2 for different weather data.

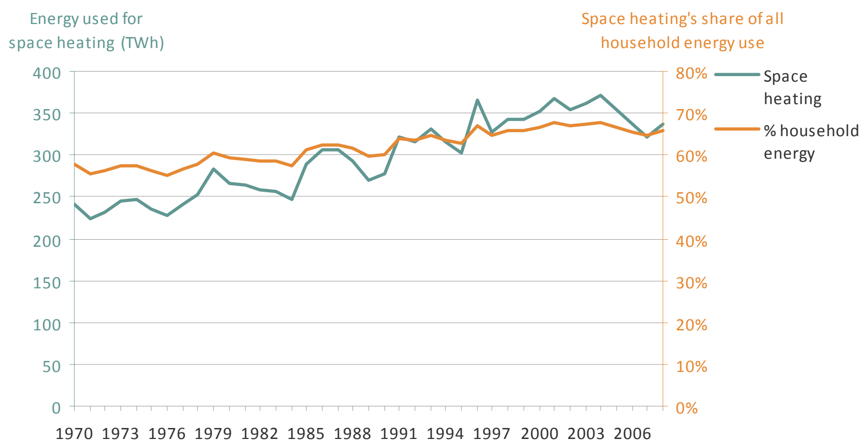
Space heating

Heating energy is by far the biggest slice of Britain's household energy use. To make serious inroads in cutting CO_2 from housing, heating energy has to be part of any solution.

Energy use for heating increased by two-fifths in the past 40 years.

(This section and the four sections that follow are based on modelling by BRE – previously the Building Research Establishment – using BREHOMES. Graphs drawn from modelled data are highlighted with a bold border. A brief summary of the modelling procedure is included as Appendix 3.)

The four-decade story about heating energy is not the direction of travel needed to meet climate change objectives. In fact modelling suggests heating energy increased by two-fifths (see graph below). This is slightly more than the increase in the number of homes (up from 18.4 to 25.6 million, an increase of 39%). This means that improvements in insulation and heating system efficiency were offset by housing growth, and the demand for warmer homes, see Chapter 6.



Graph 5b: Household energy use for space heating (TWh)

Surprisingly, given the improvements in energy efficiency, heating's share of total energy use in homes has also grown: from 58% to 66%. This may indicate that the rise of central heating made more difference to energy use than better energy efficiency – by allowing people to heat the whole of their homes rather than just individual rooms.

Another interpretation is that this reflects the way homes have been extended over the years, increasing the heated volume, and especially how conservatories have been added and heated – which significantly raises heating energy use[15].

We have saved 10% of the energy used for heating since 2004.

However, the good news is that modelling suggests a significant reduction in heating energy used since 2004: a saving of 10%. This does not appear to be the result of milder winters, and some commentators (e.g.[16]) would argue that this is largely due to the increase in energy costs since 2004.

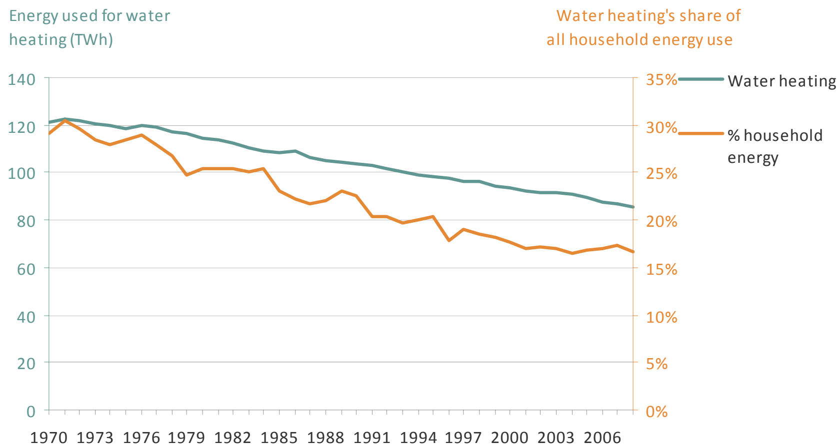
Hot water

Britain's use of energy to provide hot water in homes has fallen dramatically since 1970 – this is a quiet success story. Modelling suggested there was a 30% cut in energy used for hot water, in spite of the increase of more than two-fifths in the number of households (see graph below).

Unsurprisingly, this led to a shrinkage in the proportion of household energy used for water heating – down from nearly 30% to just 17%*.

This improvement is consistent with the reduced heat loss from stored hot water (through better lagging of tanks and pipes, and eliminating hot water tanks with combi boilers), more efficient heating systems, and also greater use of electric showers and dishwashers.

** Recent evidence from EST Field Trials[17] suggests that less energy is used for hot water than we thought in the past. Figures reported here have been adjusted compared to previous Fact Files to reflect this, with less energy used for hot water and more for heating.*



Graph 5c: Household energy use for water heating (TWh)

Lights

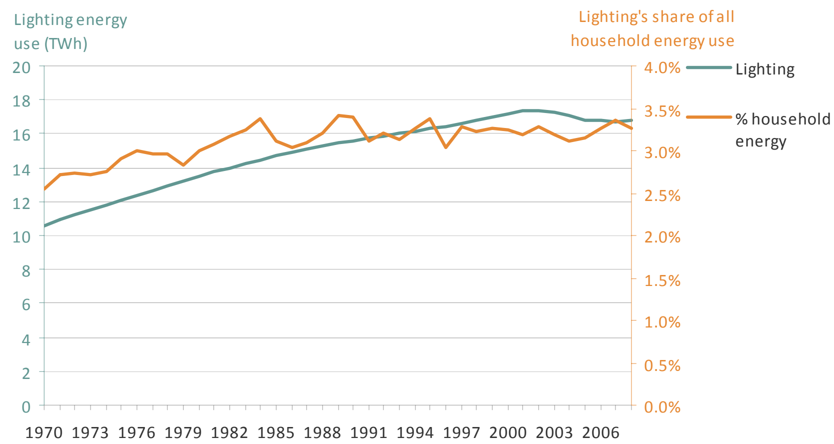
Lighting energy has always been a small proportion of total housing energy: around 3%, and here a very different story emerges. Energy use for lighting increased every year until 2002, and then began to decline – see graph below. Overall it increased by nearly 60% from 1970 to 2008.

Energy use for lighting has increased by two-thirds since 1970 despite widespread take-up of low energy lights.

As a proportion of all household energy use, there was a parallel rise – from 2.5 to 3.3%. There are opposing forces affecting the figures for lighting energy.

On one hand, most old-fashioned incandescent bulbs have been withdrawn from sale, and the Carbon Emissions Reduction Target (CERT) provided many low energy bulbs for homes, so there are now far more low energy lights being used in homes.

On the other hand, most homes now have more light fittings than they did in 1970 – especially in kitchens and bathrooms. Lighting in kitchens, in particular, tends to be a much higher specification than it was in the past. Many homes have replaced a single fluorescent strip light with many high output spotlights.



Graph 5d: Household energy use for lighting (TWh)

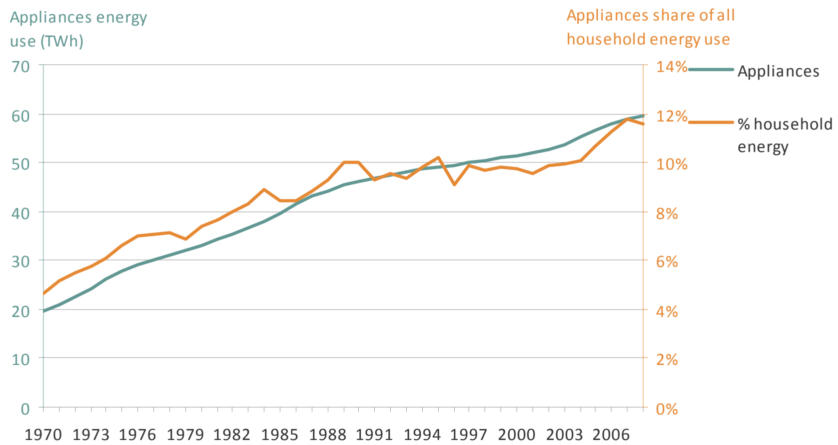
Appliances

**Appliances are defined in BREHOMES as everything except space and water heating, lighting, the oven and main hob. This means that the energy used in microwaves, sandwich toasters and toasters, for example, is counted here and not in 'Cooking' below. Central heating pumps and fans, and electric showers, are also included as 'appliances'.*

The growth in appliances* energy use has been even sharper: it has tripled in less than 40 years (see graph below). The average annual growth in appliances energy was nearly 3% a year, although the annual rise appears to be slowing.

Appliances' share of total energy use in homes has followed a similar path, and whereas household appliances used less than 5% of total energy in 1970, they now use nearly 12%.

There are three factors at play in increased appliances energy use – none of them unexpected. First, there are now many more electric gadgets in homes – washing machines, tumble driers, hairdryers, computers, consoles and chargers.



Graph 5e: Household energy use for appliances (TWh)

Second, the use of these appliances has increased (ownership alone does not raise energy use). These changes point to higher disposable incomes and complex lifestyle changes – automation of jobs previously done by hand, and substituting energy-using appliances like computers and consoles where in the past people would have worked using pen and paper or entertained themselves with board games or books.

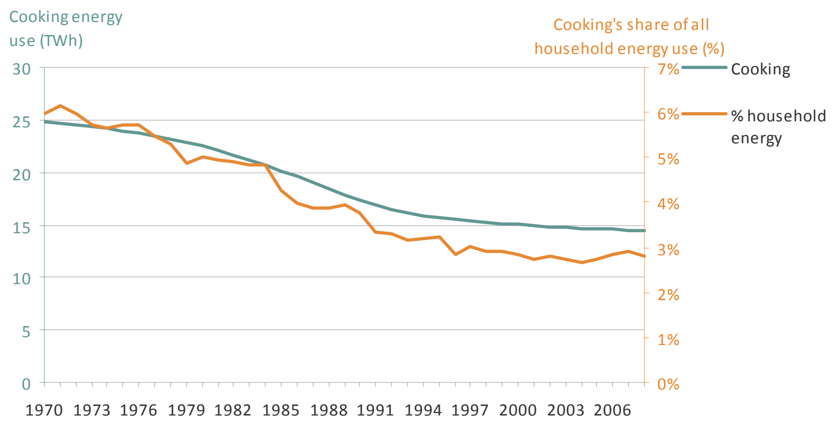
Third, much greater use of cold appliances to store food – freezers and large fridges are now commonplace, likely to increase energy use even though the efficiency of new cold appliances has improved. Further, microwaves are often used to thaw out frozen food. This energy service did not exist in 1970.

Cooking

A more positive outcome from changes in lifestyles, perhaps, is energy saving from cooking. About two-fifths less energy is now used in cooking than was in 1970 (see graph below). (Note, though, that part of this saving has really just been transferred to appliances energy, as new devices like microwaves, sandwich toasters and bread machines have replaced traditional ovens and hobs.)

We now use two-fifths less energy for cooking – partly because of more efficient appliances and more 'ready meals'.

As a proportion of all energy use in the home, cooking has more than halved: from 6% to less than 3%. The decline appears to be levelling off, and the rate of change was more rapid in the 1980s and 90s than it has been since 2000.



Graph 5f: Household energy use for cooking (TWh)

Where have the savings come from? In part from more efficient cooking devices: microwaves and fan-assisted ovens have surely helped. But the huge expansion in 'ready meals' and takeaways is probably a bigger factor in the decline in cooking energy, and it is questionable whether these lifestyle changes have saved energy overall.

Energy efficiency (SAP) ratings

__Average SAP ratings are a barometer for how the energy efficiency of Britain's homes has improved.__

The Standard Assessment Procedure, SAP, is the Government's method of evaluating the energy efficiency of homes. It has been used since 1993.

The figures before this date, shown below, are approximate back-projected estimates. Since 1993, the method for calculating SAP has been reviewed and updated periodically.

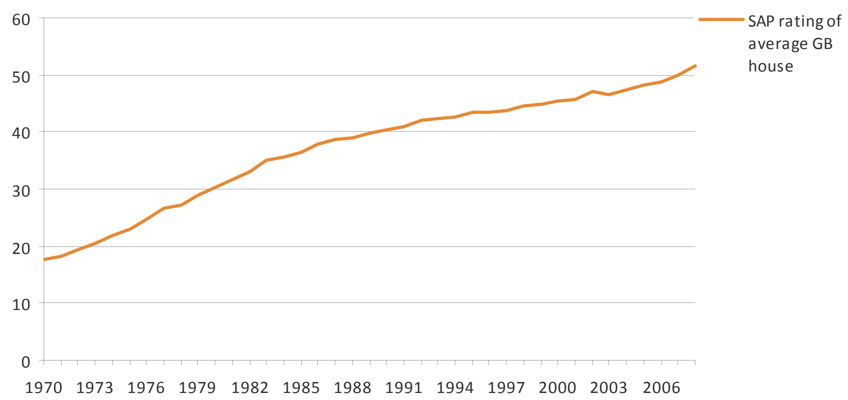
SAP 2005 has been used for the calculations below. A new version, SAP 2009, will be used for Fact File calculations from next year.

SAP rates homes based on the annual energy costs for space heating, water heating, ventilation and lighting (less savings from energy generation technologies) under standardised conditions. It uses a scale from 1 to 100 (values of more than 100 are possible for homes that generate sufficient energy from renewable sources).

The higher the rating, the better the energy efficiency and the lower the annual energy costs.

SAP also delivers an energy consumption per unit floor area metric and produces an estimate of annual CO_2 emissions.

In general, more modern homes have higher SAP ratings, and typical ratings for new homes are around 80. Older homes, conversely, have lower SAP ratings, but there is an upwards trend in the average rating for a British home (see graph below).



Graph 5g: Average SAP 2005 ratings by year

The improvement in average SAP rating is due partly to the better efficiency of new homes, but mainly to upgrades to existing homes – either to improved insulation or more efficient heating systems.

There was a marked improvement in SAP ratings in the 1970s and early 1980s, largely due to improvements in insulation and heating system efficiency – notably installing gas central heating. This improvement slowed in the remainder of the 1980s and 1990s, but was re-energised from around 2000. Improvements since 2005 coincided with the Energy Efficiency Commitment (EEC1 and 2) and subsequently the Carbon Emissions Reduction Target (CERT).

Stricter Building Regulations also drove average SAP ratings higher. The energy conservation part of the Building Regulations stipulated at least a D-rated boiler and E-rated windows from 2002, and at least B-rated (i.e. condensing) boilers from 2006.

So far there is no evidence of a plateau in average SAP ratings. These ratings are a good barometer for home energy efficiency, and further improvements in insulation and heating efficiency will inevitably push average SAP ratings higher.

There is no evidence so far of a ceiling for average SAP ratings.

However, electricity use for appliances (outside of its contribution to internal gains, ventilation fans and ceiling mounted lights) is not reflected in SAP ratings, so it would be a mistake to rely on SAP alone to assess Britain's homes. Lights and appliances are a significant and rising proportion of total energy use (and an even larger proportion of household CO_2 emissions).

SAP is driven by the Building Regulations so only 'regulated energy' is currently included in the rating. There may be a case for widening the scope of SAP so it directly incorporates electrical energy use and cost. For instance, energy use by appliances is already part of SAP but is only used to assess zero carbon homes for the purpose of exemption from stamp duty.

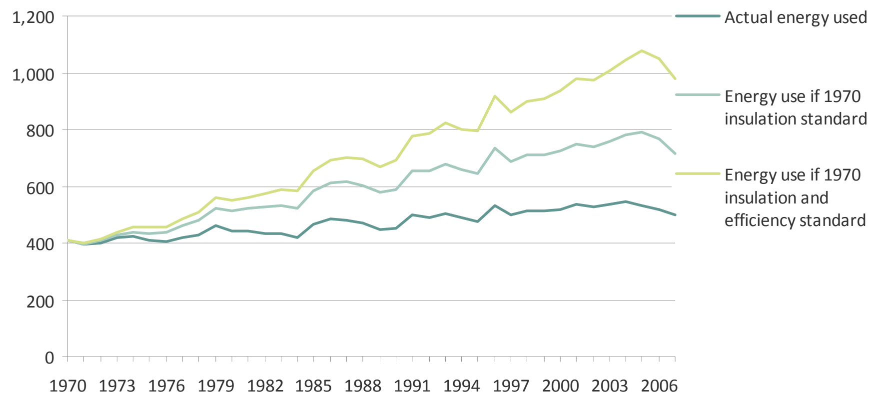
Such widening is problematic in terms of regulations. For instance, specifying low energy appliances throughout a dwelling to comply with regulations would not guarantee that such appliances would continue to be used (unlike a similarly specified heating system or insulation).

Thermal aspects of energy use in the home are now well understood by developers, and new homes are better insulated and usually have more efficient heating systems than most older homes. However, there is little evidence of parallel savings in electricity use, perhaps because new homes have more light fittings and higher installed lighting loads – especially in kitchens, bathrooms and for external lighting.

Roots of thermal improvement

The improvements above in SAP ratings can also be expressed in overall savings in energy use. Part of the saving in thermal energy is due to insulation, and part is due to better heating efficiency. But which is more significant?

The graph below shows modelled estimates of the energy that would have been used in homes without improvements to insulation or heating system efficiency since 1970 (the green line). It also shows how much energy would have been used if there were better heating efficiency but no improvement in insulation (pale blue).



Graph 5h: Effect of energy efficiency improvements on energy use (TWh)

The calculated figure in the graph is hypothetical (given the difficulties involved in defining the savings that would have been achieved depending on households' behaviour)[18]. But it does give a good indication of the quantity of energy that has been saved by energy efficiency measures.

Without the improvements in insulation and heating systems, we would be using twice as much energy in our homes.

Unsurprisingly, the graph indicates that without the improvements in insulation and heating system efficiency, dramatically more energy would be used in British homes: twice as much.

Perhaps more surprising is the fact that modelling suggests more of the saving comes from heating efficiency improvements than from insulation: nearly three-fifths of the estimated saving comes from the heating side, while just over two-fifths comes from insulation.

(It is worth noting, of course, that boilers do not last as long as insulation and they need to be replaced periodically.)

According to the modelling the graph is based on, energy use would have been considerably higher in 2005 if homes had retained the 1970 standard of insulation and/or heating system efficiency. As it is, actual energy use fell between 2004 and 2005, due partly to the combined effect of insulation and heating system improvements.

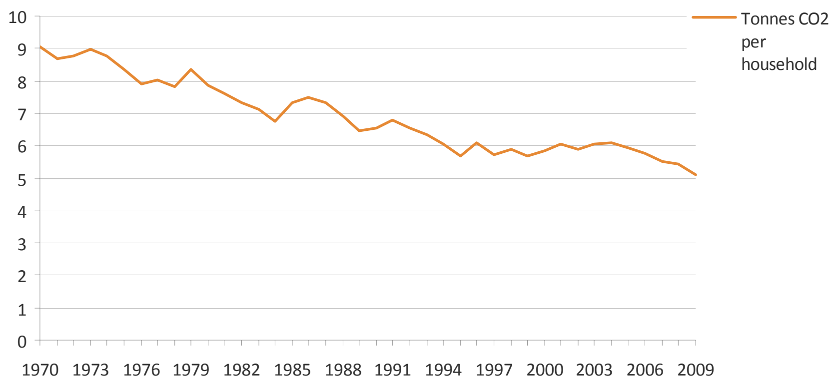
Carbon emissions

We noted above in the section on carbon emissions that CO_2 emissions from housing have fallen since 1970, even in spite of an increase of two-fifths in the number of households, and changing expectations of thermal comfort and appliances use.

We have achieved dramatic savings in CO_2 per home since 1970 – down by nearly half.

Average CO_2 per home

Carbon dioxide emissions per household have fallen markedly since 1970. This is another quiet success story: CO_2 per home is getting on for half what it was at the start of the period (see graph below).



Graph 5i: CO_2 emissions per household (tonnes)

The success is particularly impressive given big improvements in winter comfort for nearly all households.

Part of the savings came from the famous 'dash for gas' in the 1990s, when newly-privatised electricity companies developed gas-fired power stations using North Sea gas to replace (more expensive) coal-fired power stations. However, the downward trend started 20 years before, and continued after 2004.

Part of the savings also came from better insulation in homes and more efficient space and water heating systems, reported above.

Again, the trend is 'lumpy', with troughs corresponding to mild winters and peaks corresponding to severe ones, and this lumpiness is likely to continue – sometimes supporting and sometimes acting against carbon savings per home. On average, the annual reduction in CO_2 per household is 1.4%.

6. What shapes energy use in homes?

Overview

Great Britain's housing stock may change gradually but there have been profound changes to its energy efficiency over the past four decades.

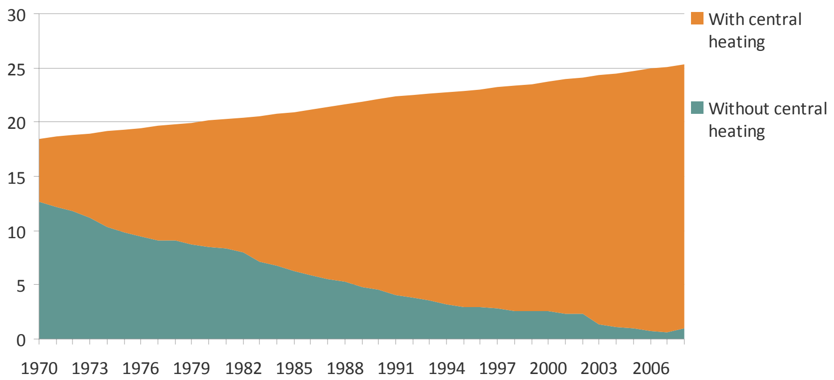
In summary, there are five main trends emerging from the data below:

- people in Great Britain now run their homes at significantly higher temperatures in the winter than they did forty years ago
- almost every home now has central heating – increasing the amount of energy used for heating unless adequate energy efficiency measures are in place
- growth in central heating, predominantly fuelled by gas, has brought great improvements in the carbon efficiency of heating
- the rate homes lose heat during the heating season has, on average, fallen sharply in the last four decades
- in new and existing homes, energy efficiency policies (including the Building Regulations) have helped drive the take-up of efficiency measures such as condensing boilers, double-glazing and loft and cavity wall insulation.

Central heating

More and more central heating has been installed in the housing stock over the last four decades and now nearly all homes have it. The rise has been steady, and within living memory central heating has changed from a relatively rare luxury to being standard almost everywhere.

In 1970, less than a third of homes had central heating – see graph below. By 1990, this had risen to four fifths and, by the turn of the century, to more than nine out of ten homes. By 2008, only 4% of the housing stock had yet to install this one time luxury.



Graph 6a: Households with central heating (millions)

This nearly complete penetration of central heating into homes marks an important turning point. Once people have central heating, their aspirations about how warm they can be at home change significantly, as do their expectations about how to achieve this.

If they have sufficient disposable income, they can heat more of their house and for longer. For most people, gone is huddling around the fire in a household's one heated room: in its place stands the potential for all day heating throughout the home.

This has important implications for energy use and CO_2 emissions. Unless installing central heating is married to improvements in insulation, an average centrally-heated home would require about twice as much energy for space heating as a similar home with heating only in the living room[19].

A centrally-heated home uses around twice as much energy for heating as an identical home with heating only in the living room.

Even with central heating, those with low disposable incomes – especially the 4 million so-called fuel poor households – may still struggle[20]. They would have to spend 10% or more of their income on fuel to maintain a satisfactory heating regime (usually 21°C for the main living area and 18°C for other occupied rooms).

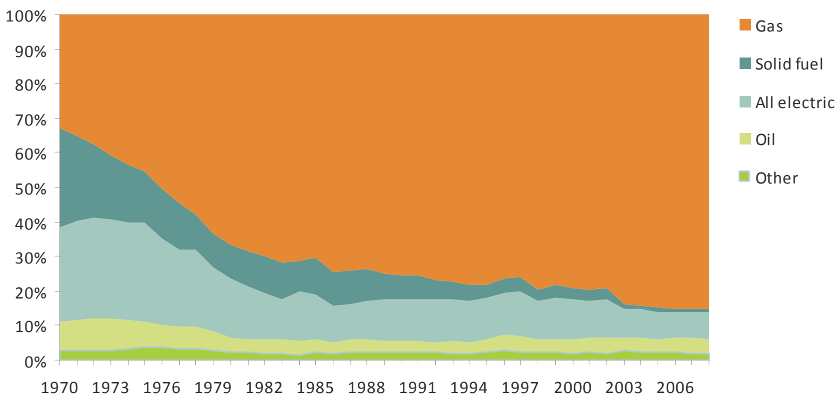
Improving the energy efficiency of low-income homes is an effective way of tackling fuel poverty. But there is likely to be a rebound effect here – where efficiency improvements are offset by changes in behaviour such as demand for warmer rooms.   And it is only when indoor temperatures approach some ceiling level of 'comfort' that households are likely to cut heating energy after installing additional energy efficiency measures[21].

On top of this, as recent research has shown[22], simply providing controls for central heating systems (thermostats and time clocks) does not necessarily result in homes being heated in ways that reduce energy consumption or carbon emissions.

Fuel use in homes with central heating

The last four decades have seen significant changes in the fuels used to heat homes in Great Britain. Solid fuel, electricity and oil have been replaced by gas as the main fuel for heating in homes with central heating.

As the graph below shows, in 1970 more than a quarter of homes with central heating used solid fuel and more than a quarter used some form of electric heating, while 8% used oil and only a third used gas. In 2008, less than 1% used solid fuel, only 8% used electricity, while oil use had halved to 4%. By then, the proportion of households using gas for their central heating had risen to 85%.



Graph 6b: Main form of heating for centrally heated dwellings (%)

On average, our heating systems are more efficient now – in terms of heating output per unit of delivered energy – than they have ever been.

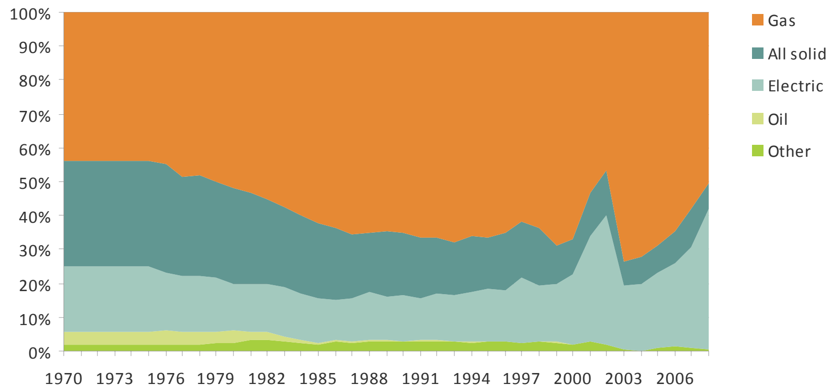
The growth in gas central heating – and especially switching from open fireplaces to condensing gas boilers – made average heating systems much more efficient. Average boiler efficiency (in terms of heating energy output/delivered energy input) has increased from 49 to 77% since 1970[23].

There has been an even greater improvement in the carbon-efficiency of heating, because of conversions from high carbon fuels (electricity and coal) to a lower carbon fuel (natural gas).

Fuel use in homes without central heating

The last four decades have also seen significant changes in the fuels used for heating homes without central heating (just 4% of dwellings). But, as the graph below shows, here solid fuel has been replaced by electricity as well as by gas. In 1970, nearly a third of these homes used solid fuel while one fifth used electricity and two fifths used gas.

By 2008, use of solid fuel had dropped to less than 8% while electricity rose to two fifths and gas to half of households with no central heating. During the same period, use of oil (outside of central heating) disappeared, falling from just under 4% to zero.



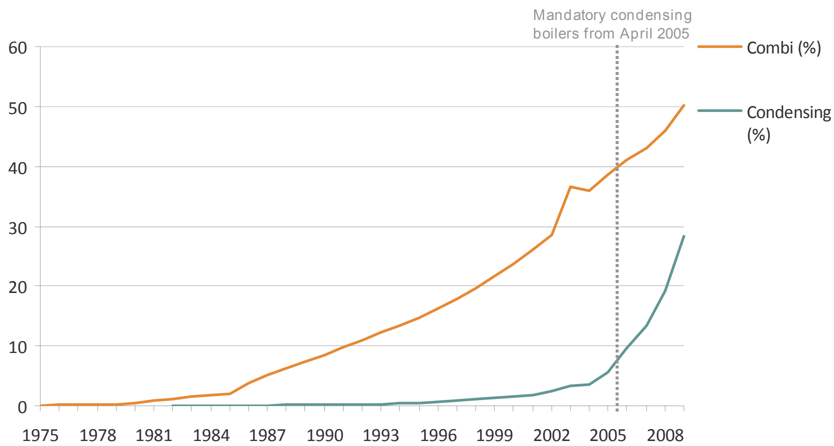
Graph 6c: Main form of heating for non centrally heated dwellings (%)

The increase in electric heating in homes without central heating since 2000 is probably due to the rising proportion of flats in the housing stock. Flats are more likely to use electric heating for safety reasons and because of lower installation costs. (The fall shown in electric heating on the graph in 2003 is probably due to the change in survey methods and/or sample sizes around this time.)

Condensing boilers

Since 2005, all new gas central-heating boilers fitted in England and Wales must be high-efficiency condensing boilers, unless there are exceptional circumstances. Since April 2007 the same condition has applied to oil-fired boilers. Similar regulations are in force in Scotland. These regulations have had a dramatic impact on the take-up of condensing boilers, see graph below.

Today almost all new boilers installed are energy efficient condensing units.



Graph 6d: Ownership of condensing and combi boilers (%)

(The kink in the graph for combi boilers in 2003 is due to changes in the English House Condition Survey.)

Before the 2005 regulation, condensing boilers made up only 6% of the gas and oil boilers in the UK. Three years later, they represented nearly a fifth. This increase translates into a significant improvement in energy efficiency.

A condensing boiler extracts additional heat from its waste gases by condensing this water vapour to liquid water, thus recovering its 'latent heat'. A typical increase of efficiency can be as much as 10-12%.

Lab tests show modern condensing boilers can offer efficiencies around 90%, which brings most brands of condensing gas boiler in to the highest available categories for energy efficiency[24]. However, field trials show lower efficiencies are achieved in practice[25].

Getting on for half of the boilers in our homes are now 'combi' boilers with no large hot water tank.

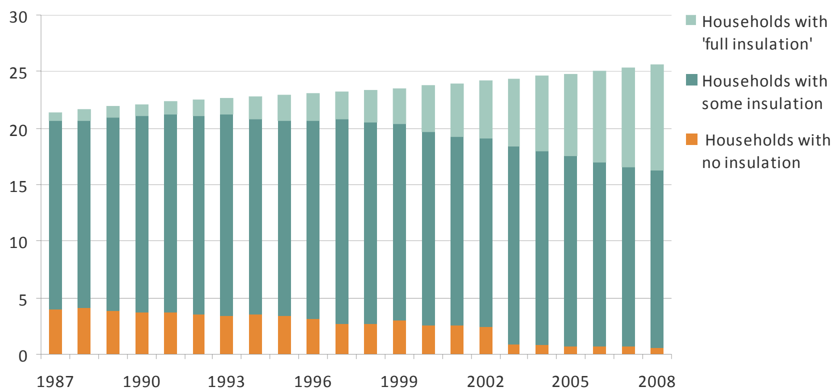
As the graph above also shows, the growth in use of combination (or 'combi') boilers has been more steady. Their share of the boiler market is now approaching half of all boilers.

Combi boilers, as their name suggests, combine central heating with domestic hot water heating in one box. These water heaters instantly heat water as it flows through the device, and retain little water internally except for what is in the heat exchanger coil.

Until 1982, less than 1% of the gas and oil central heating boilers in the UK were combis. By 2004, more than a third were. Since 2005 combis also have to be condensing boilers. In 2009, condensing combis made up more than a fifth of gas and oil central heating boilers in the UK.

Overview of insulation

Steady but relatively slow progress has been made in introducing insulation into the British housing stock, see graph below.



Graph 6e: Households with no, some and 'full' insulation measures (millions)

From 1987 (first figures available) until 2008, the number of households with no insulation fell by 85%, from nearly a fifth to just 2%. Likewise, over the same period, the number of households with what, in the past, was described as 'full insulation' (defined below) rose 12-fold, from 3% to 36%.

So now there are few homes with no insulation, but nearly two-thirds of the stock still has insufficient insulation by modern standards.

Here 'full insulation' is defined as:

- at least 100mm of loft insulation (where there is a loft)
- cavity wall insulation (where there is a cavity)
- at least 80% of rooms with double-glazing.

(This definition is well below modern standards of insulation, especially because solid wall properties with no wall insulation are treated as fully insulated. The Energy Saving Trust now recommends a minimum of 270mm of loft insulation, while DECC uses 125mm as a threshold because this depth saves 85% of the energy of 270mm of loft insulation[26]. However, we have retained the definition, using 100mm as the break-point, to allow for consistency and so readers can see trends easily.)

DECC estimates that over half of homes built with cavity walls now have cavity wall insulation[26].

'No insulation' is defined as:

- no loft insulation (where there is a loft)
- no cavity wall insulation (where there is a cavity)
- no double-glazing.

Homes without lofts or with solid walls are favoured by this categorisation. So, for example, a house with solid walls, loft insulation of 100mm or better, and full double-glazing, would be categorised as 'fully insulated'. But a house with cavity walls – with the same loft insulation and double-glazing – would not be categorised as 'fully insulated' unless its cavities were also insulated.

The majority of houses built under the 1985 Building Regulations or later are in the 'fully insulated' category. So the proportion of 'fully insulated' homes will continue to rise[27], especially as initiatives encourage more retrofitting of existing homes.

Drivers of change

The 2006 Building Regulations were themselves expected to lead to a 25% improvement in energy efficiency (relative to the previous 2002 version). Since 2002 the Regulations have made it compulsory to upgrade energy efficiency in existing homes when extensions or certain other works are carried out, which will help to improve the energy performance even of older homes over time[28].

Changes to the 2010 Building Regulations will increase the levels of insulation (and air tightness) of new homes. Energy efficiency standards for new homes are being improved by 25% in 2010 and 44% in 2013 relative to 2006 standards[29].

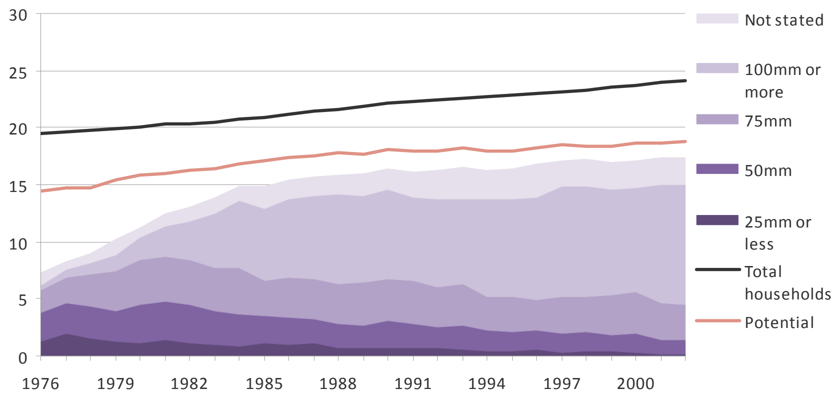
Other initiatives, such as the Energy Efficiency Commitments (EEC1 and EEC2) and the Carbon Emissions Reduction Target (CERT), have also contributed to improving insulation in existing homes[30].

Loft insulation

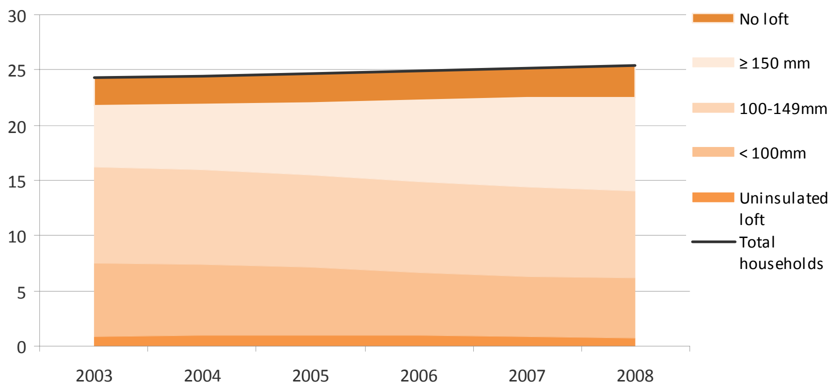
There has been a dramatic change in the number of homes with some level of loft insulation over the past four decades. As the first graph below shows, about half of Great Britain's housing stock that could have loft insulation had some in 1976. A quarter of a century later, in 2002, this proportion had increased to more than 90%[31]. But most of these homes still had what would be seen today as inadequate levels of loft insulation (from 25-100mm).

The Building Regulations, EEC and CERT have been effective in raising standards of insulation.

The regulations governing the amount of loft insulation required in new homes, and following 'material alterations' to existing ones, were increased in 2002. Further changes were made when the Building Regulations were revised again in 2006. The impact of these revisions and initiatives such as EEC1 and EEC2 (the Energy Efficiency Commitment programmes – forerunners to CERT) can be seen in the second graph below. (The graphs have been split in 2002 because of changes to the way data was collected in the English Housing Survey.)



Graph 6f: Depth of loft insulation (millions of households) - pre EHS



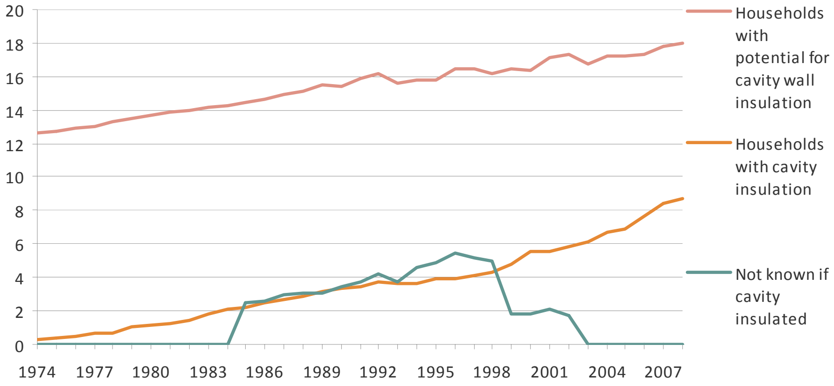
Graph 6g: Depth of loft insulation (millions of households) - post EHS

Since 2002, the number of homes with higher levels of insulation has increased notably. By 2008, 3% of homes had no loft insulation, just over a fifth had up to 100mm (4 inches) of loft insulation, just under a third had

100-149mm (4-6 inches), and around a third had 150mm or more (six inches or more).

Cavity wall insulation

There has been a stark increase in cavity wall insulation in Britain's housing stock, see graph below.



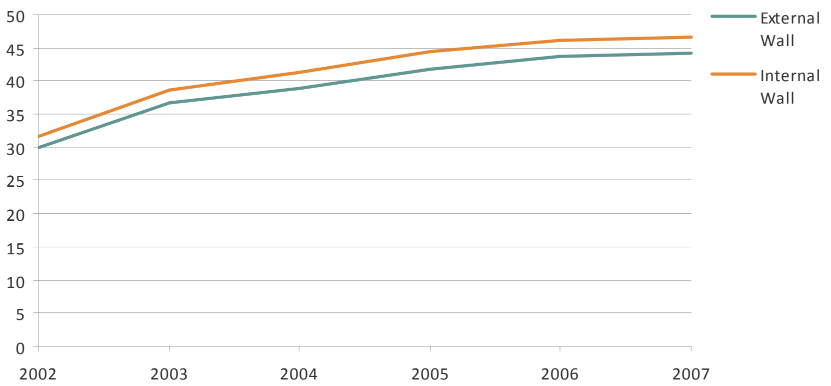
Graph 6h: Cavity wall insulation (millions)

In 1974, two-thirds of the housing stock was capable of having cavity wall insulation but it had been installed in less than 2% of these homes. By 2008, the proportion of the stock capable of having this form of insulation had grown a little to 70% and over a third, 34%, had it. This was a 17-fold increase.

Solid wall insulation

There is much less information available about the take-up of wall insulation for homes without cavities. This is unfortunate, because this insulation is often cited as a major opportunity for improving energy efficiency in older homes.

Since 2002, it seems there has been a relatively steady but slow growth in wall insulation for homes with solid wall construction. But sales of such insulation during the end of this period (2006-2007, last available figures) suggest that this growth may have reached a plateau, see graph below.



Graph 6i: The value of the UK market for wall insulation (£m)

Although insulating solid walls internally is more problematic and disruptive, sales of both external and internal insulation materials have grown at similar rates. Sales of external insulation in the UK grew by about a third by value between 2002-2007, from £30m to £44m, as did sales of internal insulation, from £32m to £47m.

However, materials for insulating solid walls still only represent about a tenth (by value) of all the insulation purchased for use in buildings in the UK.

There is an emerging consensus of opinion that insulating the existing stock of solid wall homes is one of the strategic opportunities for improving energy efficiency[32]. It will be interesting to see how continued initiatives such as CERT, the Community Energy Saving Programme (CESP), and the forthcoming Green Deal affect the solid wall insulation market.

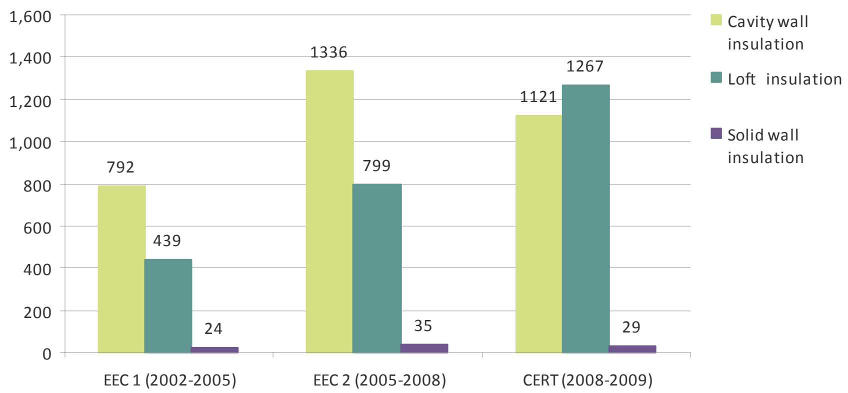
Impact of Government initiatives

EEC and CERT led to large numbers of improvements to loft and cavity wall insulation. There was less emphasis on promoting solid wall insulation.

Between 2002-2008 gas and electricity suppliers were required to achieve energy savings in households in Great Britain under the Energy Efficiency Commitments (EEC1 and 2). The EECs were the Government's key energy efficiency instruments for existing households and they were expected to curb carbon emissions from housing by 1% per annum[33].

The Carbon Emissions Reduction Target (CERT) 2008 followed on from the EEC. It sets out the carbon reductions to be achieved by suppliers between 2008-12[34].

The graph below shows the number of insulation measures installed under these two initiatives (up to March 2010).



Graph 6j: Insulation measures installed under EEC and CERT (thousands of households)

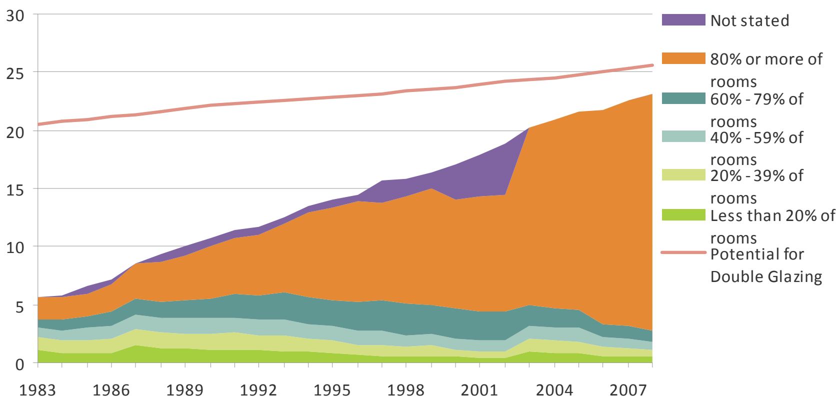
As the graph shows, in combination the two initiatives have mainly been successful at installing cavity wall and loft insulation.

EECs resulted primarily in the installation of cavity wall insulation with the CERT resulting in more even uptake of cavity wall and loft insulation.

However, both initiatives have led to much smaller numbers of solid walls being insulated. Less than 2% of the measures shown in the graph as implemented under the initiatives have involved solid wall insulation. This is in line with policy aims, which were to promote the most cost-effective measures first.

Glazing

The last four decades have seen significant increases in the number of homes with double-glazing. Since 1970, the proportion of homes with some level of double-glazing has grown nearly 12-fold, from just under 8% to 90% in 2008.



Graph 6k: Double glazing (millions)

Since 1983 (the first time figures on the amount of double-glazing present became available), the proportion of homes with 80% or more of their rooms double-glazed has increased almost nine-fold, from 9% to 80% in 2008.

Some form of whole-house double-glazing is becoming a near universal standard.

In this section, 'double-glazing' refers to sealed units rather than windows with secondary glazing. Homes built now must have double-glazing to meet the Building Regulations. Since 2002, most existing homes where windows are replaced also need to be double-glazed.

Double-glazed units have a limited life-span. Eventually their seals fail, the units mist up internally and their capacity for saving energy declines. Units can perform well for up to 35 years. However, they often fail long before this. Failed units cannot be repaired and have to be replaced[35,36].

Glazing units are available now to a significantly higher standard than previously. And a window rating system, similar to that for boilers, is in place so that consumers can identify the performance of different products[37].

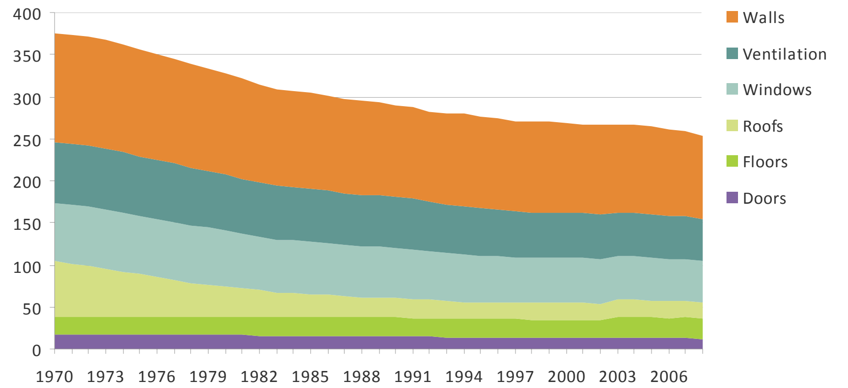
Heat loss

The rate at which homes in Great Britain lose heat during the heating season has fallen significantly in the last four decades. (This reflects the improvements described in the three previous sections.)

**Heat loss is linked to the difference between internal and external temperature, called the 'temperature difference'. This measure of heat loss says that for an average home, if it is 1 ℃ cooler outside than inside, you need 376 Watts of heating to maintain a stable temperature. The measure is affected by insulation and ventilation losses.*

The heat loss figure for 2008, 254W/℃, implies that for a typical cold winter's day with an external temperature of 0 ℃ and an internal temperature of 20 ℃, an average house would need five kilowatts of heat to maintain a stable temperature. This is equivalent to five small electric fan heaters.

In 1970, the overall rate of heat loss from a home was, on average, 376W/°C*. Thirty-eight years later, it had fallen by almost a third to 254W/°C, see graph below.



Graph 6l: Average heat loss per dwelling (W/°C)

(Data for this graph has been modelled by BRE using BREHOMES and calibrated with DUKES energy consumption figures, see Appendix 3. Figures are not drawn from the monitored performance of homes, and like the previous chapter we have signalled modelled data using a coloured border.)

On average, the rate of heat loss has reduced for all elements that make up the external envelope of a home – walls, windows, roof and doors – bar one, the floor. It has also reduced for the ventilation through those elements.

The improvement (reduction) has been most pronounced for roofs – a 70% decrease in heat loss. This reflects the dramatic improvement in loft insulation in new and existing homes. Windows, doors and ventilation have seen similar reductions of about 30%.

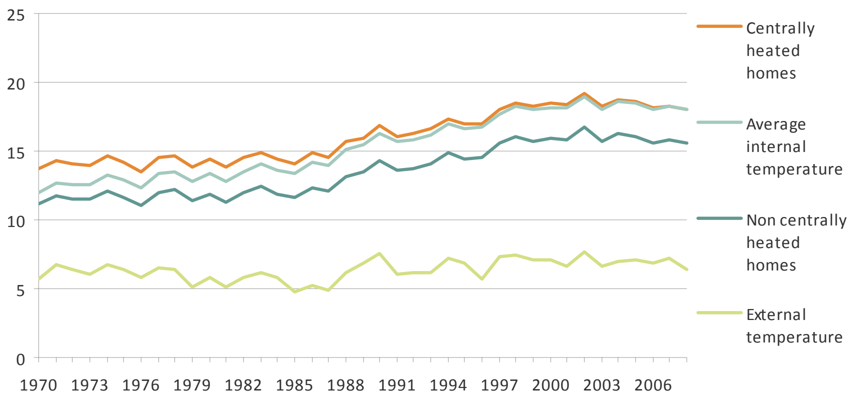
According to these figures, heat loss through floors appears to have increased by 14%, but this may be due to changes in data collection, or to more accurate judgements about whether floors lack insulation.

So there have been significant improvements over the four decades per average dwelling (i.e. the average across dwelling types, weighted according to the actual number of dwellings in each type). But, overall, the total heat loss for the stock as a whole (i.e. average heat loss x number of homes) has only reduced by about 4% in since 1970, largely because many more homes have been added to the stock.

Internal temperature

Modelling suggests that British homes are run at significantly higher average temperatures in the winter now than they were forty years ago – whether or not they have central heating. As the graph below shows, winter temperatures in homes, with and without central heating, have increased considerably over the past four decades.

Like the previous graph, internal temperatures shown in the graph are the result of BREHOMES energy balance calculations that have been modelled using building physics data and DUKES energy consumption figures. They are not drawn from the monitored performance of homes.



Graph 6m: Average winter internal and external temperatures (°C)

In 1970, during the winter, the average internal temperature in homes with central heating was estimated at 13.7°C. Thirty-eight years later, this estimate had risen by 3.6°C to 17.3°C.

Over the same period, a similar rise is estimated in average winter internal temperatures in homes without central heating, from 11.2°C to 14.8°C – again a rise of 3.6°C. (Note that the average temperature is for the whole house, and the duration and extent of heating is at least as significant here as the temperature of the living room. As others have noted[38], there is limited evidence of changed thermostat settings over the period.)

The average internal temperatures of Britain's homes in winter seems to have gone up by 5°C since 1970.

We have achieved this mainly by installing central heating and burning more fossil fuels.

During these four decades, the proportion of homes with central heating rose to 96%, see above. As a result, over this period, the average internal temperature in all homes (both with and without central heating) appears to have risen. It now stands very close to the average internal temperature for homes with central heating (17.3°C in both cases).

Meanwhile winter weather has also become somewhat milder. In the first decade shown in the graph above, the average external temperature was 6.2°C. In the last decade displayed, the average external temperature was 7.0°C – a rise of 0.8°C.

If the average internal temperatures of homes had not increased in winter, milder winters ought to have decreased the amount of fuel used to heat British homes (although this would have been offset, to some degree, by the increase in the number of households). This has not happened, see Graph 5b: Household energy use for space heating.

Instead, the average internal temperature of homes in winter seems to have risen significantly more than the external temperature. As the graph shows, the gap between the lines for external and internal temperatures has widened.

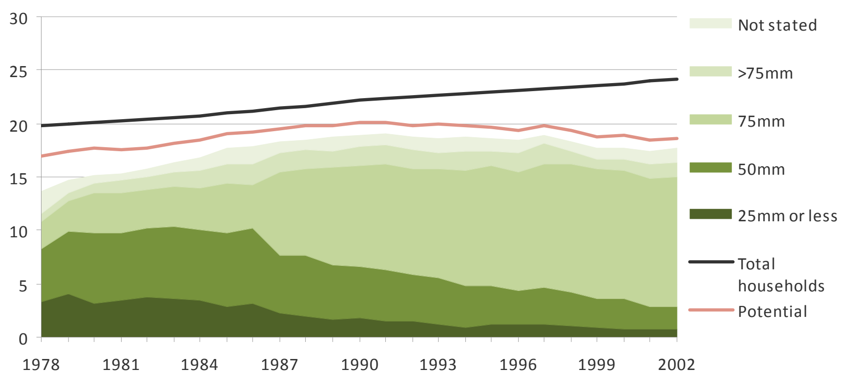
The gap between these lines is proportional to the amount of heating used to lift homes from the temperature outside to the temperature indoors that is now demanded in winter. This elevation in temperature has been achieved largely by burning fossil fuels, nowadays mainly by consuming gas.

Hot water tank insulation

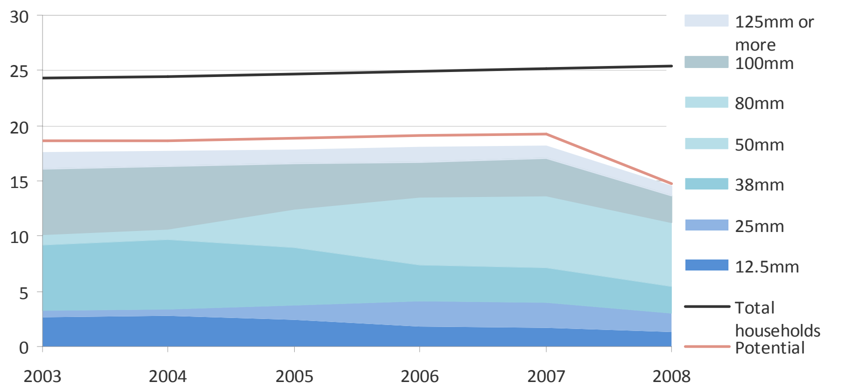
Installing adequate insulation on hot water tanks is an easy way to raise energy efficiency. It is cheap, fast, and does not require specialist skills.

In 1978, more than 3 million homes had 25mm or less insulation around their hot water tanks. Thirty years later, in 2008, 3 million homes had this same thickness of insulation installed, see graph below, but they were factory-insulated tanks, which have much better performance. (The insulation thicknesses before 2002 are 'loose jacket' equivalents, whereas those afterwards are factory insulated tanks. These modern tanks with 25-50mm of insulation are equivalent to home-fitted jackets of 75mm or more.)

And, by 2002, only 5% of homes had more than 75mm of hot water tank insulation (however, by then 9% more homes had replaced their hot water tanks, using combi boilers instead, Graph 6d above).



Graph 6n: Hot water tank insulation (millions of households) - pre EHS



Graph 6o: Hot water tank insulation (millions of households) - post EHS

The regulations affecting hot water tanks were changed in 2002. In the past, it was possible to purchase a bare tank without any insulation. This now contravenes the Building Regulations and all new tanks have to be supplied already insulated to comply with the appropriate British Standard.

These new regulations have led to a significant growth in hot water tanks with higher levels of insulation, as the second graph shows.

By 2008, more than a third of homes had hot water tanks with 80mm or more of insulation. However, as the graph also shows, the potential for improving tank insulation is in decline. As more and more combi boilers are installed (which have no tanks), there are inevitably fewer tanks to insulate.

As for loft insulation, there are also diminishing returns from progressively thicker insulation around hot water tanks. This too means potential savings from insulating tanks will lessen over time.

7. Breaking down energy use by fuel type

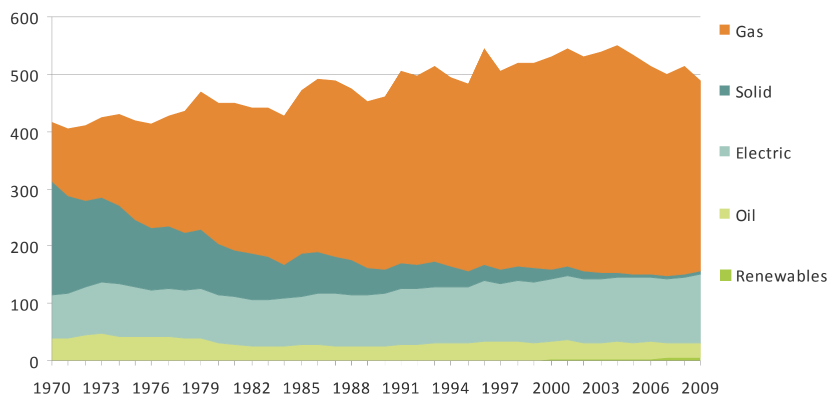
The type of fuel used in housing is important for three reasons. First, different fuels have very different carbon emissions (electricity, for example, emits towards three times as much CO_2 per kilowatt-hour as a kWh of gas).

Second, costs vary significantly between different fuels, so the choice of fuel for heating, for example, makes a big difference to energy costs for an individual household – as it does for Britain as a whole.

The mix of fuels is significant, because each fuel implies different carbon emissions, cost and different implications for fuel security.

And third, different fuels have quite different implications for fuel security. For example, theoretically it would be possible for the UK to generate all its electricity from renewables and nuclear generators.

Given the information above about changes in heating technologies in homes, it comes as no surprise to see a big expansion in gas use in homes, with a parallel contraction in solid fuel use (see graph below).



Graph 7a: Energy use in housing by fuel (TWh)

All fuels are measured in terawatt hours in the graph, TWh. (As a reminder, this is a million million Watt hours, 10^{12} Wh – equivalent to leaving on a small hairdryer in every home in Britain, continuously, for 1.6 days.)

Today, gas provides two-thirds of household energy (excluding the gas used to generate electricity in power stations). In 1970, gas provided only a quarter of household energy.

The demise of solid fuels (for heating) was even more stark: they provided nearly half of the energy used in homes in 1970, down to just 2% today. This is because so few homes now use open fires or coal stoves as their main form of heating. ("Solid fuel" included wood until 2000 because of the way BREHOMES categorised fuels.)

Electricity's share of household energy rose from a fifth in 1970 to nearly a quarter today. (Note that this is different from electricity's contribution to CO_2 emissions, described in Chapter 3.) Most of this expansion was due to increased ownership and use of electrical appliances, although in the recent past (since around 2000), more electric heating contributed to the growth.

The use of solid fuels for heating has plummeted: from nearly half of heating energy in 1970 to only 2% now.

Heating oil's share of household energy use declined from nearly a tenth in 1970 to just 7% today – partly because of increased gas-fired central heating.

8. Renewables and microgeneration

Renewables meet only a small proportion of the UK's overall demand for energy – just over 3% of primary energy demand (the energy in natural resources before they have been converted, for example, into electricity). However, renewables account for nearly 7% of the UK's electrical supply[39].

Greater use of renewables in electricity generation helps to reduce carbon emissions from all electricity drawn from the national grid. This means that housing benefits from lower carbon emissions along with other sectors of the economy.

Housing can also benefit from renewable energy systems that provide heat or electricity directly to the house. In both cases, there can be major advantages in generating energy close to the place it is used, at smaller scale than traditional power stations. This is known as 'microgeneration'.

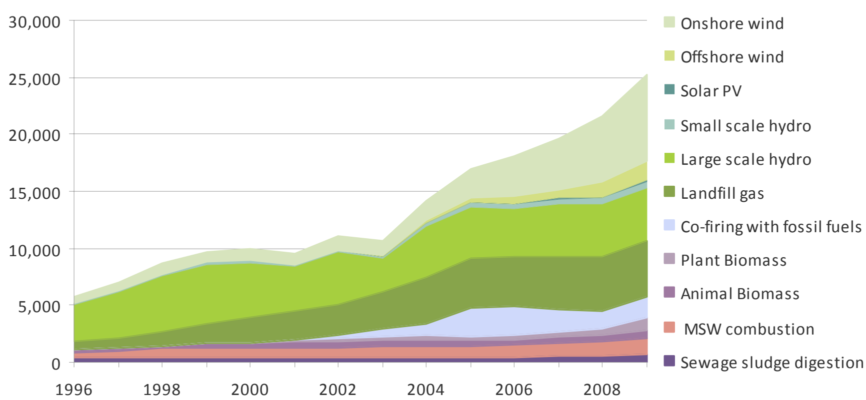
Microgeneration is a newer topic of interest than other aspects of energy use in homes. For this reason, there is much less data available than there is for other parts of this Fact File. Future editions of the Fact File will extend this part of the report.

Renewable electricity from the grid

The Digest of UK Energy Statistics, DUKES, includes data about renewable energy derived from wood, waste incineration, geothermal and active solar systems and wind. This data has only been collected since 2003, so there is a much shorter time frame than most of the other statistics reported here.

Renewable electricity grew by 140% from 2003 to 2009, and every kind of renewable technology experienced the growth.

The DUKES data shows that even in the six-year period from 2003 to 2009, there was significant growth in total renewable electricity generation – up by nearly 140% overall, see graph below, but from a very low base. In fact, every single source of renewable electricity grew in this period.



Graph 8a: Renewable electricity generation by fuel (GWh)

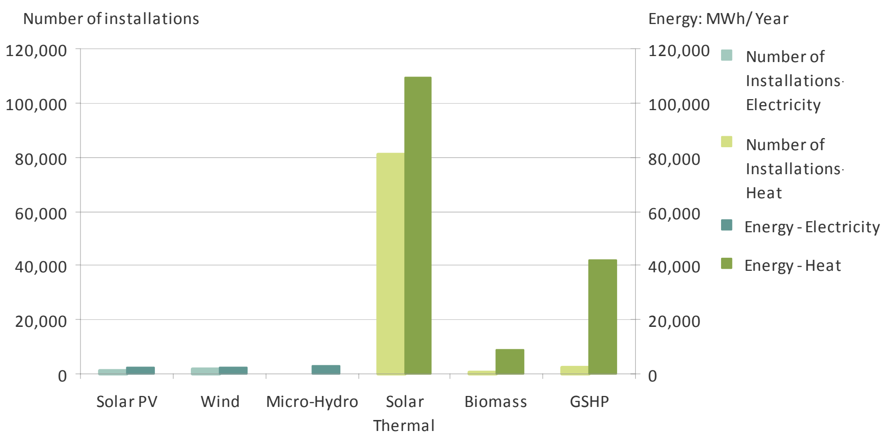
The largest growth in renewable energy was in onshore wind – predominantly power generated on wind farms – which increased by nearly 500%, or well over 6 TWh from 2003 to 2009. In total, onshore wind now provides enough electricity for around 1.7 million homes.

The share provided by offshore wind is also growing very rapidly from a low starting point. It currently represents 7% of the country's renewable energy.

Onshore wind grew much faster than other technologies, and now more than 7.5 TWh comes from onshore wind each year.

Microgeneration in housing

The graphs below separate out *cumulative* electric and heating small-scale renewables installed by 2008 – the only year data is available. The contrast between the high number and larger scale of heating technologies (shown on the right of the graph), and the low number of electric technologies (on the left) is striking.



Graph 8b: Household Electricity and Heat Generating Microgeneration Technologies (Cumulative Installations and Annual Energy, 2008)

More than 50 times as many solar thermal systems have been installed, for example, as the most common electric technology – wind power. Biomass heating and ground-source heat pumps ('GSHP') are noteworthy because although relatively few systems were installed, their *predicted* annual output in MWh (or TWh) was high – at least three times more than any of the electric systems.

However, it is important to draw a distinction between renewable electricity and renewable heat, because electricity is a more versatile form of energy. Moreover, the carbon-savings and cost savings per unit generated from renewable electricity are much greater than those from renewable heat.

On the electric side, there are 50% more wind installations than photovoltaics ('PV'). Although a tiny number of micro-hydro systems were installed – just 56, too few to show up on the graph – their annual output was considerable: nearly 3 TWh. This is more than the output of either PV or wind.

9. Conclusions

Patterns of energy use and generation

The energy used in housing is more than a quarter of Britain's total energy consumption. It is a larger fraction than the energy used by business, and about the same as road transport, see Chapter 1.

Although there has been massive expansion in central heating and appliances use in homes, average energy use per household has fallen 16%.

Despite widespread uptake of central heating and increased ownership and use of appliances, energy use per household has fallen by 16% since 1970*. However, the growth in the number of households more than offsets this efficiency improvement, and overall energy use in homes has *increased* by 17%.

The fuel mix for generating electricity in Britain has changed radically since 1970 – with coal-fired power displaced by electricity from natural gas and an increasing contribution from renewable electricity.

**Average energy use per household was 22,223 kWh in 1970 (409GWh/18.4 million households), compared to 18,672 kWh in 2009 (478GWh/25.6 million households).*

Total energy use in homes in 1970 was 409GWh, compared to 478GWh in 2009 – an increase of 17%, or an average of 0.4% per year.

Structure of the housing stock

The number of households in Britain is rising at a rate approaching 1% a year, and the average household size is falling. This is due to demographic effects and changing family structures.

Two trends are apparent in the overall housing stock: an increase in the number of flats, and a parallel increase in the number of detached houses. The rise of flats seems like a logical response to the growth in smaller (one- or two-person) households. The increasing proportion of detached houses is harder to explain, but this seems to be linked to the increase in the percentage of incomes spent on housing[40].

All these trends have important implications for energy use and CO_2 emissions. First, more homes mean more energy use – unless they are offset by energy efficiency improvements to existing homes. Second, although smaller homes tend to use less energy, there seems to be a minimum 'base load' that is not related to household size or floor area.

This means that the trend towards smaller households puts upward pressure on energy use and CO_2 from housing. Further, the growth in detached homes (with proportionately larger external walls) increases heat loss in winter compared to terraced houses or flats. This too puts upward pressure on energy use and CO_2 emissions.

The ownership of Britain's homes has also changed markedly since the 1970s, with a huge expansion in the number of people owning their own homes. Eight and a half million more households now own their homes than did in 1970.

There has been a corresponding decline in the number of homes owned by local authorities, and councils now own four million fewer homes than they did at the start of the 1970s. Registered Social Landlords have taken on part of the responsibility for social housing, and they now own 9% of homes.

Energy spending and incomes

Energy bills for households have fallen overall in real terms since 1970, although there was a period when energy prices rose from 2003 to 2008. Energy spending also fell in relation to total household spending – on average from 6% of weekly expenditure in 1970 to just 4% today.

How much households spend on energy is related to their incomes, with wealthier families spending more on energy than poorer ones. However, despite this, wealthier households spend a smaller fraction of their incomes on energy than poorer ones.

This means that initiatives aimed at encouraging people to improve energy efficiency in their homes, and trying to persuade them to cut their energy use, may need to be targeted towards different income groups – as CERT does with 'priority groups'. Varying incentives and barriers apply to different income groups, and how much people spend as a fraction of their incomes and/or expenditure probably affects their reactions to such initiatives.

Initiatives aimed at improving energy efficiency may need to be targeted towards different income groups.

Energy use trends

How energy is used in homes is shaped by many different factors: how homes are heated, how well insulated they are, how draughty they are, what temperature they are heated to, whether air conditioning is used, what appliances are used, how homes are lit, how cold it is in winter, and so on.

Many of the most important determinants of energy use are within the control of households – especially if they have the resources available to invest in making their home more energy efficient.

Total energy used for heating has increased by two-fifths since 1970 – in part because of widespread take-up of central heating and higher average internal temperatures, but also because there are over 7 million more homes today.

The huge growth in central heating is mainly fuelled by gas, which has brought great improvements in carbon efficiency. Homes with central heating also tend to use much more energy than homes without – often twice as much – because they allow households to heat the whole of their home easily instead of just one or two rooms.

This increase in energy used for heating would have been much greater but for improved insulation and boiler efficiency in most existing homes. And in recent years there has been a significant reduction in energy used for heating: down by 10% since 2004. This does not seem to be due to milder winters, and is probably due to a combination of recent increases in fuel prices and better energy efficiency.

Outcomes of Government initiatives

The Building Regulations and other Government initiatives have also been successful in driving the take-up of better insulation, double-glazing and more efficient heating systems in new and existing homes.

Modelling suggests the energy used to heat water in homes has fallen by 30% since 1970 – largely thanks to more efficient water heating systems and much improved insulation of hot water storage tanks.

However, the energy used in lighting grew rapidly after 1970 – up by nearly three-fifths. (It has started to decline since 2001, presumably due to the shift towards using low energy lights.)

One possible explanation of this large growth is that people now use electric lights for more of the day, or that they light more of their homes – similar to the changed expectations of higher internal temperature. We have witnessed increased use of spotlights for internal lighting (especially in kitchens), and households are more likely to have installed external lighting for security purposes.

The energy used by appliances has increased three-fold since 1970. We now own, and use, more electric appliances than ever before.

Appliances growth was even more dramatic: the energy used in appliances tripled in less than 40 years. This is because householders own a broader range of appliances, and because of a big jump in the use of these appliances.

For televisions and home computing, for example, many households now own multiple TV sets and computers. Hours of use of TVs and computers have increased significantly over the period.

Energy use in cooking reveals a very different trend: now two-fifths less energy is used for cooking than it was in 1970. (Although some of this is doubtless offset by increased energy in pre-prepared foods, which were not available in 1970, and by use of microwaves, which are classified as appliances and not cooking.)

This growth in energy used for lighting and appliances has, to a degree, been offset by other changes in the energy efficiency of homes. Modelling and SAP ratings – the standard way to assess thermal and lighting efficiency in homes – indicate that today's homes use energy much more efficiently to provide heating than homes in 1970. But for better insulation and more efficient heating systems in homes, twice as much energy could be used in housing now.

Not all energy-efficiency improvements to homes lead to the same reduction in energy use and CO_2 emissions. For homes that start off below acceptable standards of 'comfort', and for households in fuel poverty, more than half of any efficiency improvement is taken in higher internal temperature[41, 42].

Carbon emissions

Average CO_2 emissions per household have nearly halved since 1970. This is a result of changes in the fuel mix used to generate grid electricity, as well as greatly increased use of natural gas as a heating fuel in homes instead of (high carbon) solid fuels and oil. One factor that has grown in recent years is renewable electricity supplied to the grid, which expanded dramatically from 2003 to 2009.

To date there is only limited data about changes in the direct use of renewables in homes, whether heat from solar panels or electricity from photovoltaic panels. So far, this direct use of renewable technologies in housing is mostly to provide hot water.

Looking forward

Most of the Fact File reports what has already happened. This final section identifies shortfalls in information, where more data is needed. Policy-makers, the research community and even householders would benefit from more robust data about:

- so-called ‘unregulated’ energy use – aspects of energy use that are not covered in the Building Regulations, and specifically the use of appliances, including IT and entertainment systems, and energy for cooking
- actual take-up of renewable energy systems by householders and how much energy they are generating – split into thermal and electrical energy
- why some households behave in ways that use significantly more energy – or significantly less – than other households in identical homes
- how ‘smart meters’ affect energy use in homes by giving householders immediate feedback about the effect of their behaviour.

Policy-makers and the research community would also benefit from more robust data about:

- current heating levels in homes – the temperatures achieved when heating is used, and the number of rooms heated
- how different income groups’ use of energy is affected by the cost of fuel and power – put technically, how the price elasticity of demand varies between income groups
- the proportion of energy efficiency improvements that are ‘taken back’ in thermal comfort rather than fuel bills savings.

Across the whole economy, renewable electricity rose nearly 140% from 2003 to 2009. However, it remains a small proportion of all electricity generation.

There remain many gaps in knowledge about energy use in homes, but more research is underway – notably the English Housing Survey's Energy Follow-up Survey.

The DECC-funded Energy Follow-up Survey to the English Housing Survey will provide better data about heating levels and other aspects of energy use in homes, following field work during 2011[43].

What is already clear is that reducing carbon emissions from homes is likely to prove a long and complicated process. It will entail not only increasingly sophisticated technical improvements to housing but also significant (perhaps subtle) changes in how energy is used to deliver the services required from homes.

Over time, all parts of society may be forced to confront the truism that it is people, and not buildings, that use energy.

Appendices

Appendix 1: Tables

Sheet name	Time period
1a - Energy use by fuel users	2009
2a - Domestic energy consumption	1970-2009
3a - CO_2 emissions	1970-2009
3b - Fuel input for electricity generation	1970-2009
3c - Energy prices	1996-2008
3d - Indexed energy prices	1970-2009
3e - Fuel poverty	1996-2008
4a - Housing stock - Population	1970-2009
4b - Housing stock by region	1981-2009
4c - Housing stock - Type	1970-2008
4d - Housing stock - Age bands	1970-2008
4e - Housing stock - Tenure	1970-2008
4f & 4g - Household expenditure	1970-2008
4h - Household spending on energy	1970-2009
4i - Household gas bills	1990-2009
4j - Household electricity bills	1990-2009
4k - Household expenditure - Income	1990-2009
5a - Weather	1970-2009
5b - Energy Consumption - Space heating	1970-2008
5c - Energy consumption - Water heating	1975-2008
5d - Household consumption - Lighting	1970-2008
5e - Household consumption - Appliances	1970-2008
5f - Household consumption - Cooking	1970-2008
5g - SAP rating	1970-2008
5h - Effects - Efficient homes	1970-2007
5i - CO_2 emissions per household	1970-2009
6a - Home - Heating	1970-2008
6b - Heating - Central heating types	1970-2008
6c - Heating - Non-central heating types	2003-2008
6d - Condensing and combi boilers	1975-2008
6e - Insulation measures	1987-2008
6f - Loft insulation (pre EHS)	1976-2002
6g - Loft insulation (post EHS)	2003-2008
6h - Cavity wall insulation	1974-2008
6i - Solid wall insulation	2002-2007
6j - Insulation EEC and CERT	2002-2009
6k - Double glazing ownership	1974-2008
6l - Heat loss - Building element	1970-2008
6m - Internal and external temperatures	1970-2008
6n - Tank insulation (pre EHS)	1978-2002
6o - Tank insulation (post EHS)	2003-2008
6p - EEC1 and 2	2002-2008
6q - CERT	2008
7a - Energy demand by fuel	1970-2009
8a - Renewable electricity generation	1996-2009
8b - Renewable installations and energy	2008
8c - Renewable commodity balances	2000-2009

Table 1a: UK Final Energy Consumption by Energy Users (2009)

Energy users	Final energy consumption (TWh)	Final energy consumption (%)
Industry	309	17.4%
Road transport	474	26.8%
Air transport	148	8.4%
Other transport	30	1.7%
Housing	501	28.3%
Commercial and public administration	177	10.0%
Non energy use	103	5.8%
Other	29	1.6%

Source:
DECC: DUKES 2011, Table 1.1
http://www.decc.gov.uk/en/content/cms/statistics/source/total/total.aspx

Notes:
1) 'Other transport' includes final energy consumption by rail and national navigation.
2) 'Other' includes final energy consumption by agriculture and miscellaneous sectors.
3) Final energy consumption figures were converted from the units in DUKES (thousand toe) to TWh: 1 toe = 11,630 kWh.
4) DUKES tables are revised regularly. For further details on data revisions, please follow the link - http://www.decc.gov.uk/assets/decc/statistics/publications/trends/articles_issue/1_20090921165618_e_@@_revisionspolicyarticle.pdf.

Table 2a: Final energy use (GB, TWh)

Year	Total energy consumption	Household energy consumption
1970	1,620	409
1971	1,593	395
1972	1,622	402
1973	1,706	417
1974	1,629	422
1975	1,562	411
1976	1,602	406
1977	1,636	420
1978	1,655	429
1979	1,726	461
1980	1,580	442
1981	1,535	440
1982	1,517	435
1983	1,510	433
1984	1,506	420
1985	1,574	467
1986	1,617	485
1987	1,621	482
1988	1,648	470
1989	1,622	447
1990	1,634	452
1991	1,684	497
1992	1,676	489
1993	1,695	505
1994	1,693	488
1995	1,669	474
1996	1,742	534
1997	1,708	497
1998	1,730	512
1999	1,737	512
2000	1,768	520
2001	1,785	535
2002	1,736	527
2003	1,755	536
2004	1,774	547
2005	1,771	530
2006	1,742	517
2007	1,712	499
2008	1,709	505
2009	1,591	478

Sources:
DECC: DUKES, table 1.1.5 - internet only [1970-2009]/ ONS: Regional Accounts
http://www.decc.gov.uk/en/content/cms/statistics/source/total/total.aspx

Notes:
1) Domestic energy consumption figures were converted from the units in DUKES (thousand toe) to TWh: 1 toe = 11,630 kWh.
2) Total UK energy consumption figures from DUKES were scaled to Great Britain by dividing by 1.048.
3) DUKES tables are revised regularly. For further details on data revisions, please follow the link - http://www.decc.gov.uk/assets/decc/statistics/publications/trends/articles_issue/1_20090921165618_e_@@_revisionspolicyarticle.pdf.
4) All tables provide data for GB, unless otherwise stated.

Table 3a: CO2 Emissions from Housing Energy (MtCO2)

Year	Gas	Solid	Electric	Oil	GB total	Emission factor Electricity (kgCO2/kWh)
1970	18.7	58.2	79.1	10.0	166.0	1.069
1971	20.8	49.8	80.5	9.9	161.0	1.037
1972	23.8	43.8	85.1	11.4	164.1	1.022
1973	25.5	42.8	88.9	12.5	169.7	1.012
1974	28.6	40.4	86.8	11.1	166.9	0.972
1975	31.3	34.2	84.0	10.7	160.3	0.976
1976	32.9	31.6	77.6	10.7	152.8	0.947
1977	35.0	32.0	78.2	10.8	156.1	0.947
1978	38.6	29.2	75.4	10.6	153.8	0.914
1979	43.8	29.4	81.7	10.3	165.3	0.947
1980	44.9	25.5	78.0	8.3	156.6	0.943
1981	46.6	23.6	75.6	7.4	153.2	0.932
1982	46.5	23.3	70.8	6.9	147.5	0.889
1983	47.3	21.7	69.3	6.5	144.7	0.868
1984	47.5	17.0	66.7	6.9	138.1	0.828
1985	51.9	22.0	71.0	7.0	152.0	0.832
1986	54.8	21.6	73.0	7.3	156.7	0.824
1987	56.2	18.6	73.2	6.9	154.9	0.814
1988	54.9	17.5	68.9	6.7	148.1	0.774
1989	53.1	14.0	66.9	6.3	140.3	0.752
1990	53.0	13.7	68.9	7.4	143.0	0.770
1991	59.0	15.0	67.0	8.4	149.4	0.716
1992	58.3	13.1	64.9	8.6	144.9	0.684
1993	60.0	14.4	58.3	9.0	141.7	0.608
1994	58.2	11.9	57.1	8.9	136.1	0.590
1995	57.5	8.6	53.6	8.9	128.7	0.550
1996	66.3	9.2	52.3	10.5	138.3	0.510
1997	61.0	8.1	51.3	10.1	130.5	0.515
1998	62.8	7.7	54.1	10.5	135.1	0.518
1999	63.2	7.9	50.6	9.4	131.1	0.481
2000	65.3	6.3	55.3	9.6	136.5	0.518
2001	67.0	6.0	59.4	10.5	142.9	0.540
2002	66.4	4.7	59.9	9.2	140.2	0.523
2003	68.2	3.8	64.2	9.1	145.3	0.547
2004	70.0	3.3	64.3	9.7	147.3	0.543
2005	67.4	2.3	65.7	9.2	144.6	0.548
2006	64.8	2.1	64.6	9.7	141.1	0.543
2007	62.3	2.2	63.1	8.5	136.1	0.537
2008	63.5	2.5	60.7	9.0	135.6	0.531
2009	58.7	2.4	59.4	9.0	129.4	0.525

Sources:
Market Transformation Programme - developing evidence for government and business on energy using products, table A1 [1970-2009],
BNXS01: Carbon Dioxide Emission Factors for UK Energy Use/ DEFRA (AEA)
http://efficient-products.defra.gov.uk/spm/download/document/id/785

Notes:
1) The DEFRA 2009 emission factors are: gas = 0.185, solid = 0.296, and oil = 0.268 (kgC02/kWh).
2) The emission factors for electricity come from the Market Transformation Programme.
3) The domestic energy consumption figures in GB come from Table 7a to calculate carbon emissions.
4) These figures are for GB and as a result of this and using constant emissions factors (for all fuels except electricity) the data differs from the National Air Emissions Inventory (NAEI) data.

Table 3b: Fuel Input for UK Electricity Generation (TWh)

Year	Total all fuels	Coal	Oil	Natural gas	Nuclear	Renewables	Other fuels
1970	742.5	500.9	154.3	1.3	81.4		4.5
1971	772.9	493.3	181.8	7.4	85.7		4.7
1972	795.1	447.4	234.1	18.7	91.5		3.4
1973	824.9	515.2	210.4	7.4	86.8		5.1
1974	802.6	450.2	214.1	28.6	104.3		5.3
1975	770.5	486.7	159.3	24.9	94.4		5.1
1976	778.9	517.4	127.0	18.7	111.2		4.5
1977	806.2	531.6	132.0	14.9	123.7		4.0
1978	809.9	535.6	143.2	10.0	115.8		5.3
1979	846.7	582.7	133.2	6.3	119.0		5.6
1980	807.8	593.2	89.2	4.9	115.3		5.2
1981	767.3	577.3	63.5	2.4	118.4		5.7
1982	767.3	543.7	77.2	2.4	138.2		5.8
1983	771.9	548.5	59.8	2.4	156.7		4.5
1984	804.6	361.3	265.2	4.9	168.6		4.5
1985	832.0	497.9	132.0	6.3	191.9		4.0
1986	819.3	557.2	75.7	2.1	179.6		4.8
1987	864.2	599.9	73.3	10.6	167.9		12.6
1988	878.9	579.5	81.5	11.3	192.7		13.8
1989	875.4	565.1	82.7	6.3	206.3		15.0
1990	887.8	579.6	97.7	6.5	189.1	7.8	7.1
1991	894.0	581.3	87.9	6.6	202.7	7.5	8.0
1992	890.5	545.9	93.9	17.9	214.6	9.4	8.9
1993	876.9	460.7	67.2	81.9	251.0	9.7	6.5
1994	860.7	431.5	47.8	117.5	246.6	11.8	5.6
1995	897.3	422.1	48.3	154.3	247.1	12.1	13.4
1996	925.2	391.5	45.0	202.0	258.0	11.3	17.5
1997	892.7	329.1	23.4	252.8	255.7	13.7	18.1
1998	943.6	348.2	19.7	267.7	272.6	16.9	18.4
1999	927.1	296.7	17.9	315.5	258.4	20.1	18.6
2000	944.4	333.4	18.0	324.6	228.4	22.1	17.9
2001	977.0	367.6	16.5	312.5	241.5	23.8	15.1
2002	965.2	344.6	15.0	329.4	233.8	26.9	15.6
2003	999.6	378.5	13.9	323.9	233.1	29.5	20.7
2004	983.5	364.2	12.8	340.2	211.2	36.2	18.9
2005	1,008.0	378.8	15.2	331.7	213.7	44.0	24.7
2006	1,012.6	418.0	16.7	311.4	199.2	45.8	21.4
2007	980.8	382.9	13.5	355.9	163.3	47.2	18.1
2008	948.6	348.5	18.4	376.8	138.5	49.7	16.6
2009	913.6	286.8	17.6	359.3	177.1	56.9	15.8

Sources:
DECC: DUKES, table 5.1.1, 7.1.1 - internet only
http://www.decc.gov.uk/en/content/cms/statistics/source/electricity/electricity.aspx
http://www.decc.gov.uk/en/content/cms/statistics/source/renewables/renewables.aspx

Notes:
1) There are discontinuities in figures pre- and post-1987. Before 1987 the data are for major power producers, transport undertakings and industrial hydro and nuclear stations only, whereas data for all generating companies are available from 1987 onwards.
2) Up to 1990, "Other fuels" includes natural flow hydro, wind, coke and breeze and other fuels which include coke oven gas, blast furnace gas, waste products from chemical processes, refuse derived fuels and other renewable sources.
3) The renewable figures are available separately from 1990 onwards, and are excluded from "Other fuels" for these years.
4) Fuel input has been calculated on primary energy supplied basis.
5) DUKES tables are revised regularly.

Table 3c: Average UK Household Fuel Prices (p/KWh, 2009 prices)

Year	Coal	Coke, breeze + other solid	Total solid fuels	Gas	Electricity	Oil	Total (weighted average all fuels)	Retail Price Index (2009 = 100)	Fuel Price Index (2009 = 100)
1970	1.92	3.19	2.32	4.39	10.07	2.62	4.26	8.7	5.7
1971	1.97	3.30	2.41	4.03	9.90	2.56	4.36	9.5	6.3
1972	1.96	3.25	2.40	3.87	9.81	2.55	4.42	10.2	6.8
1973	1.87	3.15	2.30	3.50	9.08	2.71	4.17	11.1	6.9
1974	1.88	3.01	2.31	3.04	9.31	3.76	4.20	12.9	8.1
1975	1.89	3.10	2.38	2.80	10.86	3.67	4.45	16.0	10.8
1976	2.01	3.27	2.51	3.02	11.96	3.97	4.78	18.6	13.4
1977	2.06	3.29	2.55	2.95	11.98	4.15	4.74	21.6	15.5
1978	2.16	3.42	2.69	2.80	12.34	4.00	4.71	23.4	16.7
1979	2.30	3.82	2.92	2.51	11.68	4.64	4.49	26.5	18.4
1980	2.70	4.27	3.42	2.47	12.81	5.30	4.79	31.3	23.0
1981	2.83	3.83	3.44	2.79	13.75	5.80	5.12	35.0	27.9
1982	2.68	3.82	3.33	3.22	13.87	6.25	5.37	38.0	31.8
1983	2.80	3.89	3.49	3.47	13.56	6.65	5.51	39.7	34.1
1984	2.68	4.17	3.46	3.41	13.37	5.99	5.48	41.7	35.1
1985	2.64	3.84	3.41	3.29	12.81	5.71	5.19	44.3	36.6
1986	2.65	3.90	3.40	3.24	12.59	3.70	5.00	45.8	37.1
1987	2.42	3.99	3.30	3.08	11.99	3.34	4.79	47.7	36.8
1988	2.05	3.25	2.80	2.95	11.99	2.92	4.64	50.0	37.7
1989	2.14	2.93	2.87	2.88	12.10	3.05	4.72	53.9	39.8
1990	2.10	2.94	2.56	2.88	11.84	2.99	4.61	59.0	43.0
1991	2.04	3.05	2.51	2.90	12.15	2.35	4.56	62.5	46.4
1992	1.99	2.90	2.47	2.78	12.13	2.21	4.52	64.8	47.4
1993	2.19	3.03	2.43	2.67	12.03	2.11	4.37	65.8	46.8
1994	2.05	2.97	2.53	2.84	12.06	2.02	4.57	67.4	48.9
1995	2.52	3.00	3.03	2.77	11.85	2.03	4.59	69.8	49.9
1996	2.48	2.66	2.88	2.54	11.43	2.26	4.24	71.5	50.0
1997			2.77	2.52	10.85	2.02	4.15	73.7	48.5
1998			2.65	2.32	9.55	1.55	3.74	76.2	46.4
1999			2.61	2.12	9.33	1.71	3.59	77.4	46.2
2000			2.76	1.95	8.79	2.57	3.42	79.7	46.0
2001			3.24	1.95	8.45	2.25	3.35	81.1	46.4
2002			3.57	2.06	7.96	2.28	3.39	82.5	47.8
2003			2.93	2.00	7.69	2.53	3.29	84.9	48.8
2004			2.94	2.51	8.81	2.54	3.87	87.3	52.2
2005			3.09	2.51	8.97	3.28	4.01	89.8	59.3
2006			3.11	3.11	10.28	3.67	4.77	92.7	73.9
2007			3.15	3.06	11.05	3.66	4.95	96.7	79.2
2008			3.57	3.50	12.40	5.01	5.58	100.5	94.2
2009			4.31	3.97	12.85	3.73	6.02	100.0	100.0

Sources:
DECC: DUKES 2011 table 1.1-1.6 and DECC: Quarterly Energy Prices - table 2.1.1 [1980-2009]
http://www.decc.gov.uk/en/content/cms/statistics/source/prices/prices.aspx

Notes:
1) Household fuel prices are deflated using the Retail Price Index
2) The fuel prices (p/kWh) are implicit annual averages, obtained by dividing the amount spent on energy by total energy consumption for households.

Table 3d: Average Deflated UK Household Fuel Price Indices (2009 = 100)

Year	Solid fuels	Gas	Electricity	Oil
1970	53.85	110.50	78.35	70.33
1971	55.82	101.49	77.04	68.75
1972	55.54	97.35	76.33	68.54
1973	53.45	88.14	70.65	72.82
1974	53.48	76.60	72.41	100.83
1975	55.10	70.55	84.46	98.43
1976	58.27	75.99	93.08	106.60
1977	59.10	74.20	93.21	111.43
1978	62.29	70.36	95.98	107.47
1979	67.65	63.08	90.88	124.57
1980	79.35	62.24	99.64	142.24
1981	79.66	70.28	107.01	155.78
1982	77.17	80.98	107.94	167.86
1983	80.96	87.28	105.53	178.50
1984	80.27	85.78	104.01	160.91
1985	78.99	82.81	99.70	153.32
1986	78.84	81.42	97.98	99.30
1987	76.47	77.63	93.30	89.55
1988	64.96	74.32	93.27	78.46
1989	66.56	72.50	94.11	82.00
1990	59.47	72.38	92.16	80.19
1991	58.11	73.00	94.54	63.06
1992	57.38	70.08	94.35	59.44
1993	56.33	67.18	93.58	56.60
1994	58.57	71.41	93.85	54.35
1995	70.18	69.69	92.16	54.38
1996	66.83	63.94	88.97	60.64
1997	64.30	63.44	84.38	54.25
1998	61.42	58.49	74.27	41.66
1999	60.47	53.40	72.60	45.97
2000	63.91	49.08	68.40	68.89
2001	75.05	49.17	65.75	60.48
2002	82.71	51.77	61.90	61.30
2003	68.01	50.35	59.86	67.84
2004	68.25	63.13	68.57	68.30
2005	71.75	63.17	69.81	87.97
2006	72.02	78.33	80.00	98.39
2007	73.13	76.96	85.97	98.38
2008	82.88	88.10	96.49	134.56
2009	100.00	100.00	100.00	100.00

Sources:
DECC: DUKES 2011/DECC: Quarterly Energy Prices - table 2.1.1 [1980-2009]
http://www.decc.gov.uk/en/content/cms/statistics/source/prices/prices.aspx

Notes:
1) Household fuel prices are deflated using Retail Price Index.
2) Each deflated series is indexed to 2009.

Table 3e UK Fuel Poverty

Year	Number of fuel poor households (millions)	Number of vulnerable households (millions)	UK households (millions)	Fuel poor households (%)	Vulnerable households (%)
1996	6.50	5.00	23.72	27.40	21.08
1997	5.63	4.25	23.89	23.55	17.79
1998	4.75	3.50	24.05	19.75	14.55
1999	4.00	3.00	24.22	16.52	12.39
2000	3.25	2.50	24.39	13.33	10.25
2001	2.50	2.00	24.55	10.18	8.15
2002	2.25	1.75	24.79	9.08	7.06
2003	2.00	1.50	25.03	7.99	5.99
2004	2.00	1.50	25.27	7.91	5.94
2005	2.50	2.00	25.51	9.80	7.84
2006	3.50	2.75	25.75	13.59	10.68
2007	4.00	3.25	26.04	15.36	12.48
2008	4.50	3.75	26.33	17.09	14.24

Source:
DECC: Annual report on fuel statistics 2010
http://www.decc.gov.uk/assets/decc/Statistics/fuelpoverty/610-annual-fuel-poverty-statistics-2010.pdf

Notes:
1) A household is called fuel poor if it would spend more than 10% of its income on fuel to maintain a satisfactory heating regime.
2) A vulnerable household is a fuel poor household with an elderly person, child, disabled person or a person with long term illness.
3) As a result of missing data, fuel poor and vulnerable household data are interpolated for 1997, 1999 and 2000.

Table 4a: Population and Households (millions)

Year	Population	Households	Population/ Households	Mean Size (Households)
1970	54.11	18.41	2.94	
1971	54.39	18.64	2.92	2.91
1972	54.56	18.80	2.90	
1973	54.69	18.96	2.88	2.83
1974	54.71	19.13	2.86	
1975	54.70	19.29	2.84	2.78
1976	54.69	19.45	2.81	
1977	54.67	19.62	2.79	2.71
1978	54.66	19.78	2.76	
1979	54.71	19.94	2.74	2.67
1980	54.80	20.11	2.73	
1981	54.82	20.27	2.70	2.70
1982	54.75	20.38	2.69	
1983	54.77	20.53	2.67	2.64
1984	54.85	20.73	2.65	2.59
1985	54.99	20.94	2.63	2.56
1986	55.11	21.16	2.60	2.55
1987	55.22	21.39	2.58	2.55
1988	55.33	21.64	2.56	2.48
1989	55.49	21.91	2.53	2.51
1990	55.64	22.13	2.51	2.46
1991	55.83	22.32	2.50	2.48
1992	55.96	22.47	2.49	2.45
1993	56.08	22.60	2.48	2.44
1994	56.22	22.73	2.47	2.44
1995	56.38	22.90	2.46	2.40
1996	56.50	23.04	2.45	
1997	56.64	23.19	2.44	
1998	56.80	23.34	2.43	2.32
1999	57.01	23.51	2.42	
2000	57.20	23.71	2.41	2.30
2001	57.42	23.93	2.40	2.33
2002	57.63	24.13	2.39	
2003	57.85	24.30	2.38	
2004	58.13	24.47	2.38	
2005	58.49	24.69	2.37	
2006	58.80	24.91	2.36	2.32
2007	59.22	25.13	2.36	
2008	59.63	25.36	2.35	
2009	60.00	25.62	2.34	

Sources:
CLG, Live Table 401/ ONS: General Register Office for Scotland, Mid Year Population Estimates, Population Estimates Unit/ General Household Survey (updated November 2010).
http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/householdestimates/livetables-households/

Notes:
1) 1972-1980, 2005, and 2009 are interpolated household figures.
2) The 'mean size of households' is obtained from the General Household Survey, and included to allow comparison with the 'population/households' figures, which are calculated by dividing the GB population figures by the number of GB households.
3) CLG's Table 401 is revised periodically.

Table 4b: Number of Households by Region (millions)

Year	South West	South East	London	East	West Midlands	East Midlands	Yorks & the Humber	North West	North East	England	Wales	Scotland	GB total
1981	1.65	2.66	2.63	1.77	1.87	1.42	1.83	2.56	0.98	17.36	1.03	1.88	20.27
1982	1.66	2.69	2.63	1.79	1.88	1.42	1.84	2.56	0.98	17.45	1.03	1.90	20.38
1983	1.69	2.72	2.64	1.81	1.89	1.44	1.85	2.57	0.99	17.59	1.03	1.91	20.53
1984	1.72	2.76	2.65	1.84	1.91	1.45	1.86	2.58	0.99	17.76	1.04	1.93	20.73
1985	1.74	2.80	2.66	1.87	1.93	1.47	1.87	2.60	1.00	17.94	1.05	1.95	20.94
1986	1.77	2.84	2.68	1.90	1.94	1.49	1.89	2.61	1.00	18.13	1.07	1.96	21.16
1987	1.81	2.88	2.69	1.93	1.97	1.52	1.90	2.63	1.01	18.34	1.08	1.98	21.39
1988	1.84	2.93	2.70	1.96	1.99	1.54	1.92	2.65	1.02	18.55	1.10	2.00	21.64
1989	1.87	2.96	2.73	1.98	2.01	1.56	1.95	2.68	1.03	18.78	1.11	2.01	21.91
1990	1.88	3.00	2.77	2.01	2.03	1.58	1.97	2.70	1.04	18.97	1.12	2.03	22.13
1991	1.91	3.03	2.80	2.03	2.05	1.60	1.99	2.72	1.05	19.17	1.11	2.04	22.32
1992	1.93	3.05	2.80	2.05	2.06	1.62	2.00	2.73	1.05	19.28	1.12	2.06	22.47
1993	1.94	3.07	2.80	2.07	2.07	1.63	2.01	2.75	1.06	19.39	1.13	2.08	22.60
1994	1.96	3.10	2.81	2.08	2.08	1.64	2.02	2.75	1.06	19.49	1.14	2.09	22.73
1995	1.98	3.13	2.82	2.11	2.09	1.66	2.02	2.77	1.06	19.63	1.15	2.11	22.90
1996	1.99	3.15	2.84	2.13	2.10	1.67	2.03	2.77	1.06	19.76	1.16	2.13	23.04
1997	2.01	3.18	2.86	2.15	2.11	1.68	2.03	2.78	1.07	19.87	1.17	2.14	23.19
1998	2.03	3.21	2.88	2.17	2.12	1.69	2.04	2.79	1.07	20.00	1.18	2.15	23.34
1999	2.05	3.24	2.93	2.19	2.13	1.71	2.04	2.80	1.07	20.16	1.19	2.17	23.51
2000	2.07	3.27	2.98	2.22	2.14	1.72	2.05	2.81	1.07	20.34	1.20	2.18	23.71
2001	2.09	3.29	3.04	2.24	2.15	1.74	2.07	2.83	1.08	20.52	1.21	2.20	23.93
2002	2.11	3.31	3.07	2.26	2.17	1.76	2.09	2.84	1.08	20.69	1.22	2.21	24.13
2003	2.13	3.34	3.09	2.28	2.18	1.77	2.10	2.86	1.08	20.83	1.24	2.23	24.30
2004	2.15	3.35	3.11	2.30	2.19	1.79	2.12	2.88	1.09	20.97	1.25	2.25	24.47
2005	2.17	3.38	3.15	2.32	2.20	1.81	2.14	2.89	1.09	21.17	1.26	2.27	24.69
2006	2.19	3.41	3.18	2.35	2.21	1.83	2.16	2.91	1.10	21.34	1.27	2.29	24.91
2007	2.22	3.44	3.21	2.37	2.23	1.85	2.18	2.92	1.11	21.53	1.28	2.31	25.13
2008	2.24	3.48	3.24	2.41	2.24	1.87	2.20	2.94	1.11	21.73	1.30	2.33	25.36
2009	2.27	3.52	3.28	2.44	2.26	1.89	2.23	2.96	1.12	21.96	1.31	2.35	25.62
% Change	37.8%	32.3%	24.5%	37.7%	20.9%	33.6%	21.8%	15.6%	14.5%	26.5%	27.9%	24.9%	26.4%

Sources:
CLG: live table 403 - Household projections by region, England, 1971-2033 (updated Nov 2010).
http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/householdestimates/livetables-households/

Notes:
1) Household figures for Wales are interpolated for the years 2005, 2007-2009 and for Scotland from 2007-2009.
2) Figures for England are interpolated for 2009.
3) Figures do not always add up to totals due to rounding.

Table 4c: Housing Stock Distribution by Type (millions)

Year	Semi detached	Terraced	Flat	Detached	Bungalow	Other	Total
1970	5.93	5.70	3.07	1.96	1.42	0.32	18.41
1971	6.00	5.77	3.11	1.98	1.44	0.33	18.64
1972	6.11	5.78	3.16	1.94	1.47	0.33	18.80
1973	6.38	5.69	3.09	1.98	1.47	0.35	18.96
1974	6.34	5.54	3.27	2.08	1.55	0.35	19.13
1975	6.44	5.79	3.35	2.02	1.44	0.24	19.29
1976	6.79	5.75	3.34	1.86	1.52	0.19	19.45
1977	6.41	5.93	3.25	2.25	1.58	0.19	19.62
1978	6.33	5.79	3.30	2.39	1.65	0.31	19.78
1979	6.37	6.06	3.05	2.60	1.67	0.20	19.94
1980	6.38	6.32	3.12	2.50	1.58	0.21	20.11
1981	6.39	6.17	3.11	2.70	1.70	0.20	20.27
1982	6.43	6.20	3.12	2.71	1.71	0.20	20.38
1983	6.44	6.24	3.16	2.76	1.79	0.14	20.53
1984	6.51	6.30	3.19	2.78	1.80	0.15	20.73
1985	6.56	6.31	3.26	2.86	1.82	0.13	20.94
1986	6.64	6.39	3.28	2.88	1.84	0.13	21.16
1987	6.59	6.33	3.42	3.02	1.93	0.11	21.39
1988	6.60	6.32	3.53	3.12	1.95	0.13	21.64
1989	6.68	6.15	3.76	3.29	1.93	0.09	21.91
1990	6.79	6.21	3.76	3.36	1.93	0.07	22.13
1991	6.76	6.32	3.91	3.30	1.96	0.07	22.32
1992	6.74	6.38	4.02	3.26	2.00	0.07	22.47
1993	6.69	6.33	4.14	3.34	2.03	0.07	22.60
1994	6.68	6.27	4.23	3.43	2.05	0.07	22.73
1995	6.68	6.34	4.28	3.48	2.04	0.07	22.90
1996	6.73	6.34	4.33	3.55	2.03	0.07	23.04
1997	6.77	6.35	4.36	3.62	2.02	0.07	23.19
1998	6.81	6.39	4.39	3.64	2.03	0.07	23.34
1999	6.84	6.42	4.42	3.72	2.05	0.07	23.51
2000	6.88	6.43	4.46	3.84	2.04	0.07	23.71
2001	6.80	6.63	4.55	3.88	2.01	0.07	23.93
2002	6.85	6.68	4.58	3.91	2.03	0.07	24.13
2003	6.87	7.01	4.14	3.98	2.26	0.03	24.30
2004	7.01	6.93	4.00	4.18	2.31	0.04	24.47
2005	6.75	7.14	4.20	4.30	2.22	0.07	24.69
2006	6.93	7.20	4.22	4.29	2.17	0.09	24.91
2007	6.97	7.00	4.18	4.59	2.30	0.08	25.13
2008	6.66	7.25	4.73	4.36	2.27	0.08	25.36

Sources:
GfK Home Audit/CLG: English House Condition Survey, English Housing Survey, Table 401 (updated November 2010)
www.communities.gov.uk/englishhousingsurvey
http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/householdestimates/livetables-households/

Notes:
1) 'Other' category consists of all those types of dwellings that do not fit into any standard dwelling type, such as temporary dwellings.
2) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form the English Housing Survey in 2008.
3) Sampling errors in the surveys mean that there can be inexplicable fluctuations in the figures from year to year - like the fall in semi-detached homes in 2008.

Table 4d: Housing Stock Distribution by Age (millions)

Year	Pre-1918	1918-38	1939-59	1960-75	1976-	Total households
1970	4.68	5.00	4.84	3.88		18.41
1971	4.58	4.89	4.73	4.44		18.64
1972	4.64	4.82	5.20	4.15		18.80
1973	4.49	4.89	5.06	4.52		18.96
1974	4.35	4.71	4.73	5.34		19.13
1975	4.47	4.78	4.52	5.51		19.29
1976	4.24	4.83	4.62	5.44	0.32	19.45
1977	4.08	4.76	4.56	5.59	0.63	19.62
1978	4.67	4.20	4.85	5.24	0.82	19.78
1979	4.89	4.38	4.17	5.40	1.11	19.94
1980	5.14	4.45	4.16	5.33	1.03	20.11
1981	5.06	4.38	4.01	5.39	1.42	20.27
1982	5.07	4.37	3.99	5.19	1.75	20.38
1983	4.96	4.33	4.00	5.27	1.95	20.53
1984	4.87	4.36	4.02	5.25	2.23	20.73
1985	4.83	4.35	4.02	5.29	2.45	20.94
1986	4.70	4.40	4.06	5.39	2.60	21.16
1987	4.60	4.45	4.10	5.31	2.93	21.39
1988	4.44	4.48	4.16	5.37	3.20	21.64
1989	4.49	4.51	4.21	5.28	3.42	21.91
1990	4.53	4.47	4.26	5.29	3.58	22.13
1991	4.55	4.49	4.24	5.25	3.79	22.32
1992	4.52	4.47	4.25	5.26	3.98	22.47
1993	4.54	4.50	4.27	5.18	4.11	22.60
1994	4.52	4.48	4.25	5.16	4.32	22.73
1995	4.56	4.51	4.28	5.15	4.39	22.90
1996	4.56	4.54	4.31	5.12	4.52	23.04
1997	4.54	4.52	4.29	5.10	4.73	23.19
1998	4.55	4.53	4.29	5.09	4.88	23.34
1999	4.56	4.51	4.30	5.10	5.03	23.51
2000	4.60	4.56	4.32	5.12	5.12	23.71
2001	4.62	4.55	4.36	5.15	5.26	23.93
2002	4.65	4.58	4.39	5.19	5.31	24.13
2003	5.01	4.54	5.04	3.74	5.96	24.30
2004	5.10	4.40	5.12	3.74	6.11	24.47
2005	5.31	4.32	4.88	3.84	6.35	24.69
2006	5.32	4.54	4.97	3.78	6.29	24.91
2007	5.29	4.38	4.95	3.75	6.75	25.13
2008	5.43	4.12	4.97	3.82	7.02	25.36

Sources:
GfK: Home Audit. CLG: English House Condition Survey, English Housing Survey. CLG: Table 401.
www.communities.gov.uk/englishhousingsurvey

Notes:
1) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form the English Housing Survey in 2008.
2) Sampling errors in the surveys mean that there can be inexplicable fluctuations in the figures from year to year.
3) There is a discontinuity in the data in 2003, when the English House Condition Survey replaced GfK's Home Audit.

Table 4e: Housing Stock Distribution by Tenure (millions)

Year	Owner occupied	Local authority	Private rented	RSL	Total households
1970	8.65	6.35	3.40		18.41
1971	8.79	6.46	3.39		18.64
1972	8.92	6.55	3.33		18.80
1973	9.12	6.55	3.29		18.96
1974	9.26	6.34	3.53		19.13
1975	9.84	6.53	2.92		19.29
1976	10.26	6.63	2.56		19.45
1977	10.62	6.74	2.25		19.62
1978	10.62	6.75	2.41		19.78
1979	10.74	6.76	2.45		19.94
1980	11.08	6.43	2.60		20.11
1981	10.83	6.81	2.16	0.47	20.27
1982	10.88	6.84	2.17	0.48	20.38
1983	12.18	6.03	1.82	0.50	20.53
1984	12.29	6.09	1.82	0.53	20.73
1985	12.84	5.88	1.67	0.55	20.94
1986	12.97	5.95	1.68	0.57	21.16
1987	13.72	5.73	1.28	0.66	21.39
1988	14.09	5.63	1.23	0.69	21.64
1989	14.59	5.36	1.25	0.70	21.91
1990	14.80	5.29	1.28	0.75	22.13
1991	15.00	5.16	1.43	0.74	22.32
1992	15.12	5.06	1.55	0.74	22.47
1993	15.26	4.88	1.58	0.88	22.60
1994	15.37	4.77	1.57	1.02	22.73
1995	15.43	4.81	1.62	1.03	22.90
1996	15.56	4.70	1.68	1.11	23.04
1997	15.67	4.73	1.69	1.09	23.19
1998	15.82	4.71	1.70	1.10	23.34
1999	15.94	4.51	1.91	1.15	23.51
2000	16.22	4.27	1.92	1.31	23.71
2001	16.46	4.02	2.04	1.41	23.93
2002	16.60	4.05	2.05	1.43	24.13
2003	17.43	2.74	2.30	1.82	24.30
2004	17.44	2.59	2.55	1.88	24.47
2005	17.52	2.40	2.72	2.05	24.69
2006	17.75	2.32	2.78	2.05	24.91
2007	17.89	2.21	2.91	2.12	25.13
2008	17.12	2.26	3.76	2.22	25.36

Sources:
GfK Home Audit/CLG: English Housing Condition Survey, English Housing Survey
www.communities.gov.uk/englishhousingsurvey

Notes:
1) Registered Social Landlord (RSL) is the technical name for social landlords that are registered with the Tenant Services Authority (the Housing Corporation until December 2008), and consists of mainly housing associations as well as trusts, co-operatives and companies.
2) English Housing Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form English Housing Survey in 2008.

Table 4f: Average Weekly Expenditure on all Goods and on Fuel, Light and Power (£/wk) - UK figures

	Contemporary prices		2009 prices		% on fuel, light & power
Year	All goods (£)	Fuel, light & power (£)	All goods (£)	Fuel, light & power (£)	
1970	28.57	1.79	330.02	20.68	6.3%
1971	30.99	1.85	326.24	19.48	6.0%
1972	35.06	2.06	345.27	20.29	5.9%
1973	39.43	2.17	355.54	19.57	5.5%
1974	46.13	2.42	358.47	18.81	5.2%
1975	54.58	2.99	341.05	18.68	5.5%
1976	61.70	3.53	331.29	18.95	5.7%
1977	71.84	4.38	333.02	20.30	6.1%
1978	80.26	4.76	343.03	20.34	5.9%
1979	94.17	5.25	354.93	19.79	5.6%
1980	110.60	6.15	353.82	19.67	5.6%
1981	125.41	7.46	358.29	21.31	5.9%
1982	133.92	8.35	352.45	21.98	6.2%
1983	142.59	9.22	358.91	23.21	6.5%
1984	151.92	9.42	363.96	22.57	6.2%
1985	162.50	9.95	367.09	22.48	6.1%
1986	178.10	10.43	389.16	22.79	5.9%
1987	188.62	10.55	395.57	22.13	5.6%
1988	204.41	10.48	408.63	20.95	5.1%
1989	224.32	10.58	416.12	19.63	4.7%
1990	247.16	11.11	418.86	18.83	4.5%
1991	259.04	12.25	414.66	19.61	4.7%
1992	271.83	13.02	419.43	20.09	4.8%
1993	276.68	13.24	420.23	20.11	4.8%
1994	283.58	12.95	420.55	19.20	4.6%
1995	289.86	12.92	415.45	18.52	4.5%
1996	309.07	13.35	432.54	18.68	4.3%
1997	328.78	12.66	446.10	17.18	3.9%
1998	346.58	11.78	454.66	15.45	3.4%
1999	353.47	11.39	456.69	14.72	3.2%
2000	379.61	11.92	476.36	14.96	3.1%
2001	397.20	11.70	489.80	14.43	2.9%
2002	406.20	11.70	492.65	14.19	2.9%
2003	441.25	12.20	520.02	14.38	2.8%
2004	457.90	12.70	524.33	14.54	2.8%
2005	465.43	13.99	518.16	15.57	3.0%
2006	455.90	15.90	491.80	17.15	3.5%
2007	459.20	17.20	475.10	17.80	3.7%
2008	470.99	18.90	468.61	18.80	4.0%

Sources:
Family Expenditure Survey (pre 2001)/ Expenditure and Food Survey (2001- 2007)/ONS: Living Costs and Food Survey (2008 onwards)
http://www.statistics.gov.uk/downloads/theme_social/Family-Spending-2008/FamilySpending2009.pdf

Notes:
1) UK weekly expenditure figures have been deflated to 2009 prices using the Retail Price Index.
2) Percentage of expenditure on 'Fuel, light and power' has been calculated by dividing 'Fuel, light and power' figures by 'All goods' (£/week).
3) Family Expenditure Survey merged into Expenditure and Food Survey in 2001, and is known as Living Costs and Food Survey from 2008 onwards.

Table 4h: UK Weekly Energy Expenditure by Fuel (£/HH, 2009 prices)

Year	Coal	Coke, breeze & other solid	Total solid	Gas	Electricity	Oil	Total
1970	3.32	1.45	4.77	4.65	7.78	1.03	18.23
1971	2.88	1.30	4.18	4.67	7.93	0.98	17.76
1972	2.47	1.16	3.63	5.09	8.36	1.11	18.18
1973	2.33	1.05	3.38	4.89	8.09	1.28	17.65
1974	2.19	0.98	3.16	4.73	8.36	1.56	17.81
1975	1.87	0.87	2.74	4.73	9.31	1.46	18.25
1976	1.83	0.82	2.65	5.31	9.69	1.57	19.21
1977	1.91	0.80	2.70	5.48	9.70	1.64	19.52
1978	1.83	0.75	2.58	5.67	9.89	1.54	19.67
1979	1.98	0.82	2.80	5.72	9.72	1.73	19.97
1980	1.97	0.84	2.81	5.74	10.13	1.56	20.24
1981	1.94	0.66	2.60	6.67	10.58	1.52	21.37
1982	1.84	0.63	2.47	7.63	10.43	1.52	22.05
1983	1.77	0.62	2.39	8.30	10.14	1.52	22.36
1984	1.37	0.48	1.84	8.12	9.99	1.42	21.38
1985	1.77	0.55	2.32	8.49	10.04	1.38	22.23
1986	1.72	0.54	2.25	8.71	10.14	0.91	22.01
1987	1.31	0.56	1.87	8.42	9.69	0.77	20.75
1988	1.00	0.47	1.47	7.79	9.49	0.65	19.40
1989	0.81	0.37	1.19	7.26	9.45	0.64	18.53
1990	0.67	0.36	1.03	7.17	9.21	0.71	18.12
1991	0.73	0.37	1.10	7.96	9.80	0.63	19.49
1992	0.61	0.32	0.94	7.51	9.85	0.61	18.91
1993	0.67	0.34	1.01	7.37	9.81	0.60	18.79
1994	0.60	0.26	0.86	7.55	9.87	0.57	18.86
1995	0.51	0.23	0.74	7.24	9.70	0.57	18.24
1996	0.50	0.25	0.75	7.60	9.79	0.74	18.87
1997			0.63	6.89	8.96	0.63	17.12
1998			0.57	6.50	8.21	0.50	15.78
1999			0.57	5.93	8.03	0.49	15.02
2000			0.47	5.58	7.61	0.75	14.41
2001			0.53	5.68	7.47	0.71	14.39
2002			0.45	5.89	7.26	0.62	14.22
2003			0.30	5.84	7.15	0.68	13.96
2004			0.26	7.46	8.21	0.72	16.65
2005			0.19	7.12	8.38	0.88	16.57
2006			0.17	8.41	9.45	1.02	19.05
2007			0.18	7.88	9.93	0.89	18.89
2008			0.23	9.11	10.75	1.28	21.36
2009			0.26	9.46	10.91	0.93	21.57

Sources:
DECC: DUKES 2011, table 1.1.6 - internet only [1970-2009]/ CLG, live table 401 (updated November 2011)
http://www.decc.gov.uk/en/content/cms/statistics/source/total/total.aspx
www.communities.gov.uk/ http://www.statistics.gov.uk/statbase/Product.asp?vlnk=15106

Notes:
1) DUKES tables are revised regularly.
2) Total expenditure figures are deflated using the Retail Price Index.
3) Expenditure per household is calculated by dividing the expenditure figures by the number of UK households.

Table 4i: Average Annual Gas Bill (£, 2009 prices, England and Wales)

	Average Annual Gas Bill (£, 2009 prices)		
Year	Standard credit	Direct debit	Prepayment
1990	483		513
1991	491		517
1992	480		508
1993	451		478
1994	455		495
1995	469	446	497
1996	462	431	490
1997	445	417	474
1998	413	363	434
1999	393	346	411
2000	370	331	390
2001	361	328	381
2002	376	341	397
2003	377	344	396
2004	381	354	402
2005	430	393	446
2006	512	458	537
2007	556	503	593
2008	622	579	647
2009	708	653	739

Sources:
DECC: Quarterly Energy Prices, table 2.3.1 [1990-2009]
http://www.decc.gov.uk/en/content/cms/statistics/source/prices/prices.aspx

Notes:
1) Gas bills relate to total bill received in the year, e.g. covering consumption from Q4 of the previous year to Q3 of the named year.
2) All gas bills are calculated using an annual consumption of 18,000 kWh. Figures are inclusive of VAT.
3) Direct debit as a payment method is not widely available for earlier years.
4) Gas figures for direct debit are available only from 1995 onwards.
5) Figures are deflated using the Retail Price Index.

Table 4j: Average Annual Electricity Bill (£, 2009 prices, England and Wales)

	Average Annual Electricity Bill (£, 2009 prices)		
Year	Standard credit	Direct debit	Prepayment
1990	417		449
1991	434		466
1992	447		480
1993	437		469
1994	427	423	457
1995	429	421	457
1996	413	404	441
1997	384	373	407
1998	349	336	371
1999	336	324	360
2000	317	305	341
2001	303	291	324
2002	296	284	317
2003	289	277	308
2004	287	274	306
2005	313	295	335
2006	361	334	384
2007	389	359	407
2008	431	397	450
2009	443	406	452

Sources:
DECC: Quarterly Energy Prices, table 2.2.2 [1990-2009]
http://www.decc.gov.uk/en/content/cms/statistics/source/prices/prices.aspx

Notes:
1) Electricity GB bills relate to total bill received in the year, e.g. covering consumption from Q4 of the previous year to Q3 of the named year.
2) All electricity bills are calculated assuming an annual consumption of 3,300 kWh.   Figures are inclusive of VAT.
3) Electricity figures for direct debit are available only from 1994 onwards.
4) Electricity bills are deflated by the Retail Price Index.

Table 4k: Average UK Weekly Expenditure on Fuel, Light and Power by Income (£/wk/hh) 2008

Gross income decile group (per cent)	Lower boundary of income	Average energy spend	Average total spend	% on energy
Poorest 10%		12.90	154	8.4%
Second Decile	146	14.70	200	7.4%
Third Decile	224	15.60	257	6.1%
Fourth Decile	305	17.20	330	5.2%
Fifth Decile	408	17.60	393	4.5%
Sixth Decile	522	18.80	459	4.1%
Seventh Decile	664	19.90	537	3.7%
Eighth Decile	817	21.00	626	3.4%
Ninth Decile	1,026	23.00	710	3.2%
Wealthiest 10%	1,356	28.70	1,045	2.7%

Sources:
ONS: Living Costs and Food Survey, Appendix A - table A6 and A8, Family Spending (2009): a report on the 2008 Living Costs and Food Survey, Houndmills: Palgrave Macmillan
http://www.statistics.gov.uk/downloads/theme_social/Family-Spending-2008/FamilySpending2009.pdf

Notes:
1) Percentage of UK expenditure on 'Fuel, light and power' has been calculated by dividing 'Average spend on fuel, light and power' figures by 'Average total spend' (£/week).

Table 5a: Average UK Air Temperatures (°C and Annual Degree Days)

Year	Winter average temp (°C)	Annual average temp (°C)	Annual degree days
1970	5.8	9.7	2,311
1971	6.7	9.9	2,202
1972	6.4	9.3	2,355
1973	6.1	9.7	2,283
1974	6.7	9.6	2,259
1975	6.4	10.0	2,240
1976	5.8	10.0	2,262
1977	6.6	9.5	2,318
1978	6.5	9.5	2,323
1979	5.1	8.8	2,558
1980	5.8	9.4	2,356
1981	5.1	9.1	2,494
1982	5.8	9.2	2,422
1983	6.2	9.6	2,357
1984	5.8	9.4	2,408
1985	4.8	8.6	2,622
1986	5.3	8.4	2,664
1987	4.9	8.7	2,587
1988	6.2	9.4	2,340
1989	6.9	10.1	2,153
1990	7.6	10.5	2,022
1991	6.1	9.7	2,303
1992	6.1	9.9	2,221
1993	6.2	9.5	2,309
1994	7.2	10.2	2,120
1995	6.9	10.6	2,082
1996	5.7	9.4	2,387
1997	7.3	10.7	1,996
1998	7.5	10.5	1,994
1999	7.2	10.7	1,975
2000	7.2	10.4	2,040
2001	6.6	10.1	2,163
2002	7.7	10.8	1,924
2003	6.6	10.6	2,042
2004	7.0	10.6	2,007
2005	7.1	10.5	2,048
2006	6.9	10.8	2,033
2007	7.3	10.5	1,978
2008	6.4	9.9	2,195
2009	6.3	10.1	2,166

Sources:
DECC: DUKES 2011, table 1.1.8 - internet only (2311-dukes-2011-long-term-trends.pdf) [1970-2009]
http://www.decc.gov.uk/en/content/cms/statistics/source/total/total.aspx

Notes:
1) Winter temperature is average for October, November, December, January, February, and March.
2) DUKES tables are revised regularly.
3) Annual degree days have been calculated using the Hitchin Formula and normalised to 15.5°C.

Table 5b: Household Energy Use
for Space Heating (TWh)

Year	Space heating	% household energy
1970	236.3	57.8%
1971	219.5	55.5%
1972	226.5	56.3%
1973	239.3	57.4%
1974	242.6	57.5%
1975	231.8	56.4%
1976	224.8	55.3%
1977	237.9	56.6%
1978	248.1	57.8%
1979	279.6	60.6%
1980	261.9	59.3%
1981	259.7	59.0%
1982	254.8	58.6%
1983	253.2	58.5%
1984	241.6	57.5%
1985	285.5	61.2%
1986	302.1	62.3%
1987	301.3	62.5%
1988	289.3	61.5%
1989	266.4	59.6%
1990	272.4	60.2%
1991	317.3	63.9%
1992	310.5	63.5%
1993	327.0	64.7%
1994	310.4	63.7%
1995	297.4	62.8%
1996	358.2	67.1%
1997	321.4	64.7%
1998	336.2	65.7%
1999	337.3	65.9%
2000	345.3	66.4%
2001	361.3	67.6%
2002	352.0	66.8%
2003	359.9	67.2%
2004	370.1	67.6%
2005	353.5	66.6%
2006	338.7	65.6%
2007	321.7	64.5%
2008	331.7	65.7%

Source:
Building Research Establishment Housing Model for Energy Studies [1970-2008]

Notes:
1) '% household energy' is calculated by dividing 'household energy consumption due to space heating' by 'total household energy consumption'.

Table 5c: Household Energy Use for Water Heating (TWh)

Year	Water heating	% household energy
1970	118.9	29.1%
1971	120.3	30.4%
1972	118.8	29.5%
1973	118.5	28.4%
1974	117.9	28.0%
1975	116.7	28.4%
1976	117.7	29.0%
1977	117.4	27.9%
1978	115.1	26.8%
1979	114.4	24.8%
1980	112.2	25.4%
1981	111.6	25.4%
1982	110.5	25.4%
1983	108.9	25.1%
1984	106.9	25.4%
1985	107.3	23.0%
1986	107.8	22.2%
1987	104.7	21.7%
1988	103.9	22.1%
1989	102.8	23.0%
1990	102.0	22.6%
1991	101.2	20.4%
1992	99.9	20.4%
1993	99.2	19.6%
1994	97.8	20.1%
1995	96.6	20.4%
1996	95.7	17.9%
1997	94.8	19.1%
1998	94.4	18.4%
1999	92.7	18.1%
2000	92.3	17.8%
2001	90.5	16.9%
2002	90.6	17.2%
2003	90.7	16.9%
2004	90.6	16.6%
2005	89.2	16.8%
2006	88.2	17.1%
2007	86.7	17.4%
2008	83.8	16.6%

Source:
Building Research Establishment Housing Model for Energy Studies [1970-2008]

Notes:
1) '% household energy' is calculated by dividing 'household energy consumption due to water heating' by 'total household energy consumption'.

Table 5d: Household Energy Use for Lighting (TWh)

Year	Lighting	% household energy
1970	10.4	2.5%
1971	10.7	2.7%
1972	11.0	2.7%
1973	11.3	2.7%
1974	11.6	2.8%
1975	11.9	2.9%
1976	12.2	3.0%
1977	12.5	3.0%
1978	12.7	3.0%
1979	13.0	2.8%
1980	13.3	3.0%
1981	13.5	3.1%
1982	13.8	3.2%
1983	14.0	3.2%
1984	14.2	3.4%
1985	14.5	3.1%
1986	14.7	3.0%
1987	14.9	3.1%
1988	15.1	3.2%
1989	15.2	3.4%
1990	15.3	3.4%
1991	15.5	3.1%
1992	15.6	3.2%
1993	15.8	3.1%
1994	15.9	3.3%
1995	16.0	3.4%
1996	16.2	3.0%
1997	16.4	3.3%
1998	16.5	3.2%
1999	16.7	3.3%
2000	16.9	3.3%
2001	17.1	3.2%
2002	17.3	3.3%
2003	17.1	3.2%
2004	17.0	3.1%
2005	16.7	3.1%
2006	16.9	3.3%
2007	16.8	3.4%
2008	16.5	3.3%

Source:
Building Research Establishment Housing Model for Energy Studies [1970-2008]

Notes:
1) '% household energy' is calculated by dividing 'household energy consumption due to lighting' by 'total household energy consumption'.

Table 5e: Household Energy Use for Appliances (TWh)

Year	Appliances	% household energy
1970	19.1	4.7%
1971	20.5	5.2%
1972	22.0	5.5%
1973	23.9	5.7%
1974	25.7	6.1%
1975	27.3	6.6%
1976	28.5	7.0%
1977	29.6	7.0%
1978	30.6	7.1%
1979	31.6	6.9%
1980	32.6	7.4%
1981	33.6	7.6%
1982	34.7	8.0%
1983	35.9	8.3%
1984	37.4	8.9%
1985	39.3	8.4%
1986	41.0	8.4%
1987	42.5	8.8%
1988	43.7	9.3%
1989	44.7	10.0%
1990	45.4	10.0%
1991	46.1	9.3%
1992	46.7	9.6%
1993	47.4	9.4%
1994	47.9	9.8%
1995	48.2	10.2%
1996	48.7	9.1%
1997	49.2	9.9%
1998	49.7	9.7%
1999	50.2	9.8%
2000	50.6	9.7%
2001	51.1	9.6%
2002	52.2	9.9%
2003	53.4	10.0%
2004	55.0	10.0%
2005	56.5	10.6%
2006	58.3	11.3%
2007	58.8	11.8%
2008	58.4	11.6%

Source:
Building Research Establishment Housing Model for Energy Studies [1970-2008]

Notes:
1) '% household energy' is calculated by dividing 'household energy consumption due to appliances' by 'total household energy consumption'.
2) Household energy consumption estimates from appliances build on data from the Environment Change Institute's (Oxford University) DECADE project.
3) Appliances include all items not attributed to Cooking, Space Heating, Water Heating or Lighting.

Table 5f: Household Energy Consumption by End Use (TWh) - Cooking

Year	Cooking	% household energy
1970	24.4	6.0%
1971	24.2	6.1%
1972	24.0	6.0%
1973	23.9	5.7%
1974	23.8	5.6%
1975	23.6	5.7%
1976	23.3	5.7%
1977	23.1	5.5%
1978	22.8	5.3%
1979	22.5	4.9%
1980	22.1	5.0%
1981	21.7	4.9%
1982	21.4	4.9%
1983	20.9	4.8%
1984	20.3	4.8%
1985	20.0	4.3%
1986	19.3	4.0%
1987	18.7	3.9%
1988	18.2	3.9%
1989	17.6	3.9%
1990	17.0	3.8%
1991	16.6	3.3%
1992	16.2	3.3%
1993	15.9	3.1%
1994	15.6	3.2%
1995	15.4	3.2%
1996	15.2	2.8%
1997	15.1	3.0%
1998	15.0	2.9%
1999	14.9	2.9%
2000	14.7	2.8%
2001	14.7	2.7%
2002	14.7	2.8%
2003	14.7	2.7%
2004	14.6	2.7%
2005	14.6	2.7%
2006	14.7	2.8%
2007	14.5	2.9%
2008	14.2	2.8%

Source:
Building Research Establishment Housing Model for Energy Studies [1970-2008]

Notes:
1) '% household energy' is calculated by dividing 'household energy consumption due to cooking' by 'total household energy consumption'.
2) Household energy consumption estimates from cooking build on data from the Environment Change Institute's (Oxford University) DECADE project.
3) Cooking appliances consist of ovens and hobs. Microwaves, toasters and kettles, etc, are classified as appliances.

Table 5g: Average SAP 2005 Ratings by Year

Year	SAP rating of average GB house
1970	17.6
1971	18.4
1972	19.2
1973	20.5
1974	22.0
1975	23.1
1976	24.7
1977	26.6
1978	27.3
1979	29.0
1980	30.3
1981	31.6
1982	33.0
1983	34.9
1984	35.7
1985	36.5
1986	37.9
1987	38.7
1988	39.0
1989	39.7
1990	40.2
1991	41.0
1992	41.9
1993	42.4
1994	42.7
1995	43.4
1996	43.4
1997	43.7
1998	44.6
1999	44.9
2000	45.5
2001	45.8
2002	47.1
2003	46.6
2004	47.4
2005	48.1
2006	48.7
2007	49.8
2008	51.4

Sources:
Building Research Establishment Housing Model for Energy Studies [1970-2002]/ CLG: English Housing Condition Survey, English Housing
Survey [2003-2008]
www.communities.gov.uk/englishhousingsurvey

Notes:
1) Standard Assessment Procedure (SAP) ratings prior to 2003 are for GB obtained from BREHOMES. Standard Assessment Procedure ratings from 2003 onwards are for England from the EHCS/EHS survey. The change in source means there is a discontinuity in the data.
2) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form the English Housing Survey in 2008.

Table 5h: Effect of Energy Efficiency Improvements on Energy Use (TWh)

Year	Actual energy used	Energy use if 1970 insulation standard	Energy use if 1970 insulation and efficiency standard	Saving due to better insulation	Saving due to improved efficiency	Total saving
1970	409.2	409.2	409.2	0.0	0.0	0.0
1971	395.2	397.6	400.5	2.4	2.9	5.3
1972	402.3	408.4	415.6	6.1	7.2	13.3
1973	416.9	428.2	439.3	11.3	11.1	22.4
1974	421.6	439.5	454.7	17.9	15.2	33.1
1975	411.2	435.1	455.0	23.9	19.9	43.8
1976	406.5	438.0	456.5	31.5	18.5	50.0
1977	420.5	461.9	484.0	41.4	22.1	63.5
1978	429.3	480.3	507.1	51.0	26.8	77.8
1979	461.2	523.5	558.8	62.3	35.3	97.6
1980	442.0	513.6	550.8	71.6	37.1	108.7
1981	440.2	521.9	561.6	81.8	39.6	121.4
1982	435.1	526.5	572.8	91.3	46.3	137.6
1983	432.9	533.5	587.2	100.6	53.7	154.3
1984	420.5	523.0	583.1	102.5	60.1	162.6
1985	466.7	582.4	654.3	115.7	71.9	187.6
1986	484.9	612.6	690.8	127.7	78.2	205.9
1987	482.2	616.4	703.2	134.2	86.8	221.0
1988	470.1	604.4	696.3	134.4	91.9	226.3
1989	446.7	578.2	669.9	131.5	91.7	223.3
1990	452.2	590.2	690.6	138.0	100.4	238.4
1991	496.7	652.5	774.6	155.8	122.1	277.9
1992	488.9	655.1	785.1	166.2	130.0	296.2
1993	505.4	678.7	821.6	173.3	143.0	316.3
1994	487.6	657.2	800.4	169.6	143.2	312.8
1995	473.7	646.0	793.6	172.4	147.6	319.9
1996	533.9	733.1	915.7	199.2	182.6	381.8
1997	496.8	686.9	863.4	190.1	176.6	366.7
1998	511.8	708.9	896.7	197.1	187.8	384.9
1999	511.7	709.2	908.6	197.5	199.3	396.9
2000	519.8	723.3	935.1	203.5	211.8	415.3
2001	534.5	746.0	978.7	211.5	232.7	444.1
2002	526.7	736.7	974.4	210.0	237.7	447.7
2003	535.8	757.9	1,007.6	222.1	249.7	471.8
2004	547.3	782.8	1,042.4	235.4	259.6	495.1
2005	530.4	790.6	1,079.2	260.2	288.5	548.8
2006	516.7	767.7	1,048.6	251.0	280.9	531.9
2007	498.5	716.9	978.3	218.4	261.4	479.8

Source:
Building Research Establishment Housing Model for Energy Studies [1970-2008]/ DECC: DUKES, table 1.1.5: internet version only [1970-2008]
http://www.decc.gov.uk/en/content/cms/statistics/source/total/total.aspx

Notes:
1) Actual energy used figures were converted from the units in DUKES (thousand toe) to TWh: 1 toe = 11,630 kWh.
2) 'Total savings' are calculated by adding savings due to improved insulation and savings due to improved efficiency.
3) DUKES tables are revised regularly.
4) Figures may not always add up to totals due to rounding.
5) The time series is discontinued in 2007 because of concerns about the reliability of the heat balance equation used to generate figures.

Table 5i: Carbon Dioxide Emissions per Household (Tonnes of CO_2)

Year	Tonnes CO_2 per household
1970	9.0
1971	8.6
1972	8.7
1973	9.0
1974	8.7
1975	8.3
1976	7.9
1977	8.0
1978	7.8
1979	8.3
1980	7.8
1981	7.6
1982	7.2
1983	7.1
1984	6.7
1985	7.3
1986	7.4
1987	7.2
1988	6.8
1989	6.4
1990	6.5
1991	6.7
1992	6.4
1993	6.3
1994	6.0
1995	5.6
1996	6.0
1997	5.6
1998	5.8
1999	5.6
2000	5.8
2001	6.0
2002	5.8
2003	6.0
2004	6.0
2005	5.9
2006	5.7
2007	5.4
2008	5.3
2009	5.1

Sources:
DECC: DUKES, table 1.1.5 [1970-2009]/ Market Transformation Programme - developing evidence for government and business on energy using products, table A1 [1970-2009], BNXS01: Carbon Dioxide Emission Factors for UK Energy Use/ private BRE communication
http://www.decc.gov.uk/en/content/cms/statistics/source/total/total.aspx/
http://efficient-products.defra.gov.uk/spm/download/document/id/785
www.communities.gov.uk/ http://www.statistics.gov.uk/statbase/Product.asp?vlnk=15106

Notes:
1) CO_2 per household is calculated by dividing total carbon emissions by number of households.
2) The DEFRA 2008 emission factors for gas = 0.185, solid = 0.296, and oil = 0.268 ($kgCO_2/kWh$).
3) The emission factors for electricity are obtained from the Market Transformation Programme.
4) DUKES tables are revised regularly.
5) The domestic energy consumption figures in GB are obtained from Table 7a.
6) These figures are for GB and as a result of this and using constant emissions factors (for all fuels except electricity) the data differs from the National Air Emissions Inventory (NAEI) data.

Table 6a: Households with Central Heating (millions)

Year	With central heating	Without central heating	Total households
1970	5.78	12.62	18.41
1971	6.41	12.22	18.64
1972	7.01	11.79	18.80
1973	7.82	11.15	18.96
1974	8.79	10.34	19.13
1975	9.46	9.83	19.29
1976	10.01	9.44	19.45
1977	10.54	9.07	19.62
1978	10.70	9.08	19.78
1979	11.26	8.69	19.94
1980	11.57	8.53	20.11
1981	11.91	8.36	20.27
1982	12.40	7.97	20.38
1983	13.44	7.08	20.53
1984	14.00	6.73	20.73
1985	14.72	6.22	20.94
1986	15.27	5.89	21.16
1987	15.91	5.48	21.39
1988	16.35	5.30	21.64
1989	17.07	4.83	21.91
1990	17.56	4.56	22.13
1991	18.27	4.05	22.32
1992	18.64	3.83	22.47
1993	19.05	3.55	22.60
1994	19.49	3.24	22.73
1995	19.91	2.98	22.90
1996	20.05	3.00	23.04
1997	20.34	2.84	23.19
1998	20.79	2.55	23.34
1999	20.97	2.55	23.51
2000	21.12	2.59	23.71
2001	21.58	2.35	23.93
2002	21.79	2.34	24.13
2003	22.99	1.31	24.30
2004	23.39	1.08	24.47
2005	23.74	0.94	24.69
2006	24.13	0.78	24.91
2007	24.54	0.58	25.13
2008	24.32	1.04	25.36

Sources:
GfK Home Audit/ CLG: English House Condition Survey, English Housing Survey
www.communities.gov.uk/englishhousingsurvey

Notes:
1) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form the English Housing Survey in 2008.

Table 6b: Main Form of Heating for Centrally Heated Dwellings

Year	Solid fuel	Electric storage	Electric other	All electric	Gas	Oil	Other
1970	28.7%	19.4%	7.7%	27.2%	33.0%	8.2%	3.0%
1971	24.6%	20.4%	8.1%	28.5%	35.1%	8.8%	2.9%
1972	21.6%	20.6%	8.2%	28.9%	37.3%	9.5%	2.8%
1973	18.7%	20.6%	8.3%	28.9%	40.5%	8.9%	2.9%
1974	16.9%	20.1%	8.1%	28.2%	43.4%	8.0%	3.4%
1975	15.0%	20.1%	8.6%	28.7%	45.2%	7.3%	3.9%
1976	14.2%	17.6%	7.6%	25.1%	50.6%	6.5%	3.5%
1977	13.4%	15.6%	6.7%	22.2%	54.6%	6.4%	3.4%
1978	10.1%	15.7%	6.7%	22.4%	57.9%	6.3%	3.3%
1979	9.4%	13.0%	5.6%	18.6%	63.6%	5.5%	2.9%
1980	9.8%	12.1%	5.2%	17.3%	66.5%	4.2%	2.2%
1981	10.2%	10.3%	4.9%	15.2%	68.4%	4.1%	2.1%
1982	10.5%	8.6%	4.6%	13.2%	70.1%	4.1%	2.0%
1983	10.8%	7.0%	4.3%	11.4%	71.7%	4.1%	2.0%
1984	9.1%	9.4%	5.0%	14.4%	71.1%	3.9%	1.4%
1985	10.3%	8.9%	4.3%	13.2%	70.5%	3.6%	2.5%
1986	9.9%	7.5%	3.0%	10.6%	74.4%	3.2%	1.9%
1987	9.4%	7.9%	2.5%	10.5%	74.3%	3.5%	2.3%
1988	9.2%	8.4%	2.9%	11.3%	73.5%	3.7%	2.3%
1989	7.5%	8.9%	3.2%	12.0%	75.0%	3.1%	2.3%
1990	7.3%	9.3%	2.6%	11.9%	75.2%	3.2%	2.4%
1991	6.9%	9.8%	2.3%	12.1%	75.3%	3.4%	2.3%
1992	5.6%	10.0%	2.2%	12.3%	77.0%	3.0%	2.1%
1993	5.1%	10.4%	2.0%	12.3%	77.2%	3.4%	1.9%
1994	4.5%	9.7%	2.4%	12.0%	78.3%	3.2%	2.0%
1995	3.9%	9.8%	1.9%	11.8%	78.3%	3.6%	2.5%
1996	4.1%	10.3%	1.9%	12.2%	76.4%	4.5%	2.8%
1997	4.3%	10.8%	1.9%	12.7%	76.0%	4.5%	2.5%
1998	3.5%	9.9%	1.2%	11.1%	79.5%	3.7%	2.3%
1999	3.3%	10.1%	2.2%	12.3%	78.4%	3.9%	2.1%
2000	3.1%	9.9%	2.0%	11.9%	79.2%	3.9%	2.0%
2001	3.0%	8.8%	1.9%	10.8%	79.8%	4.3%	2.1%
2002	3.2%	7.4%	3.9%	11.2%	79.2%	4.8%	1.6%
2003	1.5%	7.6%	0.5%	8.1%	83.7%	4.0%	2.7%
2004	1.4%	7.7%	0.4%	8.1%	84.0%	4.3%	2.2%
2005	1.2%	7.6%	0.2%	7.8%	84.8%	4.1%	2.1%
2006	1.1%	7.1%	0.2%	7.3%	85.0%	4.4%	2.2%
2007	1.1%	7.0%	0.3%	7.3%	85.1%	4.5%	2.0%
2008	0.9%	7.6%	0.4%	7.9%	85.3%	4.0%	1.9%

Sources:
GfK Home Audit/ CLG: English House Condition Survey, English Housing Survey
www.communities.gov.uk/englishhousingsurvey

Notes:
1) 'All electric' includes 'Electric storage' and 'Other electric'.
2) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form the English Housing Survey in 2008.

Table 6c: Main Form of Heating for Non-Centrally Heated Dwellings

Year	Solid fuel fire	Solid fuel stove	All solid	Electric	Gas	Oil	Other
1970	26.1%	5.0%	31.1%	19.0%	44.1%	3.8%	2.0%
1971	26.1%	5.0%	31.1%	19.0%	44.1%	3.8%	2.0%
1972	26.1%	5.0%	31.1%	19.0%	44.1%	3.8%	2.0%
1973	26.1%	5.0%	31.1%	19.0%	44.1%	3.8%	2.0%
1974	26.1%	5.0%	31.1%	19.0%	44.1%	3.8%	2.0%
1975	26.1%	5.0%	31.1%	19.0%	44.1%	3.8%	2.0%
1976	26.6%	5.1%	31.8%	17.4%	44.9%	3.9%	2.1%
1977	24.4%	4.7%	29.1%	16.3%	48.8%	3.8%	2.0%
1978	24.8%	4.8%	29.5%	16.4%	48.2%	3.8%	2.0%
1979	21.2%	7.1%	28.2%	15.9%	50.2%	3.5%	2.2%
1980	20.4%	8.0%	28.4%	13.9%	51.7%	3.5%	2.4%
1981	19.6%	7.3%	26.8%	14.1%	53.4%	2.5%	3.1%
1982	17.4%	7.7%	25.1%	14.2%	55.1%	2.2%	3.3%
1983	14.8%	8.8%	23.6%	14.6%	57.5%	1.3%	3.0%
1984	14.7%	8.4%	23.0%	13.9%	59.8%	0.8%	2.4%
1985	14.3%	7.9%	22.3%	13.0%	62.1%	0.5%	2.0%
1986	13.7%	7.4%	21.1%	11.8%	63.9%	0.4%	2.8%
1987	12.2%	6.5%	18.7%	12.9%	65.5%	0.5%	2.4%
1988	11.5%	6.2%	17.7%	14.1%	64.9%	0.4%	2.8%
1989	12.3%	6.6%	19.0%	13.0%	64.8%	0.3%	2.8%
1990	11.9%	6.4%	18.3%	13.7%	65.2%	0.1%	2.6%
1991	11.6%	6.2%	17.8%	12.3%	66.6%	0.4%	2.9%
1992	10.8%	5.8%	16.6%	13.7%	66.5%	0.3%	3.0%
1993	10.2%	5.5%	15.7%	13.5%	67.8%	0.2%	2.9%
1994	10.9%	5.9%	16.7%	14.8%	65.8%	0.1%	2.6%
1995	9.9%	5.3%	15.2%	15.5%	66.4%	0.2%	2.7%
1996	11.1%	5.9%	17.0%	15.2%	65.0%	0.1%	2.6%
1997	10.6%	5.7%	16.4%	19.4%	61.9%	0.1%	2.2%
1998	10.9%	5.9%	16.7%	16.6%	63.9%	0.1%	2.7%
1999	7.3%	3.9%	11.3%	17.2%	68.8%	0.2%	2.5%
2000	6.7%	3.6%	10.3%	20.7%	67.1%	0.1%	1.8%
2001	8.3%	4.5%	12.8%	31.3%	53.3%	0.0%	2.7%
2002	8.7%	4.7%	13.3%	38.0%	46.7%	0.0%	1.9%
2003	4.5%	2.4%	7.0%	18.9%	73.6%	0.0%	0.5%
2004	5.1%	2.8%	7.9%	19.8%	72.3%	0.0%	0.0%
2005	5.0%	2.7%	7.7%	22.4%	69.1%	0.0%	0.9%
2006	6.2%	3.3%	9.5%	24.6%	64.5%	0.0%	1.5%
2007	7.2%	3.9%	11.0%	29.8%	58.2%	0.0%	1.0%
2008	4.8%	2.6%	7.4%	41.4%	50.5%	0.0%	0.6%

Sources:
GfK Home Audit/ CLG: English House Condition Survey, English Housing Survey
www.communities.gov.uk/englishhousingsurvey

Notes:
1) 'All solid' includes 'Solid fuel fire' and 'Solid fuel stove'.
2) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form English Housing Survey in 2008.
3) The sample size of non-centrally heated homes falls dramatically over time (see Chart 5d). As a result the main form of heating becomes more volatile towards the end of the period.

Table 6d: Gas and Oil Condensing Boilers and Combi Boilers

Year	Condensing boilers (1000s)	Condensing (%)	Combi boilers (1000s)	(Of which condensing combi boilers - in 1000s)	Combi (%)	All gas and oil boilers (1000s)
1975			1		0.02	4,517
1976			6		0.13	4,967
1977			11		0.19	5,721
1978			17		0.26	6,430
1979			22		0.32	6,871
1980			28		0.36	7,775
1981			67		0.82	8,173
1982	1	0.01	104		1.21	8,630
1983	1	0.01	142		1.54	9,204
1984	1	0.01	187		1.84	10,190
1985	2	0.02	220		2.09	10,509
1986	6	0.06	403		3.69	10,911
1987	12	0.10	604		5.10	11,850
1988	17	0.14	787		6.35	12,382
1989	21	0.17	942		7.47	12,612
1990	26	0.19	1,130		8.47	13,343
1991	32	0.24	1,338	1	9.71	13,771
1992	41	0.28	1,571	1	10.93	14,380
1993	50	0.33	1,816	3	12.17	14,914
1994	69	0.45	2,069	5	13.46	15,367
1995	86	0.54	2,348	7	14.79	15,881
1996	112	0.68	2,647	11	16.24	16,295
1997	136	0.84	2,895	18	17.86	16,208
1998	169	1.03	3,211	32	19.61	16,373
1999	217	1.25	3,727	55	21.55	17,292
2000	257	1.49	4,090	80	23.71	17,252
2001	323	1.84	4,577	119	26.09	17,544
2002	445	2.45	5,199	196	28.65	18,147
2003	601	3.28	6,686	425	36.55	18,293
2004	706	3.50	7,240	475	35.92	20,154
2005	1,171	5.67	7,958	829	38.54	20,648
2006	2,003	9.49	8,674	1,479	41.09	21,111
2007	2,890	13.40	9,261	2,094	42.94	21,566
2008	4,242	19.29	10,095	3,161	45.91	21,990
2009	6,147	28.31	10,897	4,630	50.19	21,710

Sources:
DEFRA: Market Transformation Programme boiler model - based on sales data from the Heating and Hotwater Industry Council
CLG: English House Condition Survey, English Housing Survey

Notes:
1) The Market Transformation Programme model was used for this data up to 2002. From 2003 onwards the EHCS, and then the EHS survey data, was used, scaled to GB. This introduces a discontinuity in 2003.
2) Figures for 1976 -1979, 1981 - 1984, and 1986 - 1989 are interpolations.
3) All figures are expressed to the nearest thousand households.
4) Condensing and combi boilers are expressed as a percentage of all gas and oil boilers.

Table 6e Households with No, Some and 'Full' Insulation Measures (millions)

Year	Households with no insulation	Households with some insulation	Households with 'full insulation'	Total households
1987	3.95	16.72	0.72	21.39
1988	4.05	16.63	0.97	21.64
1989	3.86	17.03	1.02	21.91
1990	3.70	17.38	1.05	22.13
1991	3.63	17.52	1.17	22.32
1992	3.58	17.53	1.36	22.47
1993	3.35	17.83	1.42	22.60
1994	3.48	17.25	2.00	22.73
1995	3.41	17.19	2.30	22.90
1996	3.05	17.65	2.34	23.04
1997	2.69	18.17	2.32	23.19
1998	2.70	17.79	2.85	23.34
1999	2.96	17.42	3.14	23.51
2000	2.59	17.10	4.02	23.71
2001	2.49	16.76	4.68	23.93
2002	2.34	16.72	5.07	24.13
2003	0.88	17.51	5.91	24.30
2004	0.79	17.10	6.58	24.47
2005	0.77	16.67	7.25	24.69
2006	0.75	16.12	8.03	24.91
2007	0.63	15.77	8.72	25.13
2008	0.57	15.50	9.29	25.36

Sources:
CLG: English House Condition Survey, English Housing Survey
www.communities.gov.uk/englishhousingsurvey

Notes:
1) English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form English Housing Survey in 2008.
2) Households with 'full insulation' are defined as those households that have at least 100mm of loft insulation (where there is a loft), cavity wall insulation (where there is a cavity), and at least 80% of rooms with double-glazing.
3) Households with no insulation are defined as those households that have no loft insulation (where there is a loft), no cavity wall insulation (where there is a cavity) and no double-glazing.
4) Households with some insulation include all those that are not included in 'full' and 'no' insulation household figures.

Table 6f: Depth of Loft Insulation (millions) - pre EHS

Year	25mm or less	50mm	75mm	100mm or more	Not stated	Potential	Total with	Total households
1976	1.32	2.48	1.93	0.43	1.18	14.51	7.34	19.45
1977	1.91	2.69	2.27	0.63	0.80	14.75	8.30	19.62
1978	1.61	2.70	2.83	1.00	0.88	14.72	9.03	19.78
1979	1.26	2.73	3.43	1.48	1.35	15.36	10.25	19.94
1980	1.12	3.31	3.96	1.95	0.91	15.83	11.24	20.11
1981	1.42	3.30	4.01	2.64	1.08	15.93	12.45	20.27
1982	1.11	3.40	3.93	3.33	1.22	16.23	12.99	20.38
1983	0.97	2.96	3.77	4.77	1.35	16.47	13.82	20.53
1984	0.87	2.82	4.03	5.86	1.25	16.85	14.83	20.73
1985	1.06	2.42	3.18	6.22	2.01	17.07	14.89	20.94
1986	1.00	2.37	3.57	6.82	1.72	17.42	15.47	21.16
1987	1.09	2.09	3.49	7.41	1.58	17.45	15.66	21.39
1988	0.72	2.04	3.53	7.83	1.76	17.77	15.89	21.64
1989	0.72	2.01	3.68	7.61	1.91	17.60	15.93	21.91
1990	0.75	2.28	3.76	7.80	1.81	18.04	16.39	22.13
1991	0.76	2.05	3.82	7.30	2.18	17.95	16.10	22.32
1992	0.67	1.90	3.44	7.74	2.50	17.93	16.25	22.47
1993	0.53	2.18	3.57	7.50	2.72	18.26	16.50	22.60
1994	0.47	1.70	2.99	8.57	2.51	17.88	16.25	22.73
1995	0.47	1.69	3.02	8.51	2.76	18.01	16.47	22.90
1996	0.52	1.68	2.74	9.00	2.86	18.26	16.80	23.04
1997	0.34	1.55	3.35	9.64	2.23	18.46	17.12	23.19
1998	0.45	1.72	3.01	9.72	2.32	18.42	17.22	23.34
1999	0.39	1.37	3.54	9.33	2.35	18.35	16.98	23.51
2000	0.30	1.67	3.57	9.21	2.33	18.70	17.08	23.71
2001	0.18	1.19	3.20	10.42	2.41	18.61	17.40	23.93
2002	0.18	1.18	3.18	10.41	2.43	18.78	17.38	24.13

Sources:
GfK Home Audit
www.communities.gov.uk/englishhousingsurvey

Notes:
1) Two separate graphs for pre and post 2003 were drawn due to discontinuities in figures, resulting from a change in data source.
2) The number of Great Britain households that have undertaken loft insulation measure of depth '25mm or less' were obtained by adding households figures for 25mm and less than 25mm.
3) The number of Great Britain households with loft insulation of depth '100mm or more' were obtained by adding household figures for all the categories with 100mm, and greater than 100mm (that is 125, 150, 200, 250, 300 or more).
4) "25mm or less" excludes homes with uninsulated lofts, which can be calculated from the difference between "Total with" and "Potential".

Table 6g: Depth of Loft Insulation (millions) - post EHS

Year	No loft	Uninsulated loft	< 100mm	100-149mm	≥ 150 mm	Total with	Potential	Total households
2003	2.57	0.87	6.64	8.75	5.46	20.86	21.73	24.30
2004	2.51	0.93	6.44	8.56	6.01	21.02	21.95	24.47
2005	2.69	0.97	6.21	8.27	6.55	21.02	22.00	24.69
2006	2.68	0.93	5.71	8.29	7.29	21.30	22.22	24.91
2007	2.58	0.83	5.47	8.15	8.09	21.71	22.54	25.13
2008	2.85	0.76	5.37	7.88	8.49	21.74	22.51	25.36

Sources:
CLG: English House Condition Survey, English Housing Survey
www.communities.gov.uk/englishhousingsurvey

Notes:
1) Two separate graphs for pre and post 2003 were drawn due to discontinuities in data as a result of a change in data source.
2) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form English Housing Survey in 2008.
3) "25mm or less" excludes homes with uninsulated lofts, which can be calculated from the difference between "Total with" and "Potential".

Table 6h: Cavity Wall Insulation (millions)

Year	Households with cavity insulation	Not known if cavity insulated	Households with potential for cavity wall insulation	Total households
1974	0.30		12.64	19.13
1975	0.38		12.77	19.29
1976	0.49		12.90	19.45
1977	0.63		13.05	19.62
1978	0.68		13.31	19.78
1979	1.04		13.51	19.94
1980	1.12		13.68	20.11
1981	1.28		13.85	20.27
1982	1.47		13.98	20.38
1983	1.77		14.13	20.53
1984	2.15		14.30	20.73
1985	2.22	2.45	14.46	20.94
1986	2.49	2.61	14.63	21.16
1987	2.66	2.92	14.89	21.39
1988	2.89	3.06	15.10	21.64
1989	3.15	3.08	15.50	21.91
1990	3.37	3.45	15.45	22.13
1991	3.47	3.74	15.84	22.32
1992	3.74	4.18	16.21	22.47
1993	3.62	3.74	15.62	22.60
1994	3.62	4.61	15.75	22.73
1995	3.90	4.84	15.80	22.90
1996	3.94	5.44	16.43	23.04
1997	4.10	5.15	16.47	23.19
1998	4.32	4.93	16.13	23.34
1999	4.74	1.78	16.49	23.51
2000	5.54	1.81	16.37	23.71
2001	5.53	2.09	17.12	23.93
2002	5.81	1.75	17.29	24.13
2003	6.24		17.18	24.30
2004	6.81		17.59	24.47
2005	6.99		17.62	24.69
2006	7.77		17.70	24.91
2007	8.49		18.15	25.13
2008	8.70		18.01	25.36

Sources:
CLG: English House Condition Survey, English Housing Survey. GfK: Home Audit.
www.communities.gov.uk/englishhousingsurvey

Notes:
1) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form English Housing Survey in 2008.
2) The EHCS replaced GfK's Home Audit in 2003, which introduced a discontinuity in this data.

Table 6i The UK Building Thermal Insulation Market Value (£m) - Solid Wall Insulation

Year	External Wall	Internal Wall	Total building insulation market
2002	29.9	31.7	497.3
2003	36.6	38.7	579.9
2004	39	41.3	644.4
2005	41.9	44.4	697.6
2006	43.7	46.2	776
2007	44.3	46.6	827.9

Sources:
Market and Business Development from Purple Market Research (2008): UK Domestic Solid Wall Insulation, Sector Profile for Energy Saving Trust, Energy Efficiency Partnership for Homes [2002-2007]

Notes:
1) The figures cover commercial, industrial and domestic building insulation as accurate figures to indicate the split between these sub-sectors are not available.
2) The external and internal was installation figures are based on trade estimates compiled for the Energy Saving Trust and the Energy Efficiency Partnership for Homes.

Table 6j: The Number of Insulation Measures installed under EEC and CERT obligations (thousands of households)

	Cavity wall insulation	Loft insulation	Solid wall insulation
EEC 1 (2002-2005)	792	439	24
EEC 2 (2005-2008)	1,336	799	35
CERT (2008-2009)	1,121	1,267	29

Sources:
Ofgem E - Serve
http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Documents1/11254-18105.pdf
http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Documents1/Annual%20Report%202008%20Final.pdf
http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Documents1/CERT%20Annual%20report%20second%20year.pdf

Notes:
1) The table shows the number of households with the three insulation measures (cavity, loft and solid wall) installed by the obligated suppliers.
2) Loft insulation figures include professional and DIY (do it yourself) installations.
3) The number of installations for loft are estimated using an average house loft space of 38 m^2.
4) Solid Wall insulation figures include both internal and external wall insulation.
5) CERT (2008-2011) figures consist of the approved supplier schemes in the first two years.

Table 6k: Double Glazing (millions)

Year	Less than 20% of rooms	20% - 39% of rooms	40% - 59% of rooms	60% - 79% of rooms	80% or more of rooms	Not stated	Total with double glazing	Potential for Double Glazing
1974						1.50	1.50	19.13
1975						1.79	1.79	19.29
1976						1.88	1.88	19.45
1977						2.43	2.43	19.62
1978						3.00	3.00	19.78
1979						3.36	3.36	19.94
1980						3.95	3.95	20.11
1981						4.24	4.24	20.27
1982						4.71	4.71	20.38
1983	1.13	1.10	0.84	0.63	1.88	0.10	5.67	20.53
1984	0.83	1.04	0.95	0.85	1.95	0.13	5.75	20.73
1985	0.80	1.18	1.03	0.97	1.91	0.69	6.58	20.94
1986	0.82	1.23	1.16	1.23	2.35	0.38	7.17	21.16
1987	1.49	1.37	1.25	1.38	2.97	0.09	8.56	21.39
1988	1.25	1.40	1.19	1.42	3.43	0.70	9.39	21.64
1989	1.20	1.30	1.31	1.59	3.84	0.77	10.00	21.91
1990	1.10	1.42	1.27	1.76	4.47	0.67	10.68	22.13
1991	1.14	1.44	1.29	2.01	4.91	0.66	11.45	22.32
1992	1.07	1.23	1.37	2.04	5.33	0.67	11.72	22.47
1993	0.94	1.34	1.37	2.38	5.91	0.61	12.55	22.60
1994	0.99	1.06	1.32	2.24	7.30	0.62	13.53	22.73
1995	0.86	1.00	1.26	2.28	8.02	0.62	14.04	22.90
1996	0.69	0.89	1.18	2.40	8.68	0.58	14.42	23.04
1997	0.59	0.95	1.23	2.60	8.39	1.94	15.70	23.19
1998	0.56	0.79	1.02	2.66	9.32	1.52	15.87	23.34
1999	0.61	0.89	1.00	2.45	10.00	1.42	16.37	23.51
2000	0.48	0.58	0.95	2.64	9.44	3.03	17.12	23.71
2001	0.41	0.57	0.93	2.51	9.96	3.55	17.92	23.93
2002	0.41	0.58	0.94	2.53	10.06	4.28	18.80	24.13
2003	0.94	1.06	1.20	1.73	15.27		20.21	24.30
2004	0.85	1.03	1.21	1.63	16.27		20.99	24.47
2005	0.77	0.95	1.24	1.54	17.08		21.59	24.69
2006	0.59	0.77	0.79	1.14	18.53		21.81	24.91
2007	0.55	0.72	0.74	1.10	19.43		22.54	25.13
2008	0.50	0.57	0.67	0.99	20.17		22.91	25.36

Sources:
CLG: English House Condition Survey, English Housing Survey. GfK: Home Audit.
www.communities.gov.uk/englishhousingsurvey

Notes:
1) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form English Housing Survey in 2008.
2) The EHCS replaced GfK's Home Audit in 2003, which introduced a discontinuity in this data.

Table 6l: Heat Loss of the Average Dwelling and the Whole Stock

Year	Average dwelling heat loss by building element (W/°C)						Average dwelling heat loss W/°C	Stock loss GW/°C
	Walls	Ventilation	Windows	Roofs	Floors	Doors		
1970	129.9	72.1	70.1	65.4	21.0	17.5	376.0	6.76
1971	129.8	72.3	70.4	62.8	21.1	17.6	374.0	6.97
1972	129.6	72.2	70.5	59.9	21.1	17.6	371.0	6.98
1973	129.2	71.9	70.4	56.8	21.1	17.6	367.0	6.96
1974	128.4	71.4	70.1	53.6	21.1	17.5	362.0	6.92
1975	127.7	70.8	69.7	50.4	21.0	17.4	357.0	6.89
1976	126.7	70.1	69.1	47.2	20.9	17.3	351.2	6.83
1977	124.9	69.1	68.3	44.7	20.9	17.1	345.0	6.77
1978	123.9	68.7	67.9	40.8	20.7	17.0	339.0	6.71
1979	121.8	67.9	67.4	38.7	21.4	16.8	334.0	6.66
1980	119.7	66.6	66.1	36.4	21.6	16.5	327.0	6.58
1981	118.2	65.7	65.3	34.0	21.5	16.3	321.0	6.51
1982	116.4	64.5	64.3	31.9	21.6	16.1	314.7	6.41
1983	114.8	63.8	63.2	29.7	21.7	15.9	309.0	6.34
1984	113.6	63.3	63.1	28.3	22.1	15.8	306.1	6.34
1985	113.6	62.8	62.7	27.2	22.2	15.7	304.3	6.37
1986	112.3	61.9	62.0	26.3	22.4	15.5	300.4	6.36
1987	111.6	61.4	61.4	24.9	22.2	15.4	296.9	6.35
1988	111.3	61.0	60.8	23.9	22.5	15.3	294.7	6.38
1989	110.7	60.8	60.7	23.1	22.2	15.2	292.6	6.41
1990	110.2	59.8	59.7	23.1	22.5	15.0	290.2	6.42
1991	109.6	59.3	59.3	22.5	22.2	14.9	287.8	6.43
1992	107.1	58.1	58.4	21.9	21.8	14.5	281.8	6.34
1993	108.7	56.9	57.1	21.7	21.9	14.2	280.6	6.35
1994	109.9	56.9	56.5	20.3	21.5	14.2	279.5	6.36
1995	108.9	55.9	55.6	20.1	21.4	14.0	276.0	6.32
1996	107.6	55.5	55.3	20.2	21.6	13.9	274.0	6.31
1997	107.3	54.8	54.2	19.8	21.7	13.7	271.4	6.29
1998	108.1	54.1	53.8	19.9	21.5	13.5	270.8	6.32
1999	107.5	54.1	54.1	19.7	21.4	13.5	270.2	6.35
2000	106.6	53.6	53.5	20.1	21.7	13.3	268.9	6.37
2001	106.2	53.7	53.3	19.4	21.6	13.3	267.5	6.40
2002	105.7	53.2	52.8	19.4	21.6	13.2	265.8	6.42
2003	105.5	52.0	51.1	21.1	24.6	12.9	267.1	6.51
2004	104.4	52.0	50.8	21.1	24.9	12.9	266.1	6.54
2005	104.6	51.5	50.3	20.6	24.6	12.7	264.4	6.56
2006	102.8	51.0	49.7	20.2	24.6	12.6	260.8	6.54
2007	101.1	50.9	49.5	20.1	24.8	12.5	258.9	6.57
2008	99.6	49.9	48.4	19.4	24.1	12.2	253.7	6.50

Source:
Building Research Establishment Housing Model for Energy Studies [1970-2008]

Notes:
1) Figures for 1970 to 1975, 1977 to 1981, 1983 and 2000 are interpolations. Full heat loss calculations have been performed for all other years.
2) Average dwelling heat loss is taken from BREHOMES. The values of individual elements are estimated and then normalised to the total.

Table 6m: Average Winter External Temperature and Internal Temperatures in °C

Year	Centrally heated homes	Non centrally heated homes	Average internal temperature	External temperature
1970	13.7	11.2	12.0	5.8
1971	14.4	11.9	12.8	6.7
1972	14.2	11.7	12.6	6.4
1973	14.0	11.5	12.6	6.1
1974	14.7	12.2	13.3	6.7
1975	14.2	11.7	13.0	6.4
1976	13.6	11.1	12.4	5.8
1977	14.6	12.1	13.4	6.6
1978	14.7	12.2	13.6	6.5
1979	13.9	11.4	12.8	5.1
1980	14.4	11.9	13.4	5.8
1981	13.8	11.3	12.8	5.1
1982	14.5	12.0	13.6	5.8
1983	14.9	12.4	14.1	6.2
1984	14.4	11.9	13.6	5.8
1985	14.1	11.6	13.3	4.8
1986	14.8	12.3	14.1	5.3
1987	14.5	12.0	13.8	4.9
1988	15.5	13.0	14.9	6.2
1989	15.8	13.3	15.2	6.9
1990	16.7	14.2	16.1	7.6
1991	15.9	13.4	15.4	6.1
1992	16.0	13.5	15.6	6.1
1993	16.3	13.8	15.9	6.2
1994	17.0	14.5	16.7	7.2
1995	16.6	14.1	16.3	6.9
1996	16.6	14.1	16.3	5.7
1997	17.6	15.1	17.3	7.3
1998	18.1	15.6	17.8	7.5
1999	17.8	15.3	17.5	7.2
2000	18.0	15.5	17.7	7.2
2001	17.8	15.3	17.5	6.6
2002	18.6	16.1	18.4	7.7
2003	17.9	15.4	17.7	6.6
2004	18.4	15.9	18.1	7.0
2005	18.8	16.3	18.5	7.1
2006	18.1	15.6	17.9	6.9
2007	17.7	15.2	17.5	7.3
2008	17.3	14.8	17.3	6.4

Sources:
Building Research Establishment Housing Model for Energy Studies/ DECC: DUKES 2011, table 1.1.8 [1970-2009]
http://www.decc.gov.uk/en/content/cms/statistics/source/temperatures/temperatures.aspx

Notes:
1) External temperature is average for October, November, December, January, February and March.
2) DUKES tables are revised regularly.

Table 6n: Hot Water Tank Insulation (millions) - pre EHS

Year	25mm or less	50mm	75mm	>75mm	Not stated	Total with insulation	Potential	Total households
1978	3.23	5.06	2.52	0.76	2.14	13.71	16.89	19.78
1979	4.01	5.93	2.77	0.81	1.13	14.65	17.41	19.94
1980	3.20	6.59	3.76	0.92	0.72	15.19	17.66	20.11
1981	3.50	6.19	3.76	1.18	0.68	15.31	17.55	20.27
1982	3.79	6.44	3.60	1.16	0.74	15.74	17.68	20.38
1983	3.59	6.75	3.71	1.46	0.84	16.35	18.12	20.53
1984	3.49	6.61	3.81	1.71	1.22	16.84	18.45	20.73
1985	2.86	6.85	4.73	1.78	1.45	17.67	19.07	20.94
1986	3.14	6.99	4.18	1.81	1.75	17.88	19.22	21.16
1987	2.19	5.51	7.77	1.80	1.02	18.30	19.50	21.39
1988	1.89	5.76	8.05	1.81	0.96	18.47	19.74	21.64
1989	1.69	5.04	9.17	1.47	1.31	18.68	19.87	21.91
1990	1.75	4.92	9.43	1.73	1.02	18.86	20.05	22.13
1991	1.53	4.83	9.88	1.73	1.11	19.08	20.15	22.32
1992	1.55	4.30	9.88	1.84	1.12	18.69	19.86	22.47
1993	1.21	4.29	10.23	1.52	1.36	18.61	19.88	22.60
1994	0.97	3.79	10.82	1.76	1.36	18.69	19.82	22.73
1995	1.19	3.54	11.28	1.43	1.14	18.58	19.68	22.90
1996	1.16	3.25	11.05	1.83	1.10	18.39	19.42	23.04
1997	1.18	3.46	11.62	1.82	0.86	18.94	19.81	23.19
1998	1.01	3.13	11.99	1.23	0.93	18.29	19.35	23.34
1999	0.96	2.67	12.06	1.03	1.00	17.72	18.74	23.51
2000	0.80	2.84	11.95	1.13	1.06	17.77	18.91	23.71
2001	0.75	2.06	12.09	1.27	1.27	17.45	18.41	23.93
2002	0.76	2.08	12.21	1.29	1.29	17.63	18.62	24.13

Sources:
GfK Home Audit [1978 - 2002]

Notes:
1) The differences in the 'Potential' and 'Total households' is the number of households in GB without hot water tanks.
2) Two separate graphs for pre and post 2003 were drawn due to discontinuities in the data resulting from a change in data source.
3) All tank insulation depths are jacket equivalents. Factory bonded insulation is converted to an equivalent jacket by considering the heat loss. In the GfK data no information is available for depth of factory bonded insulation and 3" (75mm) is assumed.

Table 6o: Hot Water Tank Insulation (millions) - post EHS

Year	12.5mm	25mm	38mm	50mm	80mm	100mm	125mm or more	Total with	Potential	Total households
2003	2.66	0.65	5.87	0.72	0.29	5.85	1.54	17.59	18.60	24.30
2004	2.78	0.65	6.29	0.69	0.26	5.69	1.28	17.64	18.66	24.47
2005	2.43	1.30	5.19	0.57	2.91	4.13	1.29	17.83	18.86	24.69
2006	1.86	2.20	3.28	0.57	5.64	3.19	1.33	18.07	19.14	24.91
2007	1.75	2.31	3.12	0.54	6.00	3.30	1.16	18.17	19.25	25.13
2008	1.28	1.70	2.50	0.44	5.36	2.38	0.90	14.58	14.76	25.36

Sources:
CLG: English House Condition Survey, English Housing Survey [2003- 2008]
www.communities.gov.uk/englishhousingsurvey

Notes:
1) The differences in the 'Potential' and 'Total households' is the number of households in Great Britain without hot water tanks for insulation.
2) This graph shows figures from 2003 onwards, and was drawn separately due to discontinuities in figures, resulting from a change in data source.
3) The English House Condition Survey is a national survey of housing in England, commissioned by CLG, and was merged with the Survey of English Housing (another housing survey) to form English Housing Survey in 2008.
4) Data for 2008 is taken directly from the EHS and scaled to Great Britain using a scaling factor of 1.140. Using data directly from the EHS creates a discontinuity in the figures.

Table 6p: Number of measures installed under EEC1 and EEC2 (thousands of households)

Insulation measures	EEC1		EEC2 (excluding carryover)	
	Priority group (EEC1)	Non priority group (EEC1)	Priority group (EEC2)	Non priority group (EEC2)
Cavity wall insulation	441	350	659	678
Loft insulation	65	373	103	696
Draught stripping	16	7	16	8
Tank insulation	99	97	66	93
Solid wall insulation	17	6	26	9

Source
Ofgem E - Serve: A review of the energy efficiency commitment
http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Documents1/11254-18105.pdf
http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Documents1/Annual%20Report%202008%20Final.pdf

Notes:
1) Loft insulation figures include professional and DIY (do it yourself) installations.
2) The number of installations for loft are estimated using an average house loft space of 38 m^2.
3) Solid Wall insulation figures include both internal and external wall insulation.
4) EEC1 figures include savings by the suppliers achieved in excess of the EEC1 target for priority and non priority group, and these additional savings are excluded from the EEC2 figures.

Table 6q: Carbon emissions savings achieved under CERT (2008)

Upgrade measures	Percentage of savings in priority groups	Percentage of savings outside priority groups
EEC2 carryover	13.50	27.10
Insulation	19.80	13.40
Lighting	10.40	12.30
Appliances	0.80	1.20
Heating	0.60	0.60
Microgen and CHP	0.00	0.20
Total	45.10	54.90

Source:
Ofgem E - Serve: The CERT annual report 2010 - a review of the second year of the Carbon Emissions Reduction Target
http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Documents1/CERT%20Annual%20report%20second%20year.pdf

Notes:
1) EEC2 carryover represents the savings by the suppliers achieved in excess of the EEC2 target which is then counted towards the CERT targets.
2) The figures are for the first year of CERT.

Table 7a: Energy Use of the Housing Stock by Fuel Type (TWh)

Year	Solid	Gas	Electric	Oil	Renewables	All fuels
1970	196.5	101.3	74.0	37.5		409.2
1971	168.4	112.2	77.6	37.0		395.2
1972	148.0	128.6	83.3	42.4		402.3
1973	144.8	137.7	87.9	46.5		416.9
1974	136.5	154.5	89.3	41.4		421.6
1975	115.7	169.4	86.1	40.0		411.2
1976	106.8	177.8	81.9	39.9		406.5
1977	108.2	189.4	82.6	40.2		420.5
1978	98.6	208.7	82.5	39.5		429.3
1979	99.5	236.8	86.3	38.6		461.2
1980	86.0	242.5	82.7	30.8		442.0
1981	79.8	251.7	81.1	27.6		440.2
1982	78.7	251.1	79.7	25.7		435.1
1983	73.2	255.5	79.8	24.4		432.9
1984	57.4	256.9	80.6	25.6		420.5
1985	74.3	280.8	85.3	26.3		466.7
1986	73.0	296.1	88.6	27.2		484.9
1987	63.0	303.6	89.9	25.8		482.2
1988	59.2	296.8	89.1	25.0		470.1
1989	47.2	286.9	88.9	23.7		446.7
1990	46.3	286.6	89.5	27.5	2.3	452.2
1991	50.8	318.7	93.6	31.3	2.3	496.7
1992	44.3	315.0	94.9	32.1	2.7	488.9
1993	48.8	324.6	95.8	33.5	2.7	505.4
1994	40.2	314.6	96.8	33.3	2.7	487.6
1995	29.1	311.1	97.5	33.3	2.7	473.7
1996	31.1	358.6	102.6	39.0	2.7	533.9
1997	27.4	329.6	99.7	37.6	2.5	496.8
1998	26.0	339.5	104.4	39.3	2.6	511.8
1999	26.8	341.6	105.2	35.1	3.0	511.7
2000	21.2	352.9	106.7	35.9	3.1	519.8
2001	20.4	362.0	110.0	39.1	3.0	534.5
2002	15.8	359.1	114.5	34.3	3.1	526.7
2003	12.9	368.7	117.3	34.0	2.9	535.8
2004	11.1	378.2	118.5	36.2	3.4	547.3
2005	7.7	364.3	119.9	34.3	4.1	530.4
2006	7.1	350.0	119.0	36.1	4.5	516.7
2007	7.5	336.6	117.4	31.9	5.0	498.5
2008	8.4	343.0	114.3	33.6	5.4	504.7
2009	8.1	317.2	113.1	33.4	5.7	477.6

Sources:
Building Research Establishment Housing Model for Energy Studies (BREHOMES)/ DECC: DUKES 2011, table 1.1.5 - internet only [1970-2009]
http://www.decc.gov.uk/en/content/cms/statistics/source/total/total.aspx

Notes:
1) Energy use figures were converted from the units in DUKES (thousand toe) to TWh: 1 toe = 11,630 kWh.
2) DUKES tables are revised regularly.
3) Building Research Establishment estimate Great Britain figures from DUKES using BREHOMES.
4) Energy from 'Wood' and 'Waste and Tyres' is included in both 'Solid Fuel' and 'Renewables'. 'Renewables' also includes energy from geothermal and active solar heat. For more information on other renewable energy sources please see table 8a.
5) Household renewable energy consumption data for the UK have been scaled to GB using the ratio of total household energy in the UK to that of GB as the scaling factor (x0.954).
6) From 2000 onwards, 'Renewables' are separated from 'Solid Fuels'.

Table 8a:Renewable Electricity Generation (GWh) - UK figures

Year	Final consumption	Household consumption	Total supply	Onshore wind	Offshore wind	Solar PV	Small scale hydro	Large scale hydro	Landfill gas	Sewage sludge digestion	MSW combustion	Co-firing with fossil fuels	Animal Biomass	Plant Biomass	Total Biomass	Total renewable generation
1996	310,570	107,510	367,622	488			118	3,275	708	410	489		197		1,805	5,685
1997	312,440	104,460	367,240	667			164	4,005	918	408	585		199		2,110	6,945
1998	315,678	109,410	375,170	877			206	4,911	1,185	386	849		234		2,654	8,648
1999	322,744	110,308	382,396	850		1	207	5,128	1,703	410	856		459	1	3,429	9,616
2000	329,420	111,842	391,243	945	1	1	214	4,871	2,188	367	840		456	31	3,882	9,914
2001	332,721	115,337	395,177	960	5	2	210	3,845	2,507	363	880		542	234	4,526	9,549
2002	333,401	114,534	395,661	1,251	5	3	204	4,584	2,679	368	907	286	568	272	5,080	11,127
2003	336,218	115,761	400,369	1,276	10	3	150	2,987	3,276	394	965	602	535	402	6,174	10,600
2004	338,949	115,526	401,357	1,736	199	4	283	4,561	4,004	440	971	1,022	565	362	7,364	14,147
2005	346,475	116,811	406,633	2,501	403	8	444	4,478	4,290	466	964	2,533	468	382	9,102	16,936
2006	344,298	116,449	404,809	3,574	651	11	478	4,115	4,424	445	1,083	2,528	434	363	9,277	18,106
2007	342,643	122,756	402,046	4,491	783	14	534	4,554	4,677	449	1,177	1,956	555	409	9,223	19,600
2008	341,853	125,811	399,690	5,792	1,305	17	568	4,600	4,757	532	1,226	1,613	587	568	9,283	21,565
2009	322,417	122,543	378,524	7,564	1,740	20	598	4,664	4,952	598	1,511	1,806	620	1,109	10,596	25,182

Source:
DECC: DUKES 2011, table 5.1, 5.1.2 (internet only), 7.4
http://www.decc.gov.uk/en/content/cms/statistics/source/source.aspx

Table 8b: Household Electricity and Heat Generating Microgeneration Technologies (Cumulative Installations and Annual Energy, 2008)

Technology	Number of Installations	Energy (MWh/year)
Solar PV	917	2,624
Wind	1,480	2,438
Micro-Hydro	56	2,939
Solar Thermal	80,883	109,243
Biomass	376	8,752
GSHP	2,457	42,052

Source:
Element Energy (2008), Number of Microgeneration units installed in England, Wales, Scotland and Northern Ireland, BERR
http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file49151.pdf

Notes:
1) Wind data is from December 2007, Photovoltaics and Micro-Hydro data is from August 2008.
2) Solar thermal data is from July 2008. Biomass and Ground Source Heat Pump data is from August 2008.
3) The cumulative number of household installation figures (both electricity and heat generating technologies) are the sum of known installations under the following grant streams - Energy Efficiency Commitment 2, Low Carbon Building Programme 1 - households and communities, Scottish Community and Householder Renewables Initiative, Reconnect, Scottish Renewable Heating (Fuel Poverty) pilot.
4) Household energy (electricity and heat generating technologies) is estimated using the ratio of household and non-household installations and the total energy delivered from both household and non-household installations in the Element Energy (2008) study.

Table 8c: Renewables and Waste: UK Commodity Balances (GWh)

Year	Wood	Waste and Tyres	Geothermal and Active Solar Heat	Total Renewables
2000	2,373	244	140	2,756
2001	2,373	267	163	2,803
2002	2,373	267	198	2,838
2003	2,373	267	244	2,884
2004	2,373	267	291	2,931
2005	3,094	267	337	3,698
2006	3,477	267	419	4,164
2007	3,861	267	523	4,652
2008	4,175	186	651	5,013
2009	4,361	186	802	5,350

Sources:
DECC: DUKES 2011, table 7.1 - 7.3 [2000-2009]
http://www.decc.gov.uk/en/content/cms/statistics/source/renewables/renewables.aspx

Notes:
1) Renewable energy figures were converted from the units in DUKES (thousand toe) to GWh: 1 toe = 11,630 kWh.
2) DUKES tables are revised regularly.

Appendix 2: Changes to methods of data collection

A significant proportion of the data in this report came originally from an annual survey carried out by GfK Marketing Services. However, this data was replaced in 2003 by questions included in the English House Condition Survey (now called the English Housing Survey).

Most of the data underpinning the section, 'How much energy is used in homes?', came from BREHOMES, which itself drew heavily on the GfK data. Until 2003, BREHOMES used annual survey data on household insulation measures and heating systems in England, Wales and Scotland, produced by GfK, as the primary source of input data.

The GfK data was based on questionnaires completed by householders themselves for around 16,000 dwellings per year. However, the quality of this data was perceived to decline following a change of methodology, such that the GfK data was thought to be quite robust up to 2001 but less and less robust thereafter.

Meanwhile, the English House Condition Survey (EHCS), which was previously a five-yearly survey, became an annual survey – with data available from a rolling annual survey of 8,000 dwellings. The combination of a perceived lack of quality in the GfK data and the availability of an alternative, high quality annual data source, led to a decision to use EHCS data in place of the GfK data from 2003 onwards.

The EHCS was subsequently merged with the Survey of English Housing (SEH) to become the English Housing Survey (EHS). The EHS is now used as the principal source of annual trend information for BREHOMES, and a significant part of this report[44].

The EHCS/EHS surveys are carried out not by householders but by trained surveyors. This leads to more accurate data collection, but also to some discontinuities in the data, and readers should be cautious in how they interpret trends from around 2000 to 2004.

Switching from GfK to EHS data meant that BREHOMES itself also had to be revised[44].

Appendix 3: Modelling GB housing energy

BREHOMES, the Building Research Establishment Housing Model for Energy Studies, is a multiple dwellings model of domestic energy consumption in Britain. BREHOMES is based on a basic version of the single dwelling Building Research Establishment Domestic Energy Model (BREDEM), which calculates annual energy requirements of domestic buildings, and can be used to estimate savings resulting from energy conservation measures.

BREHOMES assumes 1008 different categories of dwelling, based on tenure, house type, age, and the inclusion or exclusion of central heating. For primary data sources BREHOMES currently uses information on household insulation measures and heating systems from the English Housing Survey (EHS), weather data, and estimates of electricity consumption from the Market Transformation Programme (MTP) model. BREHOMES calculates heat losses and energy consumption for each of the 1008 categories of dwelling, and then aggregates to give GB totals, based on the numbers of dwelling in each category and an extrapolation from the numbers of English to GB dwellings[45].

The Digest of UK Energy Statistics (DUKES) publishes national totals of energy consumption broken down by sector, including totals for domestic energy consumption. Whilst outputs from BREHOMES are estimates, and are unlikely to match these actual figures exactly, BREHOMES allows the user to reconcile calculated outputs with actual domestic energy totals from DUKES. The reconciliation process involves the user modifying assumptions within plausible boundaries and re-running the model. (The main way to ensure that BREHOMES outputs are consistent with DUKES is altering the internal demand temperature.) This process is repeated iteratively until the model and DUKES totals are in reasonable agreement.

The reconciliation is intended to ensure that modelling assumptions are reasonable. This provides a more reliable basis for predicting future domestic energy consumption and possible savings from energy efficiency measures.

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