

The impact of UK households on the environment

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This article presents a regional breakdown of greenhouse gas emissions directly and indirectly generated by UK households. Direct emissions arise from heating, cooking and use of privately owned vehicles while indirect emissions arise from electricity generation, the use of public transport and the demand for other goods and services. The greenhouse gas emissions are broken down by UK region, by size of household and by age of head of household. The emissions are also broken down by source; that is, energy, transport and other goods and services.

Introduction

The Statistical Office of the European Communities (Eurostat) part funded the Office for National Statistics (ONS) to produce a report looking at the impact UK households made on the environment. Households can affect the environment through the use of its natural resources and through the generation of unwanted by-products such as greenhouse gas emissions¹ and household waste. This report looks at the generation of greenhouse gases by UK households in 2001 and attributes them to the use of energy products, the use of transport and to the demand for goods and services.

The decision to focus this report on the generation of greenhouse gases was based on the global concerns that increasing levels of greenhouse gas emissions are resulting in global warming and climate change. Initiatives such as the Kyoto Protocol seek to limit greenhouse gas emissions and the UK Government's Energy White Paper (Department for Trade and Industry, 2003) set a goal to reduce carbon dioxide emissions by 60 per cent by 2050. While for some industrial sectors greenhouse gas emissions are declining, emissions from households continue to rise.

Greenhouse gas emissions on a National Accounts basis

The figures contained in this report are consistent with the *Environmental Accounts* spring 2004 publication. The *Environmental Accounts* are on a National Accounts basis and differ from the basis used to monitor progress against the Kyoto Protocol in that they include emissions from international aviation and from fuels purchased abroad by UK residents, including those purchased by international shipping and aircraft on international flights. They exclude emissions from fuels purchased in the UK by non-UK residents.

Data sources

Data used to compile this report came from a variety of government and non-government sources. Wherever possible the data relate to the period 2001 as this was the latest Input-Output year available at the time of the report's compilation.

The industry breakdown of atmospheric emissions is supplied to the ONS by the National Environmental Technology Centre (Netcen) and is primarily based on information compiled for their *National Atmospheric Emissions Inventory* (NAEI) and their *Greenhouse Gas Inventory*. Detailed information on expenditure by region and household composition came from ONS's *Expenditure and Food Survey*. The 2001 EPS household composition is not Census-2001 consistent as the Census results were not available at the time of the 2001 survey.

Information on UK households' domestic travel came from the Department for Transport's *National Travel Survey* (NTS). The NTS is a continuous survey of personal travel. The survey has been running on an ad hoc basis since 1965 and continuously since 1988. The NTS data used in the compilation of this report

are based on a ten-year average rather than just for 2001. Using data based on a ten year average removes some of the anomalies arising from small sample sizes for some households.

Data on UK households' international travel came from the *International Passenger Survey (IPS)*. The IPS is a survey of a random sample of passengers entering and leaving the UK by air, sea or the Channel Tunnel. Over a quarter of million face-to-face interviews are carried out each year with passengers entering and leaving the UK through the main airports, seaports and the Channel Tunnel. Household final consumption expenditure, final demand, total demand and supply-use data came from *UK Input-Output Analysis (2003 edition)*.

Greenhouse gas emissions embedded in imports

Embedded emissions are those generated either directly or indirectly in the production of the goods or services consumed. There are a number of different sources of emissions associated with any one product. Emissions arise from the extraction of the raw materials, the manufacturing of the product, the transportation of the product and eventually its final disposal.

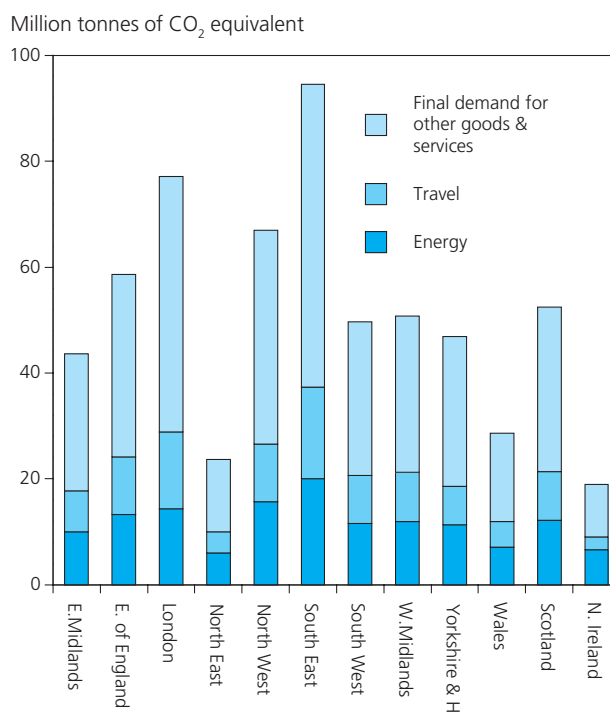
Household final demand is met by domestic production and by imports from the rest of the world. Emissions embedded in imports are an important factor to consider especially with the introduction targets such as the Kyoto Protocol and the increase in production in less developed countries where environmental legislation is less restrictive. The UK has seen a steady increase in the volume of imports since the early 1990s, all of which contain embedded emissions in their production and transportation to the UK.

Ideally the estimation of emissions from household final demand should attempt to differentiate between emissions from final demand met by domestic production and emissions from final demand met by imports. Unfortunately it is not possible to identify the proportion of household final demand met by imports using existing datasets. Therefore, emissions from final demand include emissions from final demand met by imports.

Total greenhouse gas emissions attributable to households in 2001

For 2001, the *Environmental Accounts* (spring 2004 edition) published total UK greenhouse gas (GHG) emissions of 718.5 million tonnes of CO₂ equivalent of which 155.8 million tonnes were directly emitted by domestic households through heating, cooking, driving, and so on. Indirect emissions from electricity generation, travel on public transport and final consumption expenditure are estimated to be 456.6 million tonnes of CO₂ equivalent indicating that households were directly or indirectly responsible for 612.4 million tonnes of CO₂ equivalent². Greenhouse gas emissions from household energy products such as oil, gas and electricity amounted to 140.4 million tonnes of CO₂ equivalent, emissions

Figure 1
GHG emissions attributable to households in 2001



Source: ONS, *Environmental Accounts*

from domestic and international travel were 107.3 million tonnes and emissions from household final consumption expenditure were 364.7 million tonnes.

Total regional emissions in 2001

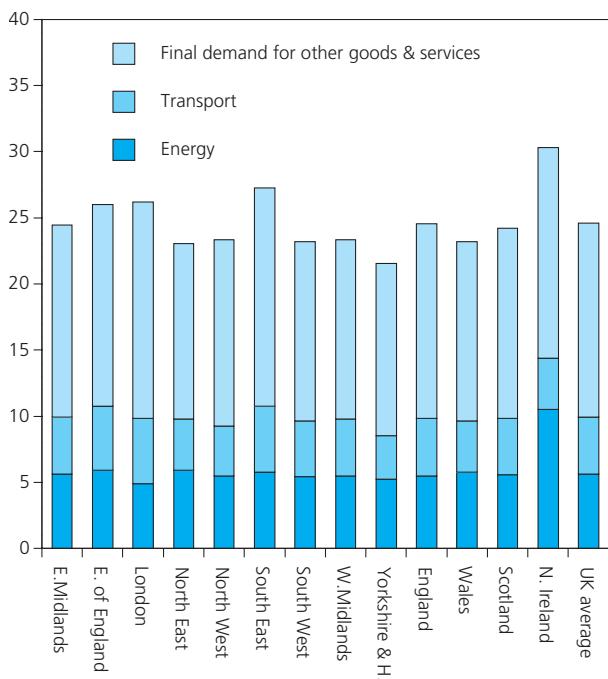
Figure 1 shows that the greatest volume of greenhouse gas emissions come from the South East with a total of 94.6 million tonnes of CO₂ equivalent, 15 per cent of the household total. The next highest region is London at 77.2 million tonnes of CO₂ equivalent, 13 per cent of the total. London and the South East are responsible for 171.8 million tonnes of CO₂ equivalent, which equates to 28 per cent of the total direct and indirect emissions of UK households. The region with the lowest volume of emissions is Northern Ireland with emissions of 19.0 million tonnes of CO₂ equivalent or three per cent of the households total. The regional totals are obviously strongly affected by the number of households in each region. The South East has the most at 3.5 million followed by London at 2.9 million; this compares to 0.6 million households in Northern Ireland.

Regional emissions per household in 2001

The highest level of emissions per household (Figure 2) comes from households in Northern Ireland, mainly due to the relatively high levels of fossil fuel products used for domestic heating and cooking compared with the rest of the United Kingdom. The average household in Northern Ireland is responsible for 30.3 tonnes of CO₂ equivalent per annum compared with an UK average of 24.6 tonnes. Other regions exceeding the UK national average are the South East, the East of England and London. Households in Northern Ireland generate 10.5 tonnes of CO₂ equivalent from heating

Figure 2
GHG emissions per household in 2001

Tonnes of CO₂ equivalent



Source: ONS, Environmental Accounts

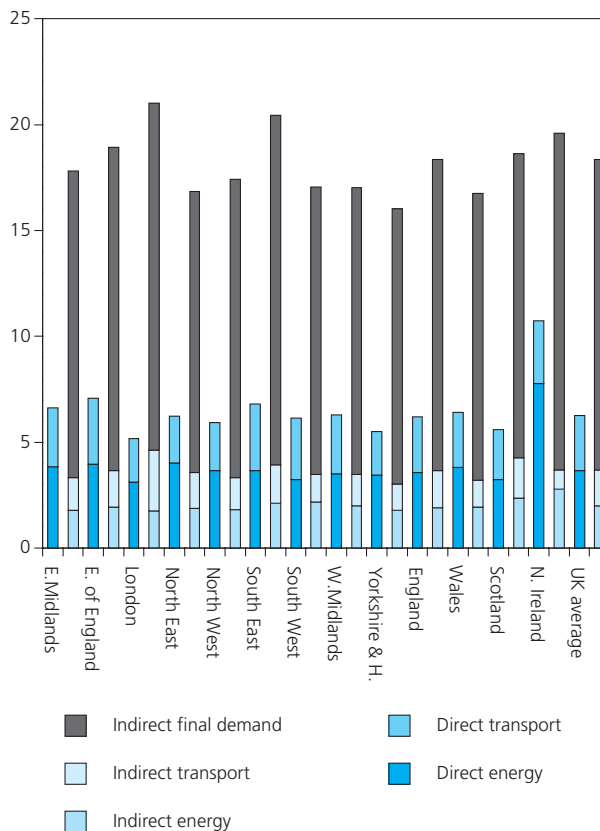
and cooking compared with 4.9 tonnes in London and a UK average of 5.6 tonnes. The burning of fuels such as coal and oil in Northern Ireland accounts for 7.4 tonnes of CO₂ equivalent compared with less than 0.1 tonnes in London and 0.8 tonnes for the UK. The region responsible for the fewest emissions per household is Yorkshire and Humberside at 21.5 tonnes. Yorkshire and Humberside has lower than average emissions from energy products, travel and household final consumption expenditure.

Direct and indirect greenhouse gas emissions in 2001

Direct greenhouse gas emissions from households are those caused by household use of fuels such as gas, oil, petrol and coal for heating, cooking and travel. Indirect greenhouse gas emissions are those arising through household demand for electricity, public transport and demand for goods and services. Indirect emissions are considered to be embedded in the product purchased. Electricity contains the embedded emissions from the combustion of coal, gas and oil used in its generation. Similarly, food products contain indirect emissions from the use of pesticides and fertilisers as well as enteric emissions from livestock. Figure 3 clearly shows that indirect emissions are far greater than direct emissions for all regions. The main source of indirect emissions is household consumption, which accounts for on average approximately 60 per cent of all emissions. Direct emissions from energy is the next highest followed by direct emissions from transportation.

Figure 3
Direct and indirect GHG emissions per household in 2001

Tonnes of CO₂ equivalent



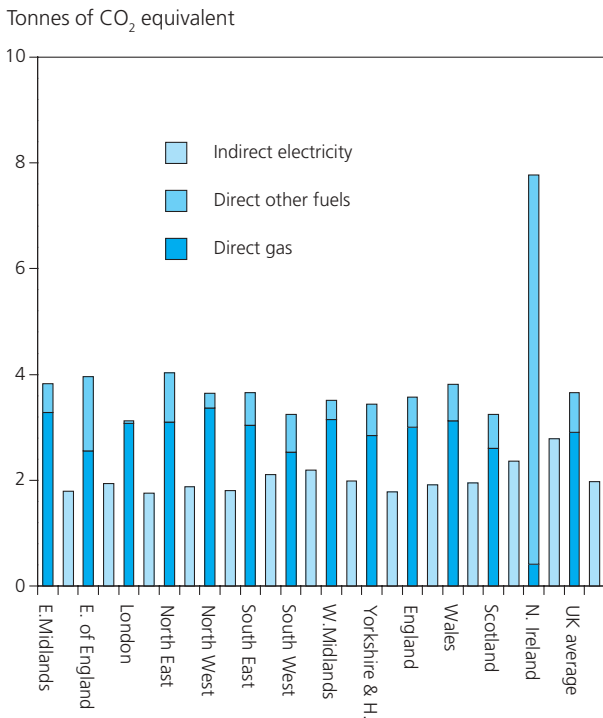
Source: ONS, Environmental Accounts

Direct and indirect emissions per household from energy

Figure 4 shows the breakdown of greenhouse gas emissions from the use of energy products. The combustion of petroleum products in private vehicles is included in the estimate of emissions from transport and travel. Energy products include gas, oil, coal and electricity. Direct emissions come from the combustion of fossil fuels such as natural gas, coal and oil and from the burning of biomass such as wood. The indirect emissions come from the use of electricity.

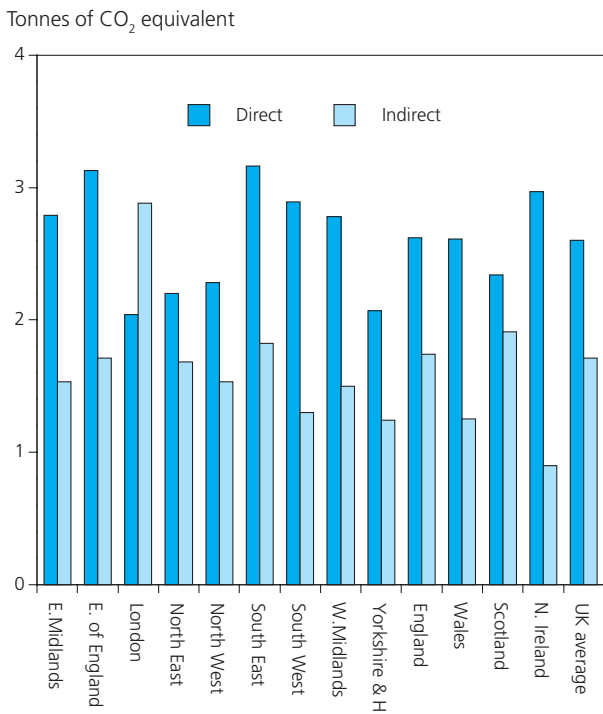
Electricity is generated in numerous ways, many of which result in the production of greenhouse gases. Electricity generation using nuclear, hydro and wind power is emission free but it is not possible to identify regional generation sources. It is therefore assumed that each region has identical generation sources. Most UK regions have fairly comparable levels of direct and indirect emissions with the exception of direct emissions from Northern Ireland. The exceptionally high levels of direct emissions from other fuels in Northern Ireland is due to the extensive use of fossil fuels such as coal and oil for domestic heating. In all other UK regions, the greatest source of emissions is from the combustion of natural gas. Regional emissions are allocated using fuel expenditure information collected in the ONS *Expenditure and Food Survey*.

Figure 4
Direct and indirect GHG emissions per household from energy in 2001



Source: ONS, Environmental Accounts

Figure 5
Direct and indirect GHG emissions per household from transport and travel



Source: ONS, Environmental Accounts

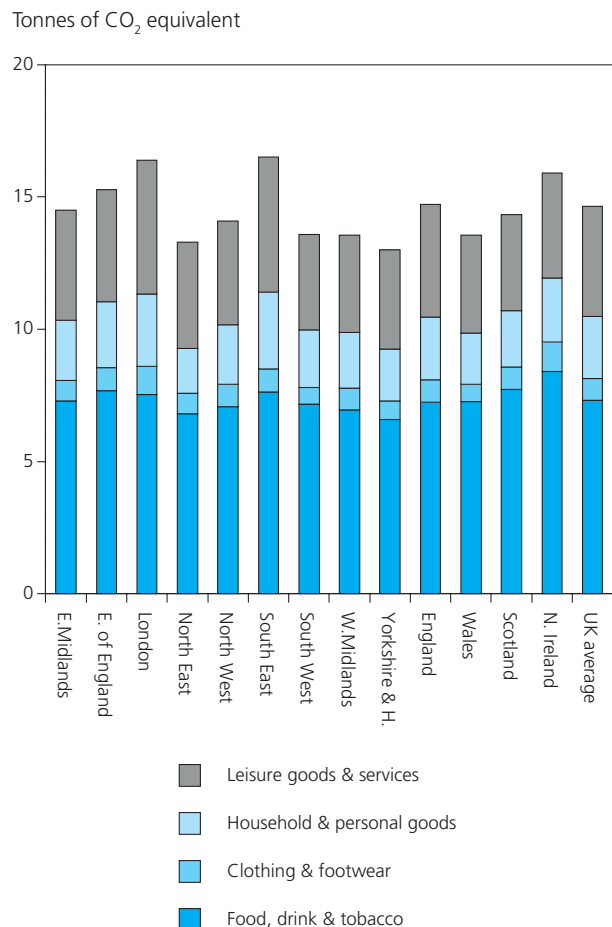
Direct and indirect greenhouse gas emissions per household from transport and travel

Greenhouse gas emissions from transport and travel arise through the use of privately owned vehicles and from the use of civil aviation and public transport. For purposes of this report public transport comprises all forms of transport

that are available to the public, such as buses, taxis and trains. Figure 5 shows that, with the exception of London, there are more greenhouse gas emissions directly generated by households through the use of privately owned vehicles than through the use of public transport.

The highest level of direct greenhouse gas emissions comes from households in the South East with an annual average of 3.2 tonnes of CO₂ equivalent per household. This compares with an average of 2.0 tonnes for households in London and 2.6 tonnes for the UK as a whole. On the other hand, Londoners have the greatest responsibility for indirect greenhouse gas emissions from public transport at 2.9 tonnes of CO₂ equivalent per household compared with 0.9 tonnes in Northern Ireland and 1.7 tonnes for the UK as a whole. Overall, households in the South East have the highest level of transport emissions at 5.0 tonnes of CO₂ equivalent per household per annum compared with 3.3 tonnes for households in Yorkshire and Humberside and an UK average of 4.3 tonnes. Direct greenhouse gas emissions from private vehicles are allocated using regional expenditure information collected through the ONS *Expenditure and Food Survey*. Indirect emissions from public transport are allocated using information from the Department for Transport's *National Travel Survey* and the ONS *International Passenger Survey*.

Figure 6
Indirect GHG emissions from household final demand for other goods and services



Source: ONS, Environmental Accounts

Indirect greenhouse gas emissions per household from final demand for other goods and services

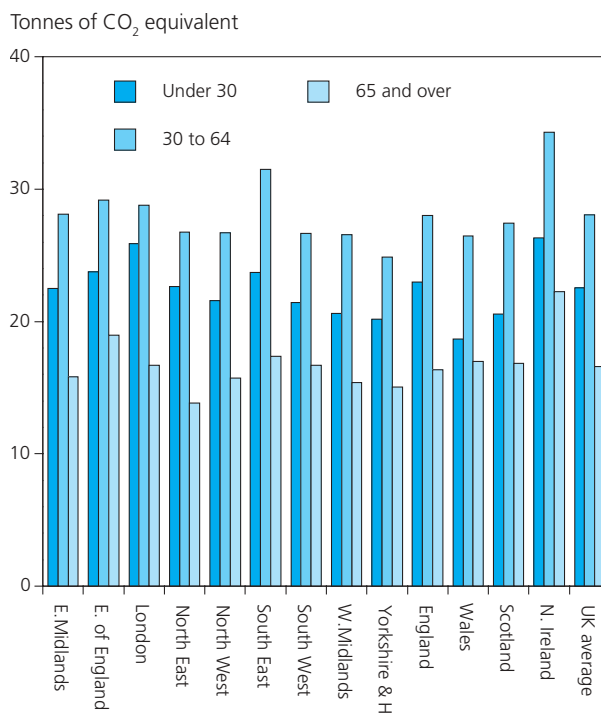
All greenhouse gas emissions from household final demand for other goods and services are indirect comprising the emissions generated through the production of the goods and services consumed by households. These emissions occur across all industrial sectors and can arise from natural sources such as the enteric emissions from cattle or from industrial sources such as iron and steel casting. The vast majority come from the manufacturing sectors but some greenhouse gas emissions are sourced from the service sectors. Greenhouse gas emissions generated by final demand are higher than those from energy and transport combined. Figure 6 shows that the highest level of greenhouse gas emissions comes from the South East at 16.5 tonnes of CO₂ equivalent per household per annum closely followed by London at 16.4 tonnes. The fewest emissions are generated by households in Yorkshire and Humberside with average emissions of 13.0 tonnes of CO₂ equivalent per household per annum. Northern Ireland has the highest level of indirect emissions from food, drink and tobacco and clothing and footwear manufacturing while the South East has the highest level of emission from the production of household and personal goods and from leisure goods and services. The emissions are allocated using regional expenditure information collected through the ONS *Expenditure and Food Survey*.

Greenhouse gas emissions per household by age of head of household

Throughout the UK, households where the head of the household is between 30 and 64 are responsible for generating the most emissions. Figure 7 shows that households in Northern Ireland are the highest with an average 34.3 tonnes of CO₂ equivalent per annum. The next highest region is the South East at 31.5 tonnes per annum. Households where the head is over 65 are responsible for the fewest emissions with the over 65s in the North East generating the fewest emissions at 13.8 tonnes of CO₂ equivalent per annum. There are numerous reasons why the 30 to 64 year-olds produce the greatest emissions, the most obvious being that they are probably the most affluent and have the largest households.

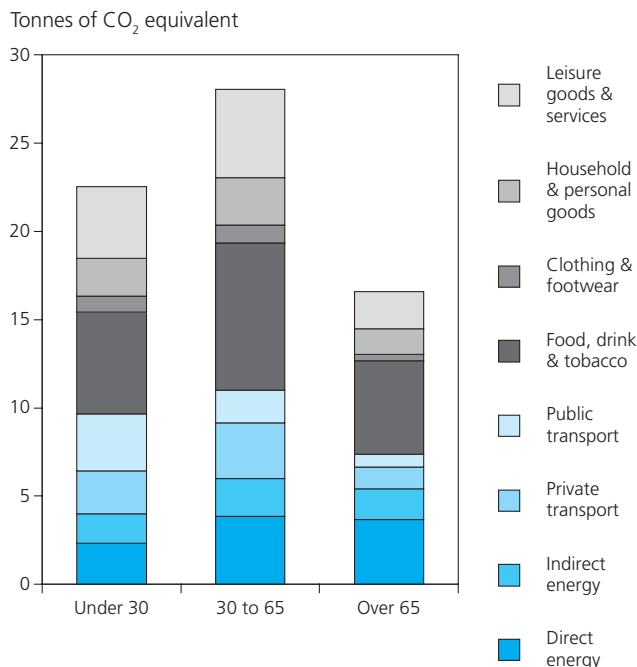
Looking at the average emissions per age group shows contrasting emission patterns across the various emission sources. Figure 8 presents a breakdown of the greenhouse gas emissions by source showing emissions that from production of food, drink and tobacco products is the single highest source for all age groups, from between 25 and 33 per cent of all emissions, after that the emission pattern changes. For the under 30s and 30 to 64s the second highest source of emissions is from leisure goods and services whereas for the over 65s the second highest source is direct emissions from energy products. Greenhouse gas emissions from energy products are broadly comparable for the 30 to 64s and the over 65s but as a proportion of all greenhouse gas emissions they represent 22 per cent of all emissions for the 30 to 64s and 33 per cent for the over 65s. Greenhouse gas emissions from leisure goods and services represent 18 per cent for the under 30s and 30 to 64s but only 12 per cent for the over 65s.

Figure 7
GHG emissions per household by age of head of household



Source: ONS, Environmental Accounts

Figure 8
GHG emissions per household by age of head of household and by source



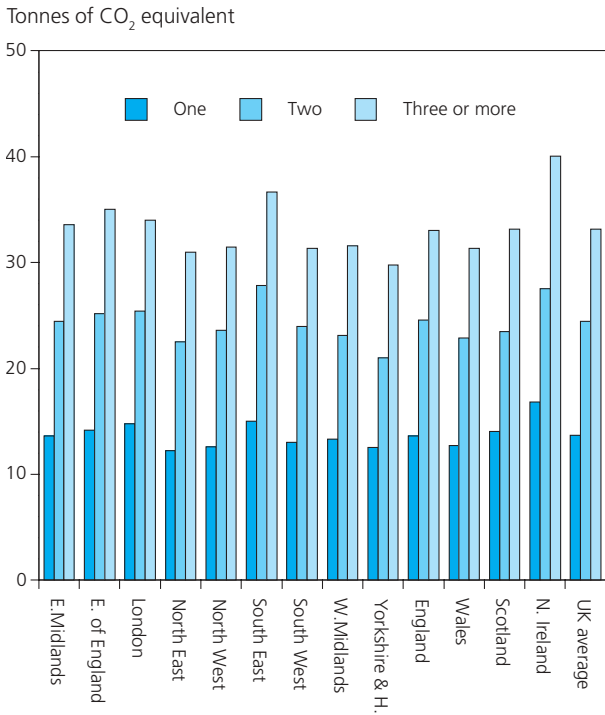
Source: ONS, Environmental Accounts

Greenhouse gas emissions per household by size of household

From Figure 9 it is clear that regional greenhouse gas emission per household by size of household follow very similar patterns throughout the UK. As you would expect, households where there are more than three occupants produce the most emissions with the highest level of

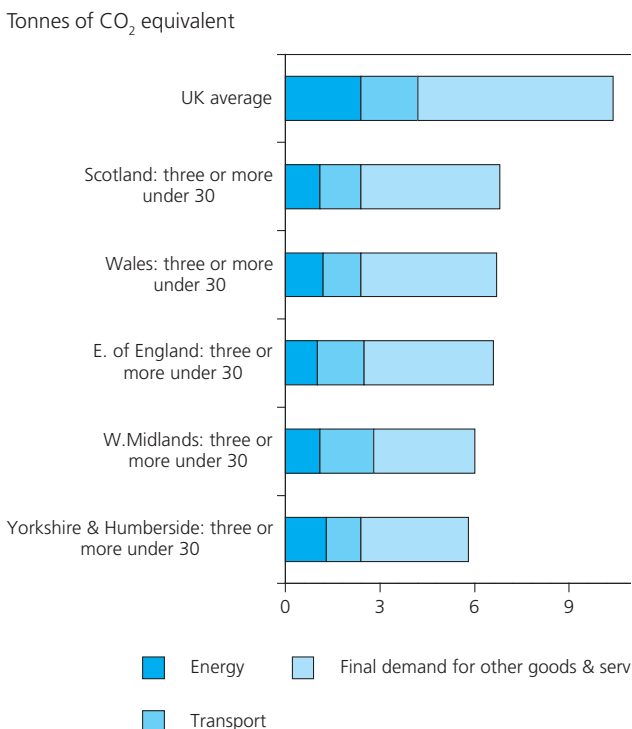
emissions coming from Northern Ireland at 40.0 tonnes of CO₂ equivalent per household per year. This compares with an UK average of 33.2 tonnes of CO₂ equivalent per household per year for houses with three or more occupants.

Figure 9
GHG emissions per household by household size



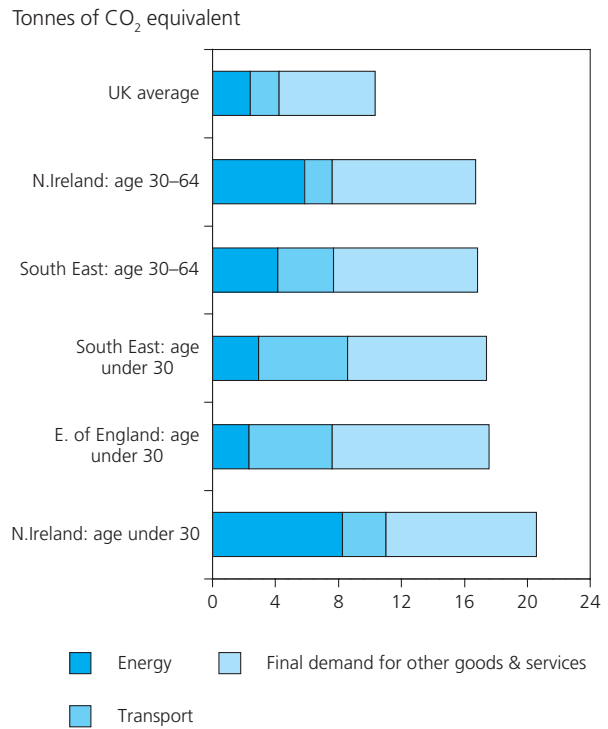
Source: ONS, Environmental Accounts

Figure 10
Greenhouse gas emissions: lowest five per capita compared with UK average



Source: ONS, Environmental Accounts

Figure 11
GHG emissions: highest five per capita compared with UK average



Source: ONS, Environmental Accounts

Greenhouse gas emissions per capita

Inevitably, households with three or more residents produce the greatest volume of greenhouse gas emissions. However, when looking at the emissions on a per capita basis, multiple occupancy households tend to produce the fewest emissions while households with single occupants produce the most.

The data used to compile the emissions shown in Figures 10 and 11 are based on information collected through various ONS and other government department inquiries. It must be born in mind that when analysing data at this level of detail the inquiry results are often based on relatively small sample sizes, thus introducing a far greater margin of error than when looking at more aggregated data.

Figure 10 shows that on a per capita basis the fewest emissions tend to come from households with three or more occupants where the head is under 30. The fewest emissions per capita come from households in Yorkshire and Humberside with average emissions of 5.8 tonnes of CO₂ equivalent per capita compared with an average UK emissions across all household types of 10.4 tonnes. Looking at the constituent sources for Yorkshire and Humberside, greenhouse gas emissions from energy comprise 1.3 tonnes of CO₂ equivalent per capita compared with a national average of 2.4 tonnes per capita. Emissions from transport are 1.1 tonnes of CO₂ equivalent per capita compared with a national average of 1.8 tonnes per capita and emissions from final demand for other goods and services are 3.4 tonnes of CO₂ equivalent per capita compared with a national average of 6.2 tonnes per capita.

Figure 11 shows that the highest level of greenhouse gas emissions on a per capita basis come from single occupancy households occupied by the under thirties. The highest level of emissions come from the under thirties in Northern Ireland with an average emissions of 20.6 tonnes of CO₂ equivalent per capita. This compares with an average UK emissions across all household types of 10.4 tonnes of CO₂ equivalent per capita. The high level of emissions in the region are once again driven by the emissions from energy products at 8.2 tonnes of CO₂ equivalent per capita compared with an UK average of 2.4 tonnes per capita. Greenhouse gas emissions from transport are 2.8 tonnes of CO₂ equivalent per capita, which compares favourably with their equivalents in the South East who produces 5.6 tonnes per capita but is still up on the national average of 1.8 tonnes per capita. Greenhouse gas emissions from final demand for other goods and services is 9.6 tonnes of CO₂ equivalent per capita compared with a national average of 6.2 tonnes of per capita.

Notes

1. Greenhouse gases comprise carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
2. Emissions from final demand for other goods and services include emissions embedded in imports of goods and services.

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