

# Carbon footprints

## Definition and Implications

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### Introduction

The term carbon footprint is the total amount of carbon dioxide plus other greenhouse gases (GHG's) released into the atmosphere as a result of a defined human activity. It may be applied to an individual, a business, a town, a country, a product or a process, and it is expressed in tonnes of carbon dioxide equivalent, written Tonnes CO<sub>2</sub> e. The term "Other greenhouse gases" includes methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and ozone (O<sub>3</sub>) as well as trace gases such as chlorofluorocarbons (CFC's).

The carbon footprint of an individual can be calculated by taking the total GHG emissions of a country (As reported to the UN in the annual "National Inventory Report") and dividing that figure by the population of that country. For the UK the "official" carbon footprint of an individual is just over 8 tonnes of CO<sub>2</sub> equivalent per annum.

However this figure does not give the entire picture as it excludes imported goods, such as processed food, clothes and electronics. It also excludes construction materials such as steel and cars manufactured abroad. Any industrial process has a carbon footprint, and the carbon emissions used to manufacture a particular product is known as the "embedded carbon". Over the past 30 years the manufacturing sector in the UK has shrunk, whilst the services sector has expanded. This means that materials and goods that were previously produced by industries based in the UK are now imported from abroad, and do not feature in the UK's carbon inventory. Thus the overseas component of the UK's overall carbon footprint has increased from 14% in 1990 to 46% today (<http://wwf.org.uk/carbon-report-2020>). In addition aviation, which accounts for 13% of the UK's carbon emissions is also excluded from the National Carbon Inventory.

The Government likes to claim that the UK has reduced its carbon footprint by 40% since 1990, the base-line year for the UN's Framework Convention on Climate Change (UNFCCC) better known as the Kyoto protocol. This gives the impression that successive UK Governments have taken climate change seriously and have been implementing far-sighted policies to reduce the UK's carbon emissions. In fact an analysis by Carbon Brief shows that most of the reductions are in the energy sector, with little change in the transport, construction and food sectors.

<https://www.carbonbrief.org/analysis-why-the-uks-co2-emissions-have-fallen-38-since-1990>

In addition, if UK emissions were calculated to allow for the difference between imported and exported goods (so-called consumption-based emissions), then the UK's carbon footprint would have fallen by only 15% over the past 30 years (<http://wwf.org.uk/carbon-report-2020>). This is why Greta Thunberg has described Britain's accounting of its carbon emissions as "inventive". This is also relevant to the UK's commitment to become net-zero carbon by 2050. Although the commitment is legally binding, it does not include aviation, and ignores the embedded carbon in goods imported from abroad. Countries are not required to report their consumption-based emissions to the UN, but they are available from the Department for Environment, Food and Rural Affairs (DEFRA).

### Direct Emissions

Let us return to the figure of 8 tonnes CO<sub>2</sub> e which represents the annual carbon footprint of the average UK individual. If we want to break it down into its individual components, then we need to make a series of assumptions. For example 1.5 tonnes can be attributed to driving, if we assume that the average individual drives 8000 miles per annum in a medium-sized car running on petrol or diesel. 0.5 tonnes can be attributed to air travel, though this will vary widely depending on an individual's income. Another 1.5 tonnes can be attributed to energy consumption in the home. This assumes 4,200 kWh of electricity use each year and 12,000 kWh of natural gas. <https://www.climatestewards.org/resources/duplo-footprint/>

Flying, driving and home energy consumption are all carbon intensive activities which individuals can control easily by holidaying in the UK, driving less or turning down the thermostat. They are sometimes referred to as "Direct Emissions", but they are true only for the year in which they are calculated. The development of renewable energy and the introduction of electric vehicles will alter the overall figures significantly, and even more so for an individual who chooses greener options.

### Food

Another 2.5 tonnes is accounted for by the food we eat. This is because food is a product with a carbon footprint, which includes methane from cattle and other ruminants. Methane is also released from paddy fields abroad when growing rice etc. Other carbon-intensive agricultural practices includes the use of ammonia-based fertiliser to grow grain. Ammonia generates nitrous oxide, a greenhouse gas responsible for approximately 7% of global warming. The carbon footprint of food also includes the contribution to carbon emissions from transporting food around the country, which can be virtually eliminated by buying food locally. Flying food in from abroad makes even less sense but is not included in the UK's carbon inventory !

Diet can make a large difference to a person's carbon footprint. For individuals with a high consumption of meat, the

figure is 2.6 tonnes CO<sub>2</sub> e. The amount falls to 2.0 tonnes for medium meat-eaters, 1.7 tonnes for low meat-eaters, 1.43 tonnes for fish eaters, 1.39 tonnes for vegetarians, and 1.0 tonnes for vegans. So even though the carbon embedded in food is outside our direct control, individuals can still reduce their carbon footprint by making dietary and life-style choices.

### Government and Services.

All the institutions and activities that make up “society” accounts for another 1.0 tonnes of carbon per annum. This includes prisons, hospitals, the armed forces, construction and road building etc. These indirect emissions are beyond our control, and can only be reduced by a change in government policy, to which individuals may contribute by lobbying or other campaigning activities.

### Consumerism.

The remainder of our carbon footprint (1.0 tonne per annum) is made up of the embedded carbon in the stuff that we buy as consumers. Consumerism can be defined as a process in which people borrow money they don't have, to buy products they don't need, to impress people they don't know. The solution is to only buy what you need. In other words spend less and keep longer. The phrase, “Re-use Recycle and Repair” is relevant in this context.

It also needs to be remembered that the figure of 1.0 tonnes per annum is only true if we ignore products manufactured abroad such as toys, mobile phones and most of the clothes that we buy. Furthermore the amount of embedded carbon increases if the goods are shipped long distances or flown in by air. Thus the true figure for the stuff we buy is closer to 2.0 tonnes making a total figure of 9 tonnes CO<sub>2</sub> e per annum for the average UK citizen. For simplicity this figure excludes emissions from businesses and the work-place.

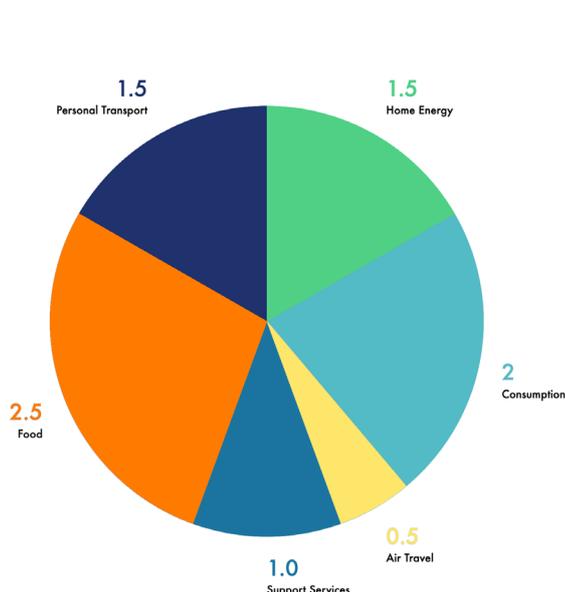
### Marlow's Carbon Footprint

Marlow Town Council are committed to making Marlow carbon neutral, but have not specified a date or a strategy, either for the council itself; the town in general; nor for the average Marlovian.

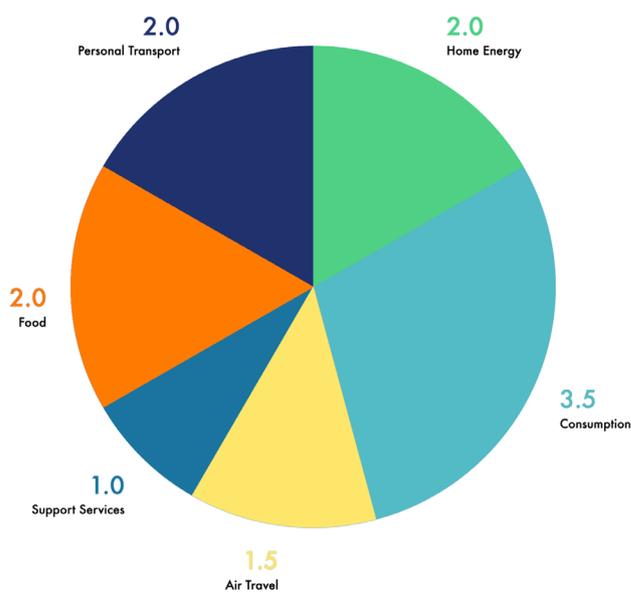
Income is strongly related to carbon emissions. Globally the richest 10 per cent of the world's population are responsible for half of all carbon emissions world-wide. A study by the Joseph Rowntree Foundation in 2013 found that direct carbon emissions from the richest households in the UK were three times that of the poorest.

[https://www.cse.org.uk/downloads/file/project\\_paper\\_1\\_household-emissions-distribution.pdf](https://www.cse.org.uk/downloads/file/project_paper_1_household-emissions-distribution.pdf)

Marlow is an affluent town in the top wealth decile (ie top 10%) for the UK. It is also located near to major airports around London. It is likely therefore that Marlovians have a larger carbon footprint than the average UK citizen, and that air travel and consumerism contribute disproportionately to their carbon emissions. This is shown in the two pie diagrams comparing the average UK citizen with the carbon footprint of a Marlovian with the proviso that the latter figures are guesstimates as we currently lack reliable data for Marlow residents.



Carbon footprint of average UK individual (9 tonnes)



Carbon footprint of typical Marlow resident (12 tonnes)

The size of the pie indicates that the carbon footprint of individuals in Marlow is one third higher than the average UK citizen. By and large the housing stock is traditional and poorly insulated with relatively few smaller dwellings such as flats, so energy consumption in the home will be above average, Similarly Marlow is poorly served by public transport, so a disproportionate number of Marlow resident are car-owners. However the increased carbon footprint is due mainly to greater consumerism and more frequent holidays abroad. By contrast Marlovians are probably more environmentally aware than the average UK citizen, so we surmise that food makes a lesser contribution

due to vegetarian or vegan diets, and the commendable activities of TTM in encouraging the purchase of locally sourced food. This is consistent with other studies showing that climate mitigation by wealthier individuals tends to focus on peripheral life-style choices rather than decisions that would have a major impact on their carbon footprint: such as deciding not to fly, or using public transport instead of driving. <https://www.vox.com/energy-and-environment/2017/12/1/16718844/green-consumers-climate-change>

Marlow has a population of approximately 15,000. Yet a survey by Marlow Energy Group showed that only 75 houses in Marlow have a PV installation, and only 39 have a solar thermal installation. Clearly there is huge potential for improvement, and we need to start soon if our grandchildren are going to inherit the world that we have known. For those who wish to estimate their own carbon footprint, there are many carbon calculators available. The Resurgence Quick Carbon Calculator is slightly out of date (2009) as it uses a figure of 10 tonnes for the average UK citizen. Even so it is broadly consistent with the figures used in the analysis above. It also excludes emissions from the work-place. For consumerism (which it calls spending habits) it estimates 1 tonne per £10,000 of household income. Since the average income today is £23,000, this would equate approximately to the 2 tonnes apportioned to consumerism for the pie diagram relating to the average UK citizen. <https://www.resurgence.org/resources/quickcalc.html>