

Briefing Paper | What is a Carbon Footprint?

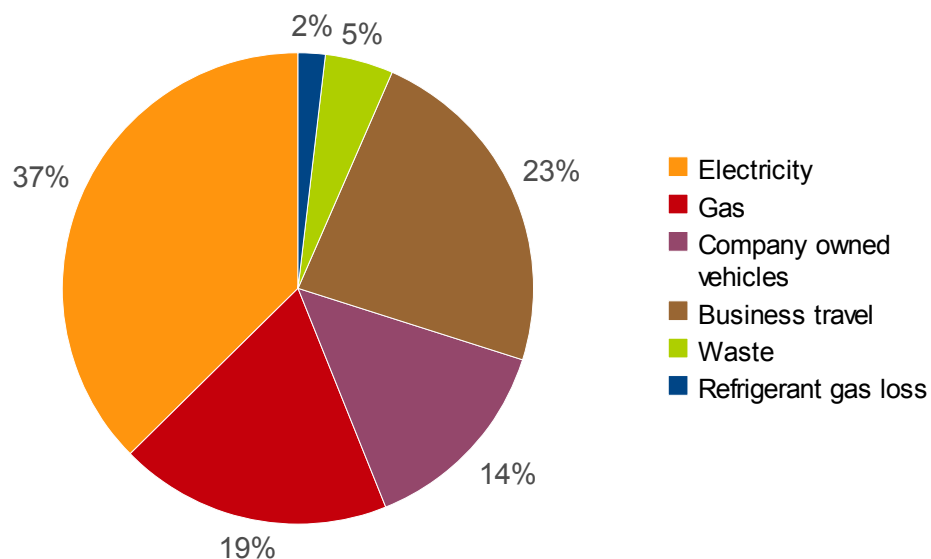
November 2008

What is a carbon footprint?

A carbon footprint is “the total set of GHG emissions caused directly and indirectly by an individual, organisation, event or product” (Carbon Trust 2008). For example, the carbon footprint of flying from London to New York is 0.68 tonnes of CO₂e¹, and the carbon footprint of the UK in 2006 was 653 million tonnes of CO₂e.

Carbon footprints can be broken down into their component parts in order to show the relative importance of different emissions sources. Figure 1 shows an example of the breakdown of an organisational footprint.

Figure 1. Example of the breakdown of an organisational carbon footprint



Carbon footprints are measured in tonnes of CO₂ equivalent or CO₂e (and less commonly in tonnes of carbon). The “equivalent” means that the footprint is made up of a number of different greenhouse gases, which have been converted into the equivalent quantity of CO₂ in order to show all emissions in a single number (for more information on CO₂e see Appendix 1).

¹ Based on a single flight from London Heathrow to New York JFK using the Defra 2008 average passenger kilometre CO₂ factor for long-haul flights, and CH₄ and N₂O factors derived from IPCC 2006, Defra 2008, Carbon Trust 2006 and Boeing 2007.

Why carry out a carbon footprint?

Carbon footprints are useful for a number of purposes:

1. For publicly reporting greenhouse gas emissions.
2. For setting a target for reducing emissions (in order to set a reductions target it is necessary to know what current emissions are).
3. To identify which activities contribute the most to a footprint (in order to identify the important areas for reduction efforts).
4. In order to measure changes in emissions over time, and to monitor the effectiveness of reduction activities.
5. To offset emissions (in order to offset emissions it is necessary to know how many reductions credits to purchase).

Different types of carbon footprint

As noted above, there are different types of carbon footprint, e.g. for organisations, individuals, products, services, and events. Different types of footprint have different methods and boundaries.

Organisational assessments involve quantifying the direct and indirect emissions associated with an organisation. Direct emissions are those from the combustion of fossil fuels in equipment or vehicles owned by the organisation, and also escaped greenhouse gases from the organisation's facilities (e.g. refrigerant gas losses from air conditioning systems). Indirect emissions are all emissions which are the result of an organisation's activities, but which are emitted from facilities or vehicles owned by third parties (e.g. an organisation's electricity consumption indirectly causes emissions at the electricity generating plant, which is owned by a third party).

There is a convention in greenhouse gas reporting which categorises emissions into three scopes:

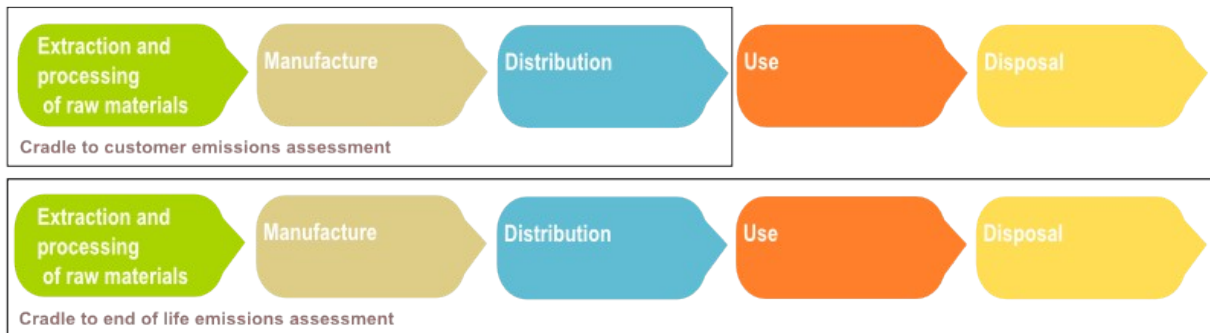
1. Scope one emissions are all direct emissions
2. Scope two emissions are all indirect emissions from electricity or other imported energy (e.g. district heating).
3. Scope three emissions are all other indirect emissions associated with the organisation's activities (e.g. business travel, commuting, deliveries in third party vehicles, waste disposal etc.).

Current world best practice for corporate or organisational greenhouse gas reporting is the World Business Council for Sustainable Development/World Resources Institute *The GHG Protocol: A Corporate Reporting and Accounting Standard*. A similar methodology is set out in ISO 14064.

Product assessments involve quantifying all the emissions associated with a product. Product footprints can be from “cradle to customer”, which includes all emissions from the extraction of the raw materials, processing, manufacturing, and delivery to retailers/customers, or “cradle to grave” (also known as “whole-of-life”), which includes all emissions sources for “cradle to customer”, and emissions associated with consumer use and final disposal of the product.

Figure 2 illustrates the difference between the product footprint boundaries.

Figure 2. Different product footprint boundaries.



Current best practice for product footprinting is the Publicly Available Specification 2050 (PAS 2050). This standard has been developed by the British Standards Institute (BSI), and is sponsored by the Carbon Trust and the UK's Department for the Environment, Food and Rural Affairs (Defra). It should be noted that although the PAS 2050 has been developed by UK based bodies the methodology is international, and is not UK specific.

The PAS 2050 provides a detailed specification for the assessment of the life cycle greenhouse gas emissions of goods and services. It builds on existing life cycle assessment methodologies such as ISO 14040 and ISO 14044, and provides additional principles, techniques and requirements relevant to greenhouse gas assessments.

Other types of carbon footprints. Assessments can be undertaken for events, services, web sites, journeys, or even, for example, comparing the emissions from sending a letter by post with those associated with sending the letter by email. To quantify such activities, the principles are the same: inclusion of the direct and indirect emissions for a defined scope of activity.

Appendix 1 - CO₂ Equivalence

CO₂ equivalence (or CO₂e) is used to express a carbon footprint, which is made up of a number of different greenhouse gases, in a single figure. It is the quantity of CO₂ which would have the equivalent global warming impact as the mixture of greenhouse gases in question.

A complete carbon footprint may include a number of types of greenhouse gas, e.g. all those controlled under the Kyoto Protocol. The Kyoto gases are listed in the table below with their global warming potential (GWP). GWP is an index of global warming potency, with CO₂ defined as having a GWP of 1 and all other gases measured relative to CO₂.

Greenhouse Gas	Global Warming Potential
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	25
Nitrous oxide (N ₂ O)	298
Hydrofluorocarbons (HFCs)	124 – 14,800
Perfluorocarbons (PFCs)	7,500 – 12,200
Sulphur hexafluoride (SF ₆)	22,800

Reference: IPCC 2007

A quantity of greenhouse gas is converted into CO₂e by multiplying its mass by its global warming potential, e.g. 1 kg of methane is equal to 25 kg of CO₂e.

References

Boeing (2007). http://www.boeing.com/product_list.html

Carbon Trust (2006). *Energy and Carbon Conversions*. www.bitc.org.uk/document.rm?id=6538

Carbon Trust (2008). *Carbon Footprinting: An Introduction for Organisations*.
<http://www.carbontrust.co.uk/publications/publicationdetail.htm?productid=CTV033>

Defra (2008). *Guidelines to Defra's GHG Conversion Factors*.
<http://www.defra.gov.uk/environment/business/envrp/pdf/ghg-cf-guidelines-annexes2008.pdf>

Intergovernmental Panel on Climate Change (2006). *IPCC Guidelines for National Greenhouse Gas Inventories*.
http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf

Intergovernmental Panel on Climate Change (2007). *Changes in Atmospheric Constituents and in Radiative Forcing*.
http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_Ch02.pdf

World Business Council for Sustainable Development/World Resources Institute (2004). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*.
<http://www.ghgprotocol.org/files/ghg-protocol-revised.pdf>