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# Time for change

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## What is a carbon footprint - definition

### **A carbon footprint is defined as:**

The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO<sub>2</sub>).

In other words: When you drive a car, the engine burns fuel which creates a certain amount of CO<sub>2</sub>, depending on its fuel consumption and the driving distance. (CO<sub>2</sub> is the chemical symbol for carbon dioxide). When you heat your house with oil, gas or coal, then you also generate CO<sub>2</sub>. Even if you heat your house with electricity, the generation of the electrical power may also have emitted a certain amount of CO<sub>2</sub>. When you buy food and goods, the production of the food and goods also emitted some quantities of CO<sub>2</sub>.

**Your carbon footprint is the sum of all emissions of CO<sub>2</sub> (carbon dioxide), which were induced by your activities in a given time frame.** Usually a carbon footprint is calculated for the time period of a year.

The best way is to calculate the carbon dioxide emissions based on the fuel consumption. In the next step you can add the CO<sub>2</sub> emission to your carbon footprint. Below is a table for the most common used fuels:

Examples:

For each (UK-) gallon of petrol fuel consumed, 10.4 kg carbon dioxide (CO<sub>2</sub>) is emitted.

For each (US-) gallon of gasoline fuel consumed, 8.7 kg carbon dioxide (CO<sub>2</sub>) is emitted.

If your car consumes 7.5 liter diesel per 100 km, then a drive of 300 km distance consumes  $3 \times 7.5 = 22.5$  liter diesel, which adds  $22.5 \times 2.7 \text{ kg} = 60.75 \text{ kg CO}_2$  to your personal carbon footprint.

<b>fuel type</b>	<b>unit</b>	<b>CO<sub>2</sub> emitted per unit</b>
<b>Petrol</b>	1 gallon (UK)	10.4 kg
<b>Petrol</b>	1 liter	2.3 kg
<b>Gasoline</b>	1 gallon (USA)	8.7 kg
<b>Gasoline</b>	1 liter	2.3 kg
<b>Diesel</b>	1 gallon (UK)	12.2 kg
<b>Diesel</b>	1 gallon (USA)	9.95 kg
<b>Diesel</b>	1 liter	2.7 kg
<b>Oil (heating)</b>	1 gallon (UK)	13.6 kg
<b>Oil (heating)</b>	1 gallon (USA)	11.26 kg
<b>Oil (heating)</b>	1 liter	3 kg

Each of the following activities add 1 kg of CO<sub>2</sub> to your personal carbon footprint:

Travel by public transportation (train or bus) a distance of 10 to 12 km (6.5 to 7 miles)

Drive with your car a distance of 6 km or 3.75 miles (assuming 7.3 litres petrol per 100 km or 39 mpg)

Fly with a plane a distance of 2.2 km or 1.375 miles.

Operate your computer for 32 hours (60 Watt consumption assumed)

Production of 5 plastic bags

Production of 2 plastic bottles

Production of 1/3 of an American cheeseburger (yes, the production of each cheeseburger emits 3.1 kg of CO2!)

To calculate the above contributions to the carbon footprint, the current UK mix for electricity and trains was taken into account.

Carbon dioxide is a so called **greenhouse gas causing global warming**. Other greenhouse gases which might be emitted as a result of your activities are e.g. methane and ozone. These greenhouse gases are normally also taken into account for the carbon footprint. They are converted into the amount of CO2 that would cause the same effects on global warming (this is called equivalent CO2 amount).

Few people express their carbon footprint in kg carbon rather than kg carbon dioxide. You can always convert kg carbon dioxide in kg carbon by multiplying with a factor 0.27 (1'000 kg CO2 equals 270 kg carbon). See my **comment** to the article about **personal responsibility for global warming**.

The carbon footprint is a very powerful tool to understand the impact of personal behaviour on global warming. Most people are shocked when they see the amount of CO2 their activities create! If you personally want to contribute to stop global warming, the calculation and constant monitoring of your personal carbon footprint is essential.

For registered users, there is a carbon footprint calculator on this website, which allows to store individual activities like, e.g. travelling by car, train, bus or air plane, fuel consumptions, electricity bills and so on (we call the individual contributions "carbon stamps"). You can then see the amount of CO2 created for each individual activity. You can do this either in advance and use it as a help for decisions or afterwards to continually sum up your carbon dioxide emissions. Klick here to see a **sample carbon footprint** with some activities.

An **off-line carbon footprint** and primary energy consumption calculator (Excel sheet) is already available in the download section.

There are graphs available on this site for the **CO2 emissions per capita by country** (average carbon footprint by country). In the medium- and long term, the carbon footprint must be reduced to less than 2'000 kg CO2 per year and per person. This is the maximum allowance for a **sustainable living**.

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## Comments

### What you can do to reduce your carbon footprint

30 January, 2008 - 13:05 — juerg

Have a look at these recommendation for [actions to reduce the carbon footprint](#).

Juerg

[reply](#)

### CO2 emission of fuels / evidence base

14 April, 2008 - 18:05 — juerg

Hi,

The figures given above are mostly calculated by myself and verified with several different sources. You can find some information how to calculate CO2 emissions at the following link:

[responsibility for your carbon footprint](#)

My company is developing and producing waste air treatment systems. So this type of calculations are almost my daily business.

Juerg

[reply](#)

## Definition of carbon footprint for cars

30 May, 2008 - 16:50 — juerg

Yes, 100 litres of fuel produce exactly the same amount of CO2 whether they are burnt in an eco car or in a SUV!

See here for the [calculation of the emission for carbon dioxide \(CO2\)](#).

[reply](#)

## Oxidation (combustion) process

22 December, 2009 - 17:19 — juerg

Please have a look at the link provided in the reply just above your question. If you can't follow those explanations, please post your further questions there.

[reply](#)

## CO2 emission for plastic bags and water bottles

15 July, 2008 - 22:08 — juerg

The following reasoning led to the above mentioned carbon dioxide (CO2) emission for plastics:

The production of 1 kg of polyethylene (PET or LDPE), requires the equivalent of 2 kg of oil for energy and raw material (see [here](#)). Polyethylene PE is the most commonly used plastic for plastic bags.

Burning 1 kg of oil creates about 3 kg of carbon dioxide (see e.g. our [offline carbon footprint calculator](#)). In other words: Per kg of plastic, about 6 kg carbon dioxide is created during production and incineration.

A plastic bag has a weight in the range of about 8 g to 60 g depending on size and thickness. For the further calculation, it now depends on which weight for a plastic bag you actually use. A common plastic carrying bag in our household had a weight between 25 g and 40 g. So I took the average of 32.5 g.

Take the above relation between kg plastics and kg of carbon dioxide, and you get about 200 g carbon dioxide for 32.5 g of plastic, which is the equivalent of the average plastic carrying bag in our household. Or in other words: For 5 plastic bags you get 1 kg of CO2.

Of course you'll find different figures on the Internet. The main factors are the weight of the plastic bag and whether the grey energy (energy used for production) is taken into account.

There is now a separate text available about the [CO2 emissions for plastic bags and plastic bottles](#).

Juerg

[reply](#)

## Carbon footprint for plastic bags and water bottles

16 October, 2008 - 10:57 — juerg

Due to many uncertainties, it is not realistic to give different amounts of CO2 emitted for different types of plastics. For a bottle or for a plastic bag, the amount of plastic used is much more important.

Some more information is available in our separate article about [CO2 emission of plastic bags](#) and in the links within the article.

Jürg

[reply](#)

## Recycling of plastic

11 April, 2009 - 19:52 — juerg

Some figures about production and recycling of plastic can be found in this [comment about plastic](#).

A recent study (see link above) showed that recycling plastic reduces the carbon footprint of plastic by 2.5 kg CO2 per kilogram of plastic. Using your figure above, the carbon footprint is 2.5 kg CO2 per kg recycled plastic compared to 5 kg CO2 per kg of new plastic. (3.5 kg compared to 6 kg using my own figures, see main article above)

So recycling does about halve the carbon footprint of plastic, but I wouldn't call this carbon footprint "next to nothing".

[reply](#)

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## Carbon footprint for electricity and gas

29 August, 2008 - 16:21 — juerg

Yes, to calculate the carbon dioxide emissions from electricity and gas, you can use our [offline carbon footprint calculator](#) (click on the link to download)

Regards Juerg

[reply](#)

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## CO2 emission of burning 1 liter of petrol

29 April, 2009 - 19:12 — juerg

The answer to your question is YES. Burning one liter of petrol always creates the same amount of CO2. It doesn't matter for the CO2-emissions whether an old car or a new car is used.

You can find further details [here](#) and [here](#).

Juerg

[reply](#)

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## Citation information

11 February, 2010 - 10:25 — juerg

Thank you for your kind remark. You can find [information about citation here](#).

Juerg

[reply](#)

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## Cradle to grave carbon footprint of fuels

14 July, 2009 - 12:11 — juerg

No, I don't have that data. It is very difficult to get because it makes a lot of difference from where the fuel is coming from (from the ground or from sand) and where it is getting transported to.

As a rule of thumb for oil from the ground you can estimate as follows:

The average energy return on crude oil is about 10:1 (see [here](#)). In other words: 10% of the energy content of crude oil is used to get it out of the ground.

The refining process to convert crude oil into fuel takes another 10% of the energy content

The effect of transportation may not be that important because of the high energy intensity of fuel.

I hope this helps as rough guideline!

Juerg

[reply](#)

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## CO2 is only from oxidation (burning)

22 October, 2009 - 10:12 — juerg

The above mentioned CO2-emissions have only been calculated for the burning (oxidation) of the fuels. These figures are easy to calculate and quite exact.

You are right that extracting, transporting and processing does also release CO2. However these values are more difficult to assess. You can find some guidelines in the following link:

[cradle to grave carbon footprint of fuels](#)

Regards, Juerg

[reply](#)

## CO2 emission of burning fossile fuels

13 November, 2009 - 10:58 — juerg

[Calculation of CO2 emissions](#)

[Table: Global warming contribution of fuels](#)

Low cost instruments to measure CO2 concentration are usually based on Infrared technology.

Juerg

[reply](#)

## Trees and plantation absorbtion of CO2

17 May, 2010 - 07:26 — jconstantinidis

Can we have a table conversion of TREE plantation in CO2 tons, or how much CO2 is absorbed to generate one kg of wood?

[reply](#)

## CO2 absorption of wood

17 May, 2010 - 09:24 — juerg

Burning 1 kg of wood releases about 2.78 kWh of energy and about 0.69 kg of CO2.

On the other hand, when trees grow, they absorb the same amount of CO2 (0.69 kg CO2 per kg wood). Please note that these are approximate figures, which depend on the sort of trees and kind of cultivation. You may find much lower and some higher figures in the literature!

Juerg

[reply](#)

## CO2 absorption of wood

26 May, 2010 - 06:26 — jconstantinidis

Thanks Juerg,

According to your answer each tree generates the same amount of CO2 generated by burning, this will be extrapolated to all the plantations?

There is a standard indicating how to determine this?

Can you tell me where can I find that literature?

[reply](#)

## It should be CO2e (Carbon dioxide equivalents)

25 November, 2012 - 17:20 — adminjr

Which calculation of CO2e are you exactly referring to? We showed some examples where only CO2 is emitted. In such cases the amount of CO2e equals the amount of CO2. On the other hand, if for example a process emits Methane, the amount of Methane is multiplied with a factor 23 to get CO2e. You can find tables with the conversion factors into CO2e for various gases.

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## Related or similar information

[Carbon footprint howto](#)

[Get a feeling how mitigation of global warming can be affected](#)

[Cumulative CO2 emissions by country](#)

[CO2 emissions by country](#)

[Global warming - it's about you](#)

[Stopping global warming is risk management](#)

[Eat less meat: CO2 emission of our food](#)

[Are cows the cause of global warming?](#)

**For whom enough is too little - nothing is ever enough.**