

Carbon Footprint

CO₂ emissions and lifestyles

If your parents decide to buy a new car, they might be attracted by a car with low CO₂ emissions or they might seek information regarding the new LPG-fuelled or hybrid vehicles, less polluting than the older petrol-powered or diesel-powered cars. In fact, if you think about it, more and more frequently, advertisements mention products which are ecological, have a low environmental impact or low emissions. Why is that? Our everyday activities release large amounts of carbon dioxide (CO₂) and other gases into the environment. These gases contribute to the so-called greenhouse effect and have an important role in climate change. For example, a banana emits 80 gm of CO₂ equivalent while a washing machine with a full load generates 700 gm of CO₂ equivalent per wash cycle. It is not easy to perceive these emissions because they cannot be seen and they are not released all at once, but gradually during the production phases of the fruit and while the washing machine is running. So how can we assess the effects of our activities in terms of CO₂eq? To quantify and reduce these effects, scientists have devised an effective indicator, the carbon footprint.

Let's find out more about carbon dioxide and the greenhouse effect

Carbon dioxide (chemical formula is CO₂), a colourless gas made up of two oxygen atoms and one carbon atom, is formed when any material containing carbon is burnt. You might know about it because plants take in carbon dioxide during photosynthesis and humans breathe out carbon dioxide during respiration. In the course of centuries, atmospheric carbon dioxide levels have remained stable within natural cyclic patterns, but industrialisation and the development of automobiles have altered this equilibrium, causing a significant increase in the amount of CO₂ present in the atmosphere. Unlike other substances, CO₂ is not directly harmful to human health, but it is indirectly, because it contributes to the phenomenon commonly referred to as the greenhouse effect, whose intensification is producing significant climate changes at a global level which require urgent intervention measures. Besides carbon dioxide, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride contribute to the greenhouse effect, even though in different measures. In order to include the effect of these gases but at the same time simplify things, scientists have decided to compare the effect of each gas to CO₂ using the global warming potential, i.e. how much global warming a particular gas may cause in a given period of time in terms of an equivalent amount of CO₂. For example, over a 50-year period, the GWP of methane is 56; in other words, 1 kg of CH₄ released into the atmosphere has an impact equivalent to 56 kg of CO₂!

International politics: from Rio de Janeiro to the carbon footprint

The idea of an indicator that could assess the impacts of human activities in terms of their greenhouse gas emissions was born many years ago, to be more precise at the 1992 United Nations Conference held in Rio de Janeiro. On this occasion, scientists and politicians representing 195 nations signed the United Nations Framework Convention on Climate Change (UNFCCC). This treaty, which was not legally binding, was ratified by the participating countries as a starting point for the fight against climate change. An important issue discussed at the Convention regarded the historical responsibility for climate change: it was ascribed to industrialized countries (Europe, the United States etc.) and hence it was these countries that would have to commit themselves to greater emission reductions. After this first step, new negotiations were carried out to take more decisive action against climate change. This led to the Kyoto Protocol, a legally binding agreement that was adopted in 1997, but did not come into force until 2005. Almost all the nations of the world have ratified the treaty, with the significant absence of the United States. The course of action proposed by the Protocol has been divided into two distinct commitment periods: the first that ended in 2012 and the second which will last until 2020. After 1992 and 1997 many things have changed and the current debate regards to what extent and at what rate each country should take measures in order to reduce its emissions, taking into consideration even those countries, such as China and India, exempt from mandatory emissions in the first phase. Since it is a global problem, it is fundamental that there should be the participation and commitment of all to try to find a solution: just one nation cannot

solve the problem, and at the same time without the participation of all countries it is impossible to implement a practical solution. In the meantime, if on the one hand, the world's most powerful countries are finding it difficult to reach an agreement, on the other, more and more people around the world are becoming aware of the great threat posed by global warming and are making efforts to promote a change of lifestyle that is triggered from the bottom by exercising their consumer power on companies and by showing greater interest in less polluting products.

Let's define the carbon footprint

The very serious situation and the need to take urgent action at a global level has led to the creation of an indicator that can quantify the impact of human activities on global warming and that is able to compare different situations. The most effective indicator has been recognized as being the carbon footprint (CF), which originated from the concept developed for the ecological footprint. Unlike the latter, however, the carbon footprint is not measured in terms of area, but is the total amount of greenhouse gas emissions associated with goods or services. Until a short while ago there was no univocal definition of the carbon footprint: the concept which scientists agreed on was that the carbon footprint represented a set amount of gas emissions that brought about climate change and that were associated with human production or consumption activities, but this is where agreement ended. In fact, there was no consensus regarding neither how to measure and quantify a carbon footprint nor as to which emissions to take into account (whether to measure only direct CO₂ emissions or even those of other gases such as CH₄, N₂O, CO, etc), nor were the units of measurement and the limits to consider in the analysis clear. In July 2013 a technical specification document was published, ISO 14067, that states that the carbon footprint of products measures “ the total amount of greenhouse gas emissions that is either directly or indirectly caused by an activity, a product, a company or a person” and is an indicator of the effect human activities have on climate change. Hence, a carbon footprint is an environmental indicator that measures the effect human activities have on global warming. This means that all those gases that affect climate change are taken into consideration and are expressed in terms of carbon dioxide equivalent (written as CO₂eq). Moreover, in order to calculate the carbon footprint correctly, all the stages of the product life cycle or all the company's activities need to be evaluated. The main advantages of knowing the carbon footprint of a product are that this indicator is easy to communicate and to be understood by the general public besides being related to one of the major environmental emergencies of our planet. The lower the carbon footprint of the product we are going to buy, the lower is its impact. However, it is not sufficient to know just the carbon footprint of a product if one wants to quantify its impacts even on other environmental sectors (such as its consumption of resources or of water).

Methodology and evaluation

The method developed for quantifying the carbon footprint of a product is rather complex, and so is its evaluation. In order to do so, all the product life cycle stages must be considered, starting from the raw materials utilized, the transport required, the energy consumption, waste production and the emissions released into the air, water and soil. This analysis is often referred to as the 'cradle-to-grave' approach, or more technically, Life Cycle Assessment (LCA). In the last years, different reference standards have been developed to ensure methodological rules and measurement accuracy, as well as a good reference system to compare the carbon footprint of different products. The most reliable and consistent are PAS 2050 (<http://www.bsigroup.com/PAS2050>, developed by the British Standards Institution) and the GHG Protocol Product Standard (<http://www.ghgprotocol.org/standards>, a collaboration of the World Resource Institute and World Business Council for Sustainable Development). Further consistency in product carbon assessments is expected with the publication of the ISO 14067.

Carbon Footprint of Nations

However, some preliminary considerations must be made when assessing the carbon footprint of a nation. In fact, measurements can be made from two perspectives: production-based and consumption-based. In the former case, the

nation that produces a particular good takes responsibility for all the emissions related to production generated on its territory, while in the latter, it is responsible for all the emissions generated to satisfy its domestic consumption, including the imports but excluding the exports. Which are the countries with the highest greenhouse gas emissions?

According to data from the Carbon Footprint of Nations, the United States and China have emitted 7.8 Mt and 5.2 Mt of CO₂eq respectively. But let us consider the number of inhabitants of these two countries: the Chinese are much more numerous than the Americans. This implies that the Chinese lifestyle and per capita emissions have a lower impact respect to the American one. This line of reasoning is confirmed by data regarding annual per capita emissions: USA is ranked second as far as per capita emissions are concerned (26.5 t CO₂eq) after Luxembourg, (41 t CO₂eq) and followed by Singapore (24 t CO₂eq) and Australia (22.4 t CO₂eq). A Carbon Trust study states that around 24% of the total greenhouse gas emissions are embedded in goods that are exchanged between different countries, while the remaining 76% is the result of domestic emissions related to internal goods and services.

And what is your carbon footprint? Calculate it with WWF footprint calculator (<http://footprint.wwf.org.uk/>)!

How can I reduce my carbon footprint?

Have you just discovered that your carbon footprint is very high and you want to reduce it? As you must have realised reading this Special, a change in one's habits is fundamental in order to achieve a more sustainable lifestyle, polluting less and creating a healthier environment for everyone. Even though each simple action we take in our everyday life may not seem relevant, collectively, we can really make a difference!

These are actions you can take:

- always remember to turn off the lights and household appliances when you are not using them;
- lower the heating and water heater temperature by 1 or 2°C. Just 1°C less will make your parents reduce their CO₂ emissions and save on their energy bill;
- always fill your washing machine and dishwasher with a full load;
- replace old incandescent light bulbs with LED bulbs;
- for daily travel, take a bicycle or public transportation whenever possible;
- improve your home's insulation;
- favour in-season, locally grown fruit and vegetables;
- try to produce as little waste as possible and separate and recycle any waste generated;
- when shopping, choose eco-friendly products.

This list could be much longer! If you want some more suggestions, look at this video (Green Ninja <http://www.youtube.com/watch?v=UeYOZgbgG1Q>)

Voluntary carbon offsetting schemes

Reducing our carbon footprint is the first step we should all take to do something tangible and to fight climate change. However, even if we carry out all the activities listed above, our carbon footprint will never drop to zero. What can we do for those actions that just cannot be avoided? For example, if one has to travel by airplane, is there a way to compensate for the emissions related to the trip? Fortunately, the answer is affirmative! There are some companies that, in compliance with the obligations of the countries participating in the Kyoto Protocol, have developed a series of programmes and projects that allow us to offset the emissions related to some of our daily activities, by paying an amount that is directly proportional to the carbon dioxide emitted. These projects usually include the production of energy

from renewable sources, reforestation measures, energy efficiency technology, etc. Some airlines already offer this service by giving their customers the opportunity of making a small donation to offset the carbon emissions from their flight, but it is possible to compensate for numerous daily activities, such as trips by car or train, household consumption, etc. The emissions produced by a flight from Milan to Rome are 0.13 t CO₂eq per passenger, which can be offset at the cost of around 1.20 euros.

Edited by Nadia Mirabella

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