

Greenhouse gas accounting: principles



Greenhouse gas (GHG) accounting is the process of measuring and tracking the amount of greenhouse gases emitted over a given reference period. There are different types of greenhouse gas accounting, such as corporate reporting, or product carbon footprints, but they all use similar calculation principles to estimate emissions. The guiding formulae for the estimation of emissions is:

$$\text{GHG emissions} = \text{Activity data} \times \text{Emission Factor}$$

The total GHG accounting is then the sum of the emissions for each GHG emission source. Much of the work in developing a GHG accounting is spent on collecting the relevant activity data and emission factors that fairly represent the emissions under consideration.

What is activity data?

Activity data refers to the quantitative measure of a level of activity that results in greenhouse gas emissions. This can be a physical or a non-physical quantity but should be representative of the actual activity that has occurred which has released emissions to the atmosphere. Typical examples include:

- **Energy consumption**
 - The amount of electricity used (in kWh or other units)
 - The volume of natural gas consumed for heat (in m3 or other units)
- **Transportation**
 - The vehicle miles or kilometres travelled by a given vehicle type
- **Industrial processes**
 - Quantity of raw material consumed or produced
 - Amount of product output in manufacturing
- **Waste management**
 - The quantity of waste and wastewater generated and/or treated

Before collecting activity data, it is sensible to consider what emission factors are available for a given emission source as this will provide a guide to the typical data that can be collected for a source, what the unit requirements are for any activity data, and inform on whether additional conversions or assumptions will be needed to use any activity data that is collected. For example, if the emission factor you wish to use is in litres of fuel consumed, but you have data for the kgs of fuel consumed, you know that you also need to collect data on the density of the fuel so that you are able to convert your activity data to be in the appropriate units.

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What is an emission factor?

In the context of greenhouse gas accounting, emission factors are expressions of the mass of emissions for a given reference unit. They should be considered a generalized average of emissions for a given reference unit. Emission factors tend to be expressed as:

$$\text{Emission factor} = \text{mass of pollutant} / \text{reference unit}$$

Where the reference unit can be any detail or activity measure for a given emission source, including mass, volume, distance, energy, duration, or financial units.

What is carbon equivalance?

Many emission factors, but not all, will be expressed in terms of the mass of carbon dioxide equivalent (or CO₂e) rather than the mass of individual greenhouse gases. It is important to understand what this means and how this is calculated. CO₂e is a metric used to compare the emissions of various greenhouse gases (GHGs) based on their global warming potential (GWP). It standardizes the impact of different gases by expressing them in terms of the amount of CO₂ that would have the same global warming effect. Different GHGs have varying capacities to trap heat in the atmosphere, and their effects last for different lengths of time. The GWP of a gas is a measure of how much heat it traps in the atmosphere over a specific period (usually 100 years) compared to carbon dioxide (CO₂). CO₂ is used as the reference gas, with a GWP of 1.

To express emissions of a GHG in terms of CO₂e, you multiply the amount of gas emitted by its GWP. The latest GWPs to use are published by the IPCC in Assessment Reports. The latest IPCC Assessment Report is the 6th which provides a new set of GWPs for the most common GHGs

