



Carbon Emissions Measurement – How It Works.

At its simplest level, carbon emissions will directly relate to the combustion of fuel for energy, with a clear relationship between carbon emissions of fuel types and their combustion. If you know how much fuel you have used, sufficient data exists on fuel types and their carbon, nitrous oxide and methane values to measure the impact of fuel usage with reasonably high accuracy.

This becomes more complicated where activity, such as a business trip or a car journey/freight distance, not direct fuel consumption is used to measure impacts, or where there is insufficient data to support more than an average for an emissions type, like rail or bus. Except where there is detailed product analysis supported by supply chain data, getting close to a last gram accuracy is unrealistic for the time being. The more reporting that is undertaken the more accurate measurements will become. The following is an overview of how emissions are currently measured.

Fuel types such as petrol or gas will have a general carbon emissions value from combustion, exact carbon content will depend on the producer, the same is true for percentage biofuel mixes with petrol. The averaged values used by the UK Government and international conversion factors, provide a well informed and researched average value. This may in future be improved or supported through the detailed data provided by fuel producers and supply chain analysis.

Electricity, not direct combustion in a car or machinery, is calculated based upon the overall carbon cost of combustion using input sources, like coal, renewables, nuclear to provide a national average value, which will not provide a specific value by generator, generation type or company. The UK government standards are updated annually to reflect the changing energy mix for electricity generation and also includes an assessment of the carbon cost of transmission and distribution in addition to generation.

Direct fuel combustion and electricity generation are the simplest and most accurate values that can be delivered. They form the basis of Scope 1 and Scope 2 carbon impacts for this reason, these being the base reporting level required under UK legislation.

Indirect emissions require multiple elements to arrive at a result. These are based upon activity types, e.g flying/driving, vehicle types, fuel types and distance. This is where the results become more distant from actual impacts of a single journey. If a driver does not know their actual fuel usage, they will have to rely on calculating the distance they travelled, know their engine size, and fuel type to estimate emissions from car use. This is done using well evolved methodologies based upon national data sets, but will not reflect actual journey emissions, more than average CO₂ per km values issued for cars. This is because the emissions will relate to the type of journey, motorway, urban, stop start, the number of passengers and or luggage contained in the vehicle. All emissions are product of distance travelled, vehicle type and weight.

Passenger numbers are a key determinant of emissions through their weight and that of any luggage. UK standards use an average car occupancy for calculations, the occupancy rates/seating capacity for air travel and total journeys offered divided by passengers travelled for journey such as bus and rail. This produces averaged results across all forms of UK travel for the impact of a given journey. The government uses the principle of total sector emissions, divided by users or output in

kwh/litre impacts to enable conversion of activity for a wide range of impacts, from air through to water use, paper consumption and waste.

In the UK the government has been doing this for over a decade, improving and updating conversion factors annually, as more data becomes available and gross data inputs, like the UK electricity mix reduce over time. At Carbon Responsible we have undertaken extensive research on activities such as aviation, where government methodology principles are used to inform more granular assessment of, for example, performance by airline. We also look at areas that support better input capture, such as actual rail track distances, car types by registration, to help support more accurate measurement and capture of key input data. These advanced calculations can support reporting, in tandem with the government standard results, but have most use in informing consumer choice to drive better supplier performance.

As companies and consumers become more aware of carbon emissions, their interest in impact calculation is increasing. With it comes a curiosity around how measurements are delivered and a desire for last gram impact accuracy. The former is valuable as it helps behavioural change, the latter can become an obstacle to measurement and action, as people speculate on methodology accuracy and discount its value, absent an understanding of data to support measurement. Current measurements are not perfect, but they are significantly more advanced than a decade ago and will become more so over time. Using accepted methodologies helps to support reporting and reduction and link that, using a common method of calculation, to government targets. In the absence of measurement by most companies, it is also the accepted start point for reporting.

Some forms of measurement, commonly those that support offset purchase, use financial cost as an input calculation. This can provide reasonable accuracy if using regularly updated monthly averaged forecourt prices for UK petrol and diesel sales, to derive a quantity of litres used, but becomes much more tenuous when used for grocery shopping or clothes purchasing. This is because the range of options in a shopping basket can be considerably varied, as opposed to fuel as a single commodity. Goods may be UK originated, imported by sea/air and have widely differing carbon impacts. This type of financial input is not for use in company reporting and reduction and produces, by its nature the least accurate impact assessment.

All goods and services use resources directly or indirectly that have an impact that can be measured. This has a reasonable degree of accuracy, but too many variables exist to be 100% accurate in relation to each individual journey whether freight or passenger. Greater accuracy exists for material and fuel use in production processes. When you are reporting it is important to understand the methodology involved to understand what level of accuracy and standards are being provided. For more information of UK government methodology [click here](#) or contact us at Carbon Responsible.