Sustainability Advisors

How to measure your scope 1 & 2 emissions

July 2025

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Defining scopes 1 & 2

Defining emissions scopes 1 & 2

The **Greenhouse Gas Protocol (GHG)** is an international standard that provides guidance, tools and training for businesses and governments to measure and manage emissions. It groups emissions from a variety of sources into **3 'scopes'.**

GHG Protocol

Scope 1

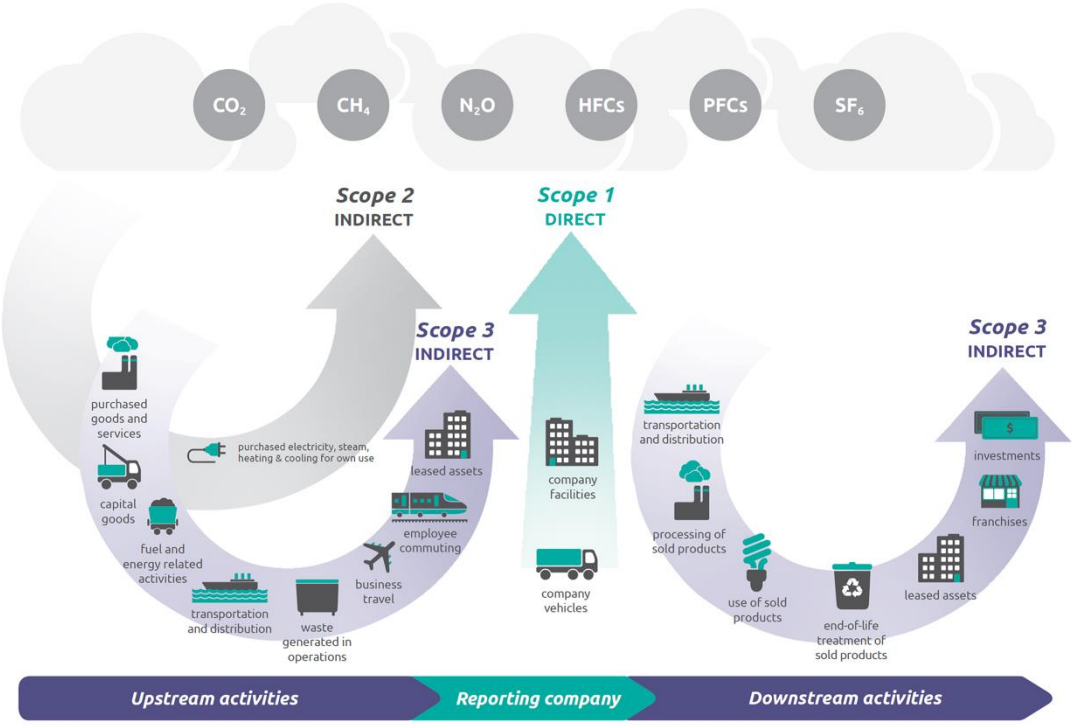
The emissions from operations that are owned or controlled by the company. For example, the gas used in heating, or the fuel used in company-owned vehicles.

Scope 2

The emissions from purchased energy. For example, the electricity a business buys.

Scope 3

The emissions from everything else in the business and supply chain (suppliers, distributors, the use of products etc.). This is broken down into 15 categories including, business travel, waste, and purchased goods and services.



02

A deeper dive into each scope

A deeper dive into each scope

What types of data would you use for measuring scopes 1 and 2?

Direct measurement of data

- Fuel consumption records (natural gas, diesel, kerosene)
- Industrial processes data
- Refrigerant / fugitive data (cooling and refrigeration systems i.e. Air-conditioning)

Purchased energy data

- Electricity, heat or steam consumption using bills or meters

To calculate emissions, you'll need to log this data in a spreadsheet or carbon calculator system.

Scope 1 - Stationary Combustion

Definition of category

Stationary combustion is the process of burning fuels in stationary equipment to produce heat, energy, steam, or electricity, at sites owned or controlled by the reporting company.

In simple terms, this is the burning of fuels used for your operations, at locations owned or within your control (i.e. where you operate from day to day).

Stationary Combustion

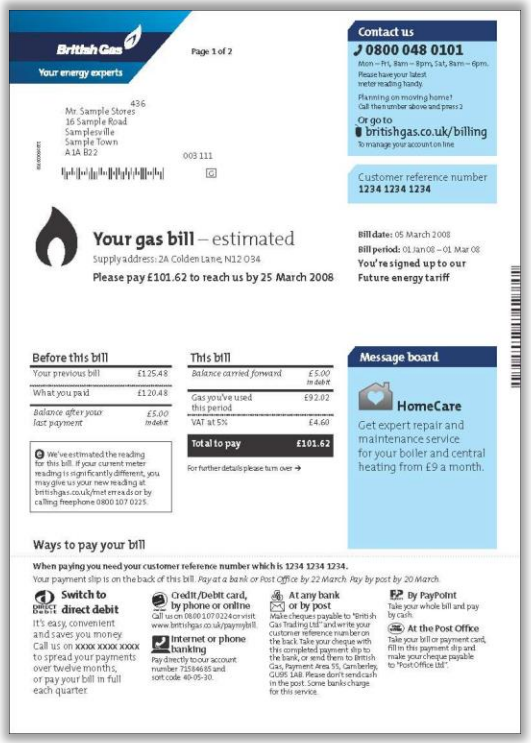
Who are the data owners?

Facilities Managers

Finance Team

Where can you find this data?

- Maintenance reports
- Utility bills
- Invoices

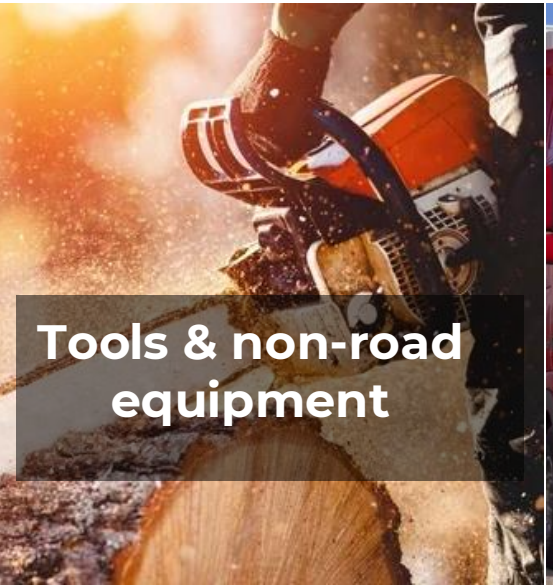


Mobile Combustion

Definition

This refers to emissions from the burning of fuels for owned or leased mobile sources (both on-road and non-road vehicles) that are in the company's inventory.

In simple terms, this includes all vehicles and equipment that move and burn fuel, including company-owned vehicles and/or a hired fleet that you have control of, forklifts, and non-road equipment.



Mobile Combustion

Who are the data owners?

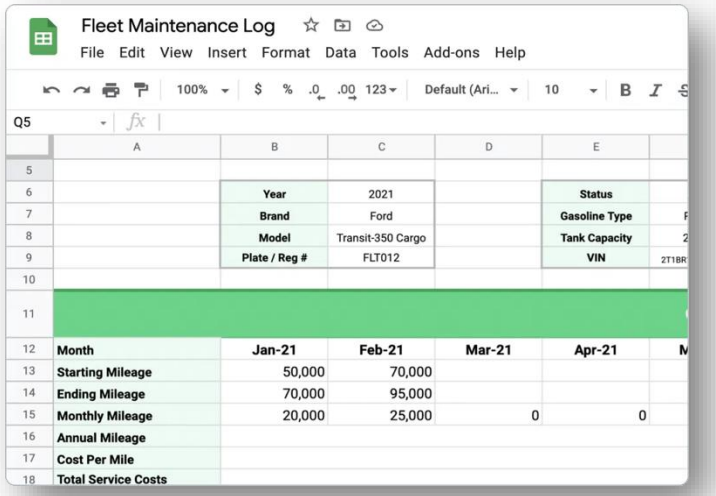
Transport and Logistics Team

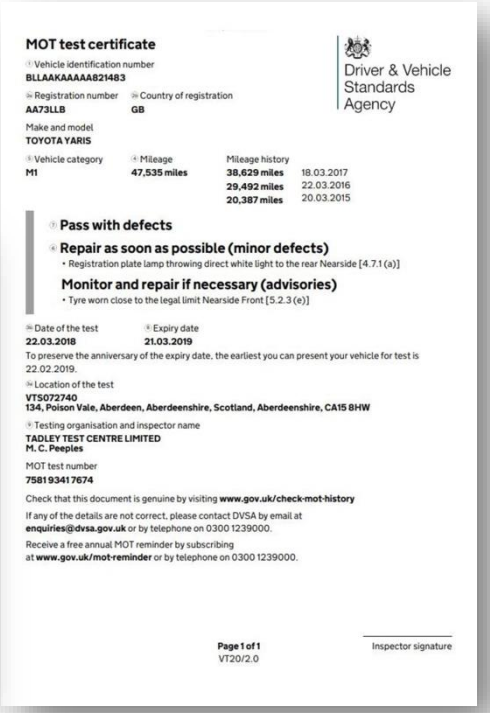
Finance Team

Company Operations Team

Where can you find this data?

- Log-books
- Maintenance reports
- Fleet inventory
- Vehicle tracking systems
- MOT certificates
- Invoices
- Expense systems





Fugitive Emissions

Definition

These are emissions from the unintentional and undesirable release of gases or vapours from pressure-containing equipment or facilities.

In simple terms, this means, for example:

- Refrigerant leaks from air conditioning systems
- Methane leaks from pipelines, or
- Leaks of gases used in manufacturing processes in compressed air systems

Fugitive Emissions

Who are the data owners?

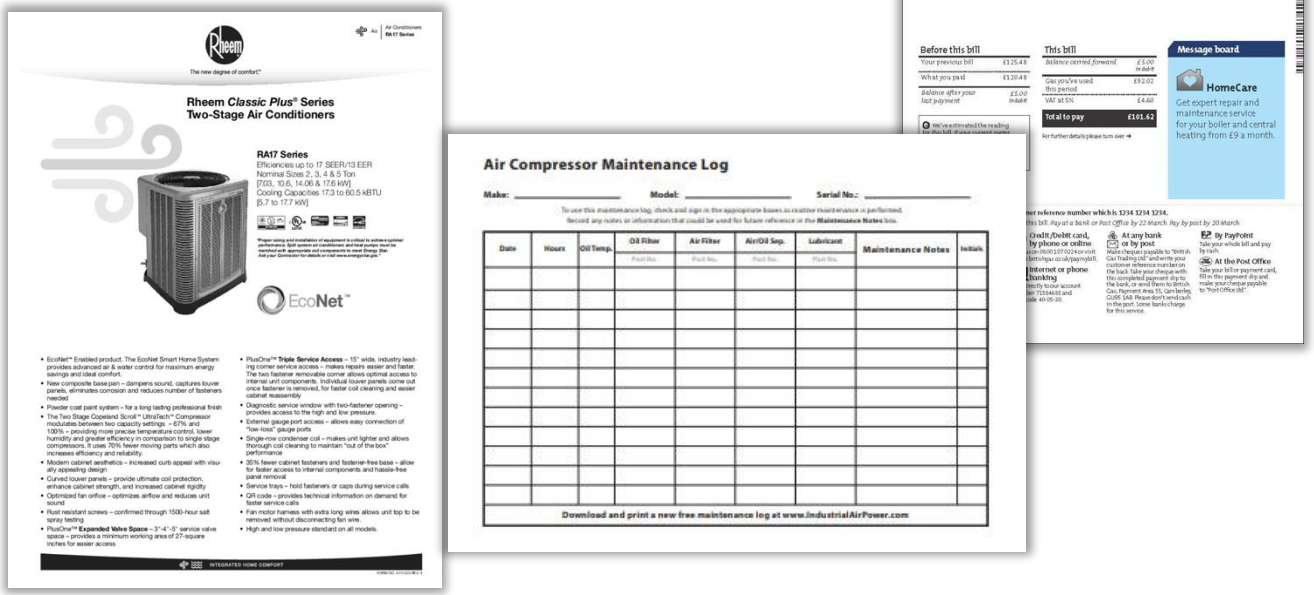
Transport and Logistics Team

Operations Team

Facilities Managers

Where can you find this data?

- Maintenance logs
- Equipment specifications
- Leak detection reports / surveys
- Gas inventory logs
- Utility bills
- Invoices



Scope 2 - Purchased Electricity

Definition

These are indirect emissions from the generation of purchased electricity that the reporting company consumes.

In simple terms, it includes emissions from the electricity a business buys to power its operations, such as lighting, machinery, and equipment.

These are classified as scope 2 indirect emissions because they occur at the power plant generating the electricity, rather than directly on site, but they are still consumed by the reporting company.

Purchased Electricity

Who are the data owners?

Maintenance / Operations Team

Finance Team

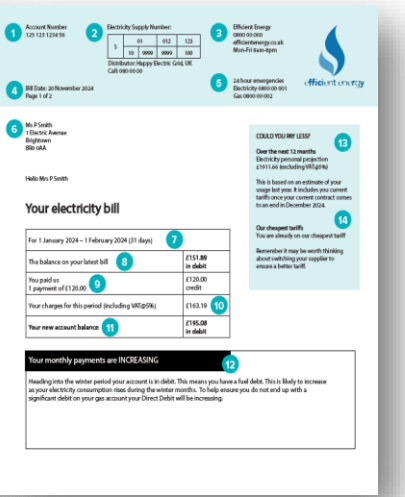
Facilities Managers

British Gas, npower, e·on, EDF, SSE, SCOTTISHPOWER

Energy Providers

Where can you find this data?

- Utility bills
- Invoices
- Meter readings
- Energy / building management systems

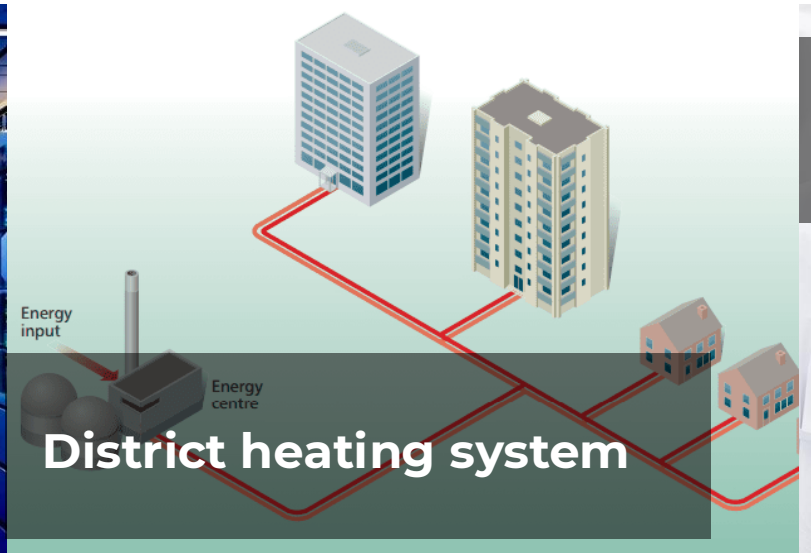


Purchased Heat / Steam / Cooling

Definition

These are indirect emissions from purchased steam, heating and cooling. Companies report emissions from buying and using these energy products, just as they would for electricity.

In simple terms, this includes emissions from the energy used to heat, cool, or provide steam to a business's operations, where the heat or steam is bought from an external source, like a district heating system or a third-party provider.



Purchased Heat / Steam / Cooling

Who are the data owners?

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03

The calculation process

Emission factors explained

The calculation process

What are emission factors?

Emission factors (EFs) are set, standardised values that quantify the greenhouse gas impact of an activity, product or process.

EFs are a way of quantifying how much of a contaminant is released into the atmosphere per unit of a particular activity, process or output. Think of it as a simplified average for a given activity, process, or output.

We can use this value to determine the CO2e* emitted in kg.

EFs change regularly (usually yearly) as processes become more or less GHG intensive. As the amount of renewable energy within the UK electricity grid varies, for example, so the UK grid electricity EF changes.

For example: The 2024 UK grid electricity emission factor is 0.20705 kgCO2e* per kWh.

* CO2e? A way to measure pollution from different gases (such as methane and nitrous oxide) by comparing them all to carbon dioxide.

The calculation process cont.

Spend-based vs activity-based emission factors

- **Activity-based** emission factors are more accurate and specific, as they’re based on direct measurements of emissions from actual activities (e.g. fuel use, electricity consumption). Researchers gather data through experiments and create factors that can be applied to similar activities elsewhere.

- **Spend-based** emission factors are used when direct activity data is unavailable. They estimate emissions per amount of money spent using economic data and life cycle analysis. While less precise, they’re commonly used for scope 3 emissions.

Where you find emission factors

DEFRA conversion factors

- The UK government publishes a big set of emission factors (they call them “conversion factors”).
- The factors are published in Excel format and updated twice annually. They’re free to use and there are no restrictions on their use.
- They cover a wide range of emissions sources, including energy, travel, production of some common materials, product disposal, and many others.

Activity	Fuel	Unit	kg CO_2e	k
Gaseous fuels	Butane	tonnes	3033.38	
		litres	1.75	
		kWh (Net CV)	0.24	
		kWh (Gross CV)	0.22	
	CNG	tonnes	2562.57	
		litres	0.45	
		kWh (Net CV)	0.20	
		kWh (Gross CV)	0.18	
	LNG	tonnes	2581.98	
		litres	1.17	
		kWh (Net CV)	0.20	
		kWh (Gross CV)	0.18	
	LPG	tonnes	2939.36	
		litres	1.56	
		kWh (Net CV)	0.23	
		kWh (Gross CV)	0.21	
	Natural gas	tonnes	2562.57	
		cubic metres	2.04	
		kWh (Net CV)	0.20	
		kWh (Gross CV)	0.18	

Other sources

- Other sources of emission factors, for example, the US Environmental Protection Agency, are available depending on the source of emissions you are researching and your location.
- Other private databases like Exiobase have large compiled repositories of emission factors for scope 3 categories.

Stationary Combustion

Fuel Type	Heat Content (HHV)	CO_2 Factor	CH_4 Factor	N_2O Factor	CO_2 Factor
	mmBtu per short ton	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu	kg CO_2 per short ton
Coal and Coke					
Anthracite	25.09	103.69	11	1.6	2,60
Bituminous	24.93	93.28	11	1.6	2,32
Sub-bituminous	17.25	97.17	11	1.6	1,67
Lignite	14.21	97.72	11	1.6	1,38
Mixed (Commercial Sector)	21.39	94.27	11	1.6	2,01
Mixed (Electric Power Sector)	19.73	95.52	11	1.6	1,88
Mixed (Industrial Coking)	26.28	93.90	11	1.6	2,46
Mixed (Industrial Sector)	22.35	94.67	11	1.6	2,11
Coal Coke	24.80	113.67	11	1.6	2,81
Other Fuels - Solid					
Municipal Solid Waste	9.95	90.70	32	4.2	90
Petroleum Coke (Solid)	30.00	102.41	32	4.2	3,07
Plastics	38.00	75.00	32	4.2	2,85

The carbon footprint calculation

Business data X emission factor

1. Take the business data for a specific operation. These can be classified as:

- Activity data - refers to your resource usage, e.g. kWh used or litres of fuel used
- Spend data – refers to the money spent on a certain good or service

2. Multiply the business data by the emission factor to find the emissions for that specific activity.

Different business activities may produce varying levels of emissions, and there is likely to be a different emission factor for each of them. So, to establish the carbon footprint of all the business activities combined, complete steps 1 and 2 for each business operation/activity, and then...

3. Total the values for each operation to reach the carbon footprint of a business's operations.

04

Mock calculations and challenges

How to deal with good, bad and no data when calculating emissions

Calculation example 1

What emissions come from this company's natural gas use?

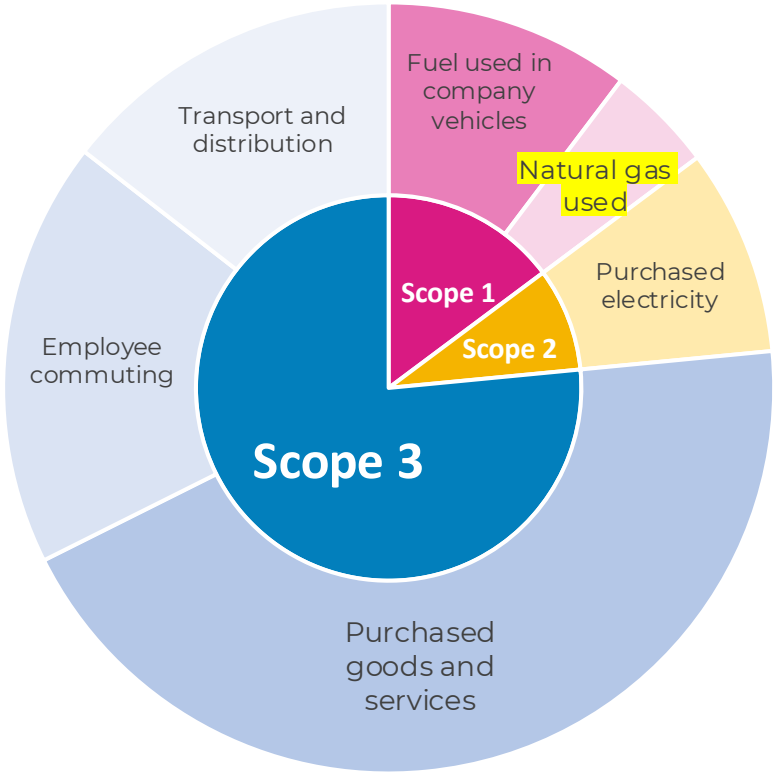
Here is an example of a **perfect calculation** with **perfect activity data** (that is, accurate and complete) for calculating emissions from stationary combustion (scope 1):

- Over 12 months, the natural gas usage for Bobble Head Ltd. (*a fictional UK company*) was *50,000 kWh*. This was taken from their activity data - gas bills covering their reporting year.
- The EF for natural gas usage in the UK, sourced from DEFRA's published emission factor database, is *0.1829 kgCO2e* per kWh produced (***kgCO2e/kWh***).
- To calculate the emissions from the 50,000kWh of gas used, make the following calculation:

50,000 X 0.1829 = 9,145 kgCO2e

- As it is common for companies to report emissions in tonnes of CO2e, the 9,145 figure would then be divided by 1000.

- So, the emissions from Bobble Head Ltd's natural gas use = **9.145 tCO2e.**



Calculation example 2

What happens when we only have partial data?

Here's how to calculate Bobble Head's emissions from purchased electricity (scope 2) with only **imperfect activity data**:

- Over 3 months, Bobble Head Ltd. purchased ***20,000 kWh*** of electricity.
- However, we need to know what a year's worth of purchased electricity produces in emissions, and we only have 3 months of data. We need to extrapolate to overcome this challenge.
- Extrapolation **in carbon accounting** means using known data from a small area or time period (3 months in this instance) to estimate the carbon emissions for a larger area or longer time.
- The calculation to extrapolate 3 months of data into a year's worth is as follows:

20,000 / 3 X 12 = 80,000 kWh…

Calculation 2

Continued

Now that we've estimated Bobble Head Ltd's use of 80,000 kWh of electricity in their reporting year, we would do the same calculation as we did in calculation 1, but with a different emission factor.

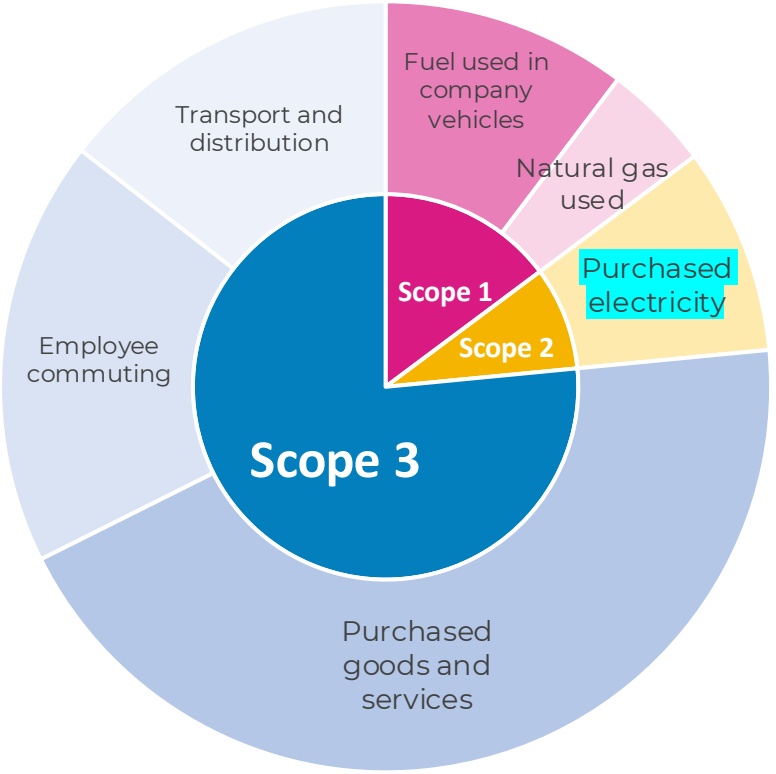
- The 2024 EF for electricity usage in the UK from DEFRA's published emission factor database is ***0.20705 kgCO2e/kWh***.

- To calculate emissions from the 80,000kWh of electricity used, do the following calculation:

80,000 X 0.20705 = 16,564 kgCO2e

- Divide the 16,564 figure by 1000.

So the emissions produced from electricity purchased in Bobble Head's reporting year = **16.564 tCO2e.**



No data?

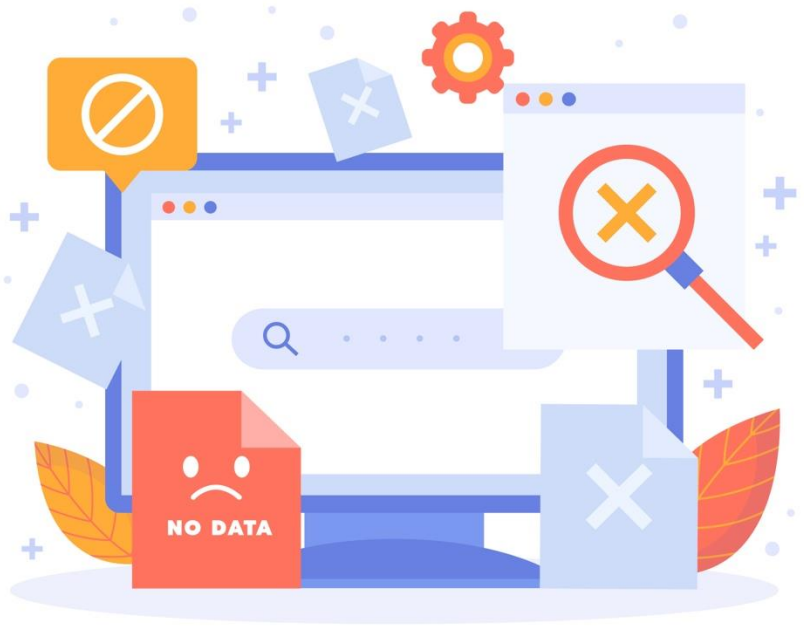
How to measure emissions when there is no activity data available

To help fill in data gaps, it is acceptable for an organisation to estimate data if it relates to something that generates minimal emissions, or if the estimate is likely to be relatively accurate.

- For example, if Bobble Head Ltd provided no data for 2024 for its office energy use, but we knew they used 10 litres of propane in 2023, it would be reasonable to estimate that they used something similar the following year.

However, extrapolation is a more thorough approach to filling data gaps:

- For example, an organisation has no energy data for an office space. It can divide the energy use of the building by the number of people in it to calculate energy use per person. The organisation can then multiply the energy use figure by the number of employees to get an extrapolated figure.



05

Summary

Summary

Key information to take away

- **Definitions of scope 1 and 2 emissions** as categorised by the Greenhouse Gas Protocol:
    - Scope 1 = Stationary, mobile and fugitive emissions
    - Scope 2 = Purchased electricity, heat and steam
- **Not all categories will be relevant to your business** – i.e. some businesses purchase gas and fuel, and some don't.
- **Emission factors are values that quantify the greenhouse gas (GHG)** impact of a product, activity or process. Multiple organisations / governmental departments publish them, such as DEFRA and EPA.
- Calculating the greenhouse gas impact of a business involves **multiplying an emission factor with their business data** – which is either activity or spend data.
- Our mock examples explore how to calculate a carbon footprint when you have perfect data, imperfect data and no data.

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- Set a strategy
- Set targets
- Set policies and governance
- Set standards & frameworks
- Report on sustainability strategy, targets and actions
- Develop and implement policies
- Set metrics and targets
- Understand, align or comply with standards and frameworks
- Report on progress
- Engage suppliers
- Engage customers and employees

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