6.2 EMISSIONS ACCOUNTING

Introduction to Scope 1 greenhouse gas emissions and calculations

Important notice
This unit is part of a package of learning materials designed to support understanding of foundational concepts relating to climate-related financial disclosures. These learning materials do not constitute application or regulatory guidance for the preparation of climate-related financial disclosures and are not intended to represent legal or professional advice. We encourage you to seek your own professional advice to find out how the *Corporations Act 2001* (Corporations Act) and other relevant laws may apply to you and your circumstances, as it is your responsibility to determine your obligations and comply with them.

Key topics

- Scope 1 greenhouse gas emissions and measurement methodologies

Relevance for climate-related disclosures

Understanding fundamental concepts on Scope 1, 2 and 3 greenhouse gas emissions may support you in identifying and understanding your emissions as part of your climate-related financial disclosures.

In this unit, you will learn foundational concepts on Scope 1 greenhouse gas emissions, and how to identify and understand them. You will also learn about greenhouse gas inventory boundaries.

Overview

Greenhouse gas emissions are categorised as Scope 1, Scope 2 or Scope 3 emissions.

Scope 1 greenhouse gas emissions are emissions from sources that are controlled or owned by the entity.

Once you have set your inventory boundary (see Module 6 Unit 1 for details), you can begin measuring your entity's Scope 1 emissions, which is a five-step process:

Step 1 – identify sources of greenhouse gas emissions
Step 2 – choose an appropriate calculation method
Step 3 – collect activity data and choose an appropriate emission factor
Step 4 – use calculation tools to estimate emissions
Step 5 – aggregate all the data within your inventory boundary

Scope 1 greenhouse gas emissions

Scope 1 greenhouse gas emissions are emissions that are from sources controlled or owned by the entity. This includes (but is not limited to) emissions from facilities through the stationary combustion of fuels, from mobile combustion sources such as vehicles, from manufacturing processes such as cement manufacturing, and from intentional or unintentional fugitive emissions.

Greenhouse gas emissions are expressed as metric tonnes of carbon dioxide equivalent (tCO_2-e). This is explained further in Module 2 Unit 2.

Accounting for Scope 1 greenhouse gas emissions

While each scope has its own specific data sources and considerations, the general steps for calculating greenhouse gas emissions, such as collecting activity data and applying emission factors, are broadly consistent across all scopes. This unit focuses specifically on Scope 1 emissions. As shown in Figure 1, there are five key steps when identifying and calculating greenhouse gas emissions, including Scope 1 emissions. Table 1 provides more detail on each of the steps.

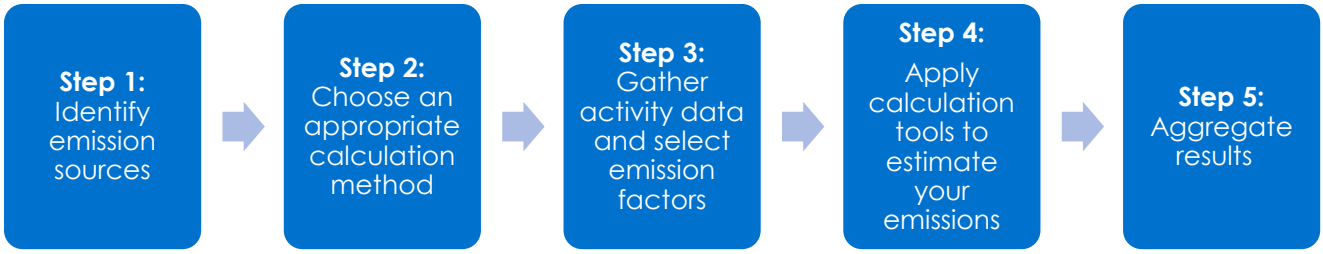

Figure 1: Steps to identify and calculate greenhouse gas emissions

Table 1: Steps to identify and calculate greenhouse gas emissions

Step	Description
Step 1: Determine the sources of Scope 1 greenhouse gas emissions	Entities should identify the sources of their Scope 1 greenhouse gas emissions. Scope 1 greenhouse gas emissions typically occur on site or through core operational activities and may be categorised into the following main groups: › Emissions from facilities, including (but not limited to) those produced through stationary combustion of fuels (e.g. fuel burned in boilers or furnaces), fugitive emissions (e.g. leaks from air conditioning systems or refrigeration), and process emissions resulting from chemical or physical processes during production (e.g. cement production) and/or waste processing › Emissions from mobile combustion sources, such as fuel used in vehicles, trains, boats or other vessels that your entity owns or controls › Emissions from manufacturing processes, such as from calcination in cement manufacturing, and › Intentional and unintentional fugitive emissions from sources such as wastewater treatment, cooling towers.
Step 2: Choose an appropriate calculation methodology	Three main calculation approaches are available for emissions data: › Direct measurement: monitoring greenhouse gas concentrations and flow rate. Example: using sensors or Continuous Emissions Monitoring Systems (CEMS) › Estimation (most common approach): multiply activity data by emission factors. Example: estimating emissions from records of fuel use (or purchase data) and data about the carbon content of different fuels, and › Stoichiometric: using knowledge of chemical processes and products or byproducts produced to calculate emissions. Example: calculating emissions from industrial processes using chemical equations to quantify the greenhouse gases produced Steps 3–4 guide you through the method to estimate emissions.

Step 3: Gather activity data and select appropriate emission factors	***(a) Gathering activity data:*** The initial step in estimating greenhouse gas emissions involves compiling relevant activity data. Activity data is the entity's activity that results in greenhouse gas emissions for the reporting period. Entities can gather activity data from: 1) internal operational records, e.g. fuel consumption logs, refrigerant servicing reports, waste disposal reports 2) procurement systems, e.g. purchase orders and invoices for goods such as liquid fuels and gas that are combusted onsite 3) facility management systems, e.g. heating, ventilation and air conditioning (HVAC) maintenance logs, energy meters, and submetering data (excluding those related to purchased electricity, steam cooling and heating which are Scope 2 (indirect) emissions), and 4) transport and logistics data, e.g. vehicle usage, mileage, and fuel receipts. ***(b) Select emission factors:*** An emission factor is a factor that allows greenhouse gas emissions to be estimated from a unit of available activity data. The emission factor is the average emissions per unit of activity (for example, fuel consumed, electricity used). It is used in estimating greenhouse gas emissions by multiplying by the activity data to calculate the total emissions associated with that activity. Entities should use the emission factors that most accurately reflect their activities. Each activity is associated with an emission factor, as we will see in the example below. Each year, the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) publishes the Australian National Greenhouse Accounts Factors (NGA Factors)[1]. The NGA Factors provide emission factors to help entities estimate their greenhouse gas emissions based on various activities and energy sources. Alternatively, there are other publicly available sources that may provide industry-specific emission factors. Examples include the national material emission factors database for the building industry, and Australian National Life Cycle Inventory Database (AusLCI) emission factors for the construction sector. Or suppliers may develop and provide their own. It is important to verify emission factors, as they are updated regularly.
Step 4: Use calculation tools to estimate emissions	To calculate greenhouse gas emissions for each activity in your inventory boundary (expressed in metric tonnes of CO_2 equivalent or tCO_2-e), the relevant activity data must be multiplied by the appropriate emission factor. Estimate of greenhouse gas emissions (tCO_2-e) = activity data (GJ) x emission factor (tCO_2-e/GJ) This estimate provides an indication of the global warming potential (GWP) of each greenhouse gas, expressed in terms of the GWP of one unit of carbon dioxide. Free calculation tools and guides[2] are on the GHG Protocol Corporate Standard website to help entities calculate their emissions. These tools make the process easier and help avoid mistakes. Third party providers may be able to offer support to develop emissions inventories. Interested entities should ensure they

	understand the methodology, inputs and outputs, and availability of data/calculations for audit before committing to a provider. In addition, the Clean Energy Regulator updates and releases the NGER calculators[3] every year. Even if a company does not meet the requirements for mandatory NGER reporting under the ***National Greenhouse and Energy Reporting Act 2007***, these calculators can help estimate emissions.
Step 5: Aggregate emissions data to the reporting entity level	Once emissions from all Scope 1 sources have been calculated, the final step is to combine the data from each facility, asset and activity within your entity's inventory boundary. This creates a total emissions profile that reflects your entire entity–similar to how financial information is combined for financial reporting.

Example: Scope 1 greenhouse gas emissions calculation

Consider the following example. Imagine you are reviewing internal operational records and you find that Facility A has used 20,000 litres of diesel for its fleet of light commercial vehicles. To calculate the Scope 1 emissions using the 2025 NGA Factors:

Table 2: Example calculation of Scope 1 greenhouse gas emissions

Step	Description
Step 1: Determine the sources of Scope 1 greenhouse gas emissions	Diesel fuel for light commercial vehicles–fuel used for transport produces carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).
Step 2: Choose an appropriate calculation methodology	You determine that the estimation method is the most appropriate for your entity because you have records of the amount of fuel that was used during the year.
Step 3: Gather activity data and select appropriate emission factors	***(a) Gather activity data*** Activity data = 20,000 litres of diesel, or 20 kL ***(b) Select emission factor*** The emission factor for transport fuel emissions in the NGA Factors is expressed as emissions per unit of energy or gigajoule (kg CO_2-e/GJ). You first need to convert the volume of diesel (in kL) into its equivalent energy content (in gigajoules or GJ) using the NGA Factors: Energy content factor: diesel oil in light commercial vehicles (2025) = 38.6GJ/kL Energy content = 20kL x 38.6GJ/kL = 772GJ The next step is to select the appropriate emission factor. As fuels used for transport produce CO_2, CH_4 and N_2O, the entity determines that the appropriate emission factor from the NGA Factors 2025 is the 'Combined gases' Scope 1 emission factor:

	Scope 1 emission factor for diesel oil: combined gases (2025) = 70.41 kg CO_2-e / GJ
Step 4: Use calculation tools to estimate emissions	To calculate the estimated Scope 1 greenhouse gas emissions from the use of diesel fuel in light commercial vehicles: Energy content = 722GJ Scope 1 emission factor for diesel oil: combined gases (2025) = 70.41 kg CO_2-e /GJ Estimated Scope 1 greenhouse gas emissions = 772 GJ x 70.41 kg CO_2-e /GJ = 54,356.52 kg CO_2-e (divided by 1000 to convert into tonnes = 54.36 tCO_2-e)

Note: This example uses estimates and average emission factors. It is important to use the most recent emission factors, as they are updated regularly, and to document assumptions and data sources when calculating emissions.

Key takeaways

- Identifying your entity's organisational boundary is an important first step in quantifying your greenhouse gas emissions.
- Greenhouse gas emissions (including Scope 1 emissions) are generally calculated by following a five-step process:
  Step 1: Identify emission sources
  Step 2: Choose an appropriate calculation method
  Step 3: Gather activity data and select emission factors
  Step 4: Apply calculation tools to estimate your emissions
  Step 5: Aggregate results
- The GHG Protocol Corporate Standard guides the emissions accounting process so that greenhouse gas emissions measurement is relevant, complete, consistent, transparent and accurate, but other methods may be appropriate depending on the entity's circumstances.
- It is important to verify emission factors as they are updated regularly and to document assumptions and data sources when calculating emissions.

Sources

[1] Commonwealth Department of Climate Change, Energy, the Environment and Water (2025) *Australian National Greenhouse Accounts Factors*
[2] GHG Protocol, *Calculation Tools and Guidance*
[3] Clean Energy Regulator (2025) *NGER Calculators*