Microsoft

Module 1

Scope 1 Emissions Accounting

in partnership with

ENGIE Impact and CDP DISCLOSURE INSIGHT ACTION

Start

Welcome to Module 1: Scope 1 Emissions Accounting

Before we start our training, please find the keys to our interactive PDF.

Previous page	Expand window	Key concepts	Further resources
Home	Minimize window	Steps needed to prepare for accounting emissions	
Next page	Click here for more information	Check out this video	

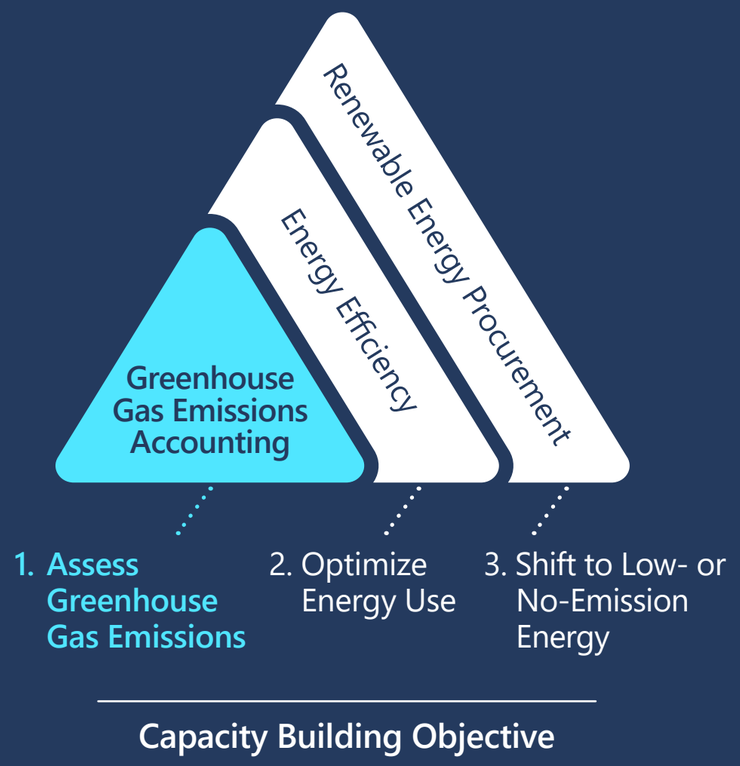
Welcome to Module 1: Scope 1 Emissions Accounting

We estimate this module will take 25 minutes for a first read-through. It can then be used as a step-by-step guide as you complete your Scope 1 emissions accounting.

This module will take you through the step-by-step process for accounting for your company's Scope 1 GHG emissions. As a reminder, Scope 1 emissions are caused by sources owned or controlled by the company — for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc. or emissions from chemical production in owned or controlled process equipment.

These emissions will be largest for companies in sectors like manufacturing, energy and freight that create a lot of their own emissions on site. They are likely to be lower for companies in sectors like professional services, financial services and information technology. However, companies in these sectors may still have Scope 1 emissions from sources like company-owned or leased vehicles.

Learning objectives



This training is the first part of a capacity building series on reducing energy-related greenhouse gas emissions

In this module, you will learn:

- The benefits and challenges of using free GHG emissions accounting tools to help you with accounting Scope 1 emissions
- The five overarching steps to calculate Scope 1 emissions
- The complicating factors to be aware of when calculating Scope 1 emissions
- How to use the GHG Emissions Calculation Tool to do your Scope 1 emissions accounting

Once you complete this module, the following modules remain:

Module 2

Scope 2 Emissions Accounting

Module 3

Scope 3 Emissions Accounting

Module 4

Emissions Reductions 101

Terms to know before you get started

Activity data

Fugitive sources

Emissions factor

Physical/ chemical processes

Before we dive in

Before we dive in, let's first talk about how tools can help you with emissions accounting

There are a variety of different free tools available to help with emissions accounting. They have a set of benefits and challenges that are outlined below:

Benefits

Challenges

For companies at the beginning of their emissions accounting journey, we suggest using the GHG Emissions Calculation Tool for Scope 1 accounting for the following reasons:

- It was developed by the World Resources Institute (WRI) and strictly follows the GHG Protocol guidance
- It has been recently updated (as of March 2021) and is likely to be updated periodically
- It allows users to easily include their own emissions factors (we will explain this in more detail later in this module)

This tool can be accessed **here**.

More tools and databases are listed on the GHG Protocol website if you'd like to learn more about options beyond the GHG Emissions Calculation Tool.

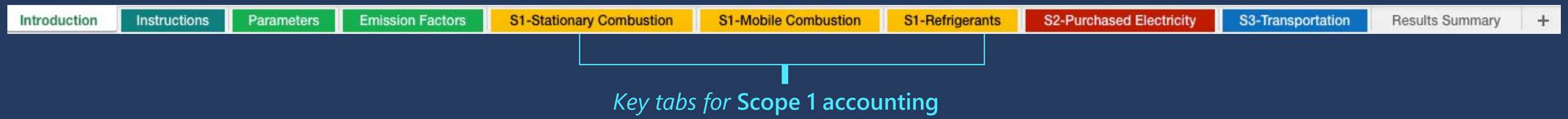
How does the GHG Emissions Calculation Tool work?

The GHG Emissions Calculation Tool is an Excel-workbook with different tabs for accounting various emissions from your company's activities.

Detailed instructions walk the user through the different elements of the tool

The tool clearly indicates what emissions sources are covered

These are the tabs that you'll want to focus on for Scope 1 emissions accounting. We will talk about the other tabs in later modules.



Key tabs for **Scope 1 accounting**

What is the step-by-step process for calculating Scope 1 emissions?

Below is the step-by-step approach to calculating Scope 1 emissions. On the most basic level, these steps involve two main types of activities: gathering data and doing multiplication. Using the GHG Emissions Calculation Tool will help you do most of these steps in one place. The rest of this module will take you through these five steps.

Steps involving gathering data | **Steps involving doing multiplication**

A

Develop a comprehensive list of all Scope 1 emissions sources associated with four types of sources:

- Stationary combustion
- Mobile combustion
- Fugitive sources
- Physical/chemical processes

B

Compile annual activity, usage, and consumption data from your company

C

Identify appropriate emissions factors for each type of GHG (We will explain this in more detail later in this module.)

D

Estimate CO_2, CH_4, and N_2O emissions (and any other applicable GHGs) by multiplying the results of steps B, and C

E

Convert to carbon dioxide equivalents (CO_2e). (Think of this as translating other types of GHG emissions into their CO_2 equivalent so that all emissions can be added together.)

Note: Some emissions factors convert to CO_2e for you, in which case you can skip this step.

The GHG Emissions Calculation Tool will help you with these 3 steps

Step A

Review the below checklist of emissions sources and create a list of those that apply to your company

Below we define each type of Scope 1 emissions and provide a checklist of where these emissions come from. Read through these definitions and then create a list of all of the different sources that apply to your company. Many of these emissions apply to sectors associated with manufacturing, energy and freight that create a lot of their own emissions on site.

Emission type	Definition	Source checklist
Stationary combustion	Emissions from stationary combustion of fuels in company-owned or controlled stationary sources	✓ Combustion of fuels in boilers ✓ Combustion of fuels in furnaces ✓ Combustion of fuels in burners ✓ Combustion of fuels in turbines ✓ On-site energy production
Mobile combustion	Emissions from mobile combustion of fuels in company-owned or controlled mobile sources	Combustion of fuel in vehicles owned or leased by your company used for transport of: ✓ Materials ✓ Products ✓ Waste ✓ Employees
Fugitive sources	Emissions from intentional or unintentional releases from the production, processing, transmission, storage and use of fuels and other substances that do no pass through a stack, chimney, vent or exhaust pipe	✓ Releases of SF_6 from electrical equipment ✓ HFC releases during the use of refrigeration and air conditioning equipment ✓ CH_4 leakage form natural gas transport
Physical/chemical processes	Emissions from any physical or chemical processes other than fuel combustion	Release of CO_2 or other GHGs associated with the manufacture of: ✓ Cement ✓ Aluminum ✓ Steel

Step B

Compile annual activity, usage and consumption data: Where can I find data in my company?

Emission type	Where to find at your company
Stationary combustion	✓ Utility bills for natural gas, propane and fuel oil ✓ Invoices for fuel purchases ✓ Data on duration of operation of equipment *Note: This will need to be multiplied by the fuel consumption rate to estimate total fuel consumption*
Mobile combustion	✓ Invoices for fuel purchases for your fleet ✓ Data on vehicle mileage (can use odometer readings) multiplied by reported fuel economy rate to estimate total fuel consumption
Fugitive sources	✓ HVAC or refrigeration maintenance records showing quantity of refrigerants used and purchased
Physical/chemical processes* *(relevant to only certain industry sectors (e.g., oil & gas, cement, aluminum, etc))*	✓ Process manager/engineer ✓ Manufacturing manager/engineer

** Note, for the purposes of this module, it is assumed that process emissions will likely not be applicable. If Process Emissions are relevant to your organization's operations, consult "sector-specific tools" via GHG Protocol (**https://ghgprotocol.org/calculation-tools**)*

Step C

Identify appropriate emissions factors: Where do I find emissions factors?

What is an emissions factor?

If I'm using the GHG Emissions Calculation Tool, do I still need to find emissions factors?

Does using outdated emissions factors make my GHG inventory wrong?

If I want to find the most up-to-date emissions factors, where should I look?

Step C

Identify appropriate emissions factors: Where can I find the most up to date emissions factors?

There is no "one-stop-shop" for emissions factors. Various organizations and agencies compile data to develop factors in different ways that result in different factors. Furthermore, emissions factors are revised/refined as the science evolves and methods are improved.

Below are three places to look for the most up-to-date emissions factors for Scope 1 emissions accounting:

United States Environmental Protection Agency (US EPA)
GHG Emission Factors Hub

Access **here**
(Click on the PDF or Excel Workbook titled: GHG Emissions Factors Hub)

Benefits: Relatively user-friendly, free of charge

Challenges: US-only

The Climate Registry Default Emission Factors

Access **here**

Benefits: Includes factors for US and Canada

Challenges: Relatively less user-friendly, (many emissions factors spread out across numerous tables)

UK Department for Environment Food & Rural Affairs (DEFRA)

Access **here**

Benefits: UK emissions factors that can also be used as a proxy for other countries.

If you can't find the emissions factors you need from the other two sources, then check here

We understand that these data bases are a little confusing to navigate – please check out the emissions factor tutorial video for additional guidance.

Step D

Putting it all together: Estimate emissions

Now we take the numbers we gathered in Steps B and C and put them together to estimate emissions. The calculations may seem complex at first glance, but it's a just few multiplication steps. At a high level, all you're doing is taking your activity data (collected in Step B) and your emissions factors (collected in Step C) and inputting them into the formula below:

Activity data from Step B	x	Emissions factor from Step C	=	Emissions

You'll apply the calculations set out in Steps D and E for each activity data point that you gathered in Step B. In the following pages, we'll take you through the step-by-step calculation process for one activity data point. Once you understand the steps, you can then repeat them for each activity data point.

Step
D

Putting it all together: Estimate emissions

There are two complicating factors that we'll cover in more detail on the following pages:

Complicating factor 1

You'll need to do multiple calculations for each activity data point.

Burning fossil fuels generally emits three different types of GHG emissions: CO_2, CH_4 and N_2O. This means that instead of the one calculation shown on the previous page, you'll actually have to do three calculations: one for CO_2, one for CH_4 and one for N_2O.

Complicating factor 2

You'll need to make sure you get your units of measure right.

In order to do the multiplication shown on the previous page, you'll need to keep a close eye on your units of measure. You can't multiply activity data by emissions factors unless you've converted both to the right units.

We'll explain these in more detail on the following pages.
The good news is that the GHG Emissions Calculation Tool will help you address both of these things.

Step **D**

Complicating factor **1**

Why you need to do multiple calculations for each activity data point

As we mentioned on the previous page, the first complicating factor is that you'll need to do a few sets of multiplication to get total GHG emissions for each activity data point. The reason is because burning fossil fuels generally creates three different types of GHG emissions: CO_2, CH_4 and N_2O. This means that instead of one calculation, you'll actually have to do three calculations:

For each activity data point

- **For CO_2:** (Activity data from Step B) x (Emissions factor from step C for CO_2) = Emissions for that activity data point
- **For CH_4:** (Activity data from Step B) x (Emissions factor from step C for CH_4) = Emissions for that activity data point
- **For N_2O:** (Activity data from Step B) x (Emissions factor from step C for N_2O) = Emissions for that activity data point

Step **D**

Complicating factor 1

Why you need to do multiple calculations for each activity data point

For each activity data point

- **For CO_2:** (Activity data from Step B) x (Emissions factor from step C for CO_2) = Emissions for that activity data point
- **For CH_4:** (Activity data from Step B) x (Emissions factor from step C for CH_4) = Emissions for that activity data point
- **For N_2O:** (Activity data from Step B) x (Emissions factor from step C for N_2O) = Emissions for that activity data point

For example, if you have collected the following:

Step **B** You collected activity data for 500 gallons of diesel fuel used in a stationary generator

Step **C** You collected the following emissions factors for diesel fuel: 10.21 kg CO_2/gallon, 0.41 g CH_4/gallon, 0.08 g N_2O/gallon

You can calculate:

For CO_2: (500 gallons) x (10.21 kg CO_2/gallon) = 5,105 kg of CO_2

For CH_4: (500 gallons) x (0.41 g CH_4/gallon) = 205 g of CH_4

For N_2O: (500 gallons) x (0.08 g N_2O/gallon) = 40 g of N_20

Step D

Complicating factor 1

What does this look like using the GHG Emissions Calculation Tool?

In the screenshot below, we show you what this looks like in practice using the GHG Emissions Calculation Tool:

Introduction | Parameter Input | Scope 1 Stationary Combustion | Scope 1 Mobile Combustion | Scope 1 Refrigerants | Scope 2 Purchased Electricity | Scope 3 Transportation | Result Summary | Emission Factors

S1 - Stationary Combustion

Includes fuel consumption at a facility to produce electricity, steam, heat, or power. The combustion of fossil fuels by natural gas boilers, diesel generators and other equipment emits carbon dioxide, methane, and nitrous oxide into the atmosphere.

Data required:
1. Fuel type
2. Fuel Usage
3. Units for usage (volume or weight)

Emissions $_{GHG, fuel}$ = **Fuel Consumption** $_{fuel}$ * **Emission Factor** $_{GHG, fuel}$

User supplied data						GHG Emissions (tonnes CO_2e)					Emission Factor	
Facility ID	Year	Custom Emission Factors?	Fuel	Amount of fuel	Units (e.g., kg or kWh)	CO_2 (tonnes)	CH_4 (tonnes)	N_2O (tonnes)	CO_2e (tonnes)	Biofuel CO_2 (tonnes)	EF ($kgCO_2e$/unit)	Source
1	2019	Yes	Example S1	10	mmBtu	0.050	0.0010000	0.0005000	0.211		22.4	Company operations
2	2019	No	Natural Gas	100	mmBtu	5.306	0.0001000	0.0000100	5.311	0.000	53.1145	EPA, "Emission Factors for Greenhouse Gas Inventories," Table 1 Stationary Combustion Emission Factors, March 9, 2018 (https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub).

Step **D**

Complicating factor **2**

Why it's important to get your units of measure right

If you look at the results of your three formulas on page 19, you'll see that they are in different units (g and kg). In order to move on to Step E (the final step!) you'll need to make sure these are all in the same units of measure. In this case, we will convert them all into kilograms (kg).

For CO_2: 5,105 kg of CO_2 = 5,105 kg of CO_2 (no change needed)

For CH_4: 205 g of CH_4 = 0.205 kg of CH_4

For N_2O: 40 g of N_20 = 0.04 kg of N_20

Note: *While this unit conversion was relatively simple, some calculations may require a greater degree of unit conversion. For example, if your activity data is in liters but your emissions factor is in grams per gallons, you need to convert liters to gallons and grams to kilograms. Make sure to be on the lookout for matching all of your units for all of your activity data and emissions factors. The good news is that the GHG Emissions Calculation Tool will help you with this. Move to the next page to understand how.*

Step D

Complicating factor 2

How can the GHG Emissions Calculation Tool help you get your units of measure right?

Introduction | Parameter Input | Scope 1 Stationary Combustion | Scope 1 Mobile Combustion | Scope 1 Refrigerants | Scope 2 Purchased Electricity | Scope 3 Transportation | Result Summary | Emission Factors

S1 - Stationary Combustion

Includes fuel consumption at a facility to produce electricity, steam, heat, or power. The combustion of fossil fuels by natural gas boilers, diesel generators and other equipment emits carbon dioxide, methane, and nitrous oxide into the atmosphere.

Data required:
1. Fuel type
2. Fuel Usage
3. Units for usage (volume or weight)

Emissions $_{GHG, fuel}$ = **Fuel Consumption** $_{fuel}$ * **Emission Factor** $_{GHG, fuel}$

User supplied data						GHG Emissions (tonnes CO_2e)					Emission Factor	
Facility ID	Year	Custom Emission Factors?	Fuel	Amount of fuel	Units (e.g., kg or kWh)	CO_2 (tonnes)	CH_4 (tonnes)	N_2O (tonnes)	CO_2e (tonnes)	Biofuel CO_2 (tonnes)	EF ($kgCO_2e$/unit)	Source
1	2019	Yes	Example S1	10	mmBtu	0.050	0.0010000	0.0005000	0.211		22.4	Company operations
2	2019	No	Natural Gas	100	mmBtu	5.306	0.0001000	0.0000100	5.311	0.000	53.1145	EPA, "Emission Factors for Greenhouse Gas Inventories," Table 1 Stationary Combustion Emission Factors, March 9, 2018 (https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub).

Step **E**

Convert your Step D results into CO_2-equivalents (CO_2e)

As we mentioned in **Module 0**, CO_2e is a simple way of normalizing non-CO_2 greenhouse gases to the reference gas CO_2 using Global Warming Potentials (GWP). GWP is a factor describing the relative heat trapping ability of GHGs in the atmosphere as compared to CO_2. GWP is explained in greater detail in **Module 0**.

Remember, *think of this as translating other types of GHG emissions into their CO_2 equivalent so that all emissions can be added together.*

Note! *In some cases your emissions factors will have already converted your answer to CO_2e. If this is the case, then you can skip Step E.*

Step E

Convert your Step D results into CO_2-equivalents (CO_2e)

To do this, simply take your results from Step D and multiply them by the GWP for the given gas. CO_2 won't change because you simply multiply it by 1; however, CH_4 and N_2O amounts will be much larger because you multiply them by 28 and 265, respectively. See below:

Greenhouse gas	Global warming potential (GWP)
Carbon dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous oxide (N_2O)	265

Now that all of your results are in terms of CO_2e, you can add them all together to get the total GHGs for your first activity data point. For reporting purposes, you'll also want to convert from kg of CO_2e to metric tons of CO_2e. (The GHG Emissions Calculation Tool will also do this for you.)

For CO_2: 5,105 kg of CO_2 x 1 = 5,105 kg of CO_2e

For CH_4: 0.205 kg of CH_4 x 28 = 5.75 kg of CO_2e

For N_2O: 40 g of N_2O x 265 = 10.6 kg of CO_2e

Total = 5,148 kg of CO_2e = 5.1 metric tons CO_2e

Now repeat this process for all of the activity data points in your list.
Navigate to the next page to see how the GHG Emissions Calculation Tool can make this easier for you.

Step E

How can the GHG Emissions Calculation Tool help you convert to CO_2e and simplify calculations for each activity data point?

Introduction | Parameter Input | Scope 1 Stationary Combustion | Scope 1 Mobile Combustion | Scope 1 Refrigerants | Scope 2 Purchased Electricity | Scope 3 Transportation | Result Summary | Emission Factors

S1 - Stationary Combustion

Includes fuel consumption at a facility to produce electricity, steam, heat, or power. The combustion of fossil fuels by natural gas boilers, diesel generators and other equipment emits carbon dioxide, methane, and nitrous oxide into the atmosphere.

Data required:
1. Fuel type
2. Fuel Usage
3. Units for usage (volume or weight)

Emissions $_{GHG, fuel}$ = **Fuel Consumption** $_{fuel}$ * **Emission Factor** $_{GHG, fuel}$

Now this process (Steps A-E) can be repeated by adding a new line for each activity data point

User supplied data						GHG Emissions (tonnes CO_2e)					Emission Factor	
Facility ID	Year	Custom Emission Factors?	Fuel	Amount of fuel	Units (e.g., kg or kWh)	CO_2 (tonnes)	CH_4 (tonnes)	N_2O (tonnes)	CO_2e (tonnes)	Biofuel CO_2 (tonnes)	EF ($kgCO_2e$/unit)	Source
1	2019	Yes	Example S1	10	mmBtu	0.050	0.0010000	0.0005000	0.211		22.4	Company operations
2	2019	No	Natural Gas	100	mmBtu	5.306	0.0001000	0.0000100	5.311	0.000	53.1145	EPA, "Emission Factors for Greenhouse Gas Inventories," Table 1 Stationary Combustion Emission Factors, March 9, 2018 (https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub).

Now that you know the steps for calculating Scope 1 emissions from burning fossil fuels, you may also want to consider calculating Scope 1 fugitive emissions.

Does my company have any fugitive emissions? If so, how do I account for them?

The most common form of fugitive emissions results from the use of refrigeration and air conditioning (AC) equipment, which releases hydrofluorocarbons (HFC_s) and perfluorocarbons (PFC_s) – GHGs with very high GWP levels! If your company uses refrigeration or air conditioning equipment, you're likely to have some of these emissions.

The overall concept for calculating fugitive emissions is the same as for other Scope 1 emissions:

Activity data	x	Emissions factor	=	Emissions

However, in this case, the activity data comes from the volume of fugitive refrigerants and not from the quantity of fossil fuels burned. There are many different refrigerant types, and using a tool can help you keep track of them.

The GHG Emissions Calculation Tool provides three approaches to quantifying fugitive emissions from refrigerants:

Approach 1-2

These “Sales-Based” Approaches are the most accurate and easiest to use

Approach 1 is designed for manufacturers of refrigeration and air conditioning equipment.

Approach 2 is designed for users of refrigeration and air conditioning equipment who maintain their own equipment.

Approach 3

The“Life-Cycle Stage” Approach

Approach 3 is designed for equipment users who have contractors maintain their air conditioning and refrigeration equipment.

How can the GHG Emissions Calculation Tool help me account for fugitive emissions?

If you're using Approach 1-2:

Find data by looking for purchase and service records tracking emissions from manufacturing, servicing, and disposal of refrigeration equipment.

If you're using Approach 3:

Find data by speaking to the contractor that services your refrigeration and air conditioning equipment.

Regardless of which approach you use, you'll need to gather the following data categories:

- Equipment and refrigerant type
- Refrigerant inventory (kgs)
- Purchases/acquisitions of Refrigerants (kgs)
- Sales/disbursements of Refrigerant (kgs)

Feed this data into the "S1-Refrigerants" tab of the GHG Emissions Calculation Tool

Once I've calculated my emissions, how and where do I report them?

How do I report my emissions?

What are some common pitfalls to lookout for?

Where do I report my emissions?

What's an example of what this looks like in a report?

Congratulations! You've completed Module 1: Scope 1 Emissions Accounting

Here's a quick recap. Now that you've completed this module you should understand:

- ✓ There are five overarching steps to calculating Scope 1 emissions:
  - ✓ **Step A:** Develop a comprehensive list of all Scope 1 emissions sources associated with the four types of Scope 1 emissions.
  - ✓ **Step B:** Compile annual activity/usage/consumption data from your company.
  - ✓ **Step C:** Identify appropriate emissions factors for each data point.
  - ✓ **Step D:** Estimate CO_2, CH_4, and N_2O emissions (and emissions for any other applicable GHGs) by multiplying activity/usage/consumption data and emissions factors.
  - ✓ **Step E:** Convert to carbon dioxide equivalents (CO_2e) in metric tons.
- ✓ The GHG Emissions Calculation Tool will help you complete steps C, D and E by providing emissions factors, completing calculations and helping you keep track of your units of measure.

Congratulations! You've completed Module 1: Scope 1 Emissions Accounting

Scope 1, 2 and 3 emissions are usually reported all together, move on to Modules 2 and 3 to learn about calculating Scope 2 and 3 emissions:

Module 2

Scope 2 Emissions Accounting

Module 3

Scope 3 Emissions Accounting

Module 4

Emissions Reductions 101

Looking for additional support?

Check out CDP's list of
accredited solutions providers

Microsoft