CLIMATE ACTION TRAINING FOR THE FASHION INDUSTRY

Module 3: GHG Accounting

Contents

1. Introduction

Welcome to the third module of the online training 'Climate Action for the Fashion Industry'.

1.1. Key lessons

In this module, you will learn about:

- **Overview of corporate GHG accounting:** what are the principles and steps of corporate GHG accounting?

- **Setting the boundaries:** how do we determine our reporting boundaries?

- **Activity data:** what are the relevant sources of information to be collected internally and by suppliers for conducting GHG accounting?

- **Measuring GHG footprint:** what is the general procedure to calculate GHG emissions related to activity data? What role do emission factors play, and how to obtain them?

1.2. Scope 1-3 emissions

a. **Scope 1 emissions:** how do we calculate direct emissions?
   - Stationary and mobile combustion
   - Refrigeration and air-conditioning equipment

b. **Scope 2 emissions:** how do we calculate indirect emissions from purchased energy?
   - Grid electricity
   - Purchased steam

c. **Scope 3 emissions:** when and how do suppliers measure emissions from upstream and downstream activities?

You can check and apply what you have learned at the end of the module by:

- Checking your knowledge in a short quiz covering the main topics of this module.

- Calculating your company's emission in a **real-life assignment**.

- You can also have a look at **the frequently asked questions (FAQs)** concerning this module's topic at the end of the lesson.

How much time should I plan for this module?

Going through the core content of this module will take approximately 2-3 hours.

For the assignments, set aside another 3-4 hours.

Before we start, take a minute to reflect:

What are the skills you expect to gain from taking this module?

Think about this before you continue. If you like, note down your expectations so that you can revisit them at the end of the module.

2. Overview of Corporate GHG Accounting

As you learned in Module 2, **GHG accounting** is the process by which a corporation or an organisation measures the total GHG emissions emitted directly or indirectly from their own operations in CO_2 equivalent (CO_2e).

We refer to **GHG inventory** as the total GHG emissions of a corporation as CO_2 equivalents within specific boundaries, such as a specified time span (usually one year) and specified areas (e.g., all sites a company owns).

In the previous module, we recommended following the GHG Protocol as it is the most widely used international standard. To ensure consistency, we will follow the Protocol again for this Module.

2.1. Five accounting principles according to GHG Protocol

Relevance
Include relevant boundaries for decision-making.
In practice, this means establishing GHG inventory boundaries that accurately reflect the GHG emissions of the organisation and serve the decision-making needs of internal and external users.

Completeness
Comprehensive emission sources.
In practice, this is related to establishing and reporting all emission sources within the GHG boundaries. Any specific exclusions should be disclosed and justified.

Consistency
Comparable GHG emissions over time.
This means establishing a process to calculate GHG footprints, including the emission factors used. Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently record any changes to the GHG emissions data, inventory boundary methods, or any other relevant information that may affect the data over time.

Transparency
Implement clear documentation and processes.

Transparency is about documentation. Disclose any GHG inventory processes, relevant assumptions and appropriate references to the accounting and calculation methodologies and data sources used.

Accuracy

Data and calculations should be as precise as possible to reduce uncertainties and ensure the integrity of the information.

When conducting GHG accounting, you should collect as much primary data as possible to ensure the accuracy of emissions calculations and minimise uncertainty. This creates credible results for both accounting and reporting activities that help with decision-making.

2.2. Major Milestones for Annual GHG Accounting

What are the major milestones in the GHG accounting process?

a. Step 1: Setting the boundaries

First, determine which activities generate GHG emissions and should be included in the GHG inventory. This is known as identifying organisational boundaries (to be explained further below).

b. Step 2: Identifying and collecting activity data under different scopes

Next, you identify the emission sources within this established boundary (e.g. the fuel consumption of boilers, company-owned vehicles or purchased electricity, heat or steam). Then, you collect activity data for the identified sources.

c. Step 3: Identifying conversion and emission factors, and calculating emissions

In this step, you first need to identify the appropriate conversion factors (also known as heat values) and emissions coefficients (also known as emission factors) to convert data to GHG emissions. Then, you calculate the GHG emissions that result from the assessed activities, such as CO_2e released due to the fuel consumption of on-site boilers.

Now you know which steps to take. It's time to delegate a team with responsible staff to support the process.

2.3. Possible Team Structure for GHG Accounting

When selecting your delegates, consider the following aspects:

- The responsible staff/team needs to be familiar with the global standards and process of GHG accounting (e.g., types and methodologies of accounting).

- The responsible staff/team will need to work closely with the management and accounting departments to collect primary data.

- Plan ahead – GHG accounting takes time depending on the scope and activities included. As you will see in the lesson below, data collection and processing can be challenging and time consuming, especially for a first timer. However, once you have established boundaries, emission sources, metrics, and emission factors, GHG accounting for subsequent years will take less time.

Before we get into details on how to do GHG accounting, let's think for a minute who within the organisation should measure the carbon footprint?

The team structure will be different depending on the comapny structure and it determines the approach taken to GHG accounting (to be explained soon). The below illustration summarizes the differences in team structure:
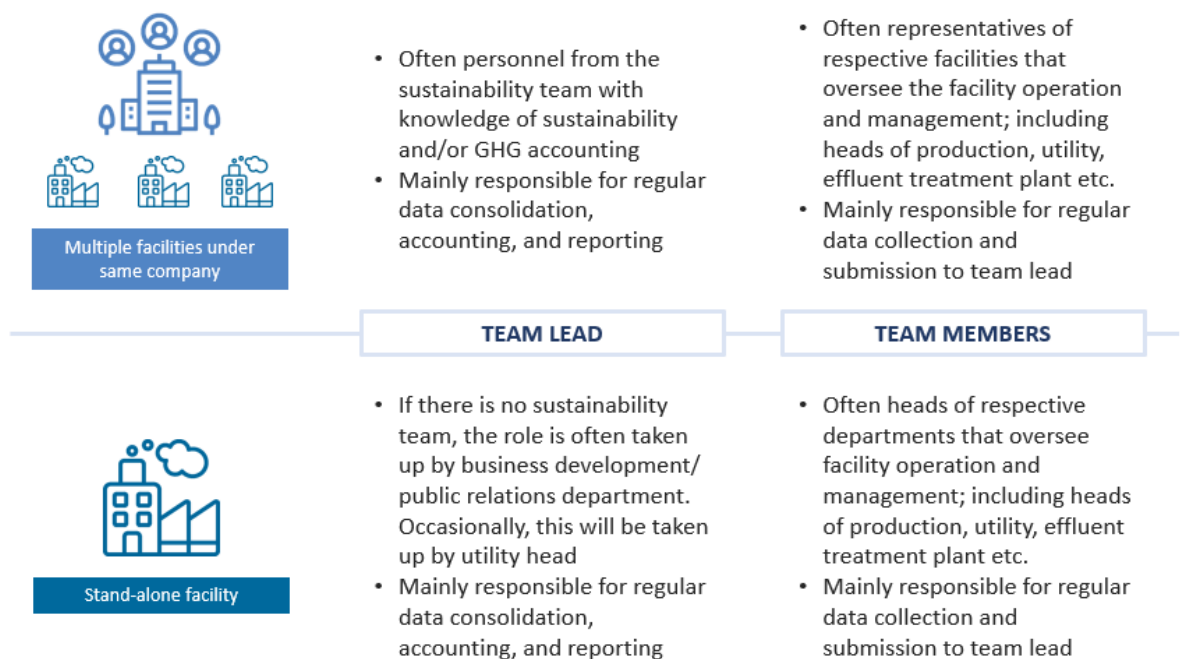
Figure 2-1 Team structure for GHG accounting

2.4. Approaches to Corporate GHG Accounting

From the previous session, we understand that for a stand-alone facility, the team lead will be responsible for consolidating all activity data, GHG accounting and reporting. However, for a company with more than 1 facility under its wings, there are two approaches to GHG accounting and reporting.

a. Centralised

In this approach, individual facilities report information to the corporate level, where GHG emissions are then calculated.
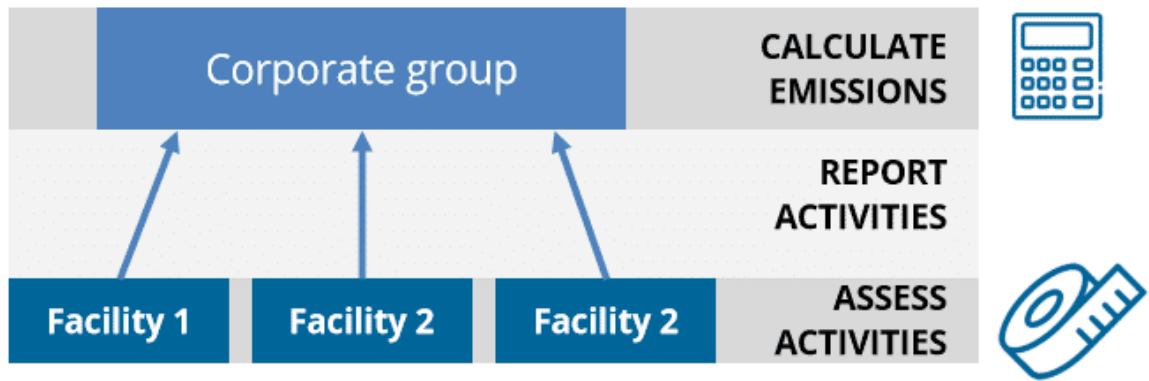
Figure 2-2 Centralized GHG reporting approach

b. Decentralised

In contrast to the centralised approach, here individual facilities collect activities information, directly calculate their GHG emissions using approved methods. This data is then reported to the corporate level.

In reality, manufacturers will probably find a blend of centralised and decentralised to be the best approach. It is common that the corporate group establishes a reporting mechanism or tool for their facilities to evaluate their GHG emissions. This resulting data is then sent back to the corporate group for aggregation and analysis.
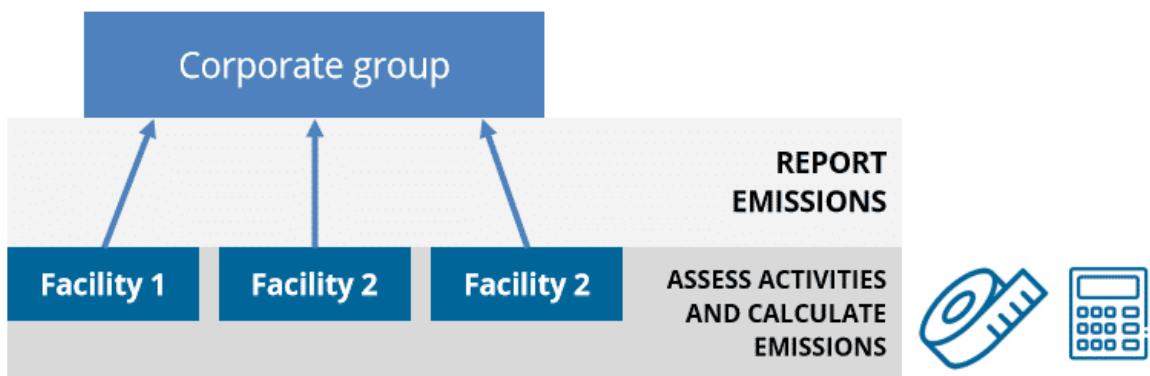
Figure 2-3 Decentralized GHG reporting approach

2.5. Overview of GHG Accounting Process

- Appoint staff or create a team that is responsible for data collection and calculating the GHG footprint.

- Define your organisational and operational boundaries.

- Understand the activity data you will need to calculate the footprint.

- List the relevant activity data. In practice, you should create a data collection template (e.g. Excel) to capture activity data such as fuel, electricity or other energy consumption at each site.

- Processing data (calculation). Recent or updated activity data should be used as much as possible to increase accuracy. You will learn how to use available GHG tools to perform these calculations later in this module.

We will discuss points 2-5 later.

3. Setting the Boundaries

Let's start with the first step in creating a GHG inventory: **setting the boundaries**.

The boundaries are imaginary lines that encompass the emissions you want to include in your inventory. Setting boundaries is crucial for identifying and gathering the relevant data. There are two different boundaries that need to be defined: **organisational and operational boundaries**.

3.1. Organisational Boundaries

The first step is to define the organisational boundaries. In general, a company's operations vary in their organisational structure, which may include wholly owned operations, joint ventures, subsidiaries and many more.

If you have business involvement in some operations but do not fully own them, defining your organisational boundaries will help you determine the business units and operations to include in your GHG accounting and reporting. There are two approaches to identify organisational boundaries:

3.1.1. Equity Share Approach

A reporting company accounts for emissions according to its share of equity in its operational sites, even if it has no financial or operational control over them. This approach is appropriate for large multinational companies.

Factory A
has 50% equity share
1,000 Mt CO$_2$e/yr
Account for 500 Mt

Factory B
has 85% equity share
1,000 Mt CO$_2$e/yr
Account for 850 Mt

Figure 3-1 Equity share approach

3.1.2. Control Approach

a. Operational control approach

A reporting company accounts for 100% of GHG emissions from **operations over which it or one of its subsidiaries has control**. This is the approach we would normally recommend, especially for a simple company (no joint ventures etc).

b. Financial control approach

A reporting company accounts for GHG emissions from all operational sites whose **cash flows** it controls.
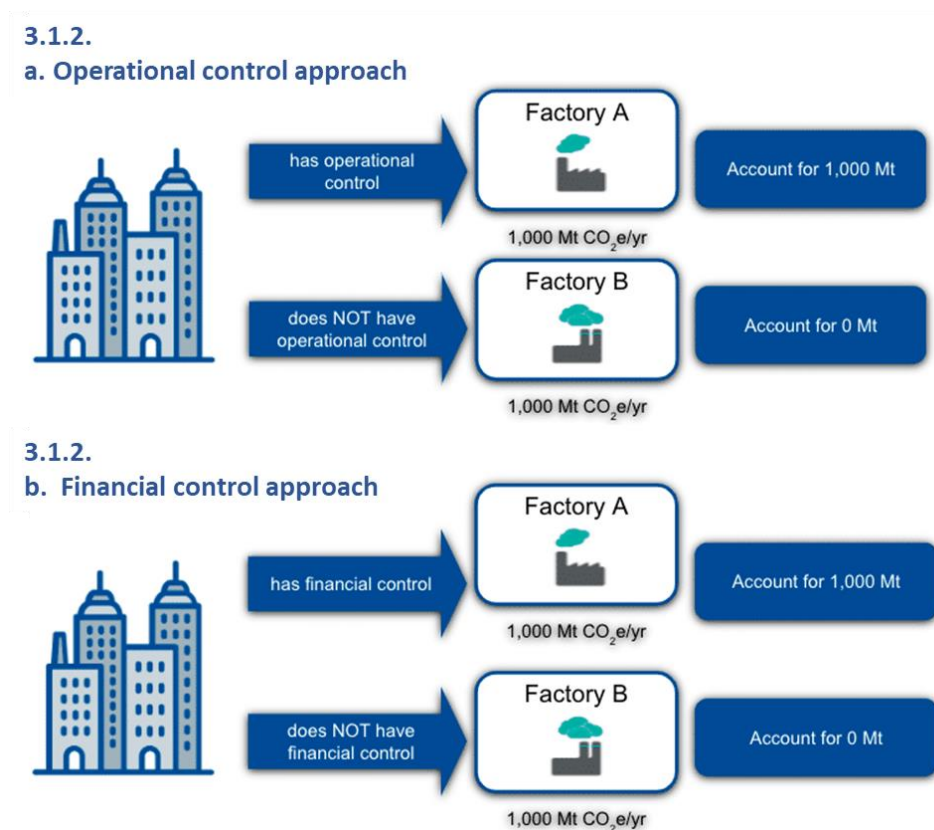
Figure 3-2 GHG reporting with operational and financial approach

3.2. Operational Boundary

Once a company has determined its organisational boundaries, the next step is to identify the emission releasing activities to be included (also known as **operational boundaries**).

Examples of emission-releasing activities include the combustion of natural gas in your boiler, consumption of electricity and purchase energy. These activities are commonly classified into three scopes. Let's recall what Scope 1, 2 and 3 emissions are. You might remember this image:
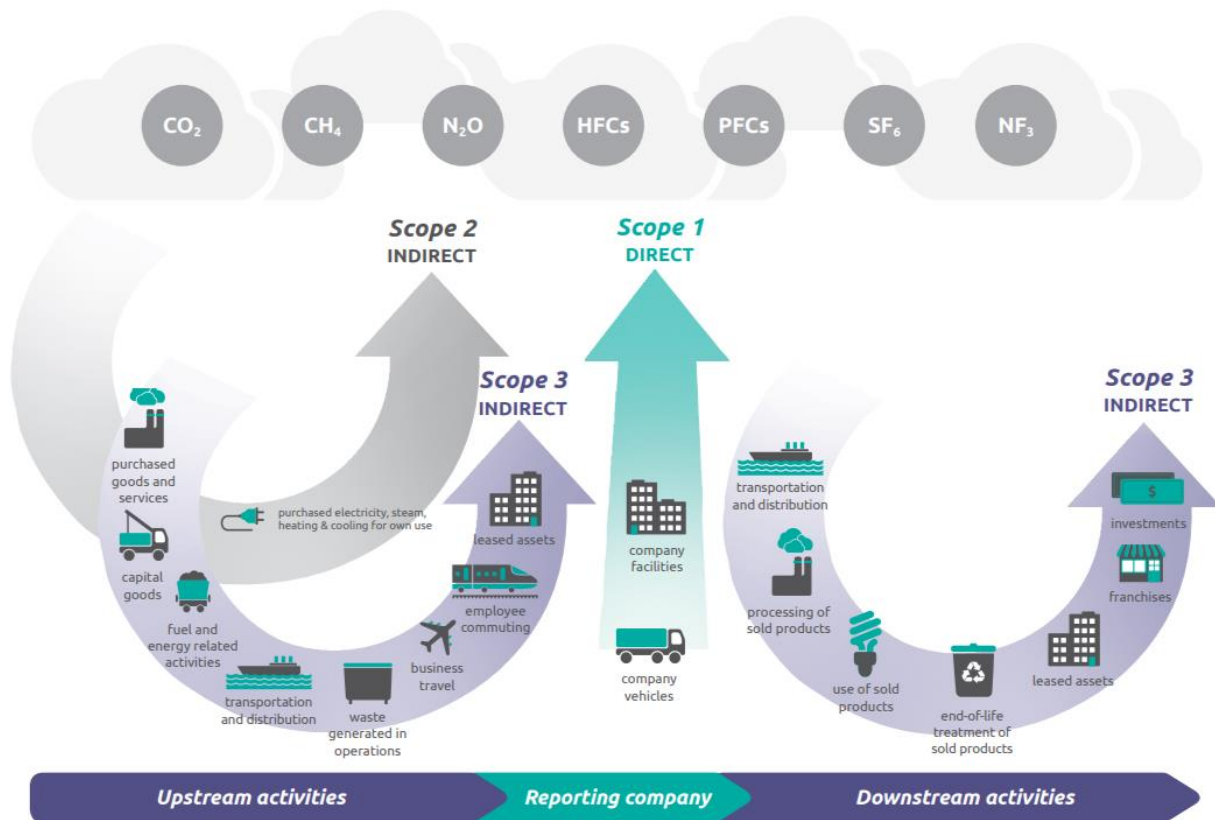
Figure 3-3 Illustration of Scope 1-3 emissions

Source: Technical Guidance for Calculating Scope 3 Emissions, the Greenhouse Gas Protocol

As you can see from the image, a company can further subdivide emissions data within scopes by **source type** (stationary and mobile combustion, fugitive emissions, etc.) and **activity type** (purchased or generation of electricity, etc.).

Depending on a company's business goals, or where the company sits in the value chain, a company can consider whether to account for only Scope 1 and 2 emissions or to include relevant Scope 3 categories for its operations. **As this is an introductory course for GHG accounting, it will focus on how to calculate Scope 1 and 2 emissions for suppliers**.

In summary, if you have a simple organisation where you own all operations, you just start with defining the so-called operational boundaries because all the owned operations should be included in your GHG inventory. However, if you have a more complex organisation, for example one with subsidiaries or joint ventures, you need to identify which operations (or share of operations) you need to include. This means that you need to define your organisational boundaries before defining your operational boundaries.

[Exercise 1]

GHG Accounting Under Different Organizational Boundaries

How familiar are you with various organizational boundaries? Let's take a look at an example from the Greenhouse Gas Protocol's Corporate Standard Training Webinar.

Your company (Company Z) utilizes 5 facilities for manufacturing, of which only one is fully owned by you and the rest are joint operations. Your business relationship with each of the facilities is seen in the table. Can you tell us which facility is within the organizational boundary under respective control approaches?

Facility	Ownership	Financial Control (Yes/No)	Operational Control (Yes/No)
A	25%	No	No
B	51%	No	Yes
C	100%	Yes	No
D	30%	Yes	Yes
E	49%	No	Yes

In the table below, apply the consolidation rules on the total emissions of each of these five facilities separately to calculate the emissions your company (Company Z) would account for:

Facilities	Total Facility Level Emissions (tCO2e)	Emissions (tCO2e)		
		Financial Control Approach (tCO2e)	Operational Control Approach (tCO2e)	Equity Share Approach (tCO2e)
A	500	0	0	125
B	1,000	0	1,000	510
C	1,000	1,000	0	1,000
D	5,000	5,000	5,000	1,500
E	2,000	0	2,000	980
Company Z's total emissions	6,000	8,000	4,115

4. Typical Activity Data for Textile and Garment Industry

Once you have chosen suitable organisational and operational boundaries for your accounting activities, the next step is to collect activity data that falls under the Scope 1 and 2 categories.

4.1. What is activity data?

Activity data is a quantitative measure of an activity that results in GHG emissions. They are usually measured in the following units:

- litres/gallons (e.g. for diesel)

- kilograms/tonnes (e.g. for coal)

- kilometres (for distances)

- MWh (for electricity)

- M^3/kg (for natural gas)

4.2. Identify Emission Source/ Activities

a. **Scope 1 emission sources** include **direct emissions from company-owned onsite stationery equipment and non-stationery equipment**:
- On-site fuel combustion for manufacturing processes (e.g., stenter and boiler).

- Fugitive emissions leakage (air conditioners and refrigerators).

- Company owned and operated vehicles for company operations.

- Onsite wastewater treatment processes (domestic and/or industrial).

- Operation of equipment (e.g., forklift and backup power generator).

- Cooking at onsite facilities (e.g., canteen and dormitory).

b. **Sope 2 emission sources** include **indirect emissions from purchased energy** used onsite:
- Grid electricity for all equipment within the facility boundary (machinery, lighting, heating/cooling etc.).

- Purchased heat and steam (e.g., cotton washing and steam processes).

c. **Scope 3 emission sources** include **indirect emissions from other activities** that are **not categorized under scope 1 and 2**:
- Your supplier's activities (upstream).

- Your clients' activities (downstream).

- Your facility's waste disposal and outsources activities.

4.3. Scope 1 and 2 Emissions Data Collection

To calculate your Scope 1 and 2 emissions, you will need information on the consumption of fuel and water from the above activities. Think about:

- How much did your company spend on gas, coal, oil, or biofuels used for generators, heat-intensive processes or boilers over a one-year period?

- How much fuel is used for your company's owned or operated vehicles over a one-year period?

- How much was spent on refrigerant purchases for air conditioning over a one-year period?

To answer these questions, you can refer to **fuel invoices**, **purchase records** or **meter records**. If you cannot get the invoices, try to estimate the consumption using other parameters.

4.3.1. Activity Data Collection with Higg FEM

If you are already using Higg FEM to track and report your environmental performance, you would be familiar with what energy sources are used at your facility and from where you can find the data. In this session, we will illustrate how you can leverage the Higg FEM for GHG accounting. All data collected via HIGG can be used for GHG accounting calculation. The table below lists some of the common activity data found in the Textile and Apparel Industry. There could be more activity data specific to your facility type, so use this as a reference only. When documenting your data, be sure to separate the data between domestic and industrial activity data.

Scope	Emission Source	Domestic Activity	Industrial Activity	Tracking Method	
				Invoice	Metering
1	Biodiesel	▪ Company-owned vehicle fleet	▪ Company-owned vehicle fleet	✓	
1	Biomass - Sustainably Sourced with certification		▪ Boiler	✓	✓
1	Solar Photovoltaic (electricity)	▪ Lighting and heating in self-operated canteen and dormitory	▪ Ironing/pressing ▪ HVAC system ▪ Wastewater treatment	✓	✓
1	Solar Thermal	▪ Hot water for self-operated canteen and dormitory		✓	✓
1	Biomass - Unsustainable sourced / Unknown		▪ Boiler	✓	✓
1	Coal - commercial mix		▪ Boiler	✓	✓
1	Diesel	▪ Company-owned vehicle fleet	▪ Forklift ▪ Generator ▪ Company-owned vehicle fleet	✓	
1	Fuel Oil - Blended		▪ Forklift ▪ Generator	✓	

1	Natural Gas	▪ Cooking and hot water for self-operated canteen and dormitory	▪ Boiler ▪ Stenter machine	✓	
1	Petrol/Gasoline	▪ Company-owned vehicle fleet	▪ Company-owned vehicle fleet	✓	
1	Refrigerants (type, specific name and quantity)	▪ Self-operated refrigerators and cooling system in canteen and dormitory	▪ Self-maintained cooling system		✓
1	Wastewater (volume, BOD influent and effluent)	▪ Self-operated canteen and dormitory	▪ Self-maintained effluent treatment plant		✓
2	Purchased Electricity	▪ Lighting and heating in self-operated canteen and dormitory	▪ Ironing/pressing ▪ HVAC system ▪ Wastewater treatment	✓	✓
2	Purchased Steam		▪ Boilers ▪ Dyeing process	✓	✓
2	Purchased Renewables	▪ Lighting and heating in self-operated canteen and dormitory	▪ Ironing/pressing ▪ HVAC system ▪ Wastewater treatment	✓	✓
2	Purchased Carbon Offsets			✓	

Table 4-1 Data collection with Higg FEM

4.4. Frequently Asked Questions about Activity Data Collection

In practice, there are also other special cases that may happen regarding activity data for both mobile and stationary combustions. See the example below:

The electricity billing cycle does not fall exactly at the end of the calendar month.

Answer: Sometimes the bill falls on the 25th or 28th of each month. For this, you could estimate the average daily usage by dividing the total usage by the total number of days in the billing cycle and use it to estimate the total usage for the remaining days that are missing from the billing cycle.

For fuel consumption records, what if my facility rents the vehicle to other companies for a certain period of time?

Answer: Depending on your company's consolidation approach, it would need to be disclosed either as part of Scope 1 or Scope 3 emissions. If your company's reporting is based on the operational control approach, the time (months) when your company uses the vehicle should be reported as your Scope 1 emissions and the remaining lease period should be included in the 'downstream leased assets' category of your Scope 3 emissions.

However, if your company uses the financial approach, regardless of whether your company uses the vehicle or not, you would still report it under Scope 1 emissions. For this, you could estimate the average monthly fuel consumption based on the period your company uses the vehicle.

My facility owns a combined heat and power plant, and we sell excessive electricity to another facility. Does that fall under our scope 2 emissions?

Answer: Only the amount of electricity that is consumed by your own facility should be accounted for under scope 2 emissions. The amount of electricity sold to a third party should be accounted for under your scope 3 emissions.

My company owns a vehicle fleet for the logistics of products, how can I find the fuel consumption data?

Answer: (Option 1) Think about who manages this equipment and ask them for the fuel invoices from the last 12 months. (Option 2) Speak with someone from the factory management /purchasing department/fleet management team to provide you with information on the vehicle fleet's consumption.

There are no invoices available for the entire time span. What do you do now?

Answer: (Option 1) Determine the fuel consumption of your vehicle per 100 km and the distance travelled over one year. (Option 2) Data can be obtained from financial records on fuel expenditures. These records can be used to generate estimates of fuel consumption using data on average fuel costs. (Option 3) Data on distance

travelled is necessary and should be available from odometer readings or other travel records. From this, you can estimate the average fuel consumed per unit of distance.

Rainwater is drained and treated onsite with domestic wastewater. However, we do not meter the amount of rainwater. What should we do?

Answer: Rainwater is treated with domestic wastewater, the volume is essential for estimating the fugitive emissions from the wastewater treatment process. To estimate the volume of rainwater going to the efluent treatment plant (ETP), you need (1) area of rainwater collection surface (e.g., area of roof used for rainwater collection) and (2) average monthly rainfall in your area – from regional weather websites. Follow the below formula to estimate the total volume of rainwater going into your ETP.

$Rainwater\ collected\ (m3)$

$= area\ of\ rainwater\ collection\ (m2) \times height\ of\ monthly\ rainwater\ in\ the\ area(m)$

To summarize, try to assess the data as accurately as possible. Perfect data sources include bills, logbooks (e.g., vehicle fuel gauge, odometer, etc.) and invoices. A good way to acquire these is through the accounting department.

If you cannot get actual data from bills, invoices, or meter records, you might need to do estimations or calculations. These estimations or calculations should be as accurate as possible. So, if no records are available, make your best estimate but make sure to keep all necessary records of actual activity data to improve your accounting next time!

Here are some practical tips:

- Ensure that all invoices and consumption data are included.

- Ensure you are collecting data for a consistent period. That would typically be 12 months.

- Pay attention to different units (e.g., kWh, joule, kilogram, tonne, megatonne).

- Avoid digit and decimal faults.

5. Measuring your GHG Footprint

Once you have assessed the activities and acquired the data on consumption, you can calculate the GHG emissions that result from these activities. This lesson will show you how to perform these calculations.

Basic formular for calculating your GHG footprint

Multiplying the activity data with a specific emission factor and conversion factor(s) (if necessary) to get the CO_2e emissions.

$$CO_2\ Emissions = Activity\ Data \times Conversion\ Factor \times Emission\ Factor$$

Activity Data: Data relating to your operations. Examples: fuel use, electricity use, quantity of wastewater treated, etc.

- Example: 60 million pounds of biomass was used during the reporting year at your facility.

Emission Factor: An emission factor is defined as an average emission rate of a given GHG for a given source, relative to the units of activity.

- For example: Biomass (wood chips) produces 39.78833 kg CO2e/tonne on average (**Department for Environment Food and Rural Affairs -** DEFRA). (Note that the units CO2e already encompass the combination of multiple GHGs)

Conversion Factor: Used to convert the units of the activity data to one that can then be used with the relevant emission factor. There are 2 types of conversion factors:

- **Unit Conversions:** Used to convert the quantity of activity data to units that can be used for calculation of CO2e emissions.
  - For example, 1 tonne = 1000 kg or 1 Litre = 0.001 m^3
- **Heat Value:** Amount of energy generated per quantity of a specific fuel source.
  - For example, 1 tonne of biomass produces 14.71 GJ of energy (DEFRA)

CO2e Emissions from Biomass (1 year)

60,000,000 pounds	÷	2204.62368 pound to tonnes	x	39.78833 kg CO2e / tonne	=	1,082,860 kg CO2e
Activity Data		Conversion Factor (from DEFRA)		Emission Factor (from DEFRA)		

If your activity data and emission factor are not of the same units for direct multiplication, you would need to use a suitable conversion factor, as depicted in the calculation above. In some cases, if the emission factor is in terms of kg CO2e per unit energy (kWh or MJ), you will need to use suitable heat values to convert your activity data to units that can be used with the emission factor, e.g. if the GHG activity data is available in weight or volume unit such as kg or liter, please convert it into energy unit (kWh or MJ) using the heat value factor.

5.1. Emission Factors, Heat Values and Global Warming Potential for GHG Inventories

There are different databases online. In this training, the GHG Protocol database will be referenced for calculation. For other available emission and conversion factor databases, please refer to 12.3 Emission Factors for GHG Inventories . For Higg users, you can find out the conversion and emission factors used in 12.5. Resources for Higg FEM Users.

Emission Factors from Cross-Sector Tools of Greenhouse Gas Protocol

The Greenhouse gas Protocol (GHGP) has developed many calculation tools that facilitate their GHG Accounting requirements. The embedded emission factors can be found on their website. This document contains conversion factors (heat values) and emission factors for stationary and mobile combustion as well as regional electricity use for the US, China, and Taiwan.

Click here to view the most updated GHG Protocol Tools

Global Warming Potential Values

Global warming potenial represents the carbon dioxide equivalent of a particular gas over a chosen time horizon. They are often used for reporting the leakage from air-conditioning and refrigeration units into the atmosphere. The GWP will be updated by Intergovernmental Panel on Climate Change.

Click here to view the AR5 GWP

UK DEFRA UK

Department for Environment, Food and Rural Affairs (DEFRA), UK Government GHG Conversion Factors for Company Reporting, DEFRA publishes a new set of emission factors every year, please visit their website (https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting) for the most updated set of emission factors

The International Energy Agency (IEA) Emission factors database contains emission factors from electricity and electricity/heat generation of national grids, for a set of three different gases (CO_2, CH_4, N_2O), for all countries globally https://www.iea.org/data-and-statistics/data-product/emissions-factors-2

5.2. Frequently Asked Questions about Emission Factors

Do I need to change/update the emission factors regularly for my calculation?

Answer: As an emission factor is specific to a unit of activity, it is often updated to reflect any changes in that activity. You need to make sure that you use the most recent emission factors database. The updated emission factors would reflect that. DEFRA and IEA release a new set of emission factors every year, which are applicable to activities that happened 2 years before the reporting year. You can use the latest data set available for accounting and reporting.

For example, you can use DEFRA and IEA 2022 database for calculations for the years 2020, 2021, and 2022. However, this is not the case for all emission sources, you need to read through the guidance provided by the publisher.

How can I decide if an emission factor is representative of my activity?

Answer: Emission factor providers and users need to provide a clear description of what activities are covered by the emission factor, as well as the data used for the estimation. When reporting, companies need to make sure the emission factors used are accurately representing their activities based on process, technologies, geographies, and timeframe aspects. Most of the databases for Scope 1 are valid worldwide. The reporting company should regularly search for and use the latest available database that best represents the specific activities.

I do not know the fuel source of the purchased steam, what emission factor should I use?

AnswerFeedback: It is worth contacting your steam supplier to collect the following information: energy source, type of boiler (CHP or not), energy output (MJ). If this is not possible, one way is to research the common industrial steam sources in your country and use them for fuel assumptions. If this information is unavailable, you could use data for natural gas as it is the most used fuel to produce steam worldwide. Remember, this assumption should be clearly communicated when you conduct the GHG accounting.

What information do I need for calculating the fugitive emissions from the onsite effluent treament plant?

Answer: You need to answer the following questions: 1) Is your domestic and industrial wastewater treated together? 2) How is the wastewater treated (aerobically or anaerobically)? 3) What is the annual average of BOD or COD level of the influent and effluent? 4) How much wastewater is produced each year? If you cannot answer all these questions, start building your inventory. For more information, you can refer to the [2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories](#).

Before we move on to the next session, let's refresh our memories and familiarize ourselves with what we have learnt:

[Exercise 1]

Most emission factor databases are complex. To find out how much CO_2e is associated with your activity, you will need to add up the impacts of GHGs such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Do you still remember what CO_2e is?

CO_2e is a unit used to compare the emissions from various GHGs by converting them to the equivalent amount of CO_2. **(correct)**

CO_2e are GHG emissions that are like CO_2 in terms of their structural formula, half-life period and global-warming potential.

CO_2e is irrelevant when it comes to GHG accounting.

$CO2e$ is a unit used to compare the emissions from various GHG based on their global warming potential by converting them to the equivalent amount of CO2. As such, it is a commonly used value in GHG accounting.

[Exercise 2]

Which of the followings is an emission factor for coal?

2,411 kgCO_2e/tonne **(correct)**

2,386 kgCO_2e of CO_2/ tonne

7 kgCO_2e of CH_4/ tonne

19 kgCO_2e of N_2O/ tonne

CO_2e is a unit used to compare the emissions from various GHG on the basis of their global warming potential by converting them to the equivalent amount of CO_2. Emission factors also consider GHGs, such as methane (CH4) and nitrous oxide (N2O), by providing values for CO2e.

[Exercise 3]

Please calculate the GHG emissions for factory A, using the GHG Protocol emission factors and GWP.

Coking Coal	
Annual usage	7,000 metric ton

CO_2 emission
2667.72 kgCO2 x 7,000 = 18,674,040 kg CO_2 ÷ 1,000 = 18,674.04 tonneCO_2e

CO_2 emission from CH_4
0.282 kgCH_4 x 28 (GWP) x 7,000 = 55,272 kgCO_2 ÷ 1,000 = 55.272 tonneCO_2e

CO_2 emission from N_2O

0.0423 kgN_2O x 265 (GWP) x 7,000 = 78,466.5 ÷ 1,000 = 78.4665 tonneCO_2e

Total emissions for coking coal
18,674.04 + 55.272 + 78.4665 = 18,807.78 tonneCO_2e

Remember we said emission factor is the expression of the impact of all GHGs. We need to add up the emissions that are coming from the combustion of coal. Then we have to be aware of the units, do all the unit conversions before your calculations!

6. Calculating Scope 1 Emissions - Stationery and Mobile Combustion

In this lesson, we will calculate emissions resulting from stationary and mobile combustion, i.e., emissions from the burning of fossil fuels to power generators, boilers, or vehicles.

You will calculate these emissions through several exercises and will learn where to find the emissions factors you need. First, let's start with the stationary combustion example. We will show you how to work with mobile combustion over the next few lessons. To answer the questions, you will need the emission factors, as well as a calculator.

Scenario 1: Natural Gas Boiler Emissions

You may remember the fictious sewing company, North Sewing Ltd., from the last module. North Sewing Ltd. runs a boiler to produce steam. The boiler uses 250 m^3 of natural gas per month.

[Exercise 4]

How high are the annual CO_2e emissions from this boiler?

Here is the calculation following the general approach:

CO_2 emission = activity data x conversion factor x CO_2 emission factor

Activity data
250 m^3 of natural gas per month (3,000 m^3 of natural gas per year)

CO_2 emission
3,000 x 0.7 kg/m³ (unit conversion) ÷ 1,000 (kg) x 2,692.8 (kg/tonne) ÷ 1,000 (kg)

= 5.65 tonneCO_2e

CO_2 emission from CH_4
3,000 x 0.7 kg/m³ (unit conversion) ÷ 1,000 (kg) x 0.24 (kg/tonne) ÷ 1,000 (kg) x 28 (GWP)

= 0.014112 tonneCO_2e

CO_2 emission from N_2O
3,000 x 0.7 kg/m³ (unit conversion) ÷ 1,000 (kg) x0.0048 (kg/tonne) ÷ 1,000 (kg) x 265 (GWP)

= 0.0026712 tonneCO_2e

> ***Total emissions***
>
> **5.65 + 0.014112 + 0.0026712= 5.67 tonneCO$_2$e**

Chino Cotton Textile

Let's do another one.

Scenario 2: Propane-powered Oven Dryer Emissions

A fabric supplier, Chino Cotton Textile, uses LPG (liquefied petroleum gas) oven to dry garments. For this, it uses 10,000 kg of LPG per year.

> **[Exercise 5]**
>
> **What are the CO$_2$e emissions resulting from this activity?**
>
> Here is the calculation following the general approach:
>
> CO$_2$ emission = activity data x conversion factor x CO$_2$ emission factor
>
> *Activity data*
> 10,000 kg of LPG per year
>
> *CO$_2$ emission*
> 10,000 ÷ 1,000 (kg) x 2,984.63 (kg/tonne) ÷ 1,000 (kg) = 29.8463 tonneCO$_2$e
>
> *CO$_2$ emission from CH$_4$*
>
> 10,000 ÷ 1,000 (kg) x 0.2365 (kg/tonne) ÷ 1,000 (kg) x 28 = 0.06622 tonneCO$_2$e
>
> *CO$_2$ emission from N$_2$O*
>
> 10,000 ÷ 1,000 (kg) x 0.00473 (kg/tonne) ÷ 1,000 (kg) x 265 = 0.0125345 tonneCO$_2$e
>
> ***Total emissions***
> **29.8463 + 0.06622 + 0.0125345 = 29.93 tonneCO$_2$e**

This is how you calculate Scope 1 emissions from stationary combustion. Now, how would you calculate the CO$_2$ emissions from travel in company-owned vehicles? Here is an example of mobile combustion.

Scenario 3: Cotton Transport Emissions

Each month, Chino Cotton Textile delivers 100 bales of cotton to North Sewing Ltd. on a Class I van that they own. The van runs on 100 gallon of diesel monthly.

[Exercise 6]

How much CO_2e results from this cotton delivery per year?

Here is the calculation following the general approach:

CO_2e emissions = activity data x CO_2 conversion factor

Activity data

100 gallon x 12 months = 1,200 gallon

CO_2 conversion factor

1,200 x 8.10442 kg/gallon ÷ 1,000 (kg) = 9.725301331 tonneCO_2e

CO_2 emission from CH_4

1,200 x 0.0162 g/gallon ÷ 1,000 (g) ÷ 1,000 (kg) x 28 = 0.00054432 tonneCO_2e

CO_2 emission from N_2O

1,200 x 0.0243 g/gallon ÷ 1,000 (g) ÷ 1,000 (kg) x 265 = 0.0077274 tonneCO_2e

Total emissions

9.725301331 + 0.00054432 + 0.0077274 = 9.73 tonneCO_2e

There are several approaches for estimating mobile combustion GHG emissions. Some approaches are more accurate than others. The exercise above shows a practical approach. As you gain more GHG accounting experience, you can begin to use more accurate methods. For example, using specific fuel consumption data and vehicle types. These exercises give you some insight into how to calculate emissions from stationery and mobile combustion.

Now, here is the good news: you do not need to do all these calculations by hand. There are several tools recommended by the GHG Protocol that help you calculate your emissions. Some of these tools will already include the emission factors and only require you to fill in your activity data. Once you become more advanced, you can use more relevant emission factors to better reflect your activities, or better yet, to create your own tailor-made calculation tools. Find out more about the available tools from GHG Protocol website here.

7. Calculating Scope 1 Emissions- Leakage from Refrigeration and Air-conditioning Equipment

Apart from stationary and mobile combustion, typical activities contributing to Scope 1 emissions are leakages from refrigeration and air conditioning. If you own or control refrigeration or air-conditioning equipment, these emissions are reported as Scope 1. There are several methods to calculate these emissions. This module focuses on the simplest method, called the 'screening method', you can find more information in 12.2 Calculation Methodology for Refrigerant Leakage.

7.1. Data Collection

Apart from stationary and mobile combustion, typical activities contributing to Scope 1 emissions are refrigeration and air conditioning.

Refrigeration equipment and air-conditioning units use refrigerants that can leak, leading to GHG emissions. If you own or control refrigeration or air-conditioning equipment, these emissions are reported as Scope 1.

There are several methods to calculate these emissions. This module focuses on the simplest method, called the 'screening method'

DEFRA Environmental Reporting Guidelines

If emissions from this equipment are found to be a large proportion of the total Scope 1 emissions, then it is recommended that you improve calculations by using a more accurate method.

In the DEFRA guidelines, you can get information on the screening method and other methods (see page 98 in the document).

Download DEFRA Environmental Reporting Guidelines [PDF, 152 pages]

Data Collection

How do I collect data for refrigeration and air-conditioning activities?

The activity data we are looking for is the amount of refrigerant emitted into the atmosphere (leakage).

First, you need to list the type of equipment you have (mobile air conditioning, chillers, medium or large commercial refrigerators, etc.). Some of the equipment you own, and control might be modern while some might be old. Make a note of the old equipment, because it is very likely this equipment is the source of the refrigerant leakage.

Then, for each piece of equipment, investigate refrigerant type (e.g., HFC 134a, HFC-143).

Next, check how much refrigerant was leaked by checking the purchase bills for the refrigerant refill (in kilograms) of the equipment.

To collect this activity data, you should check management records from the service providers of any equipment. If the activity data is impossible to obtain, you could check the default conversion factors for share capacity and annual leak rate on pages 98-100 of the DEFRA guidelines.

7.2. Calculating Emissions

How do I calculate the emissions for refrigeration and air conditioning?

Leaked refrigerant gases have significant global warming potential; therefore, the conversion factors used for refrigerants are different from the emission factors for combustion processes. There are many types of refrigerants and each one has a global warming potential or conversion factor.

Here is an example of how to calculate emissions from this equipment.

Scenario 4: Air Conditioning

The headquarters of the PINA has two stationary air conditioners. The units have labels on the compressor that indicate the type of refrigerant used. In this case, they use R410a.

In the management records, you find the invoices for the servicing of the air-conditioning equipment. Find the invoice that corresponds to your reporting year to determine the amount of refilled refrigerant per air-conditioning unit. It looks like 0.005 kg of R410a was required that year.

> **[Exercise 7]**
> **What are the CO_2e emissions from each air-conditioning unit?**
>
> Take a look at the GWPs of common GHGs and refrigerants from GHG Protocol's database.
>
> Here is the calculation following the general approach:
> CO_2e emissions = activity data x CO_2e conversion factor
>
> *Activity data*
> 0.005 kg of R410a

> *Total emissions*
> **0.005 x 1,725 (GWP) = 8.625 kg CO$_2$e**

All refrigerants listed in that sheet have global warming potential; however, only some of them are regulated under the Kyoto Protocol. You can calculate the CO$_2$ equivalent for all refrigerants, but only the refrigerants regulated under the Kyoto Protocol should be reported under Scope 1. All non-Kyoto gases (e.g., Montreal Protocol gases) should be reported separately.

8. Calculating Scope 2 Emissions - From purchased grid electricity

So far, we have simplified the calculation of Scope 1 emissions by using emission factors that are valid worldwide. However, calculating emissions from grid electricity is a bit different as it depends on where the factory is located (location-based method). *Here we use regional emission factors.*

To calculate emissions from grid electricity, regional emission factors are available.

The emissions for grid-connected activity are estimated by determining the GHG emissions of the electricity sources. Different countries and suppliers have different emission factors depending on how they generate electricity; we call these **Grid Emission Factors (GEFs)**. There are also tables where you can find these factors given per unit of energy (MWh).

IGES List of Grid Emission Factors

This Excel spreadsheet provides information on CO$_2$ emission factors (tonnes CO$_2$/MWh) that are associated with the electricity provided by an electricity system. For our purposes, the tab 'EFfromCountriesOrSB' is the most relevant. It shows the current and former official GEFs of numerous countries.

For our examples, we use the value for operating margin (OM), which refers to electricity generation from existing power plants. OM is the recommended number to use unless you are certain that the electricity comes from sources other than existing power plants.

Download the IGES List of Grid Emission Factors [.xlsx, 4.04MB]

Note: This list only refers to CO$_2$. It does not include other GHGs/CO$_2$e.

Let's take a closer look at that.

Please note: For the following exercises, we use the IGES emission factor table as of today (Version 10.10, last updated in December 2020). Once the table gets updated again, the correct answers for exercises may differ slightly.

[Exercise 10]

What is the GEF for Bangladesh in 2010?

Download the 'IGES List of Grid Emission Factors' and open the table 'EFfromCountriesOrSB'. In the table, use the 'OM' values.

0.484

0.541

0.641 **(correct)**

0.670

You will find this value in the 'EFfromCountriesOrSB' tab in version 11.0 of the IGES List of Grid Emission Factors.

[Exercise 11]

What about North Sewing Ltd.? As you know, we placed this fictitious company in Vietnam. Its sewing machines use 130,000 MWh per year altogether.

What are the total CO_2e emissions produced by the machines in 2018?

Here is the calculation following the general approach:
CO_2 emission = activity x grid emission factor

Activity
130,000 MWh per year

GEF in Vietnam for 2018
0.8795 tonnes CO_2 per MWh (tonnes CO_2/MWh – see the IGES List)

CO_2 emission
130,000 MWh x 0.8795 tonnes CO_2/MWh = 114,335 tonnes CO_2

To calculate emissions from purchased steam

Steam is used as a source of energy in many different processes in the textile industry, such as textile finishing. Some facilities might have on-site boilers generating steam while others might purchase steam from suppliers.

If your facility owns and controls the boilers on-site, the GHG emissions of these boilers should be reported under Scope 1

If your facility purchases steam from a supplier, and you do not own or control the generation of this steam, then the GHG emissions related to this steam should be reported under Scope 2

To calculate GHG emissions of purchased steam under Scope 2, the preferred method is to use emission factors obtained directly from the steam suppliers. However, it is likely that your supplier does not know how to calculate their steam GHG emissions. Thus, the alternative is for

you to calculate the purchased steam-related emissions using corresponding fuel emission factors and the thermal efficiency of the steam generation.

Let's look at an example.

[Exercise 12]

Chino Cotton Textile purchases 500 tonnes of steam per year to feed into their power boiler.

Related information obtained by Chino Cotton from their supplier:

Amount of purchased steam = **500 tonnes of steam** in an **8-bar boiler**

Type of fuel = **natural gas** (100% mineral blend without any biogas)

Thermal efficiency is assumed to be **80%**

What are the related CO₂e emissions?

165.80 tonnes

37.66 tonnes

56.65 tonnes

88.39 tonnes **(correct)**

To start, make sure to have the following data at hand:

- The amount of purchased steam. This value can be specified in energy units (e.g., megajoules or kilowatt-hours), or in mass units (e.g., kilograms or tonnes). If this data is only available in mass units, you will need to convert it to energy units. For this, you can use the standard 'Specific Enthalpy of Steam (total heat) (KJ/kg)' column from the linked table.
- The type of fuel (e.g., natural gas) used to generate steam. Make sure to ask your supplier for this information.
- Thermal efficiency of steam generation, normally provided as a percentage. You can try to ask your supplier for this number but, if it is unavailable, you can assume an efficiency of 80%.

When all the above information is ready, you can start estimating the emissions for purchased steam:

Converting steam from mass unit (tonne) into energy units (MJ)

Depending on the emission factor database you are using, you might need to convert steam from mas unit to energy unit by applying the standard specific enthalpy. In this case, **8-bar boiler is 2767.46 KJ/kg**

Steam = steam (tonnes) x specific enthalpy of steam (kJ/kg)

Activity Data   Conversion Factor   Total Energy

$$(500 \times 1000) \times (2{,}767.46 \div 1000) = 1{,}383{,}730 \; MJ$$

Conversion from tonne to kg   Conversion from KJ to MJ

Estimating the emission factor for purchased steam

Emission factor = emission factor of energy source ÷ thermal efficiency (%)

CO_2 Emission CO_2e Emission from CH_4 CO_2e Emission from N_2O CO_2 Emission

$$[(56{,}100 \div 1{,}000) + (5 \div 1{,}000) \times 28 + (0.1 \div 1{,}000) \times 265] \div 0.8 = 56.2665 \; tonne/TJ$$

Conversion from kg to tonne   Conversion from kg to tonne   GWP   Conversion from kg to tonne   GWP   Thermal efficiency

CO_2 emissions from the combustion of natural gas

Activity Data   Emission Factor   Total Emissions

$$1{,}383{,}700 \div 1{,}000 \times 56.2665 = 77.86 \; tonne$$

Conversion from MJ to KJ

A steam supplier could be producing steam in a combined heat and power or cogeneration system. This means that the facility uses the same fuel to produce both electricity and steam. You should check with your supplier to ensure that the allocation of emissions across energy outputs follows best practices, such as [GHG Protocol Allocation of GHG Emissions from a Combined Heat and Power (CHP) Plant (2006).](#)

9. Calculating Scope 3 Emissions

[Exercise 13]

We have talked a lot about Scope 1 and 2 emissions in this module, but we have not yet tackled Scope 3.

Why do you think we have not explained how to measure Scope 3 emissions yet?

Because Scope 3 emissions are more challenging to estimate due to the fact that there is 15 different categories to consider and the relevant activity data collection can be difficult to obtain **(correct)**

Because Scope 3 emissions are already covered in Scopes 1 and 2. Therefore, calculating Scope 3 again would mean double counting.

Even though it is correct that measuring Scope 3 emissions is more challenging than measuring Scope 1 and 2 emissions, this is not the reason we have not introduced them yet. You will learn why on the next page.

Developing a Scope 3 inventory strengthens companies' understanding of their value chain GHG emissions as a step towards effectively managing emissions-related risks and opportunities and reducing value chain GHG emissions. However, as these sources of GHG emissions are beyond the operational control of reporting companies, it can often be challenging to obtain the data required for the calculations, as well as to eventually reduce them.

Therefore, we recommend that suppliers start with understanding their Scope 1 and 2 emissions before considering their Scope 3 emissions.

Although Scope 3 accounting is not the priority of this course, once a supplier is ready to undertake a full GHG accounting of their operation in the future, a supplier needs to consider and include their Scope 3 emissions. In practice, you can choose to select a few categories of Scope 3 emissions that you would like to calculate and reduce emissions from, based on the emission hotspots of your Scope 3-related activities. Following up on the second point above, it is good to become familiar with the different sources of Scope 3 emissions.

Next, it is about finding the respective emission values. If you can get data on these from your suppliers that is perfect. Most likely, however, it will be difficult to get specific numbers. If you cannot get this information, you need to estimate. For this, Quantis offers a helpful tool: **The Scope 3 Evaluator.**

The Quantis Scope 3 Evaluator

The Scope 3 Evaluator is a free, web-based tool from the GHG Protocol and Quantis. It is designed to help companies measure and report GHG emissions throughout their value chain.

Click here to open the Scope 3 Evaluator

The tool is quite complex. On this site, you will find some guidance on how to use it, including an online course, a recorded webinar and the 'Technical Guidance for Calculating Scope 3 Emissions':

Click here to view the Scope 3 Evaluator instructions
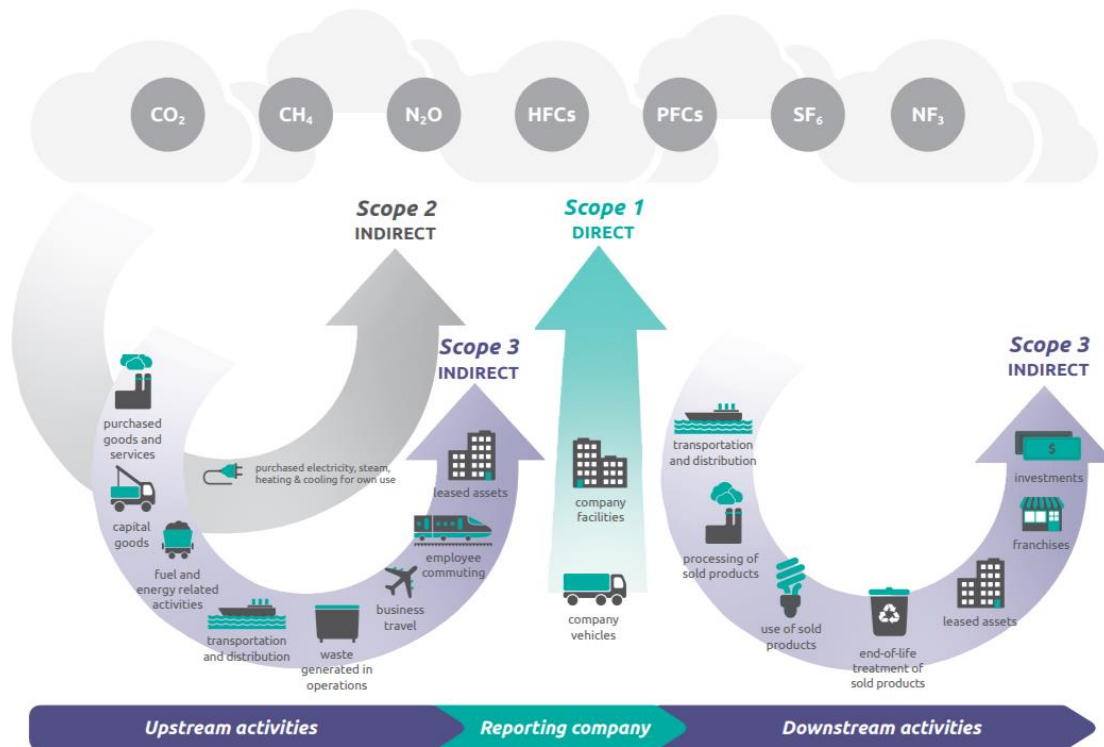
Source: Technical Guidance for Calculating Scope 3 Emissions, the Greenhouse Gas Protocol

Category of Scope 3 emissions		Illustrative Examples of Fashion Industry	Tabs to be filled out in Quantis
1	**Purchased goods and services:** Extraction, production, and transportation of goods and services purchased by a company	For brands and retailers, this includes all the emissions "embedded" in finished products, from raw materials through processing to final assembly (i.e., tiers 1 to 4)	Purchases
2	**Capital Goods:** Extraction, production, and transportation of capital goods	The impact of producing and transporting a newly purchased boiler	Purchases
3	**Fuel and energy-related activities (not included in scope 1 or 2):** Extraction, production, and transportation of fuels and energy purchased or acquired by the reporting company in the reporting year, which have not been included in scope 1 or scope 2	Refining of gasoline used in third party vehicles for garment distribution purchased by a manufacturer.	Customer-related questions
4	**Upstream transportation and distribution:** Transportation and distribution of products purchased by the reporting	Third-party transportation services for fabric purchased by a garment producer. Note that some tools like the Higg Material Sustainability Index (MSI) includes generic inputs for such transportation	Logistics
5	**Waste generated in operations:** Disposal and treatment of waste from the reporting company's operation	Incineration or landfilling of scrap yarn, fabric, samples, and unsold product	Facilities
6	**Business travel:** Transportation of employees for business-related activities (in vehicles not owned or operated by the reporting company)	Air travel for business-related meetings	Travel
7	**Employee commuting:** Transportation of employees from home to work (in vehicles not owned or operated by the reporting company)	Employee commuting (e.g., automobile, public transportation)	Logistics

8	**Upstream leased assets:** Operation of assets leased by the reporting company (lessee)	Leased retail space that was not included in a company's scope 1 and 2 inventory. This may occur if a company draws its inventory boundary via the financial control approach	Upstream leased asset and investments
9	**Downstream transportation and distribution:** Transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer (if not paid for by the reporting company), including retail and storage (in vehicles and facilities not owned or controlled by the reporting company)	Transportation of fabrics to a cut and sew facility; shipping of products to retail outlets or to customers who purchased products online.	Downstream leased asset and investments
10	**Processing of sold products:** Emissions of processing intermediate products by downstream companies	For a company that focuses on wool spinning, the emissions from further processing of knitting and/or weaving by another company	Customer
11	**Use of sold products:** End use of goods and services sold by the company	For fashion companies, customer care for products (e.g. washing and drying) is considered indirect use, as compared to direct use which would be the emissions from the operation of an automobile	Purchases
12	**End-of-life treatment of sold products:** Waste disposal and treatment of products.	Incineration or landfilling of sold clothing	Facilities
13	**Downstream leased assets:** Emissions of assets owned by the company but leased to another entity		Downstream leased asset and investments
14	**Franchises:** Emissions of franchises	Scope 1 and 2 emissions from franchisees, whom the franchisor grant licenses to sell or distribute garments in return for payments	Downstream leased asset and investments
15	**Investments:** Emissions from investment (applicable to investors and companies that provide financial services)	A reporting company's Scope 3 emissions from investments are the Scope 1 and 2 emissions of investees (e.g., jeans producer etc)	Downstream leased asset and investments

It is clear that GHG accounting is not an easy task – it requires time and effort. Let's ask ourselves: Why should we do all this work? Gather some ideas before you continue.

The answer is two-fold: you do it for your own benefit and to help reduce the GHG emissions of the fashion industry as a whole.

A corporate GHG inventory can serve several business goals, including:

- Understanding emission hotspots
- Identifying potential reduction measures
- Monitoring progress
- Public reporting
- Meeting increasing market requirements

Most importantly, it is the basis for target setting. Understanding and accurately measuring the emissions from your operations will help you set realistic climate targets. This is also because understanding your historical data (that from past years) helps you visualise the pattern of your consumption. We will discuss target setting in the next module.

9.1. GHG Accounting Quiz

Did you do the self-evaluation at the start of the module? If so: were your expectations met?

Compare your personal take-aways with the notes you might have made when starting the module. **Before we proceed with the practical assignment, please check your knowledge in a short quiz.**

[Exercise 14]

What do you need to determine when setting the boundaries?

Which sites to include in the GHG inventory (in case you are engaged in joint operations) **(correct)**

Which scopes to include when assessing your emissions **(correct)**

Which global warming potentials to use

Whom to blame when the emissions are too high

[Exercise 15]

What is the basic formula for calculating CO_2e emissions based on activity data?

Activity data x CO_2e emission factor x conversion factor **(correct)**

GHG x global warming potential x conversion factor

CO_2 emission x activity data x conversion factor

Activity data x global warming factor

[Exercise 16]

How does GHG accounting differ for emissions from grid electricity compared to emissions from stationary and mobile combustion?

Emissions from grid electricity are Scope 2 emissions, whereas emissions from stationary and mobile combustion are Scope 1 **(correct)**

Grid emission factors can differ between regions **(correct)**

Emissions from grid electricity are Scope 2 emissions, whereas emissions from stationary and mobile combustion are Scope 3

[Exercise 17]

How much is 1677 Litres of wastewater in m3?

17.38

1.677 **(correct)**

16.77

0.1738

1677 Litres / 1000 Litres/m3 = 1.677 m3

You can find the unit conversion table in DEFRA's database.

[Exercise 18]

I have a heat value that does not match with the unit of the emission factor. **How can I convert the existing heat value for diesel from 46 MJ/kg to MJ/liter so that I can apply it to DEFRA's emission factor?**

$$\frac{46\ MJ}{1\ kg} \quad \text{x} \quad \frac{1\ tonne}{1,189\ liter} \quad \text{x} \quad \frac{1,000\ kg}{1\ tonne}$$

Existing emission factor   Denisty of Diesel   Unit conversion

Heat value of diesel after conversion = 39 MJ/liter

---

10. Assignment

You have heard a lot about CO_2 accounting in this module. Let's put this into action!

Here is your assignment for this week:

Assignment B: Select one facility that is wholly owned and controlled by your company and calculate the Scope 1 and 2 emissions of your facility using real data. Use your assignment answers from Module 2 as the basis for this assignment.

Note: You should focus on accuracy more than completeness in this assignment. As we understand that collecting energy consumption data for different activities may be challenging, we recommend you list only a few emission sources (e.g., five) and focus on the process of GHG accounting.

Instructions:

Download the UNFCCC Greenhouse Gas Emissions Calculator from their website.

Read through the 'Disclaimer 'and 'Info and sources' tabs.

Note:

For this exercise you will be using both the 'default emission factors' embedded in the UNFCCC Greenhouse Gas Emissions Calculator and 'custom emission factors' for indirect emissions from electricity purchased. You will only need to calculate emissions from one facility for this exercise.

For purchased electricity, open the IGES List of Grid Emission Factors and go to the tab 'EFfromCountriesOrSB'. Identify the emission factors for the country where your facility is located. Remember to select the latest OM emission factor. You can input this emission factor into the, 'Electricity, heat, cooling, T&D' tab to override the emission factor provided by the tool if you want more accurate emission data.

Download the UK DEFRA Conversion Factors and use the 'Conversions' tab to help you convert the units of your activity data to the units specified in the UNFCCC GHG Emissions Calculator.

Then, follow through all tabs in the file and fill in your activity data for your facility. Remember that you might need to approach your management or accounting team to gather the data for 2020.

For Stationary and Mobile Combustion, you will use the default emission factors embedded in the tool. The tool does not explicitly separate stationary and mobile combustion, you will be inputting both data into the 'Fuels' tab.

For refrigerants, you will need to estimate the refrigerant leakage amount within the reporting year. To do this, follow the instructions on section 7. Remember to provide the refrigerant leakage in the units specified by the calculator tool.

If the tool does not automatically calculate the emissions (CO_2e) for any of your activity data, calculate it manually and fill in the value. Remember to use the formula of **Emissions = Activity data x Emission Factors (x Conversion Factors).**

When you finalise filling in all tabs and go to the 'Report' tab to find a summary of your facility's Scope 1 and 2 emissions for 2020.

Please submit your response by uploading the [UNFCCC Greenhouse Gas Emissions Calculator](#) (Excel) to the Moodle platform in atingi.

11. Frequently Asked Questions

How important are Scope 3 emissions?

Answer: The importance of Scope 3 emissions will differ by company or organisation. It largely depends on where a company sits in the value chain. However, it is well recognised that Scope 3 emissions are often significant. For example, the production of the fibre used in textiles is known to have significant GHG emissions. To start, you should focus on your Scope 1 and 2 emissions, as these emissions will be important to your customers. After getting used to accounting for Scope 1 and 2 emissions, you can start including some of your Scope 3 step by step.

What does 'accurate' mean?

Answer: It means that you should rely on precise data when calculating your emissions, wherever possible. When you are not able to get primary data, you need to clearly report what assumptions you have made and try to make assumptions that are as close to reality as possible.

There are different standards for GHG accounting. Do I need to learn about all different standards?

Answer: The GHG Protocol is the most widely used framework and most brands will ask you to account and report GHG emissions using this standard.

What Excel tools can I use to undertake GHG accounting? Are they free?

Answer: There are tools developed by GHG Protocol for mobile and combustion emissions that are free and publicly accessible.

[Click here to look for the tool you need](#)

It is important to note that the emission factors used for these tools might not be up to date and do not compare to conducting individual GHG calculations using more specific emission factors. However, it is still a good reference to use as it follows the standard.

There are also a few other recommended GHG tools recommended by the UN Fashion Industry Charter that may be relevant for suppliers, as shown in the 'References' section below.

Do I need to calculate the GHG emissions as Scope 1 if my factory hired a subcontractor to operate the canteen and they use LPG to cook food for my workers on site?

Answer: It depends on your consolidation approach. For example, if you are reporting emissions based on the 'operational control' approach, emissions from the LPG from the subcontractor should be accounted as part of Scope 3 emissions. This is because your factory does not have control over the subcontractor (e.g., you cannot determine how much fuel will be used). Your canteen owner, however, should report these emissions as their Scope 1 emissions.

On the other hand, if your factory has a financial control approach and your factory owns the canteen, you should report any emissions under your own Scope 1.

What should I do if I find an incorrect calculation in the GHG data I have reported?

Answer: Sometimes, technical errors can result due to various factors such as the incomplete identification of emission sources, use of incorrect methods or data, miscalculations and many more. If there are changes in the basis of reported information, the best thing to do is clarify the source of any error and report it along with the updated GHG emission results in the next reporting period. On top of that, if the error is in the baseline calculation, which is used for target setting, companies need to develop a recalculation policy that describes those cases in which the baseline would be revised.

What common mistakes should I watch out for when working on GHG accounting and reporting?

Answer: Double counting of energy sources from purchased steam (when facility separately reports usage of coal/natural gas/biomass). For example, if you purchase steam from a supplier who uses coal as their energy source, you only need to mention the emissions from purchased steam from suppliers. You should not add the coal used by your supplier into your facility's coal use.

Is energy re-sell to a third-party included in my scope 1 emissions?

Answer: Energy generated onsite that is resell to third-party should not be part of your scope 1 calculations. When reporting your energy use, remember to subtract any onite energy that was sold back to the grid or another buyer. If you are reporting your scope 3 emissions, this should be counted towards your category 3 emissions (fuel and energy-related activities not included in scope 1 or 2).

12. Additional Resources

12.1. GHG Accounting Guidance

DEFRA Reporting guidelines

HM Government, Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance (see page 98), (2019). [PDF, 152 pages]

USEPA Greenhouse Gas Inventory Guidance

United States Environmental Protection Agency, Greenhouse Gas Inventory Guidance - Direct fugitive emissions from refrigeration, air conditioning, fire suppression, and industrial gases, (2020). [PDF, 20 pages]

Allocation of Emissions from Combined Heat and Power Plant

WRI/WBCSD, Allocation of GHG emissions from a Combined Heat and Power (CHP) plant, (2006). [PDF, 17 pages]

Greenhouse Gas Emissions Calculator

UNFCCC Greenhouse Gas Emissions Calculator, version 02.6 is published on Sep 2022 can be used to account Scope 1,2 and 3 emissions. It is available to download from the following link https://unfccc.int/documents/271269

12.2. Calculation Methodology for Refrigerant Leakage

DEFRA

In the DEFRA guidelines, you can get information on the screening method and other methods (see page 98 in the document).

Download DEFRA Environmental Reporting Guidelines

EPA

In the EPA's Greenhouse Gas Inventory Guidance, you can get information on how to calculate direct fugitive emissions from refrigeration, air conditioning, fire suppression, and industrial gases.
Fugitive Emissions Guidance

12.3. Emission Factors for GHG Inventories

IGES List of Grid Emission Factors

Institute for Global Environmental Strategies, List of Grid Emission Factors, version 11.0, (2022). [xlsx, 4.04 MB]

United States EPA

Environmental Protection Agency, [Emission Factors for Greenhouse Gas Inventories](#), (2022). [pdf, 173.91 KB]

- EPA regularly updates the emission factors, please visit their [website](#) for the most updated set of emission factors.

UK DEFRA UK

Department for Environment, Food and Rural Affairs (DEFRA), [UK Government GHG Conversion Factors for Company Reporting](#), (2022). [xlsx, 3.16 MB]

- DEFRA publishes a new set of emission factors every year, please visit their [website](#) for the most updated set of emission factors.

12.4. Scope 3 Emissions Calculator

The Quantis Evaluator

[Greenhouse Gas Protocol, The Quantis Evaluator](#). [online tool]

Greenhouse Gas Protocol's Corporate Standard Training Webinar

[Greenhouse Gas Protocol's Corporate Standard Training Webinar](#). [Online webinar videos]

12.5. Other GHG Calculation Tools Recommended by UN Fashion Working Group Members

12.4.1. Free Calulation Tool

EcoDesk

This tool is suitable for suppliers worldwide and is considered user-friendly (it has a positive response rate from suppliers). It covers all GHG emissions, and the tool can be adapted to your needs (e.g. specific data types, site types and processes).
www.ecodesk.com

UNFCCC Greenhouse Gas Emissions Calculator

This tool aims to support organizations to estimate GHG emissions. The tool provides an overview of comprehensive GHG accounting and reporting, covering scope 1 to 3 emissions.
https://unfccc.int/sites/default/files/resource/GHG_emissions_calculator_ver02.6.xlsx

12.4.2. Paid Calculation Tool

Higg Facility Environmental Module (Higg FEM)

One of the most widely used tools in the fashion industry is recommended for Tier 1 to Tier 3 suppliers of the fashion value chain. It covers all GHG emissions, including fugitive gases for Scope 1 and 2. However, the tool requires detailed input data on energy and other GHG sources.

portal.higg.org

Sofi (by Sphera)

Sphera's GHG Emissions Management Software (Sofi) offers a broad set of data management and latest emission factors to support the creation of an emissions inventory and rigorous GHG reporting in line with today's regulatory standards.

sphera.com/corporate-sustainability-software/

Resource Efficiency Module (by Implementation Hub)
The Resource Efficiency Module (REM) supports suppliers in reducing the consumption of water, chemicals, energy and GHG emissions. The tool offers facilities with over 250 recommendations and 50 projects, targeted at various supplier types and processes. The REM thereby provides hands-on implementation guidance and opportunities to track efficiency gains.

www.implementation-hub.org/platforms

12.4.3. Industrial-wide Reporting Platforms

Higg Index

If you want to get more information on the Higg Index, visit the Apparel Coalition website.

apparelcoalition.org/the-higg-index/

12.6. Resources for Higg FEM Users

Higg FEM conversion factors

This Higg Index conversion factors database is another commonly used reference especially in the textile and fashion industry. It consists of heat values and emission factors for various energy sources from 2017-2020, you can also find the GWP for refrigerants.
Click here to access the latest Higg Index conversion factors

- Higg publishes a new set of database for Higg FEM data analysis annually, please visit their website for the most updated database.

GHG Emissions Coverage

Your facility's GHG emissions are calculated and outlined in the Greenhouse Gas Emissions Report. However, fugitive emissions from wastewater treatment are not captured. Higg covers all emissions from energy and air emissions only. Higg does not use the same database for emission factors and heat values as the GHG Protocol Calculation Tool. For more details about Higg's calculation methodology, please visit their website.

Higg FEM 4.0 Draft Content

The SAC is continuously enhancing their reporting tool to address the industry's needs and to align with the most recent industry standards. In November 2023, a new version of the Higg FEM would be officially released. For more information of the major changes, click here.