# Greenhouse gas accounting: the complete practitioner course

A full practitioner course in corporate greenhouse gas accounting under the GHG Protocol: gases and GWPs, boundaries and base years, Scope 1 combustion, process and fugitive emissions, Scope 2 by location and market, the 15 categories of Scope 3 and how to calculate them, data quality and assurance, targets, India's carbon market and CBAM, the PAT and CCTS filings and their penalties — with worked Indian examples, exercises with model answers, a case study and a final exam with a certificate.

Facts checked November 2026. Read online, take the exam and get a certificate: intellitick.com/learn/ghg-accounting/

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## Contents

1. Why companies count greenhouse gases, and the rulebook they use
2. The seven gases, GWPs and $CO_2e$
3. Boundaries and the base year
4. Scope 1: burning fuels
5. Scope 1: process and fugitive emissions
6. Scope 2: purchased electricity, by location and by market
7. Scope 3: the 15 categories and how to screen them
8. Calculating Scope 3: methods and worked examples
9. Data quality, controls and assurance
10. Targets, India's carbon market and CBAM
11. PAT and CCTS: the filings, deadlines and penalties
12. Reporting the inventory: BRSR, IFRS S2, ESRS and CDP
13. Case study: Vindhya Fabrics' first full inventory
14. Glossary, factor sheet and checklists

Lesson 1 · Module 1 — Foundations

# Why companies count greenhouse gases, and the rulebook they use

**In this lesson you will learn to**

- ✓ Explain what a corporate GHG inventory is and who asks for one
- ✓ Name the GHG Protocol standards and what each covers
- ✓ Describe how the standards are changing in 2026–2028
- ✓ List the five accounting principles and apply them to a decision

**A greenhouse gas inventory is a company's account of the greenhouse gases its activities cause in a year, measured in tonnes of carbon dioxide equivalent ($tCO_2e$) and divided into three scopes.** It is to climate what the profit and loss account is to money: the base for targets, disclosures, regulation and decisions.

## Who asks for an inventory

| Who | What they ask for |
|---|---|
| SEBI, through the BRSR | Scope 1 and 2 (mandatory) and Scope 3 (voluntary) under Principle 6; Scope 1 and 2 in BRSR Core, assessed or assured [6] (#ref-6) |
| India's carbon market (CCTS) | Emission intensity, in $tCO_2e$ per tonne of product, for obligated entities in designated sectors [13] (#ref-13) |
| The EU's CBAM | The embedded emissions of cement, iron and steel, aluminium, fertilisers, electricity and hydrogen exported to the EU [15] (#ref-15) |
| Investors, under IFRS S2 and similar rules | Scope 1, 2 and 3, by the GHG Protocol [7] (#ref-7) |
| Customers | Supplier emissions — your Scope 1 and 2 are their Scope 3 |
| Target-setting bodies (SBTi) | A complete inventory and a base year |

## The rulebook: the GHG Protocol

Almost every framework measures emissions with the **GHG Protocol**, published by the World Resources Institute and the World Business Council for Sustainable Development [1](#ref-1):

- the **Corporate Standard** (2004) — boundaries, Scope 1 and 2, base years, reporting [1](#ref-1);
- the **Scope 2 Guidance** (2015) — location-based and market-based methods [2](#ref-2);
- the **Scope 3 Standard** (2011) — the 15 value chain categories [3](#ref-3), with its **Technical Guidance for Calculating Scope 3 Emissions** [18](#ref-18).

**ISO 14064-1** is the international standard for organisational inventories, built on the same ideas.

> **Note**
>
> **The standards are changing.** In 2026 the GHG Protocol and ISO agreed to merge their corporate standards — Scope 1, 2 and 3, actions and market instruments, and ISO 14064-1 — into a single co-branded standard. A consolidated public consultation is planned for the second quarter of 2027 [11](#ref-11), and publication of the joint standard for the fourth quarter of 2028 [10](#ref-10). Until then, the current standards apply. Watch especially the market-based Scope 2 method (Lesson 6).

# The five accounting principles

The Corporate Standard asks every inventory to follow five principles [1](#ref-1):

| Principle | What it means in practice |
|---|---|
| **Relevance** | The inventory reflects the company's emissions and serves the decisions of its users — including the boundary |
| **Completeness** | All sources within the boundary are included; any exclusion is disclosed and justified |
| **Consistency** | Methods are the same over time, so years can be compared; changes are documented |
| **Transparency** | Assumptions, methods and sources are disclosed, so a reader could follow the calculation |
| **Accuracy** | Emissions are neither systematically over- nor under-stated; uncertainty is reduced as far as practicable |

When a judgement is not covered by a rule, these principles decide it.

### Exercise: Apply the principles

A company's diesel generators at 14 telecom towers are not metered, and the site team suggests leaving them out because "the data is poor". Their fuel is bought on company purchase orders. What should you do, and which principles apply?

**Model answer**

**Include them.** Completeness requires all sources within the boundary; the generators are owned and their fuel is bought by the company, so their emissions are Scope 1. Accuracy and transparency then govern **how**: estimate from the purchase orders (litres bought, or spend divided by the price per litre), state the method and the uncertainty, and plan metering so next year's figure is measured. Leaving them out would understate Scope 1 — a breach of completeness and accuracy that an assurer would raise.

Lesson 2 · Module 1 — Foundations

# The seven gases, GWPs and $CO_2e$

**In this lesson you will learn to**

- ✓ Name the seven greenhouse gases an inventory must cover
- ✓ Convert any gas to $CO_2e$ with the right GWP
- ✓ Choose and disclose a GWP set (AR4, AR5 or AR6) and use fossil or non-fossil methane correctly
- ✓ Calculate the GWP of a refrigerant blend

**An inventory counts seven gases, and converts each into carbon dioxide equivalent ($CO_2e$) with its global warming potential (GWP) — how much warming one tonne causes over 100 years compared with one tonne of $CO_2$.**

## The seven gases

The GHG Protocol requires [4] (#ref-4):

- **carbon dioxide ($CO_2$)** — burning fuels, cement and other processes;
- **methane ($CH_4$)** — waste and waste water, coal mining, gas leaks, livestock and rice;
- **nitrous oxide ($N_2O$)** — fertilisers, some chemical processes, combustion;
- **hydrofluorocarbons (HFCs)** — refrigerants in air-conditioning and chillers;
- **perfluorocarbons (PFCs)** — aluminium smelting, electronics;
- **sulphur hexafluoride ($SF_6$)** — insulation in high-voltage switchgear;
- **nitrogen trifluoride ($NF_3$)** — electronics manufacturing; added in 2013.

## GWPs: which values

The IPCC revises GWPs in each assessment report (AR). The GHG Protocol's 2024 table sets them side by side, and recommends the latest, **AR6** [8] (#ref-8):

| Gas | AR4 | AR5 | AR6 |
|---|---|---|---|
| $CO_2$ | 1 | 1 | 1 |

| Gas | AR4 | AR5 | AR6 |
|---|---|---|---|
| $CH_4$, non-fossil | 25 | 28 | 27.0 |
| $CH_4$, fossil | — | 30 | 29.8 |
| $N_2O$ | 298 | 265 | 273 |
| $SF_6$ | 22,800 | 23,500 | 24,300 |
| $NF_3$ | 17,200 | 16,100 | 17,400 |
| HFC-32 | 675 | 677 | 771 |
| HFC-125 | 3,500 | 3,170 | 3,740 |
| HFC-134a | 1,430 | 1,300 | 1,530 |
| HFC-143a | 4,470 | 4,800 | 5,810 |
| PFC-14 ($CF_4$) | 7,390 | 6,630 | 7,380 |

Rules for using them:

1. **Pick one set and disclose it.** Use the same set for every year you compare; if you change sets, recalculate the base year.
2. **Fossil or non-fossil methane.** Use the fossil value for fugitive emissions from fossil sources (gas leaks, coal mines) and for processes using fossil carbon; the non-fossil value for combustion and other sources [8](#ref-8).
3. **Check what your framework requires.** IFRS S2 asks for the latest IPCC values at the reporting date [7](#ref-7); some programmes prescribe a set.

**$CO_2e$ = tonnes of gas × GWP.**

**Worked example**

A waste water treatment plant emits 10 tonnes of methane (non-fossil). With AR6: 10 × 27.0 = **270 $tCO_2e$**. With AR5: 10 × 28 = 280 $tCO_2e$.

# Refrigerant blends

Many refrigerants are blends; their GWP is the **mass-weighted average** of their components. R-410A, common in air-conditioners, is 50% HFC-32 and 50% HFC-125.

**Worked example**

R-410A, AR6: 0.5 × 771 + 0.5 × 3,740 = **2,255.5**. Topping up 85 kg in a year means 85 × 2,255.5 = 1,91,718 kg = **191.7 $tCO_2e$** — the same as burning about 72,000 litres of diesel.

## Exercise: Convert to $CO_2e$

Using AR6 values, convert:

1. 4 tonnes of $N_2O$ from a nitric acid process.
2. 2.5 kg of $SF_6$ leaked from switchgear.
3. 120 kg of R-32 (pure HFC-32) added to chillers.
4. 3 tonnes of methane leaked from the company's natural gas pipelines.

**Model answer**

1. 4 × 273 = **1,092 $tCO_2e$**.
2. 2.5 kg × 24,300 = 60,750 kg = **60.75 $tCO_2e$**.
3. 120 kg × 771 = 92,520 kg = **92.5 $tCO_2e$**.
4. Fossil methane (a fugitive leak from a fossil source): 3 × 29.8 = **89.4 $tCO_2e$**.

Small masses of high-GWP gases matter: 2.5 kg of $SF_6$ outweighs 22,000 litres of diesel.

Lesson 3 · Module 1 — Foundations

# Boundaries and the base year

### In this lesson you will learn to

- ✓ Choose between equity share, financial control and operational control, and apply the choice to joint ventures, leases and subsidiaries
- ✓ Set the operational boundary — what is Scope 1, 2 and 3
- ✓ Choose a base year and write a recalculation policy
- ✓ Decide when a structural change requires recalculation

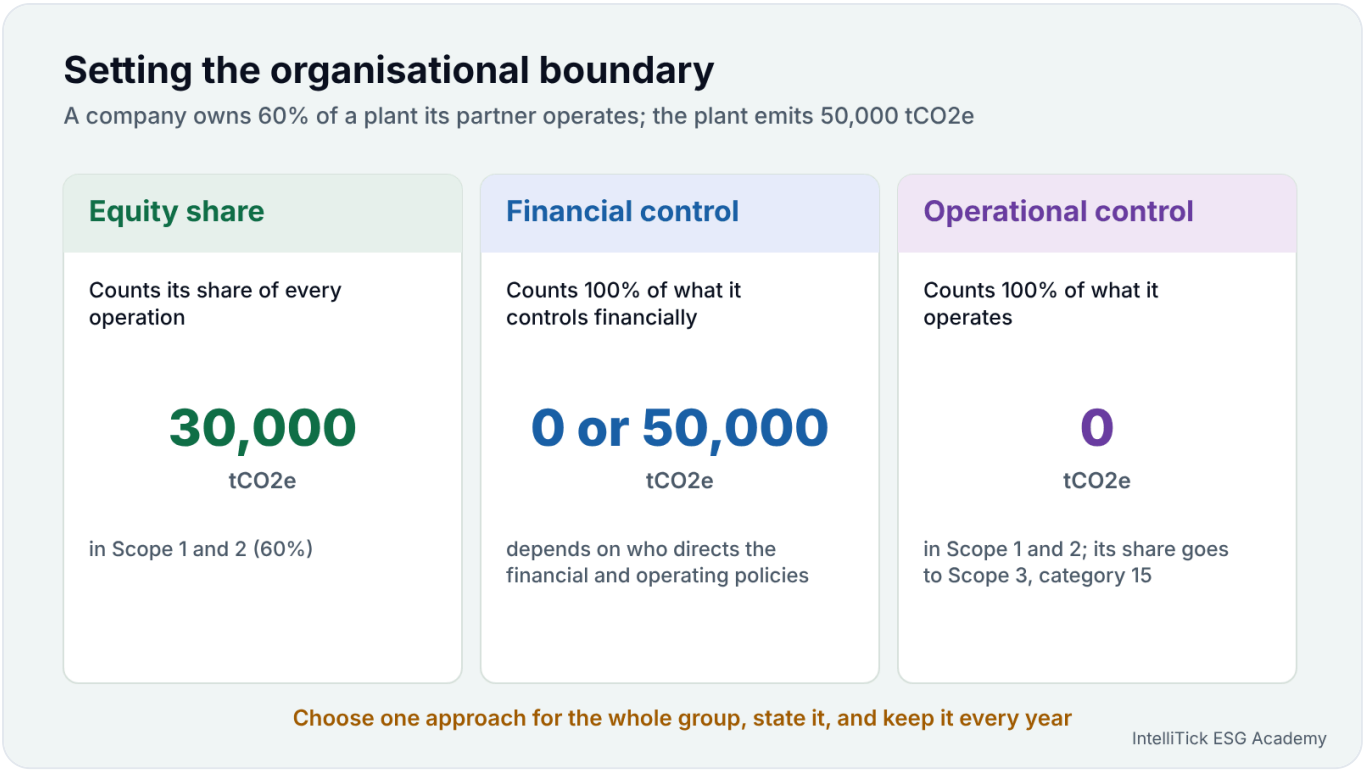
**Before counting anything, a company decides which operations are in its inventory (the organisational boundary), which emissions from them it counts and how it classifies them (the operational boundary), and the year it measures change against (the base year).**

## The organisational boundary

The Corporate Standard offers three consolidation approaches[1](#ref-1):

| Approach | Counts | Typical use |
|---|---|---|
| **Equity share** | Emissions in proportion to the company's economic interest in each operation | Groups with many joint ventures, such as oil and gas |
| **Financial control** | 100% of operations whose financial and operating policies it can direct to gain economic benefits; none of the others | Aligns with financial consolidation |
| **Operational control** | 100% of operations where it has the authority to introduce and implement operating policies; none of the others | The most common choice; it matches who can actually reduce emissions |

Choose one, apply it to the whole group, and use it every year.




Three ways to set the organisational boundary

**Worked example**

A company owns 60% of a joint venture plant, and its partner operates the plant under the joint venture agreement. The plant emits 50,000 $tCO_2e$.

- Equity share: 60% × 50,000 = **30,000 $tCO_2e$** in the company's Scope 1 and 2.
- Operational control: **0** in Scope 1 and 2 (the partner operates it) — the company reports it in Scope 3 category 15 (investments).
- Financial control: depends on whether the company directs the financial and operating policies; with 60% and consolidation as a subsidiary in its accounts, typically **50,000**.

**Note**

The BRSR's own boundary is standalone or consolidated (Section A, item 13). Make sure the GHG boundary you use in the BRSR is the BRSR's: a consolidated BRSR with emissions for the parent only is inconsistent.

# The operational boundary

Within the organisational boundary, the company identifies its sources and classifies them [1](#ref-1):

- **Scope 1** — direct emissions from sources it owns or controls;
- **Scope 2** — indirect emissions from purchased electricity, steam, heat and cooling;
- **Scope 3** — all other indirect emissions in the value chain.

**Leased assets** depend on the approach and the lease. Under operational control, a leased office or vehicle the company operates is usually its own Scope 1 and 2; an asset it leases out and does not operate falls in Scope 3.

# The base year

A **base year** is the year against which emissions are tracked. Choose a year with reliable, complete data, and write a **recalculation policy**: the base year is recalculated when changes would make comparison misleading [1](#ref-1):

- **structural changes** — acquisitions, divestments, mergers, outsourcing or insourcing of emitting activities;
- **changes in methodology** or emission factors that significantly change the result;
- **discovery of significant errors**.

The policy sets a **significance threshold** (many companies use 5% of base-year emissions; the Corporate Standard leaves the level to the company). Organic growth or decline — a plant producing more — does **not** trigger recalculation.

## Exercise: Recalculate or not?

A company's base year is FY 2023-24 (Scope 1 + 2 = 2,00,000 $tCO_2e$) and its policy threshold is 5%. Which of these require the base year to be recalculated?

1. In FY 2025-26 it acquires a plant that emitted 16,000 $tCO_2e$ in FY 2023-24.
2. A new kiln, built in FY 2025-26, adds 12,000 $tCO_2e$.
3. It discovers that a plant's coal consumption in FY 2023-24 was under-recorded by 3,000 tonnes (about 5,000 $tCO_2e$).
4. It moves from AR5 to AR6 GWPs; the effect on the base year is +0.4%.

**Model answer**

1. **Yes.** A structural change of 16,000 ÷ 2,00,000 = **8%**, above the threshold. Add the acquired plant's FY 2023-24 emissions to the base year.
2. **No.** New capacity built by the company is organic growth; it is not added to the base year.
3. **Borderline, and below the threshold:** 5,000 ÷ 2,00,000 = 2.5%. Correct the base-year figure anyway if the policy says errors are always corrected; otherwise disclose it. Many companies correct all known errors.
4. **Methodology change below the threshold** (0.4%). Under the policy it need not trigger recalculation — but because comparisons should use one GWP set, many companies restate all years when they change sets. Disclose either way.

# Scope 1: burning fuels

**In this lesson you will learn to**

- ✓ Identify stationary and mobile combustion sources
- ✓ Convert fuel quantities to energy with net calorific values, and to $CO_2$ with emission factors
- ✓ Handle fuels billed in MMBTU on a gross calorific value basis
- ✓ Choose between default and site-specific factors, and document the choice

**Most Scope 1 emissions come from burning fuel in sources the company owns or controls — boilers, furnaces, kilns, generators and vehicles. The calculation is always the same: fuel used × energy content × emission factor.**

## The sources

- **Stationary combustion:** boilers, furnaces, kilns, dryers, diesel generator (DG) sets, gas turbines, canteen LPG.
- **Mobile combustion:** trucks, forklifts, cars, tractors and vessels the company owns or controls.

Fuel bought for vehicles **someone else** operates — a hired transporter — is not Scope 1; it is Scope 3.

## The calculation

**Emissions (kg $CO_2$) = fuel quantity × net calorific value (NCV) × emission factor (per unit of energy)**

The IPCC's 2006 Guidelines give default values for each fuel — the NCV in terajoules per gigagram (TJ/Gg, the same as GJ per tonne) and the $CO_2$ factor in kilograms per terajoule [9] (#ref-9) :

| Fuel | Default NCV (TJ/Gg = GJ/t) | Default $CO_2$ factor (kg $CO_2$/TJ) |
|---|---|---|
| Gas/diesel oil | 43.0 | 74,100 |
| Residual fuel oil (furnace oil) | 40.4 | 77,400 |
| Liquefied petroleum gas | 47.3 | 63,100 |

| Fuel | Default NCV (TJ/Gg = GJ/t) | Default $CO_2$ factor (kg $CO_2$/TJ) |
|---|---|---|
| Motor gasoline (petrol) | 44.3 | 69,300 |
| Natural gas | 48.0 | 56,100 |
| Other bituminous coal | 25.8 | 94,600 |
| Sub-bituminous coal | 18.9 | 96,100 |
| Petroleum coke | 32.5 | 97,500 |

**Worked example**

**Diesel in a DG set.** 2,200 litres in a month. Litres must become tonnes first: with a density of 0.84 kg per litre, 2,200 × 0.84 = 1,848 kg = 0.001848 Gg. Energy = 0.001848 × 43.0 = 0.0795 TJ. $CO_2$ = 0.0795 × 74,100 = **5,888 kg = 5.89 t$CO_2$** — about 2.68 kg per litre.

# Default or site-specific?

Defaults are a starting point. Where the fuel varies — above all **Indian coal**, whose calorific value differs widely by grade and mine — use **site-specific** values: the NCV from the supplier's test certificate or your own laboratory, and a carbon content or emission factor from tests where available. The BRSR's Industry Standards accept factors from an accredited laboratory, the IPCC, IEA, UK DEFRA, US EPA or a country-specific source, provided the source is disclosed [17] (#ref-17) .

**Worked example**

**Coal in a boiler.** 12,000 tonnes in the year; the supplier's test certificates give an average NCV of 16.8 GJ per tonne — well below the IPCC default for bituminous coal. Energy = 12,000 × 16.8 = 2,01,600 GJ = 201.6 TJ. With a factor of 94,600 kg $CO_2$/TJ: 201.6 × 94,600 = **19,071 t$CO_2$**. Using the default NCV of 25.8 would have overstated emissions by more than half.

# Fuels billed in MMBTU

Indian natural gas is usually billed in **MMBTU on a gross calorific value (GCV)** basis, while IPCC factors are per unit of **net** calorific value. Convert carefully:

1. MMBTU to GJ: **1 MMBTU = 1.0551 GJ**.
2. Gross to net: for natural gas, the net calorific value is about **10%** lower than the gross; for coal and oil, about 5% [9](#ref-9).
3. Multiply by the $CO_2$ factor per GJ of net energy (56.1 kg/GJ for natural gas).

**Worked example**

10,000 MMBTU (GCV) = 10,551 GJ GCV → × 0.9 = 9,496 GJ NCV → × 56.1 kg/GJ = **532.7 $tCO_2$**.

# Methane and nitrous oxide from combustion

Combustion also releases small amounts of $CH_4$ and $N_2O$. They are usually under 1% of the $CO_2$ for stationary fuel use, but larger for some vehicles and for biomass. Include them with IPCC or national factors and the GWPs of Lesson 2, or state why they are excluded as immaterial.

# Biomass

$CO_2$ from burning **biomass** — rice husk, bagasse, wood — is reported **separately** from the scopes, because it is part of the biological carbon cycle; its $CH_4$ and $N_2O$ are included in Scope 1 [1](#ref-1).

### Exercise: Scope 1 from combustion

A plant used in FY 2025-26:

- furnace oil: 640 tonnes;
- LPG in the canteen: 18 tonnes;
- diesel in company-owned forklifts: 24,000 litres (density 0.84 kg/l);
- natural gas: 52,000 MMBTU (GCV).

Using the IPCC defaults in the table, calculate $CO_2$ from each and the total. Round to the nearest tonne.

**Model answer**

- **Furnace oil:** 640 t × 40.4 GJ/t = 25,856 GJ = 25.856 TJ × 77,400 = **2,001 $tCO_2$**.
- **LPG:** 18 × 47.3 = 851.4 GJ = 0.8514 TJ × 63,100 = **54 $tCO_2$**.
- **Diesel:** 24,000 × 0.84 = 20.16 t × 43.0 = 866.9 GJ = 0.8669 TJ × 74,100 = **64 $tCO_2$**.
- **Natural gas:** 52,000 × 1.0551 = 54,865 GJ GCV × 0.9 = 49,379 GJ NCV × 56.1 kg/GJ = **2,770 $tCO_2$**.
- **Total: 4,889 $tCO_2$** (plus $CH_4$ and $N_2O$, if material).

# Scope 1: process and fugitive emissions

### In this lesson you will learn to

- Recognise process emissions in cement, lime, steel, chemicals and glass
- Calculate refrigerant emissions from service records or a mass balance
- Account for $SF_6$, waste water and other fugitive sources
- Decide which sources are material enough to measure carefully

**Scope 1 also includes emissions released by chemical reactions rather than combustion (process emissions), and gases that escape (fugitive emissions). They are easy to miss, and in some industries they are the largest source.** [1](#ref-1)

## Process emissions

| Industry | Process | Gas |
|---|---|---|
| Cement and lime | Calcination: limestone ($CaCO_3$) → lime ($CaO$) + $CO_2$ | $CO_2$ |
| Iron and steel | Reduction of iron ore with coke or coal; carbon in steel making | $CO_2$ |
| Aluminium | Anode consumption; anode effects | $CO_2$, PFCs |
| Chemicals | Ammonia, nitric acid, adipic acid production | $CO_2$, $N_2O$ |
| Glass and ceramics | Carbonates in raw materials | $CO_2$ |

In a cement plant, calcination typically produces more $CO_2$ than the fuel burned in the kiln. Process emissions are calculated from the quantity of raw material or product and a factor based on its chemistry — for example, the clinker produced and its lime content — using IPCC methods or sector protocols.

## Fugitive emissions

**Refrigerants.** Air-conditioners, chillers, cold rooms and refrigerated trucks leak HFCs. Three methods, from best to simplest:

1. **Mass balance** — refrigerant in stock at the start + bought − in stock at the end − sent back for recovery = the amount that went into equipment to replace leaks (adjusting for new or retired equipment).
2. **Service records** — the kilograms topped up by the service contractor, from the service reports.
3. **Screening estimate** — equipment capacity × an annual leak rate, for small sources where records are missing, disclosed as an estimate.

**Worked example**

**Mass balance for R-410A.** Cylinders in stock 1 April: 40 kg. Bought: 120 kg. In stock 31 March: 25 kg. Recovered and returned to the supplier: 10 kg. No equipment added or retired. Emitted = 40 + 120 − 25 − 10 = **125 kg** × 2,255.5 (AR6, from the GHG Protocol's GWP table[8] (#ref-8)) = **281.9 $tCO_2e$**.

**$SF_6$** in switchgear: from the top-up or the mass balance of the gas, like refrigerants.

**Methane from waste water** treated anaerobically on site, and from **on-site landfills**: from the organic load (COD or BOD) and IPCC methods.

**Fire extinguishers** using $CO_2$ or HFCs, and **gas leaks** from the company's own pipelines, complete the list.

# Materiality

Not every small source needs the most accurate method. Rank sources by size and uncertainty, measure the large ones precisely, and estimate the small ones transparently — completeness and transparency first, precision where it matters.

## Exercise: Refrigerant and $SF_6$

An office campus's service reports show top-ups of 36 kg of R-410A and 14 kg of HFC-134a. A substation's $SF_6$ mass balance shows 1.2 kg emitted. Calculate the fugitive emissions with AR6 GWPs.

**Model answer**

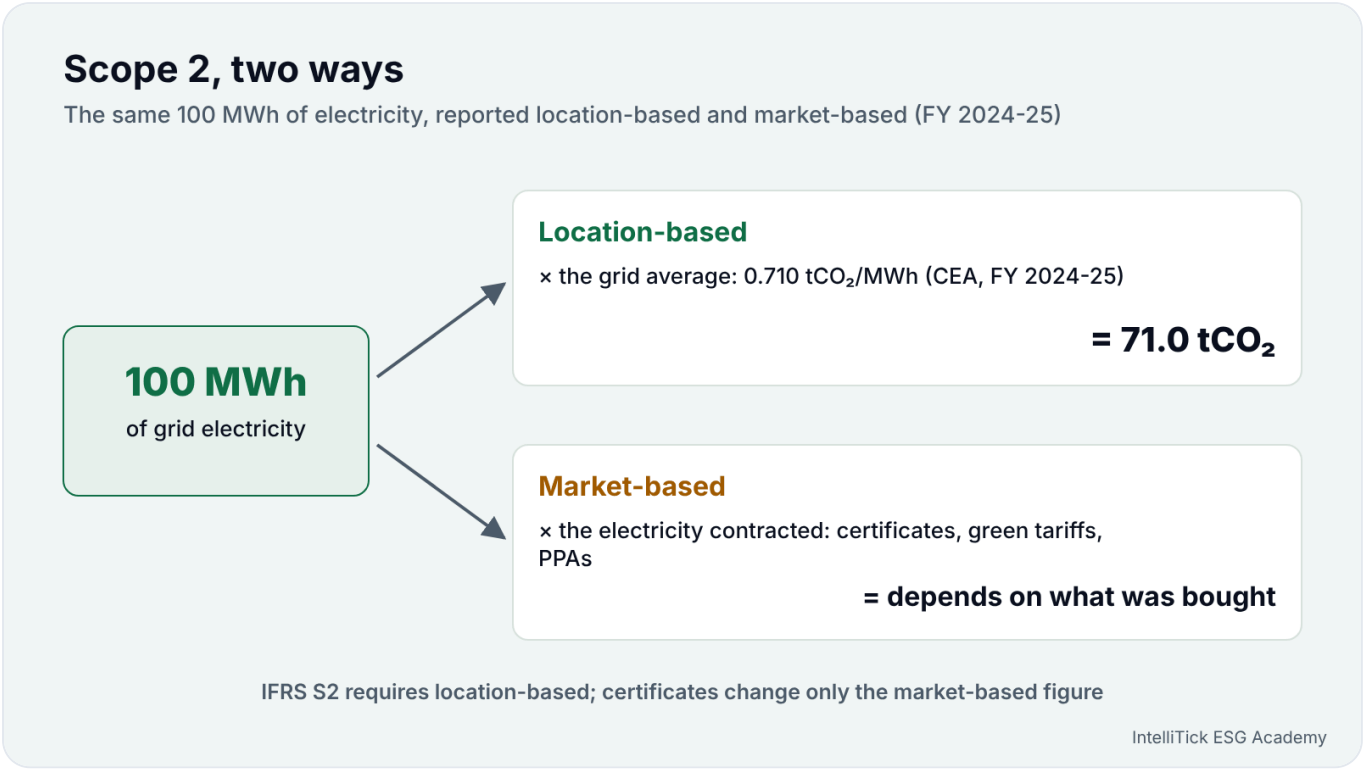
- R-410A: 36 × 2,255.5 = 81,198 kg = **81.2 $tCO_2e$**.
- HFC-134a: 14 × 1,530 = 21,420 kg = **21.4 $tCO_2e$**.
- $SF_6$: 1.2 × 24,300 = 29,160 kg = **29.2 $tCO_2e$**.
- **Total fugitive: 131.8 $tCO_2e$** — for an office campus, often more than its diesel generators.

# Scope 2: purchased electricity, by location and by market

### In this lesson you will learn to

- ✓ Calculate location-based Scope 2 with the CEA grid factor
- ✓ Calculate market-based Scope 2 from contracts, green tariffs and certificates, and apply the quality criteria
- ✓ Treat captive, open-access and on-site renewable power correctly
- ✓ Explain where the market-based rules are heading

**Scope 2 is the emissions from generating the electricity, steam, heat and cooling a company buys and uses. Since 2015, a company that can buy specific electricity reports it two ways — by location and by market** [2] (#ref-2) .




Location-based and market-based Scope 2

# Location-based

The **location-based** method uses the average emission intensity of the grid where the electricity is consumed [2] (#ref-2) . In India, that is the Central Electricity Authority's **CO2 Baseline Database**. Version 22 gives weighted averages of **0.727 $tCO_2$/MWh for FY 2023-24** and **0.710 for FY 2024-25** [5] (#ref-5) . The

factor changes every year, covers $CO_2$ only, and is published after the year it describes — so use the latest available, and say which version.

# Market-based

The **market-based** method uses the emissions of the electricity the company has chosen to buy, through **contractual instruments**[2](#ref-2):

- energy attribute certificates — in India, Renewable Energy Certificates (RECs), and international certificates (I-RECs);
- green tariffs offered by the distribution company;
- power purchase agreements (PPAs), including open-access supply from a renewable generator;
- supplier-specific emission rates.

The Scope 2 Guidance sets **quality criteria**: the instrument must convey the emission rate, be the only claim on that electricity (no double counting), be retired or cancelled for the company, match the period of consumption as closely as possible, and come from the same market as the consumption. For electricity not covered by instruments, the company uses a **residual mix** factor; where none exists — as in India — it uses the grid average and says so[2](#ref-2).

# Common Indian situations

| Situation | Location-based | Market-based |
|---|---|---|
| Grid electricity, no contract | Grid factor | Grid factor (no residual mix available) |
| Green tariff from the distribution company | Grid factor | Zero for the covered MWh, if the tariff meets the criteria |
| Open-access renewable power (wheeled through the grid) | **Grid factor** — it is delivered through the grid | Zero for the contracted MWh, with the attributes retained |
| On-site solar, not exported | Not Scope 2 at all: no purchase | Not Scope 2 |
| Captive gas or diesel generation | Fuel is Scope 1; not Scope 2 | Same |

| Situation | Location-based | Market-based |
|---|---|---|
| RECs bought separately from the power | Grid factor | Zero for the MWh covered by retired RECs |

**Check before you rely on this**

A frequent error is to give open-access renewable power a zero **location-based** factor. Location-based ignores contracts: every MWh drawn through the grid carries the grid factor. Contracts only change the **market-based** figure.

**Which figure to report where.** IFRS S2 requires location-based Scope 2, with information on contractual instruments[7] (#ref-7). The BRSR asks for Scope 2 without naming a method[6] (#ref-6): state which you report, and keep it the same each year.

# The market-based method is changing

The GHG Protocol consulted from October 2025 to January 2026 on requiring market-based claims to be **matched hour by hour** and **deliverable** to the grid where the electricity is used. In 2026 its Independent Standards Board moved towards **two market-based methods** — one with hourly matching, deliverability and incrementality, one keeping the 2015 rules — with the transition date still to be decided[10] (#ref-10). Until new rules are published, the 2015 Guidance applies; keep hourly consumption data where you can, because it is likely to be needed.

## Exercise: Both Scope 2 figures

A plant used 30,000 MWh in FY 2025-26: 20,000 MWh from the grid on the standard tariff, 4,000 MWh on the distribution company's green tariff, and 6,000 MWh of solar power through an open-access PPA with the renewable attributes transferred to the plant. It also generated 1,500 MWh from rooftop solar. Use 0.710 $tCO_2$/MWh.

Calculate location-based and market-based Scope 2.

**Model answer**

- **Location-based:** all grid-delivered electricity carries the grid factor: (20,000 + 4,000 + 6,000) × 0.710 = **21,300 $tCO_2$**. The rooftop solar is not purchased, so it is not in Scope 2.
- **Market-based:** the green tariff and the PPA are zero if they meet the quality criteria; the standard-tariff electricity uses the grid average (no Indian residual mix): 20,000 × 0.710 = **14,200 $tCO_2$**.
- Report both, state the instruments and the factor version, and note that the market-based figure uses the grid average for the uncovered MWh because no residual mix is published.

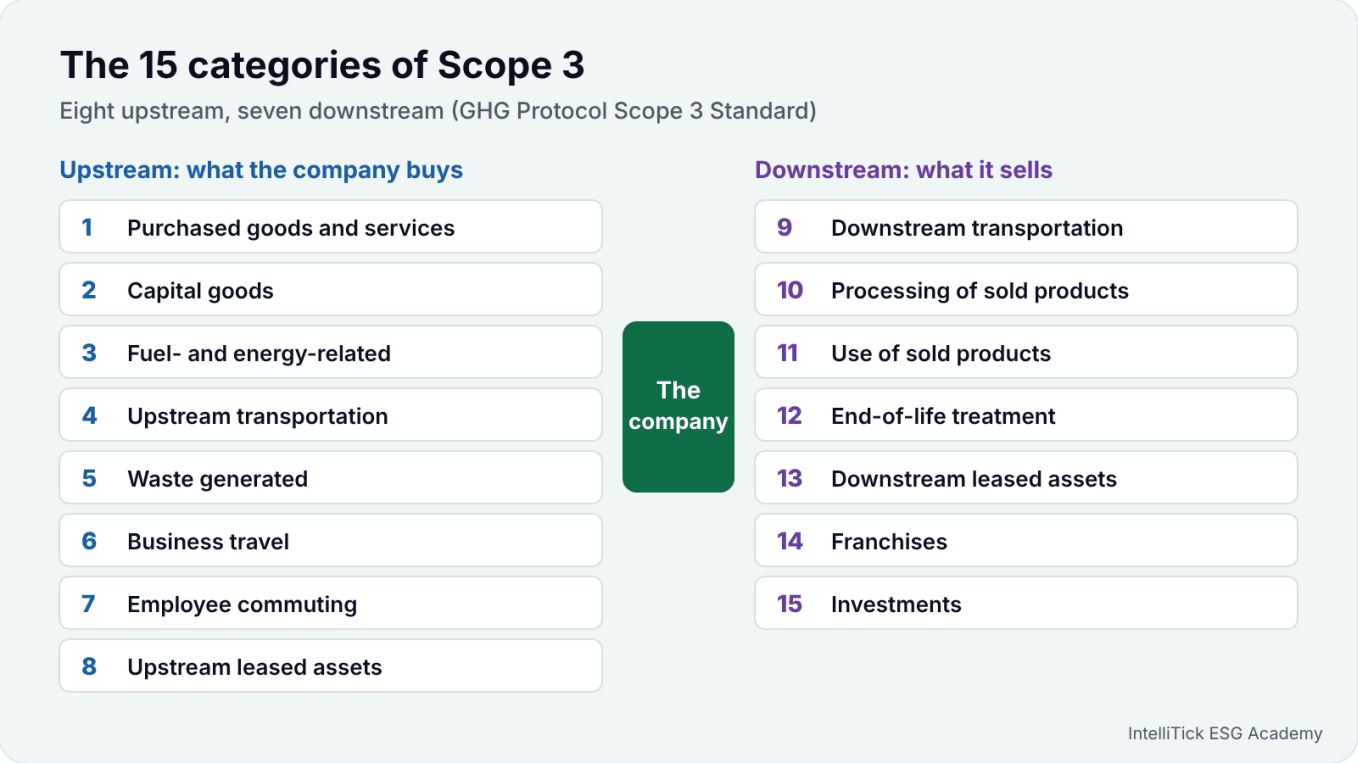
Lesson 7 · Module 3 — Scope 3

# Scope 3: the 15 categories and how to screen them

### In this lesson you will learn to

- ✓ Name and describe the 15 Scope 3 categories and their boundaries
- ✓ Decide which categories are relevant for a business, using the Standard's criteria
- ✓ Avoid double counting between scopes and between categories
- ✓ Explain what the Scope 3 Standard requires to be reported

**Scope 3 is all other indirect emissions — those that are a consequence of the company's activities but come from sources it does not own or control. For most companies it is the largest part of the footprint. The Scope 3 Standard divides it into 15 categories** [3] (#ref-3) .




The 15 categories of Scope 3

# The categories, with their boundaries

| # | Category | What it covers | Example |
|---|---|---|---|
| 1 | Purchased goods and services | Cradle-to-gate emissions of everything bought (other than items in 2–8) | Steel, chemicals, packaging, IT services |

| # | Category | What it covers | Example |
|---|---|---|---|
| 2 | Capital goods | Cradle-to-gate emissions of capital items bought in the year | A new boiler, vehicles, buildings |
| 3 | Fuel- and energy-related activities | Upstream emissions of fuels and electricity not in Scope 1 or 2: extraction and refining of fuels, transmission and distribution losses | Mining and transport of the coal you burn; grid losses |
| 4 | Upstream transportation and distribution | Transport and storage of purchased goods, and transport the company pays for, by vehicles it does not own | A hired transporter delivering raw materials |
| 5 | Waste generated in operations | Disposal and treatment of the company's waste by third parties | Landfill, incineration, recycling |
| 6 | Business travel | Travel by employees in vehicles the company does not own | Flights, trains, taxis, hotel stays (optional) |
| 7 | Employee commuting | Employees travelling between home and work (and, optionally, working from home) | Buses, two-wheelers, cars |
| 8 | Upstream leased assets | Assets the company leases and that are not in its Scope 1 and 2 | Depends on the consolidation approach |
| 9 | Downstream transportation and distribution | Transport and storage of sold products that the company does not pay for | Distributors' trucks, retail storage |
| 10 | Processing of sold products | Processing of intermediate products by customers | A steel maker's customers forming its steel |
| 11 | Use of sold products | Emissions from customers using the products | Fuel burned in sold vehicles; electricity used by sold appliances |
| 12 | End-of-life treatment of sold products | Disposal of the products and their packaging | Landfill of packaging |
| 13 | Downstream leased assets | Assets the company owns and leases to others, not in its Scope 1 and 2 | A building rented to tenants |
| 14 | Franchises | Emissions of franchisees | A restaurant chain's franchised outlets |

| # | Category | What it covers | Example |
|---|---|---|---|
| 15 | Investments | Emissions of investments, loans and projects | A bank's loans; a company's minority stakes |

Categories 1–8 are **upstream** (what the company buys); 9–15 are **downstream** (what it sells or owns)[3](#ref-3).

# Screening: which categories matter

The Standard asks companies to account for all **relevant** categories and to justify any exclusion. Relevance is judged on criteria such as[3](#ref-3):

- **size** — the category contributes significantly to total expected Scope 3;
- **influence** — the company can reduce the emissions;
- **risk** — it contributes to the company's exposure to climate-related risks;
- **stakeholders** — investors, customers or others consider it critical;
- **outsourcing** — it covers activities that were once in-house;
- **sector guidance** — sector guidance identifies it as significant.

Screening starts with a rough estimate of every category — often from spend — to see which are large. Then effort goes where it matters.

| Business | Usually largest |
|---|---|
| Manufacturer of chemicals, textiles, food | Category 1 |
| Maker of vehicles, appliances, fuels | Category 11 |
| Bank or insurer | Category 15 |
| Software and services | Categories 1, 2, 6 and 7 |
| Retailer | Categories 1, 4 and 9 |
| Cement or steel maker | Small relative to Scope 1, but categories 1, 3 and 4 still matter |

# Avoiding double counting

- **Between scopes:** your own trucks' diesel is Scope 1; a hired transporter's diesel is Scope 3 category 4 — never both.
- **Between categories:** a shipment you pay to transport is category 4, whether it carries inputs or products; transport of sold products you do not pay for is category 9.
- **Upstream energy:** the generation of purchased electricity is Scope 2; the extraction of the fuel the power station burned and the grid losses are category 3.

# What must be reported

For each relevant category: emissions in $tCO_2e$, the methods and data, the share calculated from supplier or partner data, and the exclusions with reasons. Biogenic $CO_2$ is reported separately[3] (#ref-3).

## Exercise: Classify the emissions

A packaged-foods company wants to know which scope and category each of these belongs to:

1. Diesel in its own delivery vans.
2. A logistics company's trucks bringing wheat to its plants (the company pays the freight).
3. Plastic film bought for packaging.
4. A new packaging line bought in the year.
5. Emissions from its distributors' warehouses.
6. Consumers' refrigerators storing its frozen products.
7. Landfill of its packaging after consumers throw it away.
8. Grid losses on the electricity it buys.

**Model answer**

1. **Scope 1** — its own vehicles.
2. **Scope 3, category 4** — upstream transport it pays for in vehicles it does not own.
3. **Scope 3, category 1** — purchased goods.
4. **Scope 3, category 2** — capital goods.
5. **Scope 3, category 9** — downstream storage it does not pay for.
6. **Scope 3, category 11** — use of sold products; it is an *indirect* use-phase emission (the product does not itself use energy, the fridge does), which the Standard treats as optional to report.
7. **Scope 3, category 12** — end-of-life treatment of sold products, including packaging.
8. **Scope 3, category 3** — fuel- and energy-related activities (transmission and distribution losses).

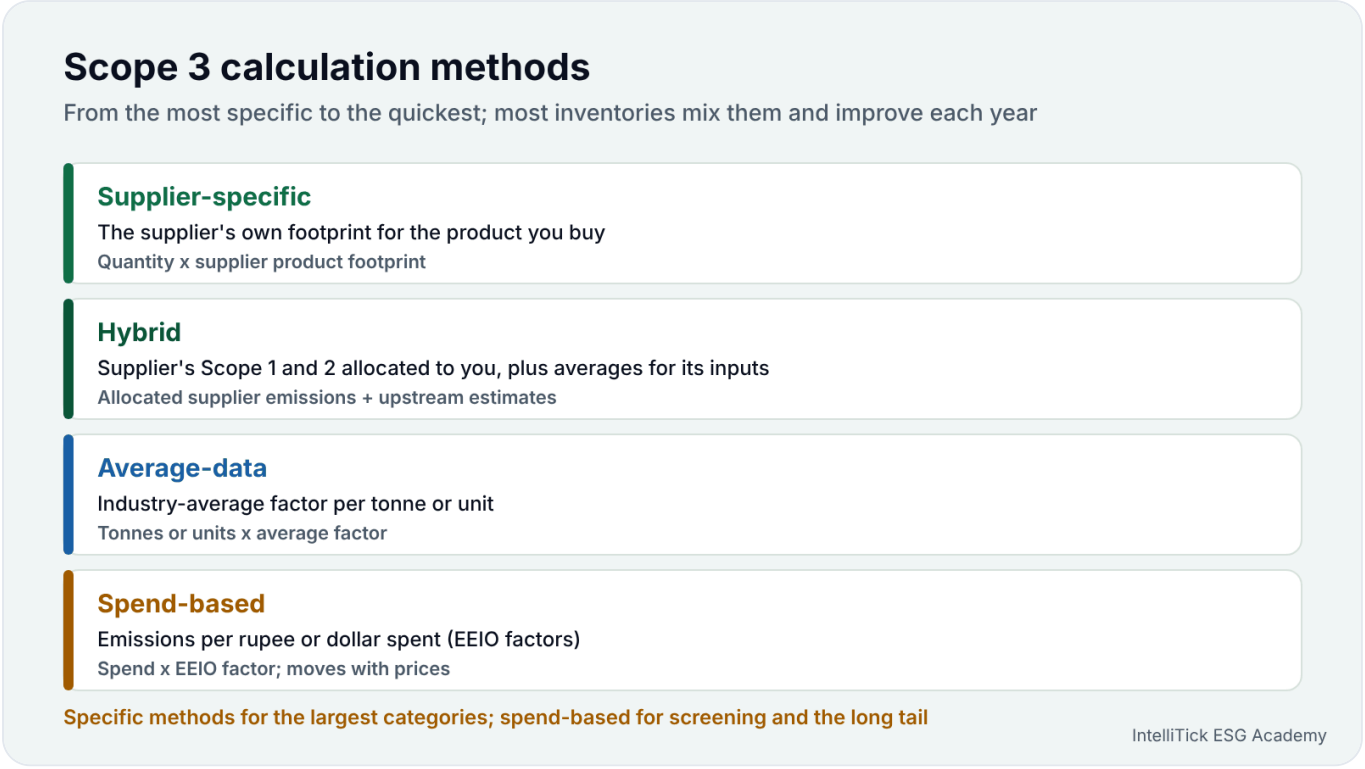
Lesson 8 · Module 3 — Scope 3

# Calculating Scope 3: methods and worked examples

### In this lesson you will learn to

- Choose between supplier-specific, hybrid, average-data and spend-based methods
- Calculate categories 1, 4, 5, 6 and 7 with worked examples
- Assess data quality and plan to improve it
- Run a supplier engagement that produces usable data

**Scope 3 can be calculated at several levels of precision. The Technical Guidance describes, for each category, a range of methods — from supplier-specific data to estimates from spend. Most inventories mix them, and improve year by year** [18] (#ref-18) .




Scope 3 calculation methods

# The methods for purchased goods (category 1)

| Method | Data | Formula | When |
|---|---|---|---|
| **Supplier-specific** | The supplier's cradle-to-gate emissions for the product | Quantity × supplier's product footprint | Key suppliers that can provide verified data |

| Method | Data | Formula | When |
|---|---|---|---|
| **Hybrid** | The supplier's Scope 1 and 2 allocated to your purchases, plus secondary data for its inputs | Supplier's allocated emissions + upstream estimates | Suppliers that report their own inventory |
| **Average-data** | Quantity (tonnes, units) × an industry-average factor per unit | Mass or units × average factor | Commodities bought by weight or count |
| **Spend-based** | Money spent × an environmentally extended input-output (EEIO) factor per rupee or dollar | Spend × factor | Screening; services; the long tail |

Source: Technical Guidance for Calculating Scope 3 Emissions[18] (#ref-18).

**Worked example**

**Average-data.** 4,200 tonnes of PET resin bought, with an industry-average cradle-to-gate factor of 2.2 $tCO_2e$ per tonne (illustrative): 4,200 × 2.2 = **9,240 $tCO_2e$**. **Spend-based.** ₹18 crore on IT and professional services, with an EEIO factor of 0.0025 kg $CO_2e$ per rupee (illustrative): 18,00,00,000 × 0.0025 = 4,50,000 kg = **450 $tCO_2e$**. Check the factor's units before multiplying: EEIO factors are often per US dollar of a specific year, so the spend must be converted at that year's rate and adjusted for inflation.

**Check before you rely on this**

Spend-based figures move with prices, not emissions: a 10% price rise looks like a 10% emissions rise. Use them for screening and the long tail, and replace them with activity or supplier data for the largest categories.

# Other common categories

**Category 4 — upstream transport (distance-based):** tonnes × kilometres × a factor per tonne-kilometre for the mode (road, rail, sea, air).

**Worked example**

1,200 tonnes of raw material carried 450 km by road at 0.1 kg $CO_2e$ per tonne-km (illustrative): 1,200 × 450 × 0.1 = 54,000 kg = **54 $tCO_2e$**.

**Category 5 — waste:** tonnes of each waste stream by treatment (landfill, incineration, recycling) × a factor for that treatment.

**Category 6 — business travel:** for flights, passenger-kilometres by class and distance band × a factor; for hotels (optional), room-nights × a factor; from the travel agency's report, not expense claims where possible.

**Category 7 — employee commuting:** a survey of how employees travel and how far, scaled to the workforce: employees × working days × distance × factor by mode.

**Worked example**

600 employees, 230 working days. Survey: 45% two-wheeler (average 2 × 12 km), 35% company-hired bus (2 × 20 km), 20% car (2 × 18 km). Illustrative factors per passenger-km: two-wheeler 0.03, bus 0.02, car 0.15 kg. Two-wheeler: 270 × 230 × 24 × 0.03 = 44,712 kg; bus: 210 × 230 × 40 × 0.02 = 38,640 kg; car: 120 × 230 × 36 × 0.15 = 1,49,040 kg. Total = **232.4 $tCO_2e$**. If the company pays for the buses itself, check whether they are already in category 4 or 6 — and do not count them twice.

# Data quality

The Technical Guidance assesses data on **technological, temporal, geographical, completeness and reliability** dimensions [18] (#ref-18) : does the factor match the material, the year, the country, the scope of activities, and is the source reliable? Keep a short data-quality note for each category, and a plan to improve the weakest large categories.

# Supplier engagement

1. Rank suppliers by estimated emissions (spend × factor), not spend alone.
2. Ask the top suppliers for their Scope 1 and 2 inventory and their revenue, or product footprints if they have them.
3. Allocate a supplier's emissions to you by your share of its revenue or output, and say which.

4. Help them: share a template, a definitions sheet and, in India, the BRSR Core indicators they may already be preparing.
5. Record which share of category 1 is supplier-specific each year — a number investors and SBTi ask for.

### Exercise: Allocate a supplier's emissions

A supplier reports Scope 1 and 2 of 48,000 $tCO_2e$ and revenue of ₹1,200 crore. You bought ₹90 crore from it this year. What is the hybrid estimate of the emissions attributable to your purchases (its Scope 1 and 2 only), and what are its limitations?

**Model answer**

Your share of its revenue = 90 ÷ 1,200 = **7.5%**. Allocated emissions = 48,000 × 7.5% = **3,600 $tCO_2e$**.

Limitations: revenue-based allocation assumes every rupee of the supplier's sales carries the same emissions, which is wrong if your products are more (or less) energy-intensive than its average; and it covers only the supplier's Scope 1 and 2, not the emissions of the supplier's own inputs (its Scope 3), which the hybrid method adds from secondary data. An allocation by physical output — tonnes of the product you buy — is better where the supplier can provide it.

Lesson 9 · Module 4 — Quality, targets and reporting

# Data quality, controls and assurance

**In this lesson you will learn to**

- ✓ Write an inventory management plan that makes the figures repeatable
- ✓ Keep a factor register and handle estimates and gaps correctly
- ✓ Prepare for verification or assurance of an inventory
- ✓ Recognise the errors assurers find most often

**An inventory is only useful if someone else can repeat it and get the same answer. That takes a documented method, controlled data and an evidence trail — the same disciplines as financial reporting.**

## The inventory management plan

A short document, updated each year, that records:

1. **Boundary** — the consolidation approach, the entities and sites included, and exclusions with reasons.
2. **Sources and methods** — for each source: the activity data, its owner and system, the calculation method, the factors.
3. **The factor register** — every emission factor, calorific value and GWP, with its source, version, year and unit.
4. **Data controls** — monthly entry with evidence, review by a second person, approval, and a change log.
5. **Estimates** — when they are allowed, the method, and how they are labelled.
6. **Base year and recalculation policy** (Lesson 3).
7. **Roles and timetable** — who does what, and when.

## Gaps and estimates

A missing month or site is a gap, not a zero. Fill it with a documented estimate — the same month last year adjusted for production, the average of neighbouring months, or spend divided by price — label it, and fix the data source for next year. The BRSR's Industry Standards allow spend-based estimates

only where measured data is not available, and do not allow a company to revert to them once measured data has been reported [17] (#ref-17) .

## Uncertainty

Every figure has uncertainty: meters have tolerances, default factors are averages, spend-based Scope 3 can be out by a large margin. You do not need a statistical model, but you should know where the big uncertainties are, say so, and reduce them where they matter most.

## Verification and assurance

An independent check of an inventory is called **verification** (under ISO 14064-3) or **assurance** (under ISAE 3410 internationally, or ICAI's standards in India — SAE 3410 for GHG statements until SSA 5000 replaces it for financial years beginning on or after 1 April 2027). Either way the provider will:

- understand the boundary, sources and methods;
- test controls over data collection and review;
- sample figures back to bills, meters, logs and invoices;
- recalculate with the factors and check their sources and years;
- review estimates and the base year.

## Errors assurers find most often

| Error | Effect |
|---|---|
| kWh multiplied by a factor per MWh | 1,000 times too high |
| Last year's grid factor, or a factor of the wrong country | Wrong Scope 2 |
| Gross and net calorific values mixed up | About 5–10% error on fuel emissions |
| Refrigerants and $SF_6$ left out | Incomplete Scope 1 |
| Open-access renewable power given zero location-based emissions | Understated location-based Scope 2 |
| Hired transport counted in Scope 1, or in both Scope 1 and 3 | Double counting |

| Error | Effect |
|---|---|
| Sites or months missing without an estimate | Incomplete inventory |
| Inconsistent boundary between BRSR and the GHG inventory | Figures that do not reconcile |

## Exercise: Review a calculation

A colleague's sheet shows: electricity 1,84,00,000 kWh × 0.710 = 1,30,64,000 $tCO_2$; natural gas 52,000 MMBTU × 2.07 kg/scm = 107.6 $tCO_2$; refrigerants "not applicable — handled by AMC vendor". Find the errors.

**Model answer**

- **Electricity:** 1,84,00,000 kWh is 18,400 MWh; × 0.710 $tCO_2$/MWh = **13,064 $tCO_2$**, not 1,30,64,000. The units were not converted (kWh × a factor per MWh).
- **Natural gas:** a factor per standard cubic metre applied to MMBTU — units mismatch. Convert MMBTU to GJ (× 1.0551), gross to net (× 0.9) and apply 56.1 kg $CO_2$ per GJ: 52,000 MMBTU → **2,770 $tCO_2$**.
- **Refrigerants:** an annual maintenance contract does not move the leaks out of Scope 1 — the equipment is the company's. Get the top-up quantities from the vendor's service reports and include them.

Lesson 10 · Module 4 — Quality, targets and reporting

# Targets, India's carbon market and CBAM

**In this lesson you will learn to**

- Set an emissions target with the right base year, scope and metric
- Explain the SBTi's Corporate Net-Zero Standard and its new version
- Explain how India's Carbon Credit Trading Scheme sets intensity targets
- Explain what CBAM asks of Indian exporters to the EU

**An inventory becomes a management tool when it carries a target. In India it is also becoming a compliance instrument — through the domestic carbon market — and a condition of trade with the EU.**

## Setting a target

A credible target states:

- **scope and coverage** — which scopes and what share of them;
- **base year and base-year emissions**;
- **target year**;
- **metric** — absolute ($tCO_2e$) or intensity ($tCO_2e$ per tonne, per rupee of revenue);
- **how progress will be reported**, and the treatment of carbon credits.

**Absolute** targets guarantee a fall in emissions; **intensity** targets allow growth but can be met while emissions rise. Many companies set both.

**Check before you rely on this**

**Reductions and credits are different things.** Buying carbon credits does not reduce your inventory. Report gross emissions, and credits separately — IFRS S2, the ESRS and the SBTi all keep them apart.

## Science-based targets

The **Science Based Targets initiative (SBTi)** validates corporate targets against climate science. It released **version 2.0 of its Corporate Net-Zero Standard on 11 June 2026** [12] (#ref-12) :

- companies may continue to use version 1.3.1 for targets submitted until **31 January 2028**; version 2.0 is required after that, with validation against it opening in early 2027;
- Scope 1 targets must cover all Scope 1 emissions; Scope 2 needs separate targets covering all Scope 2, with requirements on how low-carbon electricity is matched to consumption;
- larger companies ("Category A") must set Scope 3 targets, prioritising categories that are 5% or more of Scope 3; smaller companies in lower-income countries ("Category B") may;
- net zero by 2050 at the latest, with a new emphasis on taking responsibility for ongoing emissions [12] (#ref-12) .

# India's Carbon Credit Trading Scheme

India's **Carbon Credit Trading Scheme (CCTS), 2023** has a **compliance mechanism**: obligated entities in designated sectors receive **greenhouse gas emission intensity (GEI) targets** in tonnes of $CO_2e$ per tonne of product. Entities that beat their targets earn **carbon credit certificates**, which they can sell to entities that miss theirs [13] (#ref-13) .

- **October 2025:** targets notified for **aluminium, cement, chlor-alkali and pulp and paper** — 282 entities.
- **13 January 2026:** targets notified for **petroleum refineries, petrochemicals, textiles and secondary aluminium** — 208 more, **490** in all [13] (#ref-13) .
- The draft rules set a **2023-24 baseline**, compliance years **2025-26 and 2026-27**, and environmental compensation for shortfalls not covered by certificates [14] (#ref-14) .

For a practitioner in these sectors, the GEI calculation follows the scheme's own procedures, which differ in places from the GHG Protocol — keep the two calculations reconciled.

# CBAM

The EU's **Carbon Border Adjustment Mechanism (CBAM)** puts a carbon price on imports of **cement, iron and steel, aluminium, fertilisers, electricity and hydrogen**. After a reporting-only transition from 2023 to 2025, its definitive regime applied from **1 January 2026** [15] (#ref-15) :

- only **authorised CBAM declarants** may import CBAM goods above a **50-tonne annual threshold**;
- certificates for 2026 imports go on sale from **February 2027**, and the first annual declaration and surrender is due by **30 September 2027**;

- importers may use **default values**, or the producer's **actual embedded emissions verified by an accredited verifier** [16] (#ref-16) .

For an Indian exporter, this means EU customers will ask for **installation-level, product-level embedded emissions**, calculated by the EU's rules and verified. Producers with good data can show lower emissions than the defaults — a commercial advantage.

### Exercise: Absolute or intensity?

A cement company's Scope 1 + 2 was 4.0 million $tCO_2e$ in FY 2023-24 on 6.0 million tonnes of cement. By FY 2029-30 it plans 8.0 million tonnes and an intensity of 0.60 $tCO_2e$ per tonne. What happens to intensity and absolute emissions, and what does this tell you about the target?

**Model answer**

- Base-year intensity = 4.0 ÷ 6.0 = **0.667 $tCO_2e$ per tonne**. The target intensity of 0.60 is a **10%** improvement.
- FY 2029-30 absolute emissions = 8.0 × 0.60 = **4.8 million $tCO_2e$** — **20% higher** than the base year.
- The intensity target is met while absolute emissions grow. Investors and the SBTi will ask how the company's absolute emissions will fall; an intensity target alone does not answer that. Disclose both, and consider an absolute target alongside.

# PAT and CCTS: the filings, deadlines and penalties

**In this lesson you will learn to**

- Name the forms a designated consumer files under PAT, with their due dates and the penalties for missing them
- Follow the CCTS compliance cycle for an obligated entity — registry, monitoring plan, verified emission report, Form A, verification, surrender and Form D
- Calculate the carbon credit certificates an obligated entity must surrender or will earn
- Keep the PAT, CCTS and corporate inventories reconciled

**For energy-intensive plants in India, energy and emissions are not only reported — they are filed with the Bureau of Energy Efficiency (BEE), verified by accredited agencies and settled in certificates. Missing a form is a penalty; missing a target is a bill.**

## PAT: Perform, Achieve and Trade

Under the Energy Conservation Act, the government notifies energy-intensive plants as **designated consumers** and gives them specific energy consumption targets for each PAT cycle. Plants that beat their target earn **energy saving certificates (ESCerts)**, one for each tonne of oil equivalent (toe) saved; plants that miss it buy them [19] (#ref-19).

| Form | What it is | Who | When |
|---|---|---|---|
| Form 1 | Annual energy consumption and production | Designated consumer, to the State Designated Agency (SDA) and BEE | Every year, within three months of the financial year's end — **30 June** |
| Action plan | How the plant will meet its target | Designated consumer | Within three months of the target notification |
| Form A | Performance assessment document for the target year | Designated consumer, with Form B, to the SDA and BEE | Within **four months** of the end of the target year |
| Form B | Certificate of verification | Empanelled accredited energy auditor, after measurement and verification | With Form A |

| Form | What it is | Who | When |
|---|---|---|---|
| Form C | Certificate of check-verification | Auditor appointed by BEE | After check-verification |
| Form D | Compliance status: target met, or ESCerts surrendered | Designated consumer, to the SDA with a copy to BEE | Within **one month** of the end of ESCert trading |

Source: BEE [19] (#ref-19). The dates in a given cycle are set by BEE's notices — check them for the current cycle.

**Penalties** under section 26 of the Act, as BEE explains them [19] (#ref-19):

- missing the measurement-and-verification timelines: **₹10 lakh**, plus **₹10,000 a day** while the failure continues;
- failing to comply with the target: **₹10 lakh**, plus, for continuing failure, an amount equal to the price of every tonne of oil equivalent of the shortfall;
- a shortfall against the target must in any case be covered by **buying and surrendering ESCerts**.

# CCTS: the compliance mechanism

The Carbon Credit Trading Scheme's compliance mechanism gives **obligated entities** in notified sectors a **greenhouse gas emission intensity (GEI) target** — tonnes of $CO_2e$ per tonne of product — for each compliance year [13] (#ref-13). BEE's detailed compliance procedure sets out the cycle [20] (#ref-20):

1. **Register** on the Indian Carbon Market (ICM) Registry.
2. **Monitoring plan.** Submit it to BEE within three months of the start of the first trajectory period, and then within three months of the start of each compliance year. BEE reviews and approves it.
3. **Energy and emissions form (E2).** Submitted in time, with proof attached to Form A.
4. **Verified GHG emission report and Form A** (the performance assessment document) to BEE and the SDA **within four months of the end of the compliance year** — 31 July for a year ending 31 March.
5. **Verification.** An **accredited carbon verification agency** verifies the report and issues **Form B**; BEE may order **check verification (Form C)**, within one year of the report. If Form A turns out to contain false information, the entity bears the cost of check verification.
6. **Issuance or surrender.** On the national steering committee's recommendation, BEE issues **carbon credit certificates** to entities that beat their target. Entities that miss it surrender certificates — banked, or bought on the power exchanges.

7. **Form D** (the compliance assessment document) **within one month of the last trading session** of the compliance year.
8. **A long-term action plan** of at least five years, within one year of the first compliance year, with annual activity plans after that.

**How many certificates?** One certificate is one tonne of $CO_2e$. The quantity is [20] (#ref-20) :

> (GEI achieved − GEI target) × output in the compliance year

A positive result is the number to **surrender**; a negative one is the number the entity can **earn**. The draft rules provide **environmental compensation** for a shortfall not covered by certificates [14] (#ref-14) .

**Check before you rely on this**

**The scheme's numbers are not the BRSR's numbers.** GEI is calculated by the scheme's own sector procedures — boundaries, product definitions and factors — which differ in places from the GHG Protocol [20] (#ref-20) . Keep a reconciliation from the CCTS emissions to the plant's Scope 1 and 2 in the corporate inventory, and explain the differences in the BRSR if asked.

# Which scheme applies?

The CCTS compliance mechanism covers sectors that were under PAT — aluminium, cement, chlor-alkali, pulp and paper, refineries, petrochemicals and textiles among them; the targets notified so far also cover secondary aluminium [13] (#ref-13) . During the transition a plant may have filings under one scheme or both. Check BEE's notifications for your plant: if it is listed as an obligated entity, the CCTS cycle applies; if it is a designated consumer with a live PAT target, the PAT forms apply.

# Where these filings meet the corporate inventory

| Filing | Corporate figure it should reconcile with |
|---|---|
| PAT Form 1 | The plant's energy consumption in the BRSR (Principle 6) and the fuel data behind Scope 1 |
| CCTS verified GHG emission report | The plant's Scope 1 and 2, adjusted for boundary and method differences |

| Filing | Corporate figure it should reconcile with |
|---|---|
| ESCerts or carbon credit certificates surrendered or sold | Disclosed separately — they are not reductions in the inventory |

## Exercise: Surrender or earn?

A cement plant has a GEI target of 0.720 $tCO_2e$ per tonne of cement for FY 2025-26. It produced 2.4 million tonnes. (a) Its verified GEI is 0.745. (b) Instead, its verified GEI is 0.700. How many carbon credit certificates must it surrender or can it earn in each case, and what filings close the year?

**Model answer**

- **(a)** (0.745 − 0.720) × 2,400,000 = 0.025 × 2,400,000 = **60,000 certificates to surrender**[20] (#ref-20). It can use banked certificates or buy them on the power exchanges.
- **(b)** (0.700 − 0.720) × 2,400,000 = −0.020 × 2,400,000 = −48,000: it can **earn 48,000 certificates**, issued by BEE on the steering committee's recommendation.
- **Filings:** the verified GHG emission report and Form A by **31 July 2026**, the agency's Form B, and Form D within one month of the year's last trading session[20] (#ref-20).
- **Inventory:** the certificates are disclosed separately from emissions; the plant's Scope 1 in the corporate inventory is reconciled to the verified CCTS report.

## Exercise: Build the plant's energy-and-carbon calendar

A textile plant is a designated consumer under PAT and has just been notified as an obligated entity under the CCTS. List its filings for the year ending 31 March 2026.

**Model answer**

| By | Filing |
|---|---|
| 30 June 2026 | PAT Form 1, energy and production for FY 2025-26 [19] (#ref-19) |
| Within three months of the compliance year's start | CCTS monitoring plan (for 2026-27, by 30 June 2026) [20] (#ref-20) |
| 31 July 2026 | CCTS verified GHG emission report and Form A for FY 2025-26, with the E2 form [20] (#ref-20) |
| With Form A | Form B from the accredited carbon verification agency [20] (#ref-20) |
| One month after the year's last trading session | CCTS Form D [20] (#ref-20) |
| As BEE notifies | Any PAT target-year Form A, Form B and Form D still open [19] (#ref-19) |

Add the long-term action plan, due within one year of the first compliance year [20] (#ref-20), and name an owner for each line.

Lesson 12 · Module 4 — Quality, targets and reporting

# Reporting the inventory: BRSR, IFRS S2, ESRS and CDP

### In this lesson you will learn to

- Map one inventory to the BRSR, IFRS S2, the ESRS and CDP
- Present the inventory with the disclosures readers need
- Keep one set of numbers behind every report

**One inventory serves every framework, but each asks for it differently. Keep a single, controlled inventory and map it — never recalculate for each report.**

| Framework | What it asks |
|---|---|
| **BRSR (India)** | Scope 1 and 2 in $tCO_2e$ and intensities, under Principle 6 (essential, and BRSR Core); Scope 3 as a leadership indicator (voluntary) [6] (#ref-6) |
| **IFRS S2** | Scope 1, 2 (location-based, plus information on contractual instruments) and 3 under the GHG Protocol, with Scope 3 by category; the consolidation approach; GWPs from the latest IPCC report [7] (#ref-7) |
| **ESRS E1 (EU)** | Gross Scope 1, 2 (location- and market-based) and 3, total emissions, and intensity per net revenue (see the CSRD and ESRS course) |
| **CDP** | Scopes 1, 2 (both methods) and 3, with methods, verification status and targets |
| **SBTi** | Base-year and annual inventory covering the target boundary [12] (#ref-12) |

# A good inventory disclosure

1. The reporting period and the organisational boundary (and approach).
2. Scope 1, Scope 2 (both methods where you can) and Scope 3 by category, in $tCO_2e$.
3. Base year, base-year emissions and any recalculation.
4. Methods, factor sources and GWP set.
5. Exclusions and estimates, with reasons.
6. Biogenic $CO_2$ separately.
7. Verification or assurance status.

8. Intensity ratios with their denominators.

## Exercise: Map the inventory

Your inventory: Scope 1 = 5,009 $tCO_2e$; Scope 2 location-based 15,549 $tCO_2e$, market-based 13,064 $tCO_2e$; Scope 3 categories 1, 3, 4 and 7 = 61,200 $tCO_2e$. Which figures go into the BRSR (essential and leadership) and into an IFRS S2 report?

**Model answer**

- **BRSR, Principle 6 essential indicator 7:** Scope 1 = 5,009 and Scope 2 = the method the company has chosen and stated for the BRSR, used consistently every year, with intensities. **Leadership indicator 2:** Scope 3 = 61,200, with the categories covered.
- **IFRS S2:** Scope 1 = 5,009; **location-based** Scope 2 = 15,549, plus information on the contractual instruments that would give the market-based 13,064; Scope 3 = 61,200, **by category**, with the measurement approach and any categories excluded.
- The same inventory underlies both; only the presentation differs.

Lesson 13 · Module 5 — Capstone

# Case study: Vindhya Fabrics' first full inventory

**In this lesson you will learn to**

- ✓ Build a complete Scope 1, 2 and 3 inventory for one company
- ✓ Make and justify boundary decisions
- ✓ Calculate with site-specific and default data, and document every factor
- ✓ Interpret the result for targets, India's carbon market and customers

**Vindhya Fabrics Ltd is a fictional textile company preparing its first full inventory for FY 2025-26, for its BRSR and for a large European apparel customer. The figures are illustrative. Work through the tasks before opening each model answer.**

## The company

- A spinning and weaving mill at Bhilwara, Rajasthan, which Vindhya owns and operates. Production: **42,000 tonnes** of fabric.
- A 51% share in a joint venture processing unit in Surat, **operated by the partner** under the joint venture agreement. The unit emitted **6,200 $tCO_2e$** (Scope 1 + 2) in the year.
- Vindhya applies **operational control**.

## The data (Bhilwara)

- Coal in the boiler: **18,500 t**; laboratory NCV **15.9 GJ/t**. Factor chosen: 96,100 kg $CO_2$/TJ (IPCC default for sub-bituminous coal) [9] (#ref-9) .
- Diesel in DG sets and company forklifts: **36,000 litres** (density 0.84 kg/l; 43.0 GJ/t; 74,100 kg $CO_2$/TJ).
- LPG in the canteen: **9 t** (47.3 GJ/t; 63,100 kg $CO_2$/TJ).
- R-410A topped up in air-conditioning and chillers: **64 kg** (AR6 GWP 2,255.5).
- Electricity: **26,000 MWh** from the grid; **9,000 MWh** of solar power through an open-access PPA, with the renewable attributes transferred. Grid factor 0.710 $tCO_2$/MWh [5] (#ref-5) .
- Purchases: **30,000 t of yarn** (illustrative average factor 4.0 $tCO_2e$ per tonne); dyes and chemicals **₹45 crore** (illustrative spend factor 0.004 kg $CO_2e$ per rupee).

- Inbound transport by hired trucks: **21,000 t over an average 620 km** (illustrative 0.1 kg $CO_2e$ per tonne-km).
- Commuting survey for 900 employees, 240 days: 50% two-wheeler (2 × 10 km), 30% bus (2 × 16 km), 20% car (2 × 14 km); illustrative factors per passenger-km 0.03, 0.02, 0.15 kg.

### Exercise: Task 1 — The boundary

How does the Surat joint venture appear in Vindhya's inventory under operational control? How would it differ under equity share?

**Model answer**

Under **operational control**, Vindhya includes 100% of operations it operates and none of those it does not. The partner operates Surat, so its 6,200 $tCO_2e$ is **not** in Vindhya's Scope 1 or 2. It belongs in **Scope 3, category 15 (investments)** — Vindhya's share, 51% × 6,200 = **3,162 $tCO_2e$**, is the usual way to report it there.

Under **equity share**, Vindhya would include 51% × 6,200 = **3,162 $tCO_2e$** in its Scope 1 and 2 directly. Whatever is chosen, it must be stated, applied to the whole group, and kept the same each year — and the BRSR boundary must be consistent with it.

### Exercise: Task 2 — Scope 1

Calculate Scope 1 by source and in total.

**Model answer**

- **Coal:** 18,500 × 15.9 = 2,94,150 GJ = 294.15 TJ × 96,100 = **28,268 $tCO_2$**.
- **Diesel:** 36,000 × 0.84 = 30.24 t × 43.0 = 1,300.3 GJ = 1.3003 TJ × 74,100 = **96 $tCO_2$**.
- **LPG:** 9 × 47.3 = 425.7 GJ = 0.4257 TJ × 63,100 = **27 $tCO_2$**.
- **Refrigerant:** 64 × 2,255.5 = **144 $tCO_2e$**.
- **Scope 1 = 28,535 $tCO_2e$** ($CH_4$ and $N_2O$ from coal combustion would be added if material). Coal dominates: the laboratory NCV — not the default — is the single most important number in the inventory, so keep the test certificates.

## Exercise: Task 3 — Scope 2

Calculate location-based and market-based Scope 2.

**Model answer**

- **Location-based:** (26,000 + 9,000) × 0.710 = **24,850 $tCO_2$** — the open-access solar is delivered through the grid.
- **Market-based:** 26,000 × 0.710 = **18,460 $tCO_2$** — the PPA with transferred attributes is zero if it meets the quality criteria; the grid average is used for the rest because India has no published residual mix.

## Exercise: Task 4 — Scope 3

Calculate categories 1, 4, 7 and 15, and say where the company should improve its data first.

**Model answer**

- **Category 1:** yarn 30,000 × 4.0 = 1,20,000 $tCO_2e$; chemicals 45,00,00,000 × 0.004 kg = 18,00,000 kg = 1,800 $tCO_2e$. **Total 1,21,800 $tCO_2e$.**
- **Category 4:** 21,000 × 620 × 0.1 = 13,02,000 kg = **1,302 $tCO_2e$**.
- **Category 7:** 900 × 240 × [0.5 × 20 × 0.03 + 0.3 × 32 × 0.02 + 0.2 × 28 × 0.15] = 2,16,000 × 1.332 = 2,87,712 kg = **288 $tCO_2e$**.
- **Category 15: 3,162 $tCO_2e$** (Task 1).
- Calculated Scope 3 ≈ **1,26,552 $tCO_2e$** — more than twice Scope 1 and 2 combined. Category 3 (upstream emissions of coal and grid losses), category 5 (waste) and category 12 (end of life) are still to be screened.

**Where to improve first:** yarn. One factor, used for 95% of Scope 3, is an industry average. Ask the largest yarn suppliers for their emissions per tonne (or their Scope 1 and 2 and output, for a hybrid estimate); a supplier with renewable power could have a far lower figure, which the European customer will value.

## Exercise: Task 5 — Intensity, CCTS and the customer

1. Calculate Scope 1 + 2 intensity per tonne of fabric (both Scope 2 methods).
2. Textiles were added to India's carbon market in January 2026. What should Vindhya check?
3. Does CBAM apply to Vindhya's fabric exports to the EU?

**Model answer**

1. Location-based: (28,535 + 24,850) ÷ 42,000 = **1.27 $tCO_2e$ per tonne**; market-based: (28,535 + 18,460) ÷ 42,000 = **1.12 $tCO_2e$ per tonne**.
2. Whether the Bhilwara mill is among the **obligated entities** notified for the textile sector[13] (#ref-13). If it is, it has a greenhouse gas emission intensity target under the scheme's own rules and measurement procedures, and must reconcile its scheme calculation with this inventory. Beating the target earns carbon credit certificates; missing it means buying them or paying environmental compensation.
3. **No.** CBAM covers cement, iron and steel, aluminium, fertilisers, electricity and hydrogen[15] (#ref-15) — not textiles. The customer's request comes from its own reporting (its Scope 3, category 1), not from CBAM.

Lesson 14 · Reference

# Glossary, factor sheet and checklists

**In this lesson you will learn to**

- Use the vocabulary of carbon accounting precisely
- Keep a working factor sheet and conversion table
- Run an inventory year with a checklist

**The reference you will come back to.**

# Glossary

| Term | Meaning |
|---|---|
| GHG inventory | A company's account of its greenhouse gas emissions for a period, by scope |
| $CO_2e$ | Carbon dioxide equivalent: tonnes of a gas × its GWP |
| GWP | Global warming potential over 100 years, from an IPCC assessment report (AR4, AR5, AR6) |
| Organisational boundary | Which operations are included: equity share, financial control or operational control |
| Operational boundary | Which emissions are counted and how they are classified into scopes |
| Scope 1 / 2 / 3 | Direct / purchased energy / other value chain emissions |
| Location-based / market-based | Scope 2 using the grid average / using contracts and certificates |
| Residual mix | The emission factor of grid electricity after contracted renewables are removed (not published in India) |
| NCV / GCV | Net / gross calorific value: energy content excluding / including the heat of condensing water vapour |
| Activity data | The quantity that causes emissions: litres, kWh, tonnes, kilometres, rupees |

| Term | Meaning |
|---|---|
| Emission factor | Emissions per unit of activity, with a source, year and unit |
| EEIO factor | An environmentally extended input-output factor: emissions per unit of spend |
| Base year | The year against which change is measured; recalculated for structural and methodology changes |
| Biogenic $CO_2$ | $CO_2$ from burning biomass, reported separately from the scopes |
| Verification / assurance | An independent check of the inventory (ISO 14064-3; ISAE 3410; ICAI SAE 3410, then SSA 5000) |
| CCTS | India's Carbon Credit Trading Scheme, 2023 |
| GEI target | Greenhouse gas emission intensity target under the CCTS, in $tCO_2e$ per tonne of product |
| CBAM | The EU's Carbon Border Adjustment Mechanism |
| SBTi | Science Based Targets initiative |

# Conversion and factor sheet

| Conversion | Value |
|---|---|
| 1 kWh | 3.6 MJ |
| 1 MWh | 3.6 GJ |
| 1 MMBTU | 1.0551 GJ |
| 1 TJ | 1,000 GJ |
| 1 Gg | 1,000 t |
| NCV from GCV, natural gas | about 0.90 × GCV [9] (#ref-9) |
| NCV from GCV, coal and oil | about 0.95 × GCV [9] (#ref-9) |

| Conversion | Value |
|---|---|
| Diesel (IPCC defaults, density 0.84 kg/l) | about 36.1 MJ and 2.68 kg $CO_2$ per litre |
| Indian grid, FY 2024-25 | 0.710 $tCO_2$/MWh (CEA version 22) [5] (#ref-5) |
| R-410A, AR6 | 2,255.5 |

# The inventory year — checklist

**Before the year**

- Boundary and consolidation approach confirmed; entity and site list updated.
- Inventory management plan reviewed; owners named.
- Factor register updated: latest CEA version, GWP set, calorific values, Scope 3 factors.
- Base-year recalculation policy applied to last year's changes.

**During the year**

- Monthly activity data with evidence: fuels, electricity, refrigerant service reports.
- Supplier data requests for the largest Scope 3 categories.
- Quarterly review of trends and gaps.

**After the year**

- Estimates for gaps, labelled; reconciliation of fuel and electricity to purchase records.
- Scope 2 both ways; Scope 3 screening refreshed.
- Review by a second person; verification or assurance.
- One inventory, mapped to BRSR, IFRS S2, CDP and customers.

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