



Measuring your carbon footprint

A guide to commercial sector carbon accounting for scope 1, 2 and 3 emissions

Ontario's commercial sector is demonstrating climate leadership by aligning with government policies and stakeholder expectations to measure, manage and reduce greenhouse gas (GHG) emissions.

Preparing a carbon footprint is a foundational step for a company's climate planning, reporting and accountability. Many businesses are engaging in carbon accounting as part of their environmental, social and governance (ESG) commitments, voluntary disclosures and corporate sustainability strategies.

This fact sheet provides an overview of carbon accounting practices and is targeted at:

1 Sustainability practitioners

2 Facilities managers

3 Administrators, consultants and related professionals

Please note: Commercial sector includes retail stores, offices, lodging, the food services, education (private), health care (private), warehouses and other businesses. **It does not include the industrial or public sectors.**

This guide walks through the steps to measuring your carbon footprint, starting with how to set an organizational boundary to account for scope **1 (direct)**, **2 (energy indirect)**, and **3 (value chain)** emissions. It includes guidance on data collection and methodological challenges, provides Ontario-specific examples of GHG accounting, and suggests next steps for companies.

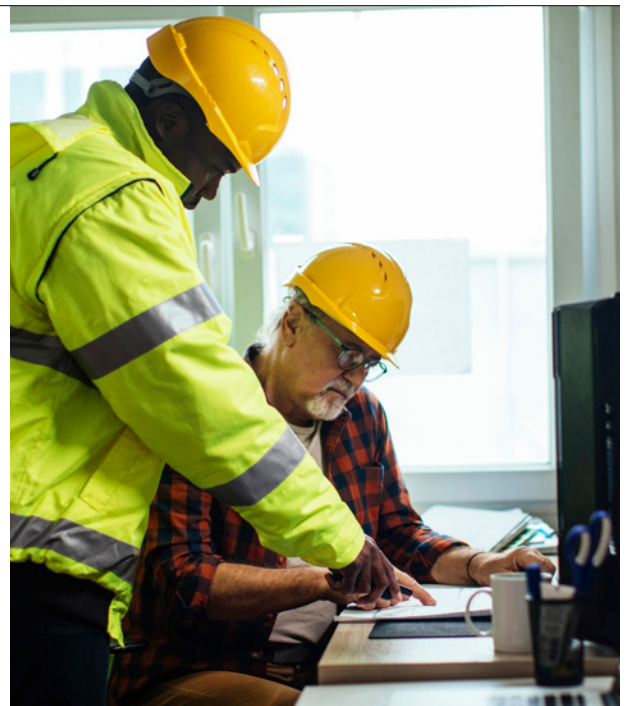
Using operational control for organizational boundaries

Choosing your organizational boundary is a critical first step to measuring GHG emissions. An organizational boundary defines the scope of operations, facilities and entities that a company includes in its greenhouse gas inventory, based on ownership, control or financial influence. It is important because it determines which emissions are accounted for, ensuring consistency, transparency and comparability in reporting across reporting periods and with other organizations. Most commercial sector companies use the “operational control” approach. This aligns with the GHG Protocol (a widely recognized framework for corporate GHG accounting) and ISO 14064-1 (an international standard for quantifying and reporting organizational emissions).

Organizations using operational control commonly measure the following scope 1 and 2 emissions sources:

- Facilities owned and operated by the company.
- Office and retail spaces.
- Company vehicles.
- On-site utilities.

The main reason the commercial sector uses the operational control approach is because it simplifies GHG accounting under different lease structures. The tenant takes responsibility for scope 1 and 2 emissions and the landlord reports emissions as scope 3, regardless of lease type.



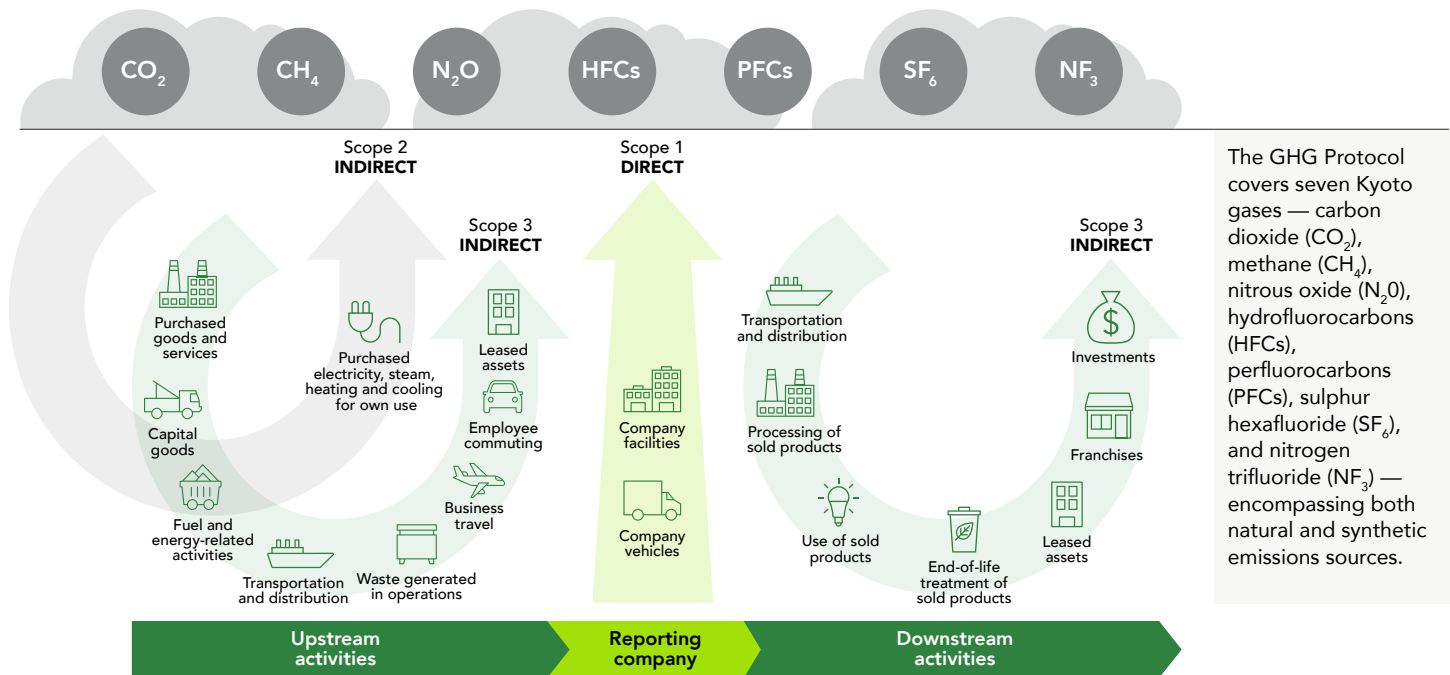
Greenhouse Gas Protocol Corporate Standard. World Resources Institute and World Business Council for Sustainable Development. The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition). Washington, DC: WRI/WBCSD, 2004. Available at: <https://ghgprotocol.org/corporate-standard>

ISO 14064-1. International Organization for Standardization. ISO 14064-1:2018 — Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals. Geneva: ISO, 2018. Available at: <https://www.iso.org/standard/66453.html>

Three scopes of emissions

The below diagram illustrates the three types of GHG emissions: Scope 1 (direct emissions), Scope 2 (indirect emissions from purchased energy), and Scope 3 (other indirect emissions from upstream and downstream activities).

Figure 1: Overview of GHG Protocol scopes and emissions across the value chain



1 Scope 1 emissions: Direct emissions from operations

Scope 1 emissions are direct GHG emissions from sources owned or controlled by a company. These typically include emissions from:

- Natural gas heating systems.
- Diesel or gasoline in company-owned vehicles and backup generators.
- Fugitive emissions from refrigerants (especially relevant in supermarkets, hospitals and restaurants).

Fugitive emissions are unintentional leaks of gases used in cooling systems such as fridges, freezers, air conditioners and heat pumps. These gases can escape slowly over time from joints and valves or during maintenance and disposal.

Companies may encounter several challenges when quantifying scope 1 emissions. These include tracking fuel consumption across multiple properties, identifying older equipment that lacks adequate documentation and estimating refrigerant leaks in the absence of detailed service records.

Scope 1 emissions calculation examples

Grocery store using 250,000 m³ of natural gas annually

Combustion of natural gas produces carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) greenhouse gas emissions. The Global Warming Potential from [Environment and Climate Change Canada \(ECCC\)](#) for each gas is below.

Emission factors (ECCC):

CO₂: 1.921 kg/m³

CH₄: 0.000037 kg/m³ (GWP = 28)

N₂O: 0.000035 kg/m³ (GWP = 265)

Calculations:

CO₂: 250,000 m³ × 1.921 kg/m³ = 480,250 kg CO₂

CH₄: 250,000 m³ × 0.000037 kg/m³ = 9.25 kg CH₄

Conversion to CO₂e → 9.25 kg CH₄ × 28 GWP = 259 kg CO₂e

N₂O: 250,000 m³ × 0.000035 kg/m³ = 8.75 kg N₂O

Conversion to CO₂e → 8.75 kg N₂O × 265 GWP = 2,318.75 kg CO₂e

Total = 480,250 kg CO₂e + 259 kg CO₂e + 2,318.75 kg CO₂e = 482,827.75 kg CO₂e OR 482.83 t CO₂e



Corporate vehicle fleet using 30,000 L of gasoline annually

Gasoline combustion emits CO₂, CH₄ and N₂O.

Emission factors (ECCC, per L):

CO₂: 2.307 kg/L

CH₄: 0.00006 kg/L (GWP = 28)

N₂O: 0.00039 kg/L (GWP = 265)

Calculations:

CO₂: 30,000 L × 2.307 kg/L = 69,210 kg CO₂

CH₄: 30,000 L × 0.00006 kg/L = 1.8 kg CH₄

Conversion to CO₂e → 1.8 kg CH₄ × 28 GWP = 50.4 kgCO₂e

N₂O: 30,000 L × 0.00039 kg/L = 11.7 kg N₂O

Conversion to CO₂e → 11.7 kg N₂O × 265 GWP = 3,100.5 kgCO₂e

Total = 69,210 kg CO₂ + 50.4 kgCO₂e + 3,100.5 kgCO₂e = 72,361 kgCO₂e or 72.4 t CO₂e

Mall losing 10 kg of R-410A refrigerant

Emission factors [IPCC Refrigerant Blend Tables \(Table 8.A.1\)](#):

R-410A is a blend of:

50% R-32 (GWP = 675)

50% R-125 (GWP = 3,170)

Weighted average GWP = 2,088

Calculation:

10 kg × 2,088 GWP = 20,880 kgCO₂e or 20.88 t CO₂e

Total = 20,880 kgCO₂e or 20.88 t CO₂e

Environment and Climate Change Canada (ECCC) is the Government of Canada's lead department for environmental stewardship, climate change policy and the collection and publication of national greenhouse gas data.

2 Scope 2 emissions: Purchased energy

Scope 2 emissions are indirect GHG emissions associated with the consumption of purchased energy. This is typically electricity purchased from the local grid or from district heating or cooling systems, where such energy services are available. A district energy system distributes heating or cooling from a central plant to multiple buildings through a network of underground pipes, reducing the need for individual boilers or chillers.

The GHG Protocol guidance includes **two accepted approaches** for calculating scope 2 emissions.

1. Location-based method

This method uses average emission factors from the regional electricity grid, such as those published by [ECCC](#). Guidance for Ontario companies, including emissions trends and grid carbon intensity, can be found in The Atmospheric Fund's [Ontario Electricity Emission factors and Guidelines Report](#), which incorporates Independent Electricity System Operator (IESO) data and ECCC methodology.

2. Market-based method

This method accounts for specific energy procurement decisions. This could include the purchase of renewable energy certificates or participation in power purchase agreements, which reflect efforts to source lower-carbon electricity.

Common issues in accurately quantifying scope 2 emissions include inconsistent energy metering across large and diverse property portfolios, as well as the complexity of allocating shared electricity or heating use in multi-tenant buildings where usage is not separately tracked.



Scope 2 emissions calculation examples

Office tower using 1,000,000 kWh of electricity

2025 emission factors for Ontario grid electricity (per kWh) [ECCC Table 5.2](#):

CO₂: 0.03782 kg

CH₄: 0.0000016 kg (GWP = 28)

N₂O: 0.0000009 kg (GWP = 265)

Calculations:

CO₂: 1,000,000 kWh × 0.03782 kg/kWh =
37,820 kg CO₂

CH₄: 1,000,000 kWh × 0.0000016 kg/kWh = 1.6 kg CH₄
Conversion to CO₂e → 1.6 kg CH₄ × 28 GWP =
44.8 kgCO₂e

N₂O: 1,000,000 kWh × 0.0000009 kg/kWh = 0.9 kg N₂O
Conversion to CO₂e → 0.9 kg N₂O × 265 GWP =
238.5 kgCO₂e

Total = 37,820 kg CO₂ + 44.8 kgCO₂e + 238.5 kgCO₂e
= 38,103.3 kgCO₂e or 38.1 t CO₂e

Retail chain purchasing 500,000 kWh of green electricity

Assuming the electricity is backed by renewable energy certificates with a market-based emission factor of 0, then:
kg CO₂/kWh = 0, kg CH₄/kWh = 0, kg N₂O/kWh = 0

Total = 0 t CO₂e

Warehouse using 8,000 GJ of district heating

Assuming a typical natural gas-based district energy system. Emission factor from [ECCC](#) reference values for quantification stationary fuel combustion.

ECCC emission factor is at 56.1 kg CO₂e/GJ, inclusive of all gases.

Breakdown of GHGs (typical combustion ratios):

CO₂: ~98.8%

CH₄: ~0.5%

N₂O: ~0.7%

Aggregated total CO₂e:

8,000 GJ × 56.1 kgCO₂e/GJ = 448,800 kgCO₂e

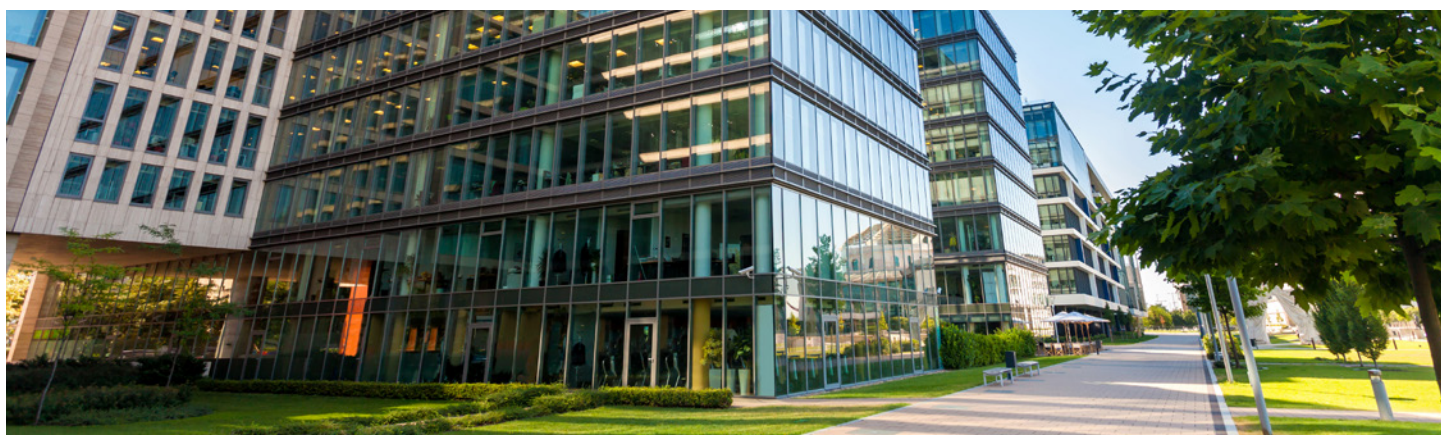
Calculations:

CO₂: 448,800 kg CO₂ × 0.988 = 443,414 kg CO₂

CH₄: 448,800 kg CH₄ × 0.005 = 2,244 kgCO₂e

N₂O: 448,800 kg N₂O × 0.007 = 3,142 kgCO₂e

Total = 443,414 kg CO₂ + 2,244 kgCO₂e + 3,142 kgCO₂e
= 448,800 kgCO₂e or 448.8 t CO₂e



3 Scope 3 emissions: Value chain emissions

Scope 3 emissions encompass all other indirect GHG emissions that occur as a result of a company's activities but are generated from sources not owned or controlled by the company. These "value chain" emissions often represent the largest share of a commercial company's carbon footprint, yet they are typically the most difficult to quantify due to the complexity and variability of upstream and downstream activities.

Common scope 3 categories relevant to commercial companies include employee commuting, business travel, procurement of goods and services, capital goods such as equipment and infrastructure and emissions associated with transportation and distribution, both upstream and

downstream. Additional sources may include waste disposal, water use, franchised operations and emissions associated with investments.

Quantifying scope 3 emissions presents several challenges. These include limited access to procurement data, the absence of supplier-specific emission factors, and the need to estimate employee commuting patterns or emissions generated by third-party contractors. Despite these complexities, measuring scope 3 emissions is increasingly seen as essential for companies aiming to meet stakeholder expectations and to develop comprehensive climate strategies.



Scope 3 emissions calculation examples

Hotel chain spending \$1 million on furnishings

Emission factor from the [U.S. EPA Supply Chain GHG Emission Factors](#).

Assumption:

Emission factor for office and hospitality furnishings:
0.5 kgCO₂e per \$1 spent

Calculations:

$$\$1,000,000 \times 0.5 \text{ kgCO}_2\text{e}/\$ = 500,000 \text{ kgCO}_2\text{e}$$

$$\text{Total} = 500,000 \text{ kgCO}_2\text{e} \text{ or } 500 \text{ t CO}_2\text{e}$$

Alternatively, ask suppliers to provide carbon data for specific products to improve carbon accounting accuracy. Environmental Product Declarations (EPDs) are becoming more common.

Supermarket generating 200 tonnes of landfill waste

Emission factor [ECCC Greenhouse gas calculator for organic waste management](#), includes methane.

Assumption:

Emission factor: 0.5 t CO₂e/tonne of landfill waste

Calculations:

$$200 \text{ tonnes} \times 0.5 \text{ t CO}_2\text{e}/\text{tonne} = 100 \text{ t CO}_2\text{e}$$

$$\text{Total} = 100,000 \text{ kgCO}_2\text{e} \text{ or } 100 \text{ t CO}_2\text{e}$$

5,000 employees commuting 15 km/day for 180 days/year

Emission factors [ECCC Fuel Combustion](#).

Assumptions:

Average fuel consumption: 8.9 L/100 km

Distance per employee: 2,700 km/year

Calculations:

Fuel used per employee: Gasoline for 2,700 km x
.089 L/km = 240.3 L/year

Total fuel use: 5,000 people x 240.3 L =
1,201,500 L/year

CO₂: 1,201,500 L x 2.307 kg CO₂/L =
2,772,860 kg CO₂

CH₄: 1,201,500 L x .0002 kg CH₄/L
= 240.3 kg CH₄ x 28 GWP = 6,728 kgCO₂e

N₂O: 1,201,500 L x .0001 kg N₂O/L
= 120.15 kg N₂O x 265 GWP = 31,839.75 kgCO₂e

Total emissions for 5,000 employees;
= 2,811,428 kgCO₂e or 2,811.4 t CO₂e

Alternatively, survey employees about their vehicle type, actual distance traveled to and from work and commuting habits for a more accurate calculation.



Data collection and methodological challenges

Collecting consistent and reliable data for carbon accounting can be difficult, particularly for companies with decentralized operations. In many cases, data relevant to emissions are spread across various organizational departments, including facilities management, finance, human resources and information technology. This makes it challenging to compile a complete and accurate inventory. These challenges are often more pronounced in small- and medium-sized businesses, which may lack dedicated expertise or internal capacity in GHG accounting.

To address these issues, companies are encouraged to begin by tracking emissions-related data using simple tools such as Excel spreadsheets. This initial step can help identify key data sources and establish internal processes for ongoing data collection. Over time, companies may benefit from transitioning to dedicated software platforms designed for GHG accounting, which can streamline data management and improve accuracy. Engaging consultants or collaborating with industry peers and working groups can also provide valuable guidance and help build capacity for emissions measurement and reporting.

Ontario-specific context and examples

The electricity system in Ontario is low carbon, providing a significant advantage when calculating scope 2 emissions from purchased electricity. The IESO's electricity mix is mainly nuclear and hydroelectric power, contributing to lower average grid emission factors compared to many other regions in North America.

To support energy efficiency and emissions reduction efforts, many commercial property managers in Ontario use the ENERGY STAR® Portfolio Manager tool for benchmarking energy performance. This widely adopted platform allows companies to track energy consumption,

compare building performance against peers, and identify opportunities for improvement.

In addition, the Ontario Building Code is evolving to incorporate carbon performance metrics alongside traditional energy-efficiency requirements. This shift reflects a trend toward integrating climate considerations into regulatory frameworks. It also signals increased expectations for low-carbon design and operational performance in the commercial sector.





Next steps

Consider forming an internal GHG working group at your company and/or designating a sustainability lead to coordinate activities. A practical starting point is to focus on collecting reliable scope 1 and 2 emissions data, as these are typically easier to quantify than scope 3 emissions and are directly within your company's control.

Selecting a clear and transparent methodology, such as those provided by the GHG Protocol or ISO 14064-1, is essential to ensuring consistency and credibility in emissions reporting. Once baseline emissions have been established, your company should communicate findings to stakeholders and use this information to support informed climate action planning. Setting science-based or net-zero-aligned targets can then provide a clear direction for long-term emissions reductions and climate leadership.

Conclusion

Ontario's commercial sector plays a critical role in supporting the province's broader climate objectives. As expectations from governments, investors and the public continue to evolve, measuring GHG emissions presents a strategic opportunity for companies to reduce operating costs, improve energy efficiency and demonstrate leadership in ESG performance. Proactively tracking emissions also helps companies prepare for future regulatory requirements and market pressures related to emissions disclosures.

By building internal capacity, adopting recognized methodologies and taking early action to measure and manage emissions, companies can position themselves for long-term success. Transitioning to a low-carbon economy will help companies meet growing stakeholder expectations as well as help them to gain a competitive advantage in a rapidly changing business landscape.

Resources and references

Resources and tools

- [GHG Protocol \(Corporate Standard and Scope 3 Guidance\)](#)
- [ISO 14064-1](#)
- [Environment and Climate Change Canada emission factors](#)
- [Ontario electricity data \(IESO\)](#)
- Carbon accounting software: [ENERGY STAR® Portfolio Manager](#), [CarbonMAP](#), [SIMAP](#)
- [Retail Council of Canada sustainability resources](#)

References

World Resources Institute and World Business Council for Sustainable Development. (2013). [Technical guidance for calculating scope 3 emissions: Supplement to the Corporate Value Chain \(Scope 3\) Accounting & Reporting Standard](#).

[Global warming potentials, ECCC.](#)

[Emission factors refrigerants, Intergovernmental Panel on Climate Change \(IPCC\).](#)

[The Atmospheric Fund's Ontario Electricity Emission factors and Guidelines Report, which incorporates IESO data and ECCC methodology.](#)

[Emission factor for office furniture, U.S. Environmental Protection Agency.](#)



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