2024 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions

For Public Sector Organizations, Local Governments, Modern Treaty Nations, and Community Emissions

December 2024

B.C. Ministry of Energy and Climate Solutions

Territorial Acknowledgement

The B.C. Public Service acknowledges the territories of First Nations around B.C. and is grateful to carry out our work on these lands. We acknowledge the rights, interests, priorities, and concerns of all Indigenous Peoples – First Nations, Métis, and Inuit – respecting and acknowledging their distinct cultures, histories, rights, laws, and governments.

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1 Introduction

The 2024 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions describes approaches to quantify and report organizational greenhouse gas (GHG) emissions for:

1. B.C.'s provincial public sector organizations (PSOs), for the purposes of meeting legislative requirements to be carbon neutral, and
2. Local governments (LGs) and Modern Treaty Nations (MTNs) for the purposes of reporting under the Local Government Climate Action Program.

This methodology document provides a basis for PSOs, LGs and MTNs to measure their GHG emissions with consistent and up-to-date best practices and provides comparable province-wide emissions reporting.

It can be used by its target audiences and by other groups wishing to calculate their organization's GHG emissions. However, private sector entities subject to the B.C. Greenhouse Gas Emission Reporting Regulation (GGERR) must use quantification methods prescribed by the GGERR.

This document consolidates the emission factors, their sources, and emissions calculation methodologies appropriate for use in British Columbia. The numerical emission factors can be found in the Emission Factors Catalogue.[1] This methodology document draws heavily on:

- Protocols established by:
  - The International Standards Organization – Standard 14064 (ISO 14064) on GHGs,
  - The Climate Registry's General Reporting Protocol, and
  - The World Resources Institute and the World Business Council for Sustainable Development's GHG Protocol, and
- Published emission factors from authoritative sources such as:
  - Environment and Climate Change Canada's (ECCC) National Inventory Report (NIR),
  - Natural Resources Canada's (NRCan) Comprehensive Energy Use Database (CEUD), and
  - The UK Department for Energy Security and Net Zero.

The emissions factors, their sources and calculation methodologies in this guidance document and in the Emission Factors Catalogue also apply to the Community Energy and Emissions Inventory (CEEI). Please reference the CEEI webpage and CEEI Technical Methods and Guidance Document for information on community-wide energy and emissions in B.C.

Significant Figures: where possible, the methodology document presents three significant figures as a standard convention to increase consistency in calculations. More significant figures may be used ahead of the decimal point.

[1] The Emission Factors Catalogue can be accessed on the Carbon Neutral Government program's website and the Local Government Climate Action Program's website.

1.1 Document Structure

Section 1 provides policy context for GHG quantification for the intended users of the document, as well as an overview of GHG emission quantification.

Sections 2 through 5 contain emission quantification information for the following activities:

- Section 2: Stationary Sources – Buildings,
- Section 3: Mobile Sources – Transportation,
- Section 4: Office Paper, and
- Section 5: Business Travel and Accommodation.

Each activity section includes:

- the emissions **type** (direct or indirect emissions)[2],
- a **description** of the common emissions sources for the activity,
- the **data sources** that have been referenced or incorporated,
- sample **calculations** that explain how:
  - The Climate Action Secretariat determined the emission factors where there are no readily available emission factors from authoritative sources, and
  - Organizations apply the emission factors, and
- Where needed, **specific instructions** related to the above. Instructions are in call-out boxes if they apply only to B.C. PSOs or only to LGs and MTNs, as follows:

For PSOs

For LGs and MTNs

1.2 Public Sector Organizations

The Carbon Neutral Government Regulation (CNGR) defines the activities, the emission sources, and the GHGs and GHG categories that PSOs are to report for their GHG inventories. These emission sources are considered "in scope" for the Carbon Neutral Government (CNG) program. Since the CNGR was introduced in 2008, in-scope activities/sources have been clarified through a series of policy decisions, which are summarized in the Scope Summary Document.

[2] The Climate Registry's General Reporting Protocol defines direct emissions as "emissions from sources within the reporting organization's organizational boundaries that are owned or controlled by the reporting organization, including stationary combustion emissions, mobile combustion emissions, process emissions, and fugitive emissions," and indirect emissions as "Emissions that are a consequence of activities that take place within the organizational boundaries of the reporting organization, but that occur at sources owned or controlled by another organization." See The Climate Registry. (2019). *General Reporting Protocol*, *Version 3.0*. Available: https://theclimateregistry.org/wp-content/uploads/2023/11/grp2023.pdf, pp. E-12 to 13.

This document is not intended to provide legal advice. PSOs remain responsible for ensuring they understand and comply with the *Climate Change Accountability Act*, the Carbon Neutral Government Regulation.

The emissions factors and emissions calculation methodologies described in this document have been integrated into the Clean Government Reporting Tool (CGRT), the online tool provided by the B.C. government to support PSO GHG measurement and reporting requirements.

CGRT contains emission factors for all PSO reporting categories. When PSOs report their annual energy consumption and activity data in the tool, CGRT calculates total GHG emissions.

1.2.1 Policy Context

Under the *Climate Change Accountability Act* (CCAA) (formerly the *Greenhouse Gas Reductions Targets Act* (GGRTA)), the B.C. public sector must be carbon neutral in its operations for 2010 and every year thereafter.[3] PSOs[4] are required to report annually in accordance with the CCAA and the CNGR.

In May 2018, the Province of B.C. enacted legislation to establish provincial targets for reducing GHG emissions by 40% below 2007 levels by 2030, 60% by 2040, and 80% by 2050. Later that year, the CleanBC Plan set targets for the B.C. public sector to reduce building emissions by 50% and fleet emissions by 40% by 2030. Given that 2010 was the first year with complete public sector emissions data, the CleanBC public sector targets are set against a baseline year of 2010.

Measuring GHG emissions is an important first step in reducing emissions and the activities/operations responsible for producing them, in support of meeting B.C.'s legislated GHG emission reduction targets under the CCAA.

1.2.2 In-Scope Activities

Guidance for in-scope PSO activities for the CNG Program is provided in:

- Section 2: Stationary Sources: Buildings,
- Section 3: Mobile Sources: Transportation,
- Section 4: Office Paper, and
- Section 5: Business Travel and Accommodation (applies only to Provincial Government).

PSOs may direct any questions related to GHG quantification, scope, and the Clean Government Report Tool (CGRT) to Carbon.Neutral@gov.bc.ca.

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[3] See http://www.bclaws.ca/civix/document/id/complete/statreg/07042_01, for the *Climate Change Accountability Act* (CCAA), Bill 44 – 2007 and the Carbon Neutral Government Regulation, B.C. Reg. 392/2008. The legislation also requires B.C. provincial government business travel to be carbon neutral as of October 2007. This requirement does not apply to the broader provincial public sector.

[4] Under the *Budget Transparency and Accountability Act*, PSOs are defined as part of the Government Reporting Entity as both Provincial government entities as reported through the Consolidated Revenue Fund (e.g., ministries and independent offices) and broader public sector agencies including health authorities, school districts, colleges and universities, and Crown corporations.

1.3 Local Governments and Modern Treaty Nations

1.3.1 Local Governments

Every LG in B.C. has voluntarily signed the Climate Action Charter (CAC), committing them to develop strategies and take actions to achieve the following goals:

- Being carbon neutral in respect of their corporate operations, [5, 6]
- Measuring and reporting on their community's GHG emissions profile, and
- Creating complete, compact, more energy efficient rural and urban communities.

The Provincial Government and Union of British Columbia Municipalities (UBCM) jointly created the Green Communities Committee (GCC) under the CAC to support local governments in planning and implementing climate initiatives.

To support LGs in meeting CAC commitments, the CEEI initiative provides a provincial framework for tracking and reporting energy and emissions at a community-wide scale. The Technical Methods and Guidance Document outlines the methodologies for producing GHG emissions estimates in the CEEI reports. To promote consistency between community-wide and traditional services emissions reporting, the CEEI program encourages LGs and MTNs to use common emission factors and refer to this document.

1.3.2 Modern Treaty Nations

The Province's relationship with MTNs in B.C. is distinct and unique. Modern treaties set out constitutionally protected rights and obligations of the parties. The Province's work with MTNs to fully implement these treaties occurs both with individual Nations and collectively through the Alliance of B.C. Modern Treaty Nations.

1.3.3 Policy Context

The Local Government Climate Action Program (LGCAP) is a commitment within the CleanBC Roadmap to 2030 and provides predictable, annual, and long-term funding for B.C. LGs and MTNs to take on climate action aligned with provincial and local objectives. To be eligible for funding, LGs and MTNs must meet eligibility requirements as described on the LGCAP reporting webpage.

Recognizing the critical role local governments play in reducing GHG emissions in B.C., the Province administers the Local Government Climate Action Program (LGCAP), attributing approximately $24 million annually of non application-based funding to eligible local governments and Modern Treaty Nations. Please reference the LGCAP website for more information on the Program.

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[5] Under the CAC, solid waste facilities regulated under the *Environmental Management Act* are not included in LG operations.

[6] While LGs do not have to achieve carbon neutrality for their traditional services under LGCAP, the LGCAP team continues to support the use of tools and resources such as the Becoming Carbon Neutral Guidebook available on the BC Climate Action Toolkit.

1.3.4 Measuring and Reporting Emissions

All B.C. LGs and MTNs are eligible for the LGCAP. There is an additional reporting requirement for LGs with populations exceeding 10,000 residents to measure and report their traditional services emissions inventory for the 2024 calendar year (reporting done in 2025). Smaller LGs and MTNs are encouraged to report their traditional services inventory on a voluntary basis. LGs and MTNs can either report using the LGCAP methodology or select an established reporting protocol, such as CDP[7], to meet this requirement, if it includes emissions from their contracted services. It is important that LGs use a consistent methodology over time to meet their requirement under the *Green Communities Statutes Amendment Act* to track progress to targets.

1.3.4.1 LGCAP Boundaries and In-Scope Activities

The boundaries for calculating emissions are based on the energy used in the delivery of traditional LG and MTN services:[8]

- Administration and Governance,
- Drinking Water, Stormwater and Wastewater,
- Solid Waste Collection, Transportation and Diversion,
- Roads and Traffic Operations,
- Arts, Recreational and Cultural Services, and
- Fire Protection.

To ensure alignment, comparability, and consistency in GHG quantification approaches, the GCC recommends aligning with the same methodologies used by PSOs in this document. To ensure methodology, emission factors and outputs from individual tools are consistent and comparable, an LG or MTN will be required to meet the following standards for their measurement processes:

- Use the same traditional services boundaries and scope as defined in the LGCAP Boundaries and Scope Guidance or another established GHG accounting framework (such as CDP),
- Use the GHG measurement methods and emission factors referenced in this document, and updates as provided by the Climate Action Secretariat, and
- Report on annual total traditional services GHG emissions as calculated by a GHG inventory tool (e.g., the Traditional Services Emissions Inventory Reporting Tool).

All supporting materials for these standards are available on the LGCAP website.

The following sections of this document apply directly to LGs and MTNs for their in-scope activities:

- Section 2: Stationary Sources – Buildings (except for refrigerants used in space conditioning and refrigeration),

[7] CDP was established as the 'Carbon Disclosure Project' in 2000, asking companies to disclose their climate impact. Since then, they have broadened the scope of environmental disclosure, to incorporate deforestation and water security, while also building their reach to support cities, states and regions.

[8] "Traditional services" include emissions related to operation and maintenance activities in the delivery of traditional services; however, LGs and MTNs need not report emissions from new construction, business travel, employee commuting, and materials.

- Section 3: Mobile Sources – Transportation (except for Mobile Air Conditioning).

All LG and MTN questions related to GHG quantification and scope for the LGCAP should be directed to LGCAP@gov.bc.ca. All questions regarding the CEEI should be directed to CEEI@gov.bc.ca.

1.4 Other Users

Other potential users of this document include energy and emissions modelling and planning consultants, energy utilities, academic researchers, non-governmental organizations, and other organizations interested in measuring their GHG emissions.

1.5 Emissions Calculation Fundamentals

This section provides context for organizations seeking to understand how emissions are calculated.

1.5.1 In-Scope Greenhouse Gases

This document includes six distinct GHGs or categories of GHGs:

- carbon dioxide (CO_2),
- methane (CH_4),
- nitrous oxide (N_2O),
- hydrofluorocarbons (HFCs),
- perfluorocarbons (PFCs), and
- sulphur hexafluoride (SF_6).

Organizations mostly emit the three main GHGs from fuel combustion – CO_2, CH_4, and N_2O.

International protocols require biogenic CO_2 (bio-CO_2) emissions from combustion be reported separately from fossil combustion and biogenic non-CO_2 emissions.[9]

For LGs and MTNs: Under LGCAP, LGs and MTNs are only required to report emissions of:

- carbon dioxide (CO_2),
- methane (CH_4), and
- nitrous oxide (N_2O).

[9] The *IPCC's Guidelines for National Greenhouse Gas Inventories* states that CO_2 emissions from the biomass combustion should be reported under the Agriculture, Forestry and Other Land Use (AFOLU) sector, which is outside of the scope of the Energy sector. See: IPCC (2019), *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories,* Energy Section 2.3.3.4, p. 2.4-5 and AFOLU Section 12.5.1, p. 12.33-34; and the Climate Registry (2019), *General Reporting Protocol Version 3.0*, p. B-7.

1.5.2 Global Warming Potentials

GHGs vary in their global warming potential (GWP), which is a measure of how much energy the emissions of a greenhouse gas will absorb over a given period (typically 100 years), relative to an equal mass of emissions of CO_2.[10]

For example, methane (CH_4) has a GWP of 28, indicating that emitting one tonne of CH_4 has the same climate warming impact as 28 tonnes of CO_2. The concept of carbon dioxide equivalent (CO_2e) is used to represent this impact, as required under the CNGR. One tonne of CH_4 is equal to 28 tonnes of CO_2e (t CO_2e).

Updates to B.C.'s GWPs specified in the CNGR are made in line with updates by the UNFCCC, the Intergovernmental Panel on Climate Change (IPCC), and the Canadian Federal Government. For the 2022 reporting year onward, the GWPs in this document and the Emission Factors Catalogue align with the IPCC's 5th Assessment Report (AR5). Emissions prior to 2022 continue to use the GWPs from the IPCC's 4th Assessment Report (AR4), as the inventory-wide impact of a change from the AR4 is very small. The Climate Action Secretariat will update historical GWPs when other GHG measurement programs in the BC Government align with the IPCC's 6th Assessment Report.

The CNGR[11] Schedule lists the GWPs for in-scope emissions.

1.5.3 Emission Factors

Emission factors are values that describe the rate at which a given activity releases GHGs into the atmosphere. They are expressed as a mass (e.g. grams (g), kilograms (kg), metric tonnes (t)) of GHG emissions per unit of emission source used/consumed. Typically, the factors for an activity category – for example, building energy or fleet fuel consumption – are expressed in the same or similar units, to enable comparison across different fuel types, travel modes, etc. (e.g., how many kilograms of carbon dioxide are produced by burning one litre of gasoline or one litre of diesel fuel in a vehicle).

Wherever possible, emission factors are specified by individual gases. In certain instances, an aggregate factor for multiple gases is provided in kg or t of CO_2e.

Organizations can calculate their GHG emissions for a given activity or source using the Emission Factors Catalogue (see Table 1 and Table 2 for an example), which the Climate Action Secretariat maintains to provide organizations with a single point for finding emission factors.

Organizations should determine the amount of the emission source used/consumed (e.g., litres (L) of gasoline, kilowatt hours (kWh) of electricity, reams of paper, kg of refrigerant). They can then calculate emissions in CO_2e, by multiplying the amount of emission source used/consumed either by converting each GHG's emission factor to CO_2e and adding up emissions by CO_2e, or by using the CO_2e emission factor for the emission source. They then report emissions in t CO_2e.

[10] United States Environmental Protection Agency, Understanding Global Warming Potentials. (2024). Available: https://www.epa.gov/ghgemissions/understanding-global-warming-potentials

[11] Carbon Neutral Government Regulation. (Deposited Dec. 9, 2008). Available: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/392_2008.

1.5.4 Principles for Determining Emission Factors

The Climate Action Secretariat use the following principles to guide development of GHG emission factors and estimation methods in this document:

(1) Use BC-specific emission factors where the required information is available. For example, the electricity emission intensity factors come from B.C.-specific data sources.

(2) Use standardized emission factors from national and international data sources where B.C.-specific information is not available. For example, where there is no BC-specific emission factor for the combustion of marine diesel, use the value from the NIR.

(3) Strive to reduce the burden and cost of measurement and reporting. Where gathering the data for an emissions source is poses an undue burden, organizations can use simplified emissions estimation methods. For example, if an organization leases a space where utility costs are included and they do not have access to the utility bills, they may provide the floor area of the leased space instead of the energy consumption, and use energy use intensity (EUI) values to determine their GHG emissions.

(4) In developing simplified emissions estimation methods, use conservative assumptions, i.e. those that are more likely to overestimate, than to underestimate, emissions.

The primary source document for emission factors is ECCC's NIR, released in 2024.[12] Where possible, the Climate Action Secretariat developed B.C.-specific emission factors, using the NIR, the CEUD, data provided by B.C. energy utilities and business travel providers. Other documents, such as The Climate Registry's General Reporting Protocol and the United States Environmental Protection Agency's GHG Emission Factors Hub, provided some emission factors that could not be sourced from the NIR or the CEUD.[13, 14]

The emission factors in this document represent the Climate Action Secretariat 's current understanding of the factors appropriate for emission sources and fuel types. The Climate Action Secretariat will update emission factors and other key inputs (e.g., energy conversion factors, GWPs) as GHG measurement methodologies and data sources evolve.

[12] Environment Canada. (2024). *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990-2022*. The Canadian Government's Submission to the United Nations Framework Convention on Climate Change. Available: https://publications.gc.ca/site/eng/9.506002/publication.html.

[13] The Climate Registry. (2019). *General Reporting Protocol*, *Version 3.0*. The Climate Registry is a cross-border initiative to develop common measurement, verification, and reporting requirements for GHG emissions. Available: https://theclimateregistry.org/wp-content/uploads/2023/11/grp2023.pdf.

[14] United States Environmental Protection Agency (2024). 2024 GHG Emission Factors Hub. Available: https://www.epa.gov/climateleadership/ghg-emission-factors-hub.

1.5.5 Understanding Scope Categories

The General Reporting Protocol[15] classifies GHG emissions in three scopes:

Scope 1: Direct GHG emissions (e.g., the combustion of fossil fuels in an organization's building, referred to as Direct Fuel Combustion in CGRT),

Scope 2: Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling (referred to as Purchased Energy in CGRT), and

Scope 3: All other (non-Scope 2) indirect GHG emissions that occur in the supply chain (referred to as Other Sources in CGRT).

1.5.6 Example Emissions Calculation

Table 1 and Table 2 provide an example of applying emission factors to calculate GHG emissions from 100 litres of propane consumption in a building and to convert those emissions to CO_2e, while

Table 2 shows how tabulate the results of Table 1 to get total emissions in t CO_2e.

For PSOs: PSOs can input their amount of each emission source used or consumed directly into CGRT.

Table 1: Example of Calculating Building Emissions by GHG

Step	Formula	CO_2 Calculation	CH_4 Calculation	N_2O Calculation
1. Calculate the emissions of each GHG using the appropriate emission factor.	Actual Consumption (L) x Emission Factor by GHG (g/L) = Emissions by GHG	100 L x 1,515 g CO_2/L = 151,500 g CO_2	100 L x 0.024 g CH_4/L = 2.4 g CH_4	100 L x 0.108 g N_2O/L = 10.8 g N_2O
2. Convert the emissions of each GHG to CO_2 equivalency (CO_2e) using Global Warming Potential.	Emissions by GHG x GWP = Emissions (g CO_2e)	151,500 g CO_2 x 1 = 151,500 g CO_2e	2.4 g CH_4 x 28 = 67.2 g CO_2e	10.9 g N_2O x 265 = 2,888.5 g CO_2e

Note: This table presents emission factors in g/L because the NIR lists fuel emission factors for propane, and most other liquid fuels, in g/L. Table 3 in Section 2 Stationary Sources – Buildings identifies where to find the emission factors in this example.

[15] The Climate Registry. (2019). *General Reporting Protocol*, *Version 3.0*. Available: https://theclimateregistry.org/wp-content/uploads/2023/11/grp2023.pdf, p. B-5.

Table 2: Example of Calculating Building Emissions in tCO_2e

Step	Formula	CO_2e Calculation
3. Sum across the gases to calculate total CO_2e emissions.	$CO_2 + CH_4 + N_2O$ (all in g CO_2e) = Total CO_2e in g CO_2e	(151,500 + 67.2 + 2,888.5) g CO_2e = 154,456 g CO_2e
4. Convert total emissions from g to tonnes for reporting purposes and round to significant figures.	Emissions in g CO_2e / 1,000,000 g/t = Emissions in t CO_2e	154,456 g CO_2e / 1,000,000 g/t = 0.154 t CO_2e (from100 L of Propane)

1.6 Small Emissions Sources

For many organizations, measuring small emissions sources can be challenging. If an emissions' source is onerous to collect and the sum of the small sources is expected to be less than 1% of the organization's total emissions inventory, organizations may consider those sources out of scope. The Climate Action Secretariat developed a decision tree to help LGs, MTNs and PSOs determine whether a certain source of emissions falls under this rule. Other methods to address small emission sources are outlined in the General Reporting Protocol.

If an emission source is considered out of scope after using the decision tree, the source of the emission and organizations should include the rationale for its exemption annual reporting documentation.

For PSOs: PSOs include the exemption rationale in their self-certification documentation and Climate Change Accountability Report each year the exemption applies.

2 Stationary Sources – Buildings

This section outlines how to calculate the direct and indirect GHG emissions from providing lighting, space and water heating, cooling, and power to facilities.

2.1 Stationary Fuel Combustion

Type: Direct Emissions

Description: Organizations combust a variety of fuels to produce heat and power. They include, but are not limited to:

- Fossil fuels:
  - natural gas,
  - propane,
  - light fuel oil (No. 2 heating oil),
  - heavy fuel oil (No. 5 heating oil),
  - kerosene,
  - diesel fuel and marine diesel, and
  - gasoline, and
- Biofuels:
  - renewable natural gas,
  - ethanol,
  - biodiesel, and
  - residential and industrial wood fuels.

Data sources: The standardized emission factors for stationary fuel combustion come from Part 2 of the 1990-2022 NIR (Table 3)[16]:

[16] Environment Canada. (2024). *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990-2022,* Part 2. Available: https://publications.gc.ca/site/eng/9.506002/publication.html

Table 3: Stationary Combustion Emission Factors Sources in the 1990-2022 NIR

Fuel Type	Table	Source
Natural Gas	A6.1-1 (CO_2) A6.1-3 (CH_4, N_2O)	B.C. Emission Factors – Marketable Natural Gas Emission Factors for Residential, Construction, Commercial/Institutional, Agriculture
Renewable Natural Gas	A6.1-1 (CO_2 as bio-CO_2) A6.1-3 (CH_4, N_2O)	B.C. Emission Factors – Marketable Natural Gas Emission Factors for Residential, Construction, Commercial/Institutional, Agriculture
Propane	A6.1-5	Propane – All Other Uses
Light Fuel Oil	A6.1-6	Light Fuel Oil – Forestry, Construction, Public Administration and Commercial/Institutional
Heavy Fuel Oil	A6.1-6	Heavy Fuel Oil – Residential, Forestry, Construction, Public Administration and Commercial/Institutional
Kerosene	A6.1-6	Kerosene – Forestry, Construction, Public Administration and Commercial/Institutional
Diesel Fuel	A6.1-6	Diesel – Refineries and Others
Marine Diesel for Stationary Purposes	A6.1-15 (CO_2) A6.1-6 (CH_4, N_2O)	Marine – Diesel Diesel – Refineries and Others
Gasoline	A6.1-6	Motor Gasoline
Wood Fuel – Industrial (50% moisture)	A6.6-1	Wood Fuel/Wood Waste – Industrial Combustion
Wood Fuel – Residential (0% moisture)	A6.6-1	Conventional Stoves – Residential Combustion
Ethanol	A6.1-15	Renewable Fuels
Biodiesel	A6.1-15	Renewable Fuels

The Climate Action Secretariat sourced energy conversion factors for fuels from Statistics Canada's *Report on Energy Supply and Demand in Canada* (RESD). Organizations can use the factors to convert cubic metres (m^3) of natural gas or litres (L) of liquid fuels to GJ.[17]

Calculations: In B.C., the Low Carbon Fuels (General) Regulation, under the Low Carbon Fuel Standard (LCFS) sets the requirements for renewable fuel in the province's transportation and heating fuel blends.[18] Since January 1, 2011, fuel suppliers have been required to incorporate at least 5% renewable fuel content in gasoline and 4% in diesel.

[17] Statistics Canada (2023). *Report on Energy Supply and Demand in Canada 2005-2022*, pp. 14 to 15. Available: https://www150.statcan.gc.ca/n1/en/catalogue/57-003-X

[18] Renewable and Low Carbon Fuel Requirements Regulation, B.C. Reg. 394/2008.

The Emission Factors Catalogue treats the standard gasoline blend as 95% fossil fuel gasoline and 5% ethanol, and the standard diesel blend as 96% fossil fuel diesel and 4% biodiesel (Table 4).

Table 4: Renewable Fuel Content in Liquid Fuels

Fuel	Gasoline	Diesel
Percent fossil fuel	95% gasoline	96% diesel
Percent biofuel	5% ethanol	4% biodiesel

Renewable Natural Gas

If an organization captures biogas for their own stationary combustion, they can calculate the percentage of CH_4 in the biogas and apply the renewable natural gas (RNG) emission factors accordingly.

As of July 1, 2024, FortisBC has designated 1% of all marketable gas sold to its customers as RNG. The standard natural gas emission factor in the Emission Factors Catalogue reflects 1% RNG as of July 1, 2024. Organizations report their natural gas as standard if they do not purchase additional RNG.

Organizations in both the FortisBC and Pacific Northern Gas service areas may choose to purchase gas with higher RNG percentages.[19]

Organizations that purchase any mix of RNG other than the standard mix may follow the steps in Table 5 to calculate emissions from fossil natural gas and from RNG.

Specific Instructions:

For PSOs: PSOs that purchase 100% RNG can continue to report their natural gas 100% RNG in CGRT. PSOs that purchase a non-standard RNG blend should report their purchases as a proportion of standard natural gas and 100% RNG.

Table 5 has an example of the calculations for an organization purchasing 10,000 GJ of natural gas at a 10% RNG blend. Once the calculations are complete, PSOs can enter the amount of standard natural gas and 100% RNG that represent their blend into CGRT.

[19] FortisBC (2024). *Renewable Natural Gas.* Available: https://www.fortisbc.com/services/sustainable-energy-options/renewable-natural-gas

Table 5: Calculations for Non-Standard RNG Blend Purchases

Step	Example Calculation
(1) Determine the amount of gas purchased and the RNG blend purchased.	Amount of gas purchased: 10,000 GJ RNG blend purchased: 10%
(2) Calculate the proportion of standard natural gas to report by multiplying the amount of gas purchased by 100% minus the RNG blend purchased, and dividing by the proportion of fossil gas in standard natural gas.	Amount of gas × (100% – RNG blend purchased) / 99% fossil gas = 10,000 GJ × (100% – 10%) / 99% = 10,000 GJ × (90%) / 99% = 9,091 GJ of standard natural gas to report (with 1% RNG, that results in 91 GJ of RNG and 9,000 GJ of fossil gas)
(3) Subtract the amount of standard natural gas to be reported from the total amount of gas purchased to get the amount of 100% RNG to be reported.	Amount of gas purchased – amount of standard natural gas reported = 10,000 GJ – 9,091 GJ = 909 GJ 100% RNG

2.2 Stationary Space Conditioning and Refrigeration

This section explains how to quantify the direct fugitive emissions from refrigeration, heat pump and space conditioning equipment in buildings.

Type: Direct Fugitive Emissions

Description: Fugitive refrigerant emissions are attributed to the loss of GHGs, such as hydrofluorocarbons[20] (HFCs) from refrigeration equipment into the atmosphere. This section details methods for quantifying HFC refrigerant emissions from equipment.

Refrigeration equipment means any equipment that employs the expansion and compression of refrigerants, regardless of its application. This includes refrigerators, heat pumps, air conditioners, and similar devices.

HFC refrigerants are the most common type of refrigerant. Two other common categories of GHG refrigerants are Ozone Depleting Substances (ODSs) and Perfluorocarbons (PFCs).

[20] Equipment can also use perfluorocarbon (PFC) refrigerant. Organizations may apply the Mass Balance or Nameplate Methods described in this section to estimate PFC emissions.

Specific Instructions:

For PSOs: ODSs are out of scope for reporting under the CNGR. PFCs are in scope for reporting, however CAS is not aware of any PSOs who use PFCs in equipment.

Equipment owned by PSOs are in-scope for reporting under the CNGR. Equipment owned by third parties, but used by PSOs, is not in-scope. For more information see Carbon Neutral Government program fleet and contracted services - Province of British Columbia.

Data sources:

The approach in this section relies on the following sources:

- The Intergovernmental Panel on Climate Change (IPCC)'s Special Report on Safeguarding the Ozone and the Global Climate Systems, Chapter 4, Table 4.9.,
- Environment and Climate Change Canada (ECCC)'s Offset Protocol for Reducing Greenhouse Gas Emissions from Refrigeration Systems,
- The Carbon Neutral Government Refrigerants Pilot,
- ASHRAE's Refrigerant Designations, and
- The Carbon Neutral Government Regulation.

Calculations:

Three factors influence fugitive emissions from refrigeration equipment:

(1) The full charge mass, which refers to the total amount of refrigerant the equipment is designed to hold at full capacity,

(2) The leak rate, which indicates how much of the refrigerant is lost from the system over time due to leaks or breaks, and

(3) The GWP of the refrigerant.

The amount of refrigerant: The amount of refrigerant, also known as the charge, varies significantly depending on the type of equipment, its power rating, and the amount of piping. For example, air conditioning units can contain anywhere from 0.5 kg to 100 kg of refrigerant. Equipment with larger refrigerant charges tend to emit more HFCs when leaks occur, as more refrigerant is available to escape.

Leak rate: HFC emissions occur when refrigeration equipment using HFCs leaks or breaks. While all refrigeration equipment is expected to leak over its lifetime, the leak rate can vary significantly depending on the unit.

Leaks typically occur at connection points, so equipment with more connections is generally more prone to higher leak rates. As a result, each type of refrigeration equipment has an associated predicted leak rate based on its design and the number of potential failure points.

See Section 2.2.2 for descriptions of the common equipment types. See Table 7 in Section 2.2.3 for the leak rate for each type.

The GWP of the refrigerant: The most common refrigerants are blends of two or more HFCs. Equipment using refrigerants with a higher GWP will have greater emissions than equipment that employes a lower GWP refrigerant, assuming an equal mass of leaked refrigerant. See Section 1.5.2 for more information about GWPs and Table 8 for the GWPs of common HFC blends. To quantify HFC emissions, organizations must have the mass of refrigerant leaked from the equipment and the GWP of the refrigerant. These factors are used to calculate the total emissions using the equation below:

$$Emissions\ (CO_2e) = Mass\ of\ refrigerant\ leaked \times GWP\ of\ the\ refrigerant$$

2.2.1 Determining mass of refrigerant leaked

To determine the mass of refrigerant leaked, organizations identify the type of equipment, the full refrigerant charge, and the leak rate. The following sections will explore how to quantify these factors.

There are three methods for quantifying the mass of refrigerant leaked outlined in this document. They are, in order of decreasing accuracy:

- **The mass balance method**: This method directly measures the amount and type of refrigerant that has leaked. The type of equipment and the full charge mass are recorded for analysis and emission reduction.
- **The nameplate method**: This method estimates the leak rate by identifying the type of equipment. The full refrigerant charge and type of refrigerant are determined directly.
- **The estimation method**: This method estimates the full charge mass, refrigerant type, and leak rate by identifying the type of equipment.

2.2.1.1 Mass balance method

The mass balance method is suitable for large units that are regularly maintained. Since this method measures every factor, it is the most reliable way to quantify HFC emissions.

Equipment begins its lifetime at full charge. Over time HFC leaks into the atmosphere. Equipment is re-charged periodically with HFC by a technician. The amount of HFC a technician adds to a system is the amount which has leaked since the last maintenance.

This methodology measures emissions when the unit is maintained and for simplicity, all the leakage that occurred is attributed to the year where maintenance occurs. For example, if a unit is maintained every four years, the technician will measure the mass of refrigerant that has leaked since its last maintenance, that is, four years ago. However, the organization will report the total emissions from the HFC emitted over those four years in the year that the technician maintained the equipment.

The mass balance method is effective for units with a nameplate power rating over 5 kilowatts. Smaller units may not be regularly maintained and the nameplate method may be a better methodology in those cases (see Section 2.2.1.2).

Organizations seeking to use the mass balance method should contact the refrigeration technicians that maintain their equipment and request the:

- mass of refrigerant used in the maintenance,
- the mass required for a full charge, and
- the type of refrigerant.

Organizations should then record the equipment type, full charge, type of refrigerant and annual leak rate for future reference, and to guide decisions on reducing emissions from refrigeration equipment.

2.2.1.2 Nameplate method

Smaller units with nameplate ratings less than 5 kW are often not regularly maintained. In these cases, the nameplate method is the most practical way to quantify HFC emissions.

Organizations should quantify the type of equipment, the refrigerant type, and the mass of a full charge, and then apply the leak rate. For each unit, the organization should:

(1) quantify the mass of refrigerant in the system at full charge,
(2) identify the type of refrigerant used,
(3) determine the type of the equipment (as described in Section 2.2.2),
(4) select the appropriate leak rate, and
(5) calculate the mass of refrigerant leaked by the equipment using the equation below:

$$Mass\ HFC\ leaked\ each\ year = Leak\ rate \times Full\ charge\ mass$$

Record the equipment type, full charge, type of refrigerant and assumed annual leak rate for future reference and to guide decisions on how to reduce emissions from refrigeration equipment.

2.2.1.3 Estimation method

The estimation method is the least accurate method so it should be used as an interim method until additional data can be collected. Once organizations gather the required data, they can switch to the nameplate or mass balance methods.

Specific Instructions:

For PSOs: There is a calculator in CGRT that completes steps 2-4 for the identified equipment and produces a formatted spreadsheet that can be uploaded into CGRT.

The following steps should be taken for estimating refrigerant loss:

(1) Identify the type and size of the equipment to be estimated. Refer to Section 2.2.2 for descriptions of equipment types. If the nameplate power rating is unknown and the size is unclear, assume the unit is large, following the ISO 14064 principle of conservativeness.
(2) Estimate the full charge mass from Table 9.
(3) Apply the estimated leak rate (from Table 7) to the full charge mass according to the equation below:

$$Mass\ HFC\ leaked\ each\ year = Number\ of\ units \times Leak\ rate \times Full\ charge\ mass$$

(4) Use Table 10 to estimate the percentage of each refrigerant type. Multiply the annual mass of HFC leaked by these percentages to find the amount leaked for each type.

Organizations should record the equipment type and its assumed full charge, assumed type of refrigerant and assumed annual leak rate for future reference and to guide decisions on how to reduce emissions from refrigeration equipment.

Table 6: Example Mass HFC Leaked estimation from 100 plug-in display cases

Step	Reference	Notes
(1) Identify the type and size of the equipment to be estimated	Section 2.2.2	Plug-in display cases are fully integrated, with all components built into their structure, and are not designed to keep items frozen. Consequently, they are classified as stand-alone, medium-temperature refrigeration systems. These units are generally large.
(2) Estimate the full charge mass	Table 9	The full refrigerant charge of an average large stand-alone, medium-temperature refrigeration system is 0.64 kg.
(3) Apply the estimated leak rate	Table 7	Stand-alone, medium-temperature refrigerators typically leak refrigerant at a rate of 1%/year. $Mass\ HFC\ leaked\ each\ year =$ $Number\ of\ units \times Leak\ rate \times Full\ charge\ mass =$ $100 \times 1\% \times 0.64kg = 0.64kg$
(4) Determine the proxy type of refrigerant that has leaked[21]	Table 10	49% of stand-alone medium temperature refrigerators use R-134a, 36% use R-404a, 10% use R-438a and 3% R-290. $R-134a = 0.64kg \times 49\% = 0.31\ kg$ $R-404a = 0.64kg \times 10\% = 0.23\ kg$ $R-438a = 0.64kg \times 36\% = 0.06\ kg$ $R-290 = 0.64kg \times 3\% = 0.03\ kg$
(5) Result	The 100 units are estimated to have leaked 0.31kg R-134a, 0.23kg R-404a, 0.06kg R-438a, and negligible R-290.	

Specific Instructions:

For PSOs: As of 2021, equipment using R-438a can no longer be imported into Canada. However, some pilot project participants reported that some of their older equipment still uses R-438a. R-438a is not a position in CGRT; the refrigerant calculator assumes units use R-134a instead of R-438a.

PSOs that are aware of R-438a in their equipment should contact Carbon.Neutral@gov.bc.ca.

[21] If the HFC used in the systems is unknown, the HFC type must be estimated. The research results from the pilot project suggests that 49% of stand-alone medium temperature refrigerators use R-134a, 36% use R-404a, 10% use R-438a and 3% R-290. For the other unit types, please see Table 10 in Section 2.2.3.

2.2.2 Equipment types

The Climate Action Secretariat based the equipment categories in this section on 'Table 1: Baseline Scenario Refrigeration Systems' from Environment and Climate Change Canada's (ECCC) Refrigerants Offset Protocol.

The distinctions between large and small units were developed from refrigerant pilot project data. Units with a nameplate power rating less than the average are considered small; units greater than the average are considered large. As the Climate Action Secretariat collects more data the distinction between large and small units will be refined.

The nameplate power rating is the maximum amount of power a piece of equipment is designed to use or produce under normal operating conditions, as specified by the manufacturer.

Note there was not sufficient data for centralized refrigeration systems, condensing units, and chillers to distinguish large units from small units.

2.2.2.1 Stand-alone medium temperature refrigeration systems

Stand-alone medium temperature refrigeration systems are self-contained units, with all components integrated into their structure. These systems are designed to maintain an internal temperature of 0°C or higher. Small units of this type are those with a nameplate power rating of less than 0.74 kW. Typical examples include:

- Staff fridges,
- Under-counter coolers,
- Sandwich bars, and
- Small refrigerated merchandisers.

Large units of this type are those with a nameplate power rating greater than 0.74 kW. Typical examples include:

- Two-door reach-in coolers, and
- Display coolers.

2.2.2.2 Stand-alone low temperature refrigeration systems

Stand-alone low temperature refrigeration systems are self-contained units with integrated components, designed to maintain internal temperatures below 0°C but not lower than -50°C. These systems include stand-alone freezers.

Small units of this type have a nameplate power rating of less than 1.1 kW. Typical examples include:

- Ice cube dispensers,
- Under-counter freezers, and
- Domestic freezers.

Large units of this type have a nameplate power rating greater than 1.1 kW. Typical examples include:

- Blast chillers,
- Ice cream machines, and
- Large stand-up display freezers.

2.2.2.3 Centralized refrigeration systems

Centralized refrigeration systems consist of a cooling evaporator in the refrigerated space, connected to a compressor rack in a separate machinery room and an outdoor condenser, designed to maintain internal temperatures above -50°C.

These systems are the largest and highest emitting type, with a typical nameplate power rating greater than 5kW, and leaking around 25% of their refrigerant annually. Due to the significant refrigerant charges and leakage, the mass balance method should be used wherever possible to track refrigerant use accurately.

Examples of centralized refrigeration systems include:

- Supermarket refrigeration systems,
- Industrial cold storage units, and
- Large food processing refrigeration systems.

2.2.2.4 Condensing units

Condensing units are refrigeration systems with a cooling evaporator located in the refrigerated space, connected to a compressor and condenser unit placed in a separate location. These systems are designed to maintain an internal temperature of above -50°C.

Walk-in fridges are a common example of condensing units. Because walk-in fridges were a common equipment type reported by refrigerant pilot participants, they have a separate designation in the estimation method.

Other typical examples of condensing units include:

- Refrigerated storage rooms in restaurants or grocery stores,
- Cold rooms in pharmaceutical facilities, and
- Data centers or server rooms.

2.2.2.5 Chillers

Chillers are refrigeration or air-conditioning systems which have a compressor, an evaporator and a secondary coolant. An example of a secondary coolant is water.

Chillers are typically large units (above 5kW) that are regulated by Technical Safety BC. Therefore, organizations should have the necessary data to follow the Nameplate or Mass Balance method.

Specific Instructions:

For PSOs: PSOs that cannot acquire the necessary data to follow the nameplate or mass balance method may contact Carbon.Neutral@gov.bc.ca for guidance.

2.2.2.6 Commercial air conditioning (AC) systems

The commercial air conditioning system type includes large single-split or multi-split air-conditioning units, variable refrigerant flow systems, and ducted or packaged rooftop systems. However, it does not include chillers (Section 2.2.2.5) or heat pumps (Section 2.2.2.7).

Small units of this type have a nameplate power rating of less than 4.6 kW. Typical examples include:

- Small split air conditioners, and
- Small self-contained air conditioners.

Large units of this type have a nameplate power rating greater than 4.6 kW. Typical examples include:

- Rooftop units (RTUs),
- Split air conditioners, and
- HVAC systems.

2.2.2.7 Heat pumps

Heat pumps, also known as reversible air-conditioning, are units that can operate as an air-conditioning unit in hot weather or can provide heating in cold weather. In heating mode, the indoor unit functions as condenser and the outdoor unit as evaporator. In cooling mode, the functions are reversed.

Heat pumps can reduce emissions where they are on lower carbon electricity grids (such as British Columbia's integrated grid and most hybrid renewable/diesel grids) and when they replace fossil fuel space conditioning and water heating systems.

In addition to heat pumps for heating and cooling this type includes heat pumps used in other systems such as water heaters and clothes dryers.

2.2.3 Reference Tables for HFC Quantification Methods

Table 7: Refrigerant Leak Rates by Equipment Type

Equipment type	Sub-categories for the estimation method	Leak rate
Stand-alone medium temperature refrigeration systems	Large and Small	1%
Stand-alone low temperature refrigeration	Large and Small	1%
Centralized refrigeration systems	None	25%
Condensing units	Condenser and Walk-in fridge	25%
Chillers	None	2%
Commercial air conditioning system	Large and Small	8%
Heat pumps	Large and Small	8%

Source: Table 4: Default values for annual emissions of refrigeration systems, ECCC's Offset Protocol for Reducing Greenhouse Gas Emissions from Refrigeration Systems.

Table 8: GWPs of common refrigerant blends

Refrigerant	Mixture percentages	GWP (kg CO_2e/kg HFC)
HFC R-134a	100% $C_2H_2F_4$ (CH_2FCF_3)	1300
HFC R-134	100% $C_2H_2F_4$ (CHF_2CHF_2)	1120
HFC R-404a	44% R-125 52%, R-143a, 4% R-134a	3942.8
HFC R-407c	23% R-32, 25% R-125, 52% R-134a	1624.2
HFC R-410a	50% R-32, 50% R-125	1923.5
HFC R-507	50% R-125, 50% R-143a	3985
HFC R-438a	8.5% R-32, 45% R-125, 44.2% 134a, 1.7% R-600, 0.6% R-601a	3055.1[a]
R-290	100% propane	0[b]

a. R-600 and R-601 are out of scope in the CNGR and therefore have a GWP of 0 for the purpose of the CNG program.

b. Fugitive R-290 (propane) is out of scope in the CNGR. It is a hydrocarbon that can be used as a refrigerant, and has a very low GWP of 3.

Sources: ASHRAE Refrigerant Designations; Carbon Neutral Government Regulation

Table 9: Estimated full charge by equipment type

Equipment type	Full charge mass (kg)
Small stand-alone medium temperature refrigeration system	0.24
Large stand-alone medium temperature refrigeration system	0.64
Small stand-alone low temperature refrigeration system	0.32
Large stand-alone low temperature refrigeration system	0.65
Condensing unit	5.16
Walk-in fridges	3.21
Small commercial air conditioning system	1.33
Large commercial air conditioning system	3.41
Small heat pump	2.73
Large heat pump	11.3

Source: Carbon Neutral Government Refrigerants Pilot

Table 10: Refrigerants Commonly Used by Equipment Type

Equipment type	Refrigerants used by frequency
Stand-alone medium temperature refrigeration systems	49% R-134a, 36% R-404a, 10% R-438a, 3% R-290
Stand-alone low temperature refrigeration systems	92% R-404a, 5% R-134a
Condensing units	51% R-410a, 46% R-407c, 1% R-134a, 2% R-404a
Walk-in fridges	53% R-507, 47% R-404a
Commercial air conditioning systems	100% R-404a
Heat pump	100% R-410a

Source: Carbon Neutral Government Refrigerants Pilot

2.3 Purchased Electricity for Stationary Sources

Type: Indirect Emissions

Description: Organizations purchase electricity in B.C. from the three types of grids: [22, 23]

- the integrated grid (which covers most of B.C.),
- the Fort Nelson grid (from Fort Nelson east to the Alberta border), or
- micro-grids in non-integrated areas. [24]

Organizations with operations outside of B.C. purchase electricity from local suppliers. An organization that is unsure from which grid it purchases electricity should contact their utility.

Data sources: The Climate Action Secretariat publishes electricity emission intensity factors (EEIFs) for the integrated grid and the Fort Nelson grid.[25] Schedule D of the Greenhouse Gas Emission Reporting Regulation (GGERR) sets the methodology for B.C. EEIFs.

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[22] B.C. Ministry of Environment and Climate Change Strategy. Frequently Asked Questions: Electricity Emission Intensity Factors for Grid-Connected Entities. Available: https://www2.gov.bc.ca/assets/download/DFFB28009F6D4AB58F06B4F8F4AE81ED

[23] A map of the B.C. transmission system is available here: https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/transmission/maps/Transmission-System-2023-2024.pdf

[24] Non-integrated areas are areas that are not connected to either the integrated grid or the Fort Nelson grid. They range in size from a grid that supplies 18 customers (Ehthlateese) to one that supplies 1,700 customers (southern Haida Gwaii). See BC Hydro (2023). BC Hydro's Non-Integrated Areas Planning Regulatory Framework, pp. 7-9. Available: https://docs.bcuc.com/documents/proceedings/2024/doc_75671_b-1-bch-non-integrated-areas-planning-framework.pdf

[25] B.C. Ministry of Environment and Climate Change Strategy. Electricity Emission Intensity Factors for Grid-Connected Entities. Available: https://www2.gov.bc.ca/gov/content?id=616BC0B3E8354AD3B500B279FE56B337

The Climate Action Secretariat uses either the integrated grid or the Fort Nelson grid emission factors as proxies for hybrid renewable and diesel micro-grids, depending on the emission intensity of the micro-grid. It has also created an off-grid diesel electricity emission factor for micro-grids that rely solely on the use of diesel, based on the average consumption of diesel and production of electricity across diesel-only communities in B.C.

Specific Instructions:

For PSOs: The Climate Action Secretariat draws EEIFs for **other Canadian provinces** from the 1990-2022 NIR (Part 3, "Consumption Intensity") and averages the values from the previous four years. PSOs with operations that are located outside of B.C. and are in the scope of the CNG program must report the emissions using the EEIFs for those provinces (Table 11).

The Climate Action Secretariat sources EEIFs for **countries and regions outside of Canada** from Ember Climate, using the average of the previous four years under Generation Intensity.[2] PSOs with operations that are located outside of Canada and are in the scope of the CNG program must report the emissions using the EEIFs published by Ember Climate for those countries and regions.

[1] – Environment Canada (2023). National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990-2021, Part 3, p. 58. Available: https://publications.gc.ca/site/eng/9.506002/publication.html.

[2] – Ember Climate (2024). Yearly electricity data. Available: https://ember-climate.org/data-catalogue/yearly-electricity-data/. Ember sources data from Global Energy Monitor.

Table 11: Emission Factors Sources for Electricity in Other Provinces in the 1990-2022 NIR

Province	NIR Reference
Alberta	Table A13-10
Ontario	Table A13-7
Quebec	Table A13-6
Nova Scotia	Table A13-4

2.3.1 Renewable Energy Certificates (RECs)

Specific Instructions:

For PSOs: The CCAA does not recognize Renewable Energy Certificates (RECs), Green Rights or Green Power Credits as a means of lowering the emissions associated with electricity consumed or offsetting emissions for PSOs to meet their CNG obligations.

2.4 District Energy Systems for Stationary Sources

Type: Indirect Emissions[26]

Description: Some organizations purchase energy from district energy systems (DESs) that have one or more energy plants that produce hot water, steam, and/or chilled water, which is then distributed through a network of insulated pipes to provide hot water, space heating, and/or air conditioning for buildings connected to the DES.[27] Several organizations operate DESs and sell their excess energy to customers, while others purchase energy from DES operators. DES operators can use a variety of feedstocks, including, but not limited to, natural gas, diesel fuel, other liquid fossil fuels, solid, liquid or gaseous biofuels, renewable electricity, recovered and/or upgraded waste heat, and cold water, e.g., from an ocean or a lake.

Data Sources: Organizations can determine their district energy emission factor and emissions by:

(1) contacting their district energy provider for the emission factor of the DES, or
(2) contacting their district energy provider for the energy source mix, equipment efficiency and distribution efficiency of each fuel source in the DES, and inputting the data into the DES Use and Emissions calculator (described below).

Calculations: When an organization produces district energy for its own consumption, the organization can determine the resulting GHG emissions by applying the appropriate emission factors of the fuels consumed by the system (refer to Section 2.1 for the emission factors for stationary fuel combustion).

Where an organization purchases heating or cooling from another entity, estimating emissions requires information on the fuels consumed by the DES plants and the generation, distribution, and system efficiencies of the DES.

The average efficiency of DESs depends on characteristics such as the physical condition of the energy plants, distribution losses, and operation and maintenance practices. The Emission Factors Catalogue includes ten tiers of emissions intensities for DESs for organizations to determine their GHG emissions. The tiers range from a low-carbon DES (Tier 1) to a high-carbon DES (Tier 10). Tiers are used so that organizations can report a fixed emission intensity for their DES if they do not have access to a GHG calculation tool that permits the use of variable emission factors.

Specific Instructions:

For PSOs: PSOs that purchase steam can load their purchased steam totals in pounds (lbs) or kg into CGRT for conversion into megajoules (MJ) of energy.

DES Use and Emissions Calculator: The Climate Action Secretariat developed a DES Use and Emissions Calculator based on guidance from the General Reporting Protocol to help organizations

[26] Organizations that operate their own DES should treat the energy they use from the system as direct emissions, following the guidance in Section 2.1. Section 2.5 applies to PSOs that sell energy to other organizations.

[27] US Department of Energy, Office of Energy Efficiency & Renewable Energy (2020). District Energy Systems Overview. Available: https://www.energy.gov/sites/default/files/2021/03/f83/District_Energy_Fact_Sheet.pdf

determine which of the tiers to use for emission measurement and reporting purposes.[28] The DES Use and Emissions Calculator outputs the emission intensity at the upper bound of each tier to provide conservative estimates across all tiers. The exception is Tier 10 which is based on a DES system using gasoline with 75% system efficiency. While the Climate Action Secretariat chose the upper bound of Tier 10 to be conservative, it is possible for some DESs to have higher emissions intensities than this upper bound. The calculator is on the Carbon Neutral Government Program Requirements page under "Links and Tools." The steps for using the DES Calculator are:

(1) Use the calculator to determine the district energy system's emissions intensity.
(2) Compare the calculated emissions intensity with the thresholds provided in the calculator.
(3) Select the tier where the calculated value falls by referencing the upper and lower thresholds of each tier. The emissions intensity of the DES will align with the upper threshold (e.g., if Tier 1 has a cutoff of 0.2 kg CO_2e/kWh and Tier 2 has a cutoff of 0.25 kg CO_2e/kWh, and the DES has an emission factor of 0.22 kg CO_2e/kWh, it would be reported as Tier 2).

For PSOs: CGRT requires PSOs to use specified emission factors that align with the 10 tiers in the Emission Factors Catalogue. PSOs enter the tier identified for their district energy use in the DES Use and Emissions Calculator into CGRT.

PSOs that own or lease and operate a DES only report the fuel that is consumed by the DES as per Section 2.1, not the energy purchased from the DES, except as described in Section 2.5.

PSOs using the DES Use and Emissions Calculator should document all the variables they input into the calculator for reference by other/future staff, for annual self-certification purposes, and for possible third-party verification. PSOs should update the documentation annually, as system operations and efficiencies will vary based on climate, exposure, occupancy patterns, heating controls, insulation, fuel types, and other factors. PSOs may submit documentation or any questions about DES calculations to Carbon.Neutral@gov.bc.ca.

2.5 Energy Sold by a PSO

For PSOs: Energy sold by a PSO to another PSO should be entered as a negative value in CGRT to avoid double counting when aggregating the associated emissions across the B.C. public sector.

If a PSO sells energy to an organization that is not a PSO, including the private sector, LGs or MTNs, the PSO does not enter that energy as a negative value. In other words, PSOs remain responsible for reporting the energy and emissions associated with energy sold to any non-PSO.

[28] The Climate Registry (2019). General Reporting Protocol, Version 3.0. Available: https://theclimateregistry.org/wp-content/uploads/2023/11/grp2023.pdf.

2.6 Estimating a Building's Energy Use

Type: Direct and Indirect Emissions

Description: Organizations have two options for estimating energy consumption in buildings when utility data is not readily available: the Regional Calculated Energy Use Intensity method, and the Fixed Energy Use Intensity method. Both methods rely on the organization having the building's conditioned space[29] floor area in square metres (m^2). The conditioned space floor area includes all areas inside the building such as tenant areas, common areas, mechanical equipment areas, and storage rooms.[30]

See Figure 1 for guidance on selecting one of the two options.

2.6.1 Regional Calculated Energy Use Intensity

The Regional Calculated Energy Use Intensity (Regional Calc EUI) method estimates a building's energy use by employing data from similar buildings in the organization's portfolio. To use the Regional Calc EUI method, organizations should have measured utility data for the majority of their buildings in a category (e.g., educational facilities, hospitals, residences, long-term care centres) within similar climates zone.[31] Organizations should use at least two years of utility data to smooth out annual climate variability.

To estimate the building's energy use (Table 12), organizations should:

(1) Collect utility energy data and conditioned space floor area for all their buildings with reported utility data and aggregate these buildings by building category and by climate zone,
(2) For each energy source (e.g., natural gas, electricity, propane, etc.) divide the energy used in the aggregated buildings by the conditioned space floor area of the aggregated buildings to get the Regional Calc EUI for each energy source by building type and climate zone,
(3) Multiply the floor area of the building to be estimated (BTBE) by the Regional Calc EUI for each energy source used in the BTBE to estimate its energy consumption,
(4) Apply the emission factor for each GHG by the estimated energy source used to estimate emissions by GHG,
(5) Apply the GWPs to each GHG to estimate total CO_2e emissions by GHG, and

[29] The term "conditioned space" is defined in the 2024 BC Building Code as "any space within a *building*, the temperature of which is controlled to limit variation in response to the exterior ambient temperature by the provision, either directly or indirectly, of heating or cooling over substantial portions of the year." BC Ministry of Housing (2024). 2024 British Columbia Building Code, p. 20. Available: https://www2.gov.bc.ca/gov/content?id=95E068C480804BCDA9ECE716CA921B1D.

[30] Energy Star Portfolio Manager. Glossary – Gross Floor Area. Available: https://portfoliomanager.energystar.gov/pm/glossary

[31] The 2024 BC Building Code describes the climate zones by the annual heating degree-days of the building location. BC Ministry of Housing (2024). 2024 British Columbia Building Code, p. 1011. Available: https://www2.gov.bc.ca/gov/content?id=95E068C480804BCDA9ECE716CA921B1D. Climate data is located on pp. 1573 to 1578 of the BC Building Code. The Better Homes BC Program shared a map with communities in B.C. and their climate zones.

(6) Sum estimated GHGs to develop total estimated building emissions.

Organizations follow the calculations in Table 12 to convert estimated energy use to estimated GHG emissions.

Specific Instructions:

For PSOs: PSOs using the Regional Calc EUI approach may enter the estimated energy use (Step 3 in Table 12) into CGRT.

Table 12: Regional Energy Use Intensity Estimation Calculation

Step	Formula (apply for each energy source)
(1) For buildings with reported utility data, collect utility energy data and conditioned space floor area, and aggregate these buildings by building category and by climate zone.	$Area_{,building\ 1} + \ldots + Area_{,building\ N}$ = Total Conditioned Spaced Floor Area with Reported Energy Source Use[a] (m^2) $Energy_{,building\ 1} + \ldots + Area_{,building\ N}$ = Total Annual Energy Source Use (GJ/year)
(2) For aggregated buildings (i.e., similar building category and climate zone) for which the organization has energy use data, determine the combined reported annual consumption for each energy source and divide by the combined conditioned space floor area.	Total Annual Energy Source Use (GJ/year) ÷ Total Conditioned Space Floor Area with Reported Energy Source Use[a] (m^2) = Regional Calculated Energy Use Intensity (Regional Calc EUI) (GJ/m^2/year)
(3) Multiply the floor area of the Building(s) to be Estimated (BTBE) by the Regional Cal EUI to estimate annual consumption by each energy source.	Floor area of the BTBE (m^2)[a] × Regional Calc EUI (GJ/m^2/year) = Estimated Annual Energy Source Use in BTBE (GJ/year)
(4) Multiply the emission factor for each GHG by the estimated annual consumption by each energy source in BTBE to estimate emissions by GHG.	Emission Factor by GHG for Energy Type (t/GJ) × Estimated Annual Energy Source Use in BTBE (GJ) = Estimated Emissions by GHG in BTBE (t)
(5) Apply the GWPs to each GHG to estimate total BTBE CO_2e emissions by GHG.	Estimated emissions by GHG in BTBE (t) × GWP of GHG (t CO_2e/t) = Estimated emissions (t CO_2e) by GHG in BTBE
(6) Sum estimated GHGs to develop BTBE emissions.	Emissions of ($CO_2 + CH_4 + N_2O$) in BTBE (t CO_2e) = Total Estimated Emissions in BTBE (t CO_2e)

a. If the floor area of a building has changed within the reporting period, multiply each area by the number of days during the year for which it was effective. Sum the results and divide that sum by the total number of days in the year to get a prorated area for that year.

2.6.2 Fixed Energy Use Intensity

The Fixed Energy Use Intensity (Fixed EUI) method uses the energy intensity factors in NRCan's CEUD.[32] This database includes statistics on energy use by province, building use, building type, and energy source. The Emission Factors Catalogue includes the EUIs for different building classifications. The Fixed EUI method is less complex than the Regional Calc EUI, but it may be less accurate.

Organizations may choose either method, but the Fixed EUI estimation method (Table 13) may be the only option available, if:

- They do not have access to enough data to determine a Regional Calc EUI, or
- They do not have the capacity to determine a Regional Calc EUI.

Specific Instructions:

For PSOs: Enter the conditioned space floor area into CGRT for each building to be estimated (BTBE). CGRT completes the calculations described in Table 13.

Table 13: Fixed Energy Use Intensity Estimation Calculation

Step	Formula (apply for each energy source)
(1) For each energy source, determine the annual consumption amount by multiplying the conditioned space floor area of the BTBE by the Energy Use Intensity from the CEUD.	BTBE's Conditioned Space Floor Area[a] (m^2) × Energy Use Intensity (GJ/m^2/month)[b] × 12 months = BTBE's Annual Energy Consumption Estimate (GJ)
(2) Apply the emission factor by energy source to yield total BTBE emissions by energy source	Emission Factor by GHG (t/GJ) × BTBE's Annual Energy Consumption Estimate (GJ) = Emissions by GHG (t)
(3) Apply the global warming potentials to yield total emissions	Emissions by GHG (t) × GWP = Emissions (t CO_2e)
(4) Sum across the gases to calculate total BTBE CO_2e emissions	Emissions of (CO_2 + CH_4 + N_2O) (t CO_2e) = Total BTBE Emissions (t CO_2e)

a. If the area of a building has changed within a monthly reporting period, multiply each area by the number of days during the month for which it was effective. Sum the results and divide that sum by the total number of days in the month to get a prorated area to use for that month.

b. The CEUD provides annual energy intensity. In CGRT, the EUI has been divided by 12 so PSOs can measure energy use and emissions monthly, so PSOs can measure new estimated building energy use based on occupancy date. If working directly from the CEUD, there is no need to multiply by 12 months.

[32] NRCan through the Office of Energy Efficiency. Comprehensive Energy Use Database. Available: https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive_tables/list.cfm

2.6.3 Hybrid Energy Estimations

In some instances, organizations can access energy data for one energy type in a building but not for another. In those instances, organizations may estimate the unknown energy type using one or a combination of the methods above. For example, the Regional Calc EUI may be used to estimate one energy type within a building while other energy types in the same building may use the Fixed EUI.

Figure 1 depicts the process of choosing the best approach for estimating the use of an energy source in a building.

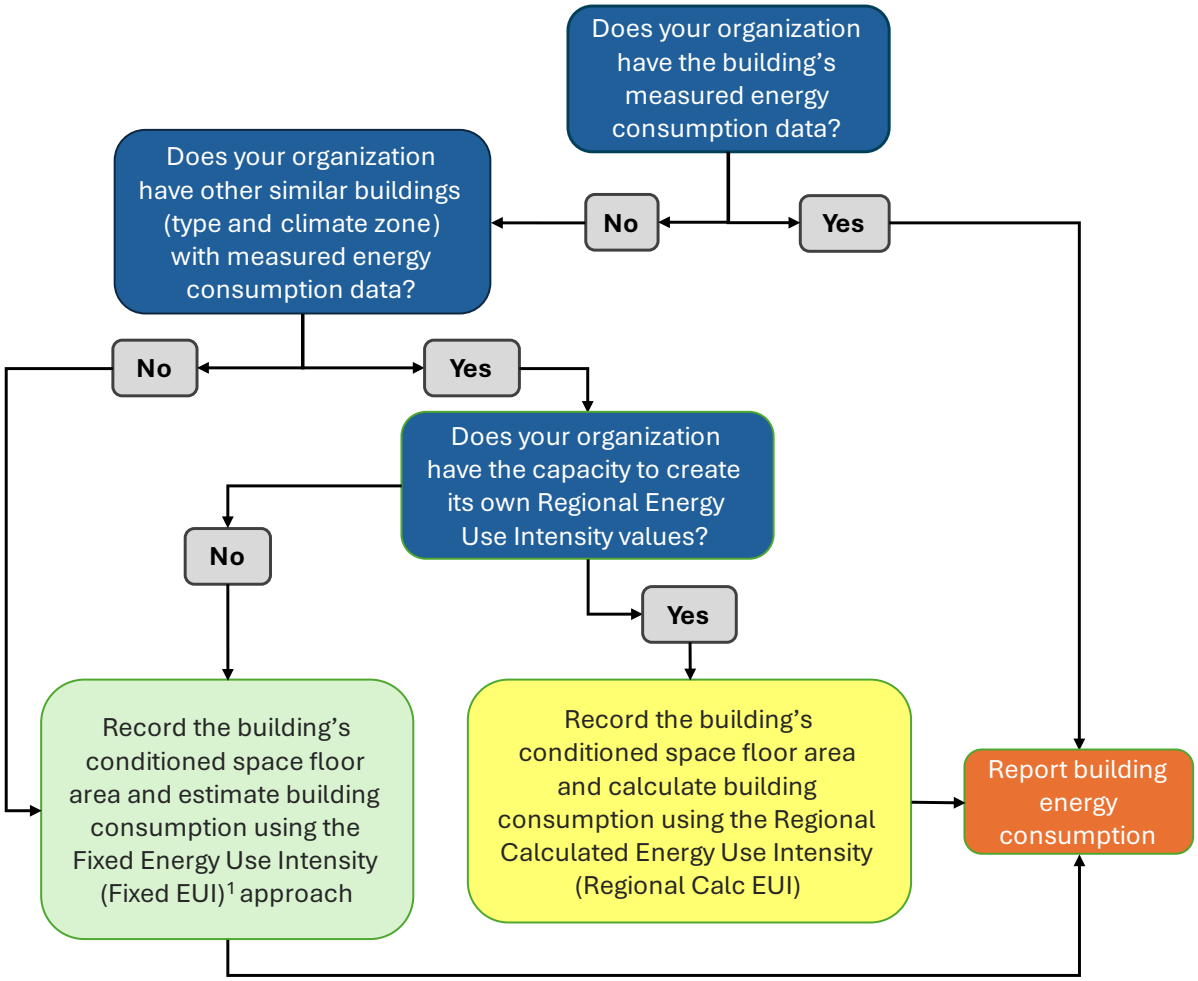

Figure 1. Decision-making flow chart for when and how to estimate building emissions.

3 Mobile Sources – Transportation

This section outlines how to calculate the direct and indirect GHG emissions from operating seven modes of vehicles or equipment:

- Light-duty vehicles (excluding trucks, SUVs, and minivans),
- Light-duty trucks (including SUVs and minivans),[33]
- Heavy-duty vehicles,
- Motorcycles,
- Off-road vehicles and equipment (e.g., snowmobiles, ATVs, lawnmowers and trimmers, tractors, construction equipment),
- Marine vessels, and
- Aviation.

3.1 Mobile Fuel Combustion

Type: Direct Emissions

Description: Organizations use a variety of fuels and energy sources are used to power vehicles and equipment. The fuels include, but are not limited to:

- Fossil fuels:
  - gasoline,
  - diesel,
  - marine gasoline,
  - marine diesel,
  - aviation gasoline,
  - aviation turbo fuel,
  - natural gas[34] and
  - propane, and
- Biofuels:
  - biodiesel,
  - ethanol, and
  - renewable natural gas, and
- Electricity.

The Emission Factors Catalogue does not include emission factors for hybrid electric and plug-in hybrid electric vehicles, because their fuel consumption is captured under gasoline cars and trucks. Their higher fuel economy relative to conventional gasoline cars and trucks is reflected in their lower overall fuel consumption, and therefore, lower GHG emissions.

[33] The NIR defines light-duty cars and trucks as those with a Gross Vehicle Weight Rating (GVWR) of 3,900 kg or less and heavy duty as those vehicles with a GVWR greater than 3,900 kg.

[34] The density of natural gas in CGRT is 0.6937 kg/m3 at standard temperature and pressure, based on 2006 information from Terasen Gas (now FortisBC Gas) on the chemical composition of natural gas flowing through B.C. pipelines at the time.

To calculate mobile electricity emissions, organizations use the appropriate electricity emission intensity factor (EEIF) based on the grid to which their utility is connected. See Section 2.3 Purchased Electricity for Stationary Sources.

If organizations can collect vehicle electricity consumption separately from that of the building, such as through separate meters for their charging infrastructure, organizations may report electricity consumed by vehicles as mobile electricity.

Hydrogen powered transit busses produce zero emissions at the tailpipe and are not included in emissions reporting for mobile sources.

Data sources: The Emission Factors Catalogue references emission factors for mobile fuel combustion from Table A6.1-15 in the 1990-2022 NIR (Part 2).[35] Table 14 Identifies where to find the emission factors for each transport mode in the NIR.

Table 14: Mobile Combustion Emission Factors Sources in the 1990-2022 NIR

Transport Mode	Fuel Type	Source
Light-duty Vehicle	Gasoline Diesel	Tier 2 Advanced Control
Light-duty Truck (includes SUV and Minivan)	Gasoline Diesel	Tier 2 Advanced Control
Heavy-duty	Gasoline Diesel	Three-way Catalyst Advanced Control
Motorcycle	Gasoline	Non-catalytic Controlled
Off-Road (Vehicle/Equipment)	Gasoline Diesel	Off-road Gasoline 4-stroke Off-road Diesel ≥ 19kW, Tier 4
Marine	Gasoline Diesel	Marine
Aviation	Gasoline Turbo Fuel	Aviation
Various	Biodiesel Ethanol	Renewable Fuels

Calculations: In B.C., the Low Carbon Fuels (General) Regulation sets the requirements for renewable fuel in the province's transportation and heating fuel blends.[36] Since January 1, 2011, fuel suppliers have been required to incorporate at least 5% renewable fuel content in gasoline and 4% in diesel.

[35] Environment Canada (2024). *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990-2022,* Part 2, p. 275. Available: https://publications.gc.ca/site/eng/9.506002/publication.html

[36] Renewable and Low Carbon Fuel Requirements Regulation, B.C. Reg. 394/2008.

The Emission Factors Catalogue treats the standard gasoline blend as 95% fossil fuel gasoline and 5% ethanol, and the standard diesel blend as 96% fossil fuel diesel and 4% biodiesel (Table 4).

In B.C., biofuels are almost always blended with fossil fuels, most commonly gasoline or diesel, in varying proportions (e.g., E10, B5, B20).[37] The values in the Emission Factors Catalogue for bio and non-bio mobile emissions for standard blends already include the proportion of biofuels consumed, and CGRT does the same. Table 15 demonstrates the calculation of the bio-CO_2 emission factors for standard light-duty gasoline and light-duty diesel vehicles. Values for renewable fuels are derived from the NIR and are available in the Emission Factors Catalogue.

Table 15: Calculations for Bio-CO_2 emission factors (EFs) for Standard Fuels

Standard Fuel Classification	100% Biofuel Bio-CO_2 EF	Minimum Renewable Fuel Content	Bio-CO_2 EF for Standard Fuel
Light-duty Vehicle – Gasoline (E5)	1.508 kg/L (Ethanol)	× 5% =	0.0754 kg bio-CO_2/L
Light-duty Vehicle – Diesel (B4)	2.472 kg/L (Biodiesel)	× 4% =	0.09888 kg bio-CO_2/L

The standard blends represented in the Emission Factors Catalogue are:

Ethanol/gasoline blends:

- 5% ethanol,
- 10% ethanol,
- 15% ethanol, and
- 100% ethanol.

Biodiesel/diesel blends:

- 4% biodiesel,
- 5% biodiesel,
- 20% biodiesel, and
- 100% biodiesel.

The Emission Factors Catalogue does not include emission factors for fuels with less than 5% ethanol or 4% biodiesel. Organizations seeking to report straight gasoline (i.e., E0) and straight diesel (i.e., B0) can use the CO_2 emission factors for the appropriate fossil fuels in the NIR (see Table 14) in place of the CO_2 emission factors in the Emission Factors Catalogue.

[37] International protocols require the separate reporting of biogenic emissions from fossil fuel-based emissions (see Section 2.1), and the CO_2 emissions from the biofuel component must be calculated and reported separately from those of the fossil fuel component.

3.1.1 Renewable Fuel Blends

If an organization captures biogas for their own stationary combustion, they can calculate the percentage of CH_4 in the biogas and apply the renewable natural gas (RNG) emission factors accordingly.

As of July 1, 2024, FortisBC has designated 1% of all marketable gas to its customers as RNG. The standard natural gas emission factor in the Emission Factors Catalogue reflects 1% RNG as of July 1, 2024. Organizations can report their natural gas as standard if they do not purchase additional RNG.

Organizations in both the FortisBC and Pacific Northern Gas service areas may choose to purchase gas with higher RNG percentages.[38]

Organizations purchasing renewable fuel blends (e.g., biodiesel, ethanol and RNG) that differ from the standard blends listed in Section 3.1 should follow the example in Table 16 to calculate the volume of standard and renewable fuels that should be reported to their program.

Table 16: Calculations for Non-Standard Mobile Fuel Blend Purchases

Step	Example Calculation
(1) Determine the amount of fuel purchased and the biofuel blend purchased.	Amount of fuel purchased: 10,000 L Biodiesel blend purchased: 25%
(2) To calculate the proportion of the standard fuel to report, multiply the amount of fuel purchased by 100% minus the biodiesel blend purchased, and divide by the proportion of fossil diesel in standard diesel fuel.	Amount of fuel purchased × (100% – biofuel blend purchased) / 96% diesel = 10,000 L × (100% – 25%) / 96% = 10,000 L × (75%) / 96% = 7,812.5 L of standard diesel to report (with 4% biodiesel, that results in 312.5 L of biodiesel and 7,500 L of fossil diesel)
(3) Subtract the amount of standard diesel to be reported from the total amount of diesel purchased to get the amount of 100% biodiesel to be reported.	Amount of diesel purchased – amount of standard diesel reported = 10,000 L – 7,812.5 L = 2,187.5 L 100% biodiesel (B100)

The Emission Factors Catalogue does not include emission factors for renewable diesel or renewable gasoline. Organizations seeking to report renewable diesel and renewable gasoline use the CO_2 emission factors of fossil diesel and gasoline from the NIR as their bio-CO_2 emission factors.

[38] FortisBC (2024). *Renewable Natural Gas.* Available: https://www.fortisbc.com/services/sustainable-energy-options/renewable-natural-gas

Specific Instructions:

For PSOs: PSOs report biogenic emissions (bio-CO_2, CH_4, and N_2O) from combusting ethanol, biodiesel, and renewable natural gas, in alignment with international emissions reporting protocols, and report bio-CO_2 emissions separately from CH_4 and N_2O emissions. CGRT converts biofuel consumption into all three GHGs being tracked for fuel combustion.

PSOs do not offset the CO_2 portion of biogenic emissions. PSOs may exclude the CO_2 portion of biogenic emissions from their total emissions for the purpose of tracking progress towards their emission reduction targets.

PSOs enter fuel consumption in litres by vehicle type and fuel type in CGRT because the emission factors for CH_4 and N_2O vary by vehicle and fuel.

CGRT does not have positions for renewable diesel, renewable gasoline, straight gasoline (i.e., E0) and straight diesel (i.e., B0). PSOs reporting report renewable diesel and renewable gasoline shall report their biofuel consumption as the same as biodiesel and ethanol. PSOs using fuel blends with less biofuel than the minimum requirement under the *Low Carbon Fuels Act* should report their fuels as standard blends.

3.2 Mobile Air Conditioning

Type: Direct Emissions (also called Direct Fugitive Emissions)

Description: Motor vehicles refrigerants leak from motor vehicle air conditioning (MVAC) units during the lifetime of the vehicle. Fuel consumption, which is measurable, does not provide insight into MVAC use or refrigerant loss.

Data sources: The Climate Registry's General Reporting Protocol offers two emission factor data sources for estimating MVAC refrigerant emissions.

1. The "Simplified Mass Balance Approach"[39] for organizations that their MVACs service, and
2. The "Screening Method" is a simplified estimation method that uses default emission factors. To apply the default factor, organizations must provide the number of vehicles in its fleet with MVAC.

Calculations: The Climate Action Secretariat used the Climate Registry's Screening Method to calculate a default emission factor, in kg of Hydrofluorocarbons (HFCs) per vehicle. The default emission factor assumes that MVAC systems use HFC-134a as their refrigerant with a global warming potential of 1,300.

[39] The Climate Registry (2019). *General Reporting Protocol Version 3.0*, C-22.

Vehicles:

- Upper bound capacity charge for MVAC equipment: 2 kg
- Operating emission factor 20 percent of capacity per year

Busses:

- Upper bound capacity charge for MVAC equipment: 18 kg[40]
- Operating emission factor 20 percent of capacity per year

Table 17: Mobile Air Conditioning Default Emission Factors

Vehicle Type	GHG	Emissions per Vehicle per Year ($kg\ CO_2e$/year)
Busses	HFCs	5,148
Other Vehicles	HFCs	572

Specific Instructions: Organizations may use one of two options for calculating their mobile air conditioning emissions. Organizations may use both options for different feet MVACs.

1. Organizations that have their fleet MVAC serviced (e.g., transit fleets) may receive invoices with the quantity of each HFC the service technician added to the MVAC. This aligns with the Climate Registry's General Reporting Protocol's "Simplified Mass Balance Approach."
2. Organizations without access to detailed mobile refrigerant information may estimate and report their annual HFC emissions using default emission factors in Table 17.

[40] The Climate Registry publishes the upper bound capacity charges for busses and other vehicles. The Climate Registry (2024). *2024 Climate Registry Default Emission Factors*, p. 58. Available: https://theclimateregistry.org/download/2024-default-emission-factors-03-2024/

4 Office Paper

This section outlines how to calculate the lifecycle emissions associated with office paper use.

The content below applies to PSOs and organizations that wish to voluntarily report paper.

Type: Indirect Emissions

Description: Unlike the other emission factors, the office paper category uses lifecycle[41] emission factors.

Office paper is differentiated by size and the percentage of post-consumer recycled (PCR) content. In practice, the PCR content ranges between 0 and 100 percent.

Some organizations use alternative paper types, i.e. paper made from agricultural residues such as sugarcane bagasse, wheat straw, bamboo, etc. The Climate Action Secretariat is reviewing the emission intensities of alternative paper types. This work may result in future adjustments to the methodology to support more accurate reporting.

Data sources: Ideally, organizations use emission factors that accurately reflect the extraction, transportation, manufacturing, and disposal processes of specific paper purchases. However, this information is rarely available.

In the absence of paper-specific information, the Climate Action Secretariat sources proxy emission factors from the Environmental Paper Network Paper Calculator.[42] This tool assesses the lifecycle impacts of different wood fibre-based paper choices, from raw material extraction and processing to the end-of-life phase. It is publicly available and is updated regularly with peer-reviewed data. The Paper Calculator estimates the associated GHG emissions in pounds of CO_2e based on a specified paper grade (e.g., copy paper), quantity by weight and PCR content.

Alternative paper types have lifecycle emission factors that differ from conventional wood fibre paper; however, in the absence of emissions factors specific to alternative paper types, the Climate Action Secretariat recommends organizations apply the emission factors in the Emission Factors Catalogue for 100% PCR content of the corresponding paper size as an approximation when reporting use of the alternative paper types.

Calculations: To determine the proxy emission factor, the Climate Action Secretariat entered the weight of a 500-sheet package for each paper size and the PCR content into the Paper Calculator, and converted the resulting GHG emission estimates from lbs to kg CO_2e.

Organizations can interpolate between the emission factors for other PCR contents (e.g., 85 percent) by averaging between the values shown.

[41] Lifecycle emissions account for all emissions relating to the production, use, and disposal of a product, including the extraction of raw materials, product manufacturing, and intermediate transport steps.

[42] Emission factors are based on information provided by the Environmental Paper Network's Paper Calculator up to 2012.

Special Instructions:

For PSOs: PSOs report three different sizes of office paper in the CNG program – 8.5″×11″, 8.5″×14″ and 11″×17″. In each case, PSOs enter data on the number of 500-sheet (20lb) packages, or reams, into CGRT, by PCR content.

For LGs and MTNs: Paper is out of scope for the LGCAP program.

5 Business Travel

This section outlines the approach to measuring and reporting business travel emissions, by all travel modes, based on distance or spending, and for accommodations.

The Climate Action Secretariat refined this business travel methodology in 2024. This section reflects these improvements and provides guidance for:

- The provincial government that, in accordance with the CCAA, is required to quantify, reduce, offset, and report business travel and accommodation emissions of its public officials; and
- Organizations who wish to voluntarily report their business travel emissions.

Specific Instructions: The Provincial government reports business travel either via a tool called iExpenses or based on direct expenditures. Annex 3 presents a description of these accounting systems. PSOs, Local Governments and Modern Treaty Nations that voluntarily measure and report business travel emissions may organize data to align with the descriptions of iExpenses in Annex 3.

For PSOs: PSOs can use the methodology described in this section to voluntarily measure and report their business travel emissions. PSOs are not to enter business travel data into CGRT, because the system is unable to differentiate voluntarily reported data from data that is required under the CCAA. They may use Section 5 to guide quantification of travel related emissions, and voluntarily report these emissions in their Climate Action Accountability Reports (CCARs). PSOs that choose to report travel emissions in their CCARs may omit these emissions from their official totals.

The GHG Protocol provides three methods for quantifying business travel emissions, which are listed below in order of accuracy, [43] and recommends selecting a method based on data availability:

1. Fuel-based method: follow Section 3.1 of this document.
2. Distance-based method: determine the distance and travel mode and apply the emission factors for the travel mode, per Sections 5.1, Ferry (Distance-based)5.2**Error! Reference source not found.** and 5.3 of this document.
3. Spend-based method: determine the expenditures and travel mode and apply the emission factors for the travel mode per Sections 5.4 and 5.5 of this document.

The instructions in the business travel sections apply a mix of these three methods.

5.1 Light-duty Vehicles and Light-duty Trucks (Distance-based)

Type: Direct Emissions

Description: This section covers travel by rental vehicles and business use of personal vehicles, specifically light-duty vehicles and light-duty trucks. Vehicle types are:

[43] The Greenhouse Gas Protocol (2004). *The Greenhouse Gas Protocol – a Corporate Accounting and Reporting Standard*. Available: https://ghgprotocol.org/

- Light-duty vehicles: includes taxi, compact, full-sized, mid-sized and mini compact. This covers regular gasoline, diesel and hybrid vehicles.
- Light-duty trucks: Includes pickup trucks, SUVs and mini vans. This covers regular gasoline, diesel and hybrid vehicles.

Data sources: For gasoline, diesel, and hybrid vehicles, the Climate Action Secretariat uses 2018-2024[44] data from NRCan's[45] fuel consumption ratings search tool to calculate fuel efficiency.[46] The NRCan data contains up-to-date information that allows users to distinguish between hybrid and non-hybrid cars. The Climate Action Secretariat obtained data for electric vehicles from the Government of Canada website. [47]

For road travel, NRCan publishes "city", "highway" and "combined" fuel economy ratings by vehicle manufacturer and model in the fuel consumption ratings research tool.[48] Most business travel includes city and highway driving. Considering this mixed nature, the Climate Action Secretariat only uses the "combined" measure from the research tool for estimating car efficiencies in Table 18.

Fuel efficiencies from NRCan are expressed in litres per 100 kilometres driven. For easier interpretation, this document converts NRCan's units to litres per kilometre (L/km) driven. Emission factors are expressed in kg CO_2e/km in CGRT.

[44] This timespan reflects the seven-year fleet replacement cycle of the B.C. provincial government.

[45] Explanation of terms used in public datasets can be found here in NRCAN (n.d.). *Understanding Tables*. Available: https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/personal-vehicles/choosing-right-vehicle/buying-electric-vehicle/understanding-the-tables/21383

[46] Natural Resources Canada. (2024). Fuel consumption ratings search tool. Available: https://fcr-ccc.nrcan-rncan.gc.ca/en

[47] Government of Canada. (2024). *Fuel consumption ratings.* Available: https://open.canada.ca/data/en/dataset/98f1a129-f628-4ce4-b24d-6f16bf24dd64/resource/026e45b4-eb63-451f-b34f-d9308ea3a3d9

[48] Natural Resources Canada. (2024). *2024 Fuel Consumption Guide*. Available*: https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/2024-fuel-consumption-guide/21002*.

Table 18: Average Fuel Efficiencies for light-duty vehicles and light-duty trucks

Travel Mode	Vehicle/ Fuel Type	Average Fuel Efficiency (L/km)	Emission Factor ($kgCO_2e/km$)	Dataset	Source	Reference[a]
Light-Duty Vehicles (includes taxi, compact, full-sized, mid-sized, and mini compact)	Gasoline	0.082	0.181	(1) and (2)	(3)	Light-duty vehicles / gasoline
	Diesel	0.067	0.176	(1) and (2)	(3)	Light-duty vehicles / diesel
	Hybrid	0.050	0.111	(1) and (2)	(3)	Light-duty hybrid vehicles / gasoline
Light-Duty Trucks (includes pick-up truck, SUV and minivan)	Gasoline	0.1126	0.247	(1) and (2)	(3)	Light-duty trucks / gasoline
	Diesel	0.099	0.261	(1) and (2)	(3)	Light-duty trucks / diesel
	Hybrid	0.076	0.167	(1) and (2)	(3)	Light-duty hybrid trucks / gasoline
Electric Vehicles	Electricity	0.225 kWh/km	0.002	(4)	Consumption – combined	Light-duty vehicles and light-duty trucks

a. All emission factors are based on the fuel economy of the combined driving test cycle, which is a combination of the highway and city driving test cycles.

Sources referenced in Table 18:

(1) 2024 Fuel Consumption Ratings – Government of Canada
(2) National Inventory Report 1990 –2022: Part 2. Table A6.1–15 – Environment and Climate Change Canada
(3) 2024 Fuel Consumption Ratings – Government of Canada and National Inventory Report 1990 – 2022: Part 2. Table A6.1–15 – Environment and Climate Change Canada
(4) Fuel consumption ratings - Battery-electric vehicles 2012-2024 – Government of Canada

Calculations: The Climate Action Secretariat calculated emissions for distance-based, light-duty vehicle and light-duty truck travel by applying the relevant Average Fuel Efficiency (L/km) in Table 18 multiplied by the corresponding estimated carbon dioxide emissions (CO_2e) for the vehicle and fuel type (available in Section 3.1 and the Emission Factors Catalogue).

Table 19 shows the calculations for the distance-based gasoline light-duty vehicle emission factor in kg CO_2e per km. The average fuel efficiency in column 3 is multiplied by the estimated CO_2e emission factors of light-duty vehicles (column 8).

Table 19: Example of Emission Factor Calculation for Light-Duty Vehicles

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Travel Mode	Vehicle/ Fuel Type	Average Fuel Efficiency (L/km)	Emission Factor (kg/L)[a]					Emission Intensity (kg CO_2e/km)
			Bio-CO_2	CO_2	CH_4	N_2O	CO_2e[b]	(8) × (3)
Car	Gasoline	0.082	0.075[c]	2.191	0.00014	0.000022	2.201	0.181

a. Emission factors in columns (5) through (7) are those for gasoline (regular) in the emission factors catalogue, taken from the National Inventory Report Part 2 (Table A6.1–15).
b. The Climate Action Secretariat calculates the total non-bioCO_2 emissions using the following equation, where numbers in brackets refer to the column number:
(8) = (5) + (6) × GWP_{CH4} + (7) × $GWP_{N2O.}$
c. The bio-CO_2 emission factor comes from Table 14. National guidelines for reporting GHG emissions recommend separating bio- and non-bio-CO_2 emissions. Refer to GWPs in Section 1.5.2 and mobile fuel combustion in Section 3.1.

Where:

- GWP_{CH4} represents the GWP of methane (CH_4), which is 28, following CNGR.[49]
- GWP_{N2O} represents the GWP of nitrous oxide (N_2O), which is 265, following CNGR.[50]

the calculation for kg CO_2e/L in Table 19 is:

kg/L CO_2e = (column 5) + (column 6) × GWP_{CH4} + (column 7) × GWP_{N2O}
kg/L CO_2e = 2.191 + 0.00014 × 28 + 0. 000022 × 265
kg/L CO_2e = 2.191 + 0.00392 + 0. 00583
kg/L CO_2e = 2.201

5.2 Ferry (Distance-based)

This section provides guidance on business travel using ferries using distance-base emission factors.

Type: Indirect Emissions

Description: This section describes emission factors for the main routes used by B.C. provincial government staff. In the context of ferry travel, the emission factor is expressed in kilograms of CO_2e per passenger kilometre (kg CO_2e/psg-km).

[49] Carbon Neutral Government Regulation. (Deposited Dec. 9, 2008). Available: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/392_2008.

[50] Ibid.

Data sources: BC Ferries provided emission factors for the following five ferry routes in kg CO_2e per passenger trip (kg CO_2e/psg-trip).[51] The Climate Action Secretariat employed those emissions and calculated an average of five years spanning from fiscal year 2017 to fiscal year 2021.

Table 20: Emission Factors for BC Ferries Routes

Route Number	Ferry Route	Emission Factor (kgCO_2e/psg-trip)
(1)	Tsawwassen – Swartz Bay	5.77
(2)	Horseshoe Bay – Departure Bay	5.90
(3)	Horseshoe Bay – Langdale	2.21
(8)	Horseshoe Bay – Snug Cove	1.39
(30)	Duke Point – Tsawwassen	7.41

Specific Instructions:

For PSOs: CAS configured CGRT with a single emission factor for ferry travel in kg CO_2e/psg-km. Therefore, CAS calculated a five-year weighted average of the above routes to determine a single emission factor for ferry travel (see Table 21below).

Calculations: BC Ferries provided emission factors for the routes mentioned above in kilograms of CO_2e per passenger trip (kg CO_2e/psg-trip). The Climate Action Secretariat calculated a five-year utilization percentage (2017-2021) by dividing the five-year average of automobile equivalents (AEQ) by the five-year average capacity provided of each ferry route.[52]

The Climate Action Secretariat extracted ferry travel data from iExpenses for trips made by Provincial government between 2016 and 2020, and found that about 85% of the trips occurred between Metro Vancouver and Vancouver Island on average (routes 1, 2, and 30). iExpenses does not distinguish data from these routes, and therefore CAS weighted them based on BC Ferries AEQs for each route. Trips from Metro Vancouver to the Sunshine Coast corresponded to the Horseshoe Bay to Langdale route.

The Climate Action Secretariat assumed that the remaining trips had similar GHG intensities to the Horseshoe Bay to Snug Cove route. iExpenses reported these trips as Haida Gwaii to Inside Passage (Prince Rupert), Vancouver Island to Inside Passage (Prince Rupert), Metro Vancouver to Gulf Islands, and Other.

The Climate Action Secretariat weighted trips by multiplying each route's total trip numbers by the average percent of trips made for each route by government employees. The overall emission factor can be calculated by dividing the emission factors provided for each route by the five-year average

[51] BC Ferries average emission factors (2017-2021) were provided by BC Ferries Services.

[52] BC Ferries. *Plans, Reports, Policies and Other Resources*, "Annual Reports to the Commissioner". Available: https://www.bcferries.com/in-the-community/resources

route utilization rate, and then multiplying by the route length. Multiplying each route's emission factor by its proportion of total trips provides the weighted contribution to total emissions.

BC Ferries uses renewable fuel in its diesel blends, and the Climate Action Secretariat reduced the fossil carbon intensity to reflect a 4% biodiesel component, the baseline under the LCFS. The fossil emission factor is calculated for each route by subtracting the bio-CO_2 component from total emissions and taking an average of all routes to obtain a single emission factor for ferry travel (Table 21).

Table 21: Emission Factor for Ferry Travel

Travel Mode	Emission Factor (kg CO_2e/psg-km)
Ferry	0.1117

5.3 Air Transport (Distance-based)

This section provides distance-based emission factors for different modes of air travel in B.C. and elsewhere, including float plane, helicopter and airplane travel.

Type: Indirect emissions

Description: Organizations can calculate air travel emissions by using the distance staff have travelled on during business air travel.

Data sources: Harbour Air's 2017 GHG Report contains emissions factors for distance-based float plane.[53] Helijet provided the emission factor for helicopter transportation.

For airplane travel emissions, the UK Department for Energy Security & Net Zero (UKDES)[54] estimated emission factors for three categories of flights:

(1) Domestic flights,
(2) Short-haul international flights, and
(3) Long-haul international flights.

Calculations: The Climate Action Secretariat calculates the emission factor for float planes by using Harbour Air's emissions per passenger on the Victoria-Vancouver route (41.3 kg CO_2e) and dividing this by the distance between the Vancouver and Victoria harbour airports (99 km).

The Climate Action Secretariat applied the UKDES emission factors for airplane travel by equating:

(1) domestic flights to B.C. short-haul flights,
(2) short-haul international flights to B.C. medium-haul flights, and

[53] Harbour Air. (2017). *Harbour Air's 2016-2017 Greenhouse Gas Report.* Available: https://www.harbourair.com/wp-content/uploads/2019/01/Harbour-Air-2017-GHG-Report.pdf

[54] UKDES. (2024). *Greenhouse Gas Reporting: Conversion factors 2024*. Available: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024

(3) long-haul international flights to long-haul flights (i.e., out of province).[55]

The UKDES airplane travel emission factors include an eight percent uplift factor based on the recommendation of the IPCC to account for discrepancies between geographical distance and actual flight distance.[56] The uplift factor adjusts for the difference between the shortest distance calculation, the actual travel path of the aircraft, non-linear routing, delays or circling.

Table 22: Distance-based Air Transport

Travel Type	Travel Mode	Source	Emissions ($kgCO_2e$/psg-km)
Air Transport	Float plane (Vancouver to Victoria)	Harbour Air 2017 GHG Report	0.417
	Helicopter	Helijet	0.446
	Airplane (short-haul: <415km)	UKDES Conversion Factors 2024: condensed set[a]	0.160
	Airplane (medium-haul: 415 to 1316km)		0.109
	Airplane (long-haul: >1316km)		0.154

a. Emission factors are in the 'Scope 3 factors: Business travel – air' spreadsheet of the emission factors catalogue.

5.4 Air travel (Spend-based)

This section provides spend-based estimates for float plane, helicopter and airplane travel.

Type: Indirect emissions

Description: Organizations can calculate air travel emissions by using the amount spent on staff business air travel. This approach is the least accurate option.

Data sources: The Climate Action Secretariat calculated spend-based emission factors by dividing distance-based emission factors (Table 22) by the cost of air travel per km, as collected from the B.C. Government's iExpenses tool. The distance between the origin and destination of flights enables the categorization of flights by short-, medium-, and long-haul.

Calculations: The spend-based emission factor for each travel mode uses the following formula:

Emission Factor:	**Travel Mode's Distance-Based Emission Factor ($kg\ CO_2e$/km)**	÷	**Travel Mode's Cost per kilometre ($/km)**	=	**Travel Mode's Spend-Based Emission Factor ($kg\ CO_2e$/$)**

[55] The Climate Action Secretariat assessed the UKDES categories by distance rather than by flight type because typical Canadian domestic flights are often much longer than typical domestic flights in the United Kingdom or the European Union.

[56] IPCC (1999). *Aviation and the Global Atmosphere*, Section 8.2.2.3. Available: http://www.ipcc.ch/ipccreports/sres/aviation/index.php?idp=118

For float plane and helicopter travel, the Climate Action Secretariat used the average cost from 2019[57] and adjusted it to 2023 prices using the Bank of Canada's Consumer Price Index (CPI) calculator.[58]

For airplane travel, the Climate Action Secretariat calculated the average cost per kilometre using iExpenses, based on air travel data from 2022-2023 for employees who:

- Selected "float plane", "helicopter", "airplane" as travel modes, and
- Specified a destination (i.e., Did not select "Other" or "Other BC" as their destinations).

Table 23 presents the calculated spend-based emission factors for air travel (column 5). These emission factors are the result of dividing the distance-based factor (column 3) by the average cost (column 4).

Table 23: Emission Factors for Spend-based Air Transport

Travel Type (1)	Travel Mode (2)	Distance-based Emission Factor (kg CO_2e/psg-km) (3)	Average Cost ($/km) (4)	Spend-based Emission Factor (kgCO_2e/$) (5)
Air Transport	Float plane	0.417	1.77[a]	0.235
	Helicopter	0.446	2.62[b]	0.170
	Airplane – Short Haul	0.160	1.74	0.092
	Airplane – Medium Haul	0.109	0.94	0.115
	Airplane – Long Haul	0.154	0.19	0.789
	Airplane – Weighted Average of Short/Med/Long Haul[c]	0.139	1.32	0.105

a. Previous value: $1.52. The Climate Action Secretariat adjusted prices to 2023 Canadian dollars using the Bank of Canada consumer price index (CPI) calculator.
b. Previous value: $2.25. The Climate Action Secretariat adjusted prices to 2023 Canadian dollars using the Bank of Canada CPI calculator.
c. If the organization does not have distance data, it is not possible to distinguish between short-, medium-, and long-haul airplane travel. In this case, the Climate Action Secretariat employs a weighted average emission factor based on total distance reported in iExpenses for each category in 2022 and 2023 for both distance-based and spend-based estimations.

[57] For details on previously calculated emission factors for float plane and helicopter, see British Columbia Ministry of Environment and Climate Change Strategy (2023). *2023 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*, pages 35-37. Available: https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2023_pso_methodology_for_quantifying_greenhouse_gas_emissions.pdf

[58] Bank of Canada (n.d.). *Inflation Calculator*. Available: https://www.bankofcanada.ca/rates/related/inflation-calculator/

Specific Instructions:

For PSOs: In the context of ministry directly-paid expenditures on travel, the Climate Action Secretariat provides spend-based emission factors for the following air transport categories, which line up with the provincial government's internal financial coding:

- Victoria-Vancouver travel;
- in-province travel;
- out-of-province travel, and
- out-of-country travel.

The air transport categories are presented in Table 24. The emission factor selected for each subaccount was based on historical data which identifies the modes most frequently taken for each subaccount (i.e., trip category).

Table 24: Emission Factors for Spend-based Ministry Directly-Paid Air Transport

Directly Paid Sub-account[59]	Common Air Transport Modes	Spend-Based Emission Factor ($kgCO_2e/\$$)	Reference
Victoria to Vancouver	Float plane Helicopter	0.235	Table 23: Helicopter
In-Province	Short-haul	0.092	Table 23: Short-haul
Out-of-Province	Medium-haul	0.115	Table 23: Medium-haul
Out-of-Canada	Long-haul	0.789	Table 23: Long-haul

5.5 Public Transport (Spend-based)

This section provides public transport distance-based, trip-based and spend-based emission factors. This includes travel by TransLink and BC Transit on local buses, rail and SeaBus. This section also covers emission factors for travel by public transport between communities, e.g., inter-city rail and buses, and spend-based emission factors for taxis and ride-hailing services. The Climate Action Secretariat recommends using distance-based emission factors in Table 25 for ride hailing services.

Type: Indirect Emissions

Data sources:

- Taxi – fare rates from the Passenger Transportation Board.

[59] The Standard Object of Expenditure (STOB) account numbers for these subaccounts are: 5711 for Victoria to Vancouver, 5712 for In-Province, 5713 for Out-of-Province, and 5714 for Out-of-Canada.

- Bus – data from BC Transit Annual Service Plan Report and TransLink Accountability Report 2023. Additionally, the Climate Action Secretariat used a Vancouver Panel Survey report for estimating bus trip distance.
- SeaBus – TransLink Accountability Report 2023.
- Rail – Railway Association of Canada 2024 report.

Calculations: Table 25 presents spend-based emission factors and their supporting information where applicable. Please refer to Annex 4: Public Transport Emission Factors for details on how the Climate Action Secretariat calculated the individual emission factors.

Table 25: Emission Factors for Spend-based and trip-based Public Transport

Public Transport Mode	Distance-based Emission Factor ($kgCO_2e$/psg-km)	Trip-based Emission Factor ($kgCO_2e$/trip)	Average Cost ($/km OR $/trip)	Spend-based Emission Factor ($kgCO_2e$/$)
Taxi	0.181[a]	N/A	2.28/km	0.079
City Bus	N/A	0.475	2.85/trip	0.166
Skytrain	N/A	0.011	4.65/trip	0.002
SeaBus	N/A	0.728	4.65/trip	0.156
Average - Transit	N/A	N/A	N/A	0.108
Rail	0.093	N/A	0.39/km	0.238
Intercity Bus	N/A[b]	N/A	N/A	0.166
Average – Public Transport, Other	N/A	N/A	N/A	0.202

a. The distance-based emission factor for taxis is from Table 18.
b. Not shown, as it represents the same as city buses.

5.6 Accommodation

This section outlines how to calculate the indirect emissions from accommodations during business travel.

Type: Indirect Emissions

Description: Employees may stay in accommodations while traveling for business. The Climate Action Secretariat provides emission factors only for hotels in B.C. and in the rest of Canada.

Data sources: The Climate Action Secretariat derived the B.C. and rest-of-Canada accommodation emission factors using the Cornell Hotel Sustainability Benchmark 2024 study. This source provides information on energy and water usage, as well as emission factors for overnight stays, in over 20,000

hotels across 83 countries, using data from 2022.[60] . Additionally, CAS employed iExpenses data (Annex 3: BC Government Travel Management Systems) to calculate the weighted average in Table 26.

Calculations: The Climate Action Secretariat calculated emissions using non-resort accommodations, specifically 432 observations for Canada and 58 for British Columbia. This includes establishments with varying subclassifications.[61] Using these observations allows for the calculation of a comprehensive emission factor within the province and the country. iExpenses tracks accommodations in terms of the number of nights per person. For the 2022-2023 period, 89.6% of B.C. provincial government accommodation nights were in B.C.

Table 26: Emission Factor for Accommodation

	Location	kg CO_2e / room / night
Hotel Stay	Rest of Canada	18.92
	B.C.	9.65
Weighted Average[a]		10.61

a. Based on 89.6% B.C.-stay rate in 2022-2023.

Voluntary reporters who wish to account for international hotel accommodations should refer to the relevant country in the Hotel Stay spreadsheet on the UK Department for Energy Security and Net Zero's Greenhouse gas reporting: conversion factors 2024 workbook.

Specific Instructions:

For PSOs: PSOs are not to enter accommodation data into CGRT.

[60] Ricaurte, Eric, and Rehmaashini Jagarajan. (2024). Hotel Sustainability Benchmarking Index 2024: Carbon, Energy, and Water. Available: https://hdl.handle.net/1813/115166.

[61] These consist of several market segments, number of stars, etc. Refer to the Ricaurte and Jagarajan's methodological section (p. 11).

Annex 1: Glossary

Note: The Climate Action Secretariat derived the Terms and Acronyms in from:

- Government of B.C. (2024a). Community Energy and Emissions Inventory. Available: https://www2.gov.bc.ca/gov/content?id=9CD252EC63C84868AC2325F70E21683C
- Government of B.C. (2024b). *Climate Change Accountability Act.* Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/07042_01
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Table 27: Terms, Abbreviations and Acronyms

Term, Abbreviation or Acronym	Definition
Biofuel	A fuel made from biomass, including, for example, wood and wood waste, vegetal waste (straw, hay, grass, leaves, roots, bark, crops), animal materials/waste (fish and food meal, manure, sewage sludge, fat, oil and tallow), landfill gas, other sources of biogas, bio-ethanol, biodiesel, and other liquid biofuels which are added to, blended with, or used straight as a fuel. (General Reporting Protocol, 2019)
Carbon dioxide (CO_2)	A naturally occurring gas (0.03% of atmosphere) that is also a by-product of the combustion of fossil fuels and biomass, land-use changes, and other industrial processes. It is the principal anthropogenic greenhouse gas. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential of 1. (IPCC, 2014)

Term, Abbreviation or Acronym	Definition
Carbon dioxide equivalent (CO_2e)	"The universal unit of measurement to indicate the global warming potential (GWP) of each of the six greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide." (General Reporting Protocol, 2019) Expressing all GHGs in terms of tonnes of CO_2e enables the summation of the emissions of different GHGs.
Community Energy and Emissions Inventory (CEEI)	The Community Energy and Emissions Inventory (CEEI) provides community-level greenhouse gas (GHG) emissions and energy consumption estimates for communities across B.C. The data covers the buildings, municipal solid waste, and on-road transportation sectors for 161 municipalities, 28 regional districts, and one region (Stikine). (The Government of B.C., 2024a)
Comprehensive Energy Use Database (CEUD)	The Comprehensive Energy Use Database (CEUD) provides an overview of sectoral energy markets in Canada and in each region of the country. These tables are used by the Carbon Neutral Government Program to develop energy use intensities (EUIs). (NRCan, 2024)
Direct emissions	Emissions from sources within the reporting organization's organizational boundaries that are owned or controlled by the reporting organization, including stationary combustion emissions, mobile combustion emissions, process emissions, and fugitive emissions. (General Reporting Protocol, 2019) For PSOs, these are sources owned or leased by the PSO. For LGs and MTNs, these are sources used by LGs and MTNs to deliver traditional local government services.
Emission factor	GHG emissions expressed on a per unit activity basis (e.g., tonnes of CO_2 emitted per GJ of natural gas combusted, or tonnes of CO_2 emitted per MWh of electricity consumed). (General Reporting Protocol, 2019)
Fugitive emissions	Intentional or unintentional releases from the production, processing, transmission, storage, and use of fuels and other substances, that do not pass through a stack, chimney, vent, exhaust pipe or other functionally equivalent opening (such as releases of sulfur hexafluoride from electrical equipment; hydrofluorocarbon releases during the use of refrigeration and air conditioning equipment; landfill gas emissions; and CH_4 leakage from natural gas transport). (General Reporting Protocol, 2019)
Global Warming Potential (GWP)	See the definition in Section 1.5.2.
Greenhouse gases (GHGs)	Gases that trap heat in the atmosphere, in the form of infrared radiation. (USEPA, 2024)
Hydrofluorocarbons (HFCs)	A group of human-made chemicals with various commercial uses (e.g., refrigerants) composed of one or two carbon atoms and varying numbers of hydrogen and fluorine atoms. Most HFCs are highly potent GHGs with 100-year GWPs in the thousands. (General Reporting Protocol, 2019)

Term, Abbreviation or Acronym	Definition
Indirect emissions	Emissions that are a consequence of the operations of the reporting organization (i.e., PSO, local government, community), but occur at sources owned or controlled by another organization. (General Reporting Protocol, 2019)
Intergovernmental Panel on Climate Change (IPCC)	An international body of climate change scientists. The role of the IPCC is to assess the scientific, technical and socio-economic information relevant to the understanding of the risk of human-induced climate change. (General Reporting Protocol, 2019)
Inventory	A comprehensive, quantified list of an organization's GHG emissions and sources. An inventory report provides an emissions summary and related information reported as part of an inventory. (General Reporting Protocol, 2019)
Methane (CH_4)	A colorless, odorless, flammable gas that is the simplest hydrocarbon and is the major constituent of natural gas. Methane is present in the Earth's atmosphere at low concentrations and acts as a greenhouse gas. Methane, usually in the form of natural gas, is used as feedstock in the chemical industry (e.g., hydrogen and methanol production), and as fuel for various purposes (e.g., heating homes and operating vehicles). Methane is produced naturally during the decomposition of plant or organic matter in the absence of oxygen, as well as released from wetlands (including rice paddies), through the digestive processes of certain insects and ruminant animals such as termites, sheep and cattle. Methane is also released from industrial processes, fossil fuel extraction, coal mines, incomplete fossil fuel combustion, and garbage decomposition in landfills. (Government of Canada, 2015).
NIR	National Inventory Report (Environment and Climate Change Canada).
Nitrous oxide (N_2O)	A colourless, non-flammable, sweet-smelling gas, which is heavier than air. Used as an anesthetic in dentistry and surgery and as a propellant in aerosol cans, nitrous oxide is most commonly produced via the heating of ammonium nitrate (NH_4NO_3). It is also released naturally from oceans, by bacteria in soils, and from animal wastes. Other sources of nitrous oxide emissions include the industrial production of nylon and nitric acid, combustion of fossil fuels and biomass, soil cultivation practices, and the use of commercial and organic fertilizers. (GoC, 2015)
Office Paper	A variety of paper products used in offices and businesses, including writing, computer and copying paper. (Waste 360, 2009)
Perfluorocarbons (PFCs)	A group of human-made chemicals composed of one or two carbon atoms and four to six fluorine atoms, containing no chlorine. PFCs have no commercial uses and are emitted as a byproduct of aluminum smelting and semiconductor manufacturing. PFCs have very high GWPs and are very long-lived in the atmosphere. (General Reporting Protocol, 2019)

Term, Abbreviation or Acronym	Definition
PSO	A public sector organization, or any of the following: • the Provincial Government; • an organization or corporation that is not part of the Provincial Government but is included within the government reporting entity under the *Budget Transparency and Accountability Act*, unless excluded by regulation under the *Climate Change Accountability Act*; • any other public organization or corporation included by regulation. PSOs are subject to the government's carbon neutral commitment under the *Climate Change Accountability Act*. (Government of B.C., 2024b).
RESD	Report on Energy Supply and Demand in Canada (Statistics Canada).
Sulphur Hexafluoride (SF_6)	A synthetic gas that is colourless, odorless, non-toxic (except when exposed to extreme temperatures), and non-flammable. SF_6 is primarily used in the electricity industry as insulating gas for high voltage equipment. (Government of Canada, 2015)

Table 28: Units of Measurement

Unit	Definition
MJ	One million joules, (a joule is a common unit of energy for comparing across fuel types and electricity).
GJ	One billion joules (equal to 1,000 MJ)
kWh	kilowatt-hour, a common unit for measuring electricity, equal to one kilowatt of power delivered over one hour, or 3.6 MJ.
kg	kilogram
t	metric tonne, a standard measurement for the mass of GHG emissions, equivalent to 1,000 kg, 1,204.6 pounds, or 1.1 short tons.
kt	kilotonne, or 1,000 tonnes
lb	pound (weight) (equal to 0.4536 kg)
km	kilometre
L	litre
m^3	cubic metre (equal to 1,000 L)
pkg	package (e.g., a ream of paper)

Annex 2: Selected References

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Natural Resources Canada. (2024). Fuel consumption ratings. Retrieved October 1, 2024, from https://open.canada.ca/data/en/dataset/98f1a129-f628-4ce4-b24d-6f16bf24dd64

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Annex 3: BC Government Travel Management Systems

Organizations in the B.C. Provincial Government (ministries and independent offices) report their business travel expenses employing two different systems: the iExpenses system, and through Ministry directly-paid expenditures on air travel. Annex 3 provides an overview of those systems.

iExpenses: Distance and Spend-based Methods

The B.C. provincial government's iExpenses system is used to reimburse employees for out-of-pocket travel expenses. iExpenses tracks travel modes, some fuel types, and some travel distances, in addition to related expenditures for B.C. Provincial Government employees only.

Where travel distances are collected by iExpenses, employees can quantify business travel emissions using the distance-based method. Otherwise, they may calculate travel emissions using the spend-based method. Table 1 below illustrates when each method is used with iExpenses data. For details on the individual business travel calculations, refer to the appropriate mode in Section 5.

Employees enter mandatory information into iExpenses about business trips, including the expense type (Table 29, column 2), travel mode (column 3) and fuel used along with other details (column 4).

Table 29: iExpenses Business Travel Selections

(1) Employee's Travel Mode	(2) iExpenses "Expense Type" Selection	(3) iExpenses "Travel Mode" Selection	(4) Key iExpenses Dropdown Selection	(5) GHG Estimation Method	(6) Section w/ Detailed Description
Air Travel, common routes	Air You Paid	Helicopter, Airplane, Float Plane	Route	Distance-Based	5.3
Air Travel, Other routes	Air You Paid	Helicopter, Airplane, Float Plane	"Other" or "Other BC" as Route option	Spend-Based	5.4
All rental vehicles	Car Rental	Car, other, Truck/SUV	Fuel type, vehicle type	Distance-Based	5.1
Personal vehicle	Mileage	Car, other, Truck/SUV	Fuel type, vehicle	Distance-Based	5.1
Ferries	Ferry	N/A	Route	Distance-Based	5.2
Rail, Intercity Bus, other public transport	Public Transport	Other	N/A	Spend-Based	5.5
Taxis	Public Transport	Taxi	N/A	Spend-Based	5.5
City Bus, Skytrain, SeaBus	Public Transport	Transit	N/A	Spend-Based	5.5
Accommodation	Accommodation	Hotel, Private, Other	N/A	Nightly stay-based	5.6

The distance data, in combination with mode and fuel type, enables voluntary reporters to apply the distance-based method for quantifying business travel emissions. In addition, voluntary reporters using iExpenses may not possess all the necessary data points to use distance-based methods. In such a case, the Climate Action Secretariat recommends employing the spend based methods. All these approaches are reflected in column 5 of the following table 1. Similarly, Column 6 indicates which section of the document provides detail on the corresponding estimation method.

Other Accounting System Data

An additional government accounting system tracks Employee travel expenditures. This is done through ministry directly-paid expenditures on airfare. Column 5 of Table 30 indicates which section of this document provides more detail on this travel mode. See transportation method in the following table (Column 4).

Table 30: Non-iExpenses Business Travel Selections

(1)	(2) Subaccount	(3) Travel Mode Possibilities	(4) Most Frequent Travel Mode	(5) Section with Detailed Description
Directly Paid Air Travel	Victoria to Vancouver	Float Plane, helicopter, short-haul air	Float Plane	5.4
	In-Province	Short-haul flights; medium-haul air	Short-Haul	5.4
	Out-of-Province	Medium and long-haul flights	Long-Haul	5.4
	Out-of-Canada	Long-haul flights	Long-Haul	5.4
Travel Voucher or Other Modes	Victoria to Vancouver; In-Province; Out-of-Province; Out-of-Canada	All ground transport modes and accommodations	N /A	5.5

Annex 4: Public Transport Emission Factors

The following sections provide a description of how each public transport mode's emission factors in Table 25 were calculated to derive emission factors for the reporting categories. The sections are:

- Public Transport – Taxi;
- Public Transport – Transit: City Bus, Skytrain, SeaBus, and
- Public Transport – Other: Rail and Intercity Bus.

Public Transport - Taxi

Type: Indirect Emissions

Description: This was calculating considering only regular taxi companies and excludes hailing transportation taxi services. The spend-based emission factor for Taxi was calculated using equations which require:

- Average taxi cost per km
- Taxi emissions per km

Calculations:

Average Taxi Cost Per Kilometre

In British Columbia, the Passenger Transportation Board, an independent tribunal of the Ministry of Transportation and Infrastructure, regulates the rates charged by all taxis.[62] Rates vary across the province's operating areas. The Climate Action Secretariat calculated a provincial average using the approved Board prices since September 2023, namely:

- **Flag Fee average:** $3.76: The flag fee is the automatic minimum fee a passenger pays for a taxi, i.e., the meter will already be at $3.76 when a passenger steps inside.
- **Per Kilometre Fee average:** $2.28: Passengers are charged this fee for every kilometre they travel in a taxi if the taxi is not in traffic and forced to drive slowly. If it is, the following fee may apply.
- **Wait Time average:** $44.13 per hour: This fee is charged if the taxi must wait.

Average Taxi Emissions Per Kilometre

Based on the conservative assumption that taxis are generally standard gasoline-fuelled cars, the distance-based emission factor is 0.181 kg of CO_2e per km travelled (refer to Table 18). This is a conservative assumption, as taxi companies are increasingly using hybrid and plug-in electric vehicles.[63] This assumption will be reviewed in future iterations of this document.

Spend-Based Taxi Emission Factor

The Climate Action Secretariat calculated the spend-based emission factor as follows:

[62] Passenger Transportation Board. (2023). *Taxi Rates.* Available: http://www.ptboard.bc.ca/taxi-rates.htm

[63] In the preparations of this document, the CAS reviewed the Passenger Transportation Board policy manual for 2023 and verified that no mandatory provision exists to date.

Taxi **Distance-Based** Emission Factor (kg CO_2e/km)	÷	Taxi **Cost per kilometre** ($/km)	=	Taxi **Spend-Based** Emission Factor (kg CO_2e/$)
0.181	÷	2.28	=	**0.0795**

Public Transport - Transit (City Bus, Skytrain, SeaBus)

Employees who travel on a local bus, Skytrain, or SeaBus must select "Transit" within the iExpenses system. For this reason, the Climate Action Secretariat calculates the spend-based emission factor for the transit travel as a simple average of the city bus, Skytrain, and Seabus factors.

City Bus:

City bus emissions are based on two bus service providers: BC Transit and TransLink. The spend-based emission factor for total City Bus was estimated using equations that require:

- Average City Bus cost per trip
- Average City Bus emissions per trip

Average Cost Per Trip

A standard trip on a city bus costs $2.50 in Victoria and $3.20 in Vancouver. BC Transit fares are currently less in some of the 51 transit systems they operate. For example, a single ride ticket costs $1.75 in Williams Lake, $2 in Chilliwack and Prince Rupert, $2.25 in West Kootenay, Central Fraser Valley and Salt Spring Island and $2.50 in Prince George and Nanaimo.[64] Considering these discrepancies, the Climate Action Secretariat used the average of $2.85 between Greater Victoria and Metro Vancouver as the standard price for a single bus trip.

Average Emissions Per Trip – BC Transit

In the 2023 reporting year, BC Transit's revenue bus fleet emitted 41,203,000 kg CO_2e.[65] BC Transit reported approximately 54.13 million rides during the same period (April 1, 2023 to March 30, 2024).[66] The Climate Action Secretariate calculated BC Transit's emission factors as follows:

BC Transit Revenue Fleet Emissions (kg CO_2e)	÷	**BC Transit Passenger Trips**	=	**Emissions per Passenger Trip** (kg CO_2e/trip)
41,203,000	÷	54,128,000	=	0.761

[64] BC Transit lists fares individually by regional transit system, at their website https://www.bctransit.com/. For example, fares for Regional District of Nanaimo Transit are posted at https://www.bctransit.com/nanaimo/fares/.

[65] Internal report generated in CGRT.

[66] IBID, page 18.

Average Emissions Per Bus Trip – TransLink

TransLink provided their 2023 revenue fleet emissions.[67] TransLink reported 99,009,000 kg CO_2e from 240,913,000 annual bus boardings in 2023.[68]

Calculating Total Emissions Per Bus Trip –TransLink

TransLink Bus Emissions (kg CO_2e)	÷	TransLink Bus Boardings	=	Emissions per Boarding (kg CO_2e/trip)
99,009,000	÷	240,913,000	=	0.411

By combining emissions from BC Transit and TransLink, the Climate Action Secretariat calculated total city bus emissions as 0.475 kg CO_2e/trip:

Bus Emissions (kg CO_2e)	÷	Bus Boardings	=	Emissions per Boarding (kg CO_2e/trip)
140,212,000	÷	295,041,000	=	0.475

Spend-Based City Bus Emission Factor

Using the previous equation and the cost per trip, the spend-based emission factor for City Bus travel is calculated as follows:

Bus Emissions per Trip (kg CO_2e/trip)	÷	Bus Cost per Trip ($/trip)	=	Bus Spend-Based Emission Factor (kg CO_2e/$)
0.475	÷	2.85	=	0.166

Skytrain:[69]

The Climate Action Secretariat estimated the spend-based emission factor for Skytrain using equations requiring:

- Average Skytrain cost per trip, and
- Average Skytrain emissions per trip.

[67] Internal communication with TransLink.

[68] Source for trips by bus: TransLink (2024). *Bus: Annual indicators by route and year*. Available: https://www.translink.ca/-/media/translink/documents/plans-and-projects/managing-the-transit-network/tspr/csv-data/2023/tspr2023_bus_yearline.csv. Bus related emissions are from private communications with TransLink.

[69] For the purposes of this document, the Canada Line is included within Skytrain.

Average Skytrain Cost Per Trip

Skytrain fares depend on the number of zones travelled (1, 2, or 3). Many different possibilities exist for trip distance within each zone. This estimate uses the price for a 2-zone trip ($4.65) combined with the average trip distance reported to the City of Vancouver peaking to 11.2 km/trip.[70]

Average Skytrain Emissions Per Trip

TransLink calculated the Skytrain emissions to be 0.001 kilograms per passenger per kilometre travelled (kg CO_2e/psg-km).[71] Using the 11.2-kilometre distance per trip noted above, and the distance-based emission factor of 0.001 kg CO_2e/km, the Climate Action Secretariate estimates that a standard trip will generate 0.0112 kg of CO_2e.

Spend-Based Skytrain Emission Factor

Using the information above and the following equation, the spend-based emission factor for Skytrain travel is calculated at 0.0024 kg CO_2e/$:

Skytrain Emissions per Trip (kg CO_2e/trip)	÷	Skytrain Cost per Trip ($/trip)	=	Skytrain Spend-Based Emission Factor (kg CO_2e/$)
0.0112	÷	4.65	=	0.0024

SeaBus:

The spend-based emission factor for SeaBus was estimated using:

- The average SeaBus cost per trip, and
- The average SeaBus emissions per trip.

Average SeaBus Cost Per Trip

A one-way trip on the SeaBus costs $4.65.

Average SeaBus Emissions Per Trip

TransLink[72] reported in 2023 that SeaBus trips generate 0.224 kg CO_2e/psg-km, or 0.728 kg CO_2e/trip over the 3.25 km one-way distance.

[70] McElhanney (2021). *2020 Vancouver Panel Survey. Summary Report prepared for the City of Vancouver.* Available: https://vancouver.ca/files/cov/2020-transportation-panel-survey.pdf

[71] TransLink (2023). *Accountability report 2023.* Available: https://www.translink.ca/-/media/translink/documents/about-translink/corporate-reports/accountability_reports/2023/accountability_report_2023.pdf

[72] TransLink (2023). *Accountability report 2023.* Page 74. Available: https://www.translink.ca/-/media/translink/documents/about-translink/corporate-reports/accountability_reports/2023/accountability_report_2023.pdf

Spend-Based SeaBus Emission Factor

The spend-based emission factor for SeaBus travel is calculated as follows:

SeaBus Emissions per Trip (kg CO_2e/trip)	÷	SeaBus Cost per Trip ($/trip)	=	SeaBus Spend-Based Emission Factor (kgCO_2e/$)
0.728	÷	4.65	=	0.156

Transit Average

The spend-based emission factor for the Transit travel mode was calculated as a simple average of the city bus, Skytrain, and Seabus factors:

$$\frac{(0.166) + (0.0024) + (0.156)}{3} = 0.108 \text{ kg } CO_2e/\$$$

Public Transport - Other Public Transport (Rail, Intercity Bus)

Employees who travel by rail and intercity buses must select "Other" under Public Transport within the iExpenses system. For this reason, the spend-based emission factor for the transit travel mode was calculated as the simple average of the factors for these two modes of travel.

Rail:

The spend-based emission factor for rail was estimated using an equation which require:

- Average cost of rail per kilometre, and
- Average rail emissions per kilometre.

Average Cost of Rail Per Kilometre

The Climate Action Secretariat used iExpenses data for the period of 2008 to 2016 to calculate an average passenger rail transportation cost of $0.31/km.[73] Using the Bank of Canada's inflation calculator tool,[74] the Climate Action Secretariat updated this value to $0.39/km for passenger rail.

Average Rail Emissions Per Kilometre

The Railway Association of Canada published a distance-based emission factor of 0.093 kg CO_2e/psg-km for passenger railway transportation in 2022.[75]

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[73] BC Ministry of Environment and Climate Change Strategy. (2017). *2017 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*. Available: https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2017-pso-methodology.pdf

[74] Bank of Canada (n.d.). *Inflation Calculator*. Available: https://www.bankofcanada.ca/rates/related/inflation-calculator/

[75] Railway Association of Canada. (2024). *Locomotive Emissions Monitoring Report 2022*. Page 5. Available: https://www.railcan.ca/wp-content/uploads/2024/02/SPARK-RAC-LEM-2024-EN.pdf

Spend-Based Rail Emission Factor

Using the information above and the following equation, the Climate Action Secretariat calculated the spend-based emission factor for rail travel to be 0.238 kg CO_2e/$:

Rail Distance-Based Emissions Factor (kg CO_2e/km)	÷	Rail Cost per kilometre ($/km)	=	Rail Spend-Based Emission Factor (kg CO_2e/$)
0.093	÷	0.39	=	0.238

Intercity Bus:

iExpenses does not capture Intercity Bus travel. In the absence of reliable cost data, the spend based emission factor of city bus (0.166 kg CO_2e/$) has been applied to intercity buses. This is a conservative approach, as NRCan's Comprehensive Energy Use Database indicates that the BC intercity bus emission factor for BC is about 35% of city buses per passenger-kilometre.[76]

Simple Average – Other Public Transport

The spend-based emission factor for the "Other" public transport mode was calculated as a simple average of the rail and intercity bus factors.

$$\frac{(0.238) + (0.166)}{(2)} = 0.202 \text{ kg } CO_2e/\$$$

[76] Natural Resources Canada. (2023). *Comprehensive Energy Use Database, Transportation Sector, 2000-2021*. Available: https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=tran&juris=bct&year=2021&rn=23&page=0

Annex 5: Document Version Control

Reporting Year	Section(s)	Updates Include:
2024	Throughout	Made document more accessible
	Throughout	Increased readability (including removing passive language)
	Throughout	Reflected changes from reference document updates
	Throughout	Added boxes for content specific to PSOs and LGs and MTNs
	1.1	Created a new section on the document's structure
	1.2	Added a disclaimer for PSOs that the document is not intended to provide legal advice
	1.3	Updated context for LGs and MTNs on the LGCAP
	1.5	Reorganized Emission Calculation Fundamentals section to improve flow and clarity for document users
	2.1	Informed organizations of changes made to reflect FortisBC's decision to provide 1% RNG to all clients as of July 1, 2024
	2.2	Significantly updated section to facilitate refrigerants reporting
	2.3	Clarified how electricity for stationary sources should be reported, and providing more context on sources for EEIFs
	2.4	Substantially revised the DES section to make more consistent with other sections of the document
	2.6	Increased clarity on approaches for calculating energy estimates, including revising the decision-making flow chart
	3.1	Clarified context on calculating emissions from renewable blends
	4	Updated context on in-scope paper
	5	Combined Sections 5 through 7 into a single section Made substantial changes to the structure of the sections, including: • Moving much of the previous Section 5 into an Annex on BC Government Travel Management Systems, • Updating most emission factors and some calculation approaches based on newer emissions and cost data, and • Moving much of the public transport emission factor guidance to an Annex
	Annex 1	Updated glossary to provide more relevant references Separated out units of measurement into their own table
	Annex 2	Revised references to include those most relevant to the document

Reporting Year	Section(s)	Updates Include:
2023	Throughout	Formatting and font changes to align with B.C.'s Visual Identity
		Clarified context under which the document, its sections and its references apply
		Updated references and sources
		Calculation explanations updated and units made more consistent
	1	Reorganized to create PSO, LG/MTN, and Other user sections; added and updated policy context for the sections
	1.4	Incorporated previous section 1.3 as Section 1.4.3. in a new section on Emissions Calculations Fundamentals, with other sections on GWPs, EFs, scope categories and in-scope GHGs
	1.4.1	Removed references to radiative forcing and focused section on GWPs
	1.5	Moved section on small emissions sources from within the buildings section (Section 2.2.1.) to the front material, so it is clearer that it applies beyond stationary sources
	2.1	Clarified that CO_2 emissions from biogenic sources are separate from total emissions in the CNG Program.
	2.1	Fixed NIR reference for stationary gasoline (shifted from Table A6.1-14 of NIR to Table A6.1-5)
	2.4	Enhanced clarity on district energy tiers and conservativeness
	2.5	Change language from Energy Intensity Unit to Energy Use Intensity to align with language in other Province of B.C. guidance (e.g., B.C. Energy Step Code)
	Annex 1	Update definitions of GHGs to remove references to AR4 GWPs
	Annex 2, 3 and 4	Removed Annex 2 from 2022 MD, Annex 3 is now Annex 2, Annex 4 is now Annex 3
2022	Throughout	Improved accessibility
		Changed GWP references from AR4 to AR5
	1.1	Moved the Community Emissions Inventory (CEEI) to section 1.1.2
	2.3	Updated Renewable Energy Certificate policy
	3.1	Update mobile emission factors to reflect more stringent federal air pollution standards
		Added electricity as a mobile fuel option
	4	Added research being undertaken on the relative merits of alternative types of paper

Reporting Year	Section(s)	Updates Include:
2021	Table of Contents (TOC)	Updated structure
		Removed Section 3.2 Natural Gas Vehicle Emission Factors
		Removed Section 3.3.2 Public Transport (distance-based)
		Removed Section 6 Agricultural Emission Factors
	Throughout	Removed references to Local Governments and other users in Section 1.4 Users/Audience and throughout document
		Updated emission factors and their respective sources
		Section 2.3 Purchased electricity emission factors aligned with GGIRCA
2020	Figure 2	Updated decision tree to reflect available CGRT configuration
	Throughout	Updated references from SMARTTool to CGRT to reflect transition to the new tool and decommissioning of SMARTTool in 2019
	Table 21	Updated Energy Intensity Unit factors based on primary function to align with those adopted by Energy Star Portfolio Manager and configured in CGRT
	Section 2.2	Updated intention to align with GGIRCA's grid-based electricity emission factors for 2021 reporting year
	Section 3.2	Reinstated reference to the conversion of compressed natural gas to litres of gasoline and diesel equivalent
	Section 3.2	Ferry emission calculation correction
2018	Section 1	Updated dates from 2017 to 2018
	9, 12	Updated Carbon.Neutralapps@gov.bc.ca to Carbon.Neutral@gov.bc.ca
	7, 8, 29	Changed *Greenhouse Gas Reductions Target Act* (GGRTA) to *Climate Change Accountability Act* (CCAA)
	Section 3.2	Removed reference to the conversion of compressed natural gas to litres of gasoline and diesel as the web references are no longer valid
	Annex 1	Updated Glossary of Terms and Acronyms
2017	TOC	Removed Section 1.5 Structure
	Section 1.3	Reference to the National Inventory Report: Greenhouse Gas Sources and Sinks in Canada updated from 1990-2013 to 1990-2014
	Table 1, Table 2	Marine Diesel Emission Fraction for CH_4, N_2O and CO_2e updated
	Table 1, Table 2	Wood Fuel - Residential emission factor for bio-CO_2, CH_4, N_2O and CO_2e updated

Reporting Year	Section(s)	Updates Include:
2017 (continued)	Section 2.2	Electricity emission factors for Quebec and Nova Scotia added
	Table 3	Emission factors updated for BC Hydro, Kyuquot Power, Hemlock Valley, Alberta, Ontario, United Kingdom, India, Japan, China, Hong Kong, Nova Scotia, Quebec
	Table 4	Added Table 4: Historical Emission Factors for Purchased Electricity
	Table 7	Updated Emission Factors for Fleet: Off-Road Vehicle (Diesel), Marine (Gasoline), Marine (Diesel)
	Section 4	Updated Business Travel reporting methods
	Table 22	Fixed EIU Factors updated for all Building Classifications
	Annex 5	Business Travel Methodology Added


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