Emission Factors and Reference Values

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Canada's Greenhouse Gas Offset Credit System

Environment and Climate Change Canada
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Document revision history

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1.1	June 13, 2023	Update of information and emission factors in alignment with the April 2023 publication of the *National Inventory Report 1990 – 2021: Greenhouse Gas Sources and Sinks in Canada*
1.0	June 8, 2022	Initial version

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Introduction

Canada's Greenhouse Gas (GHG) Offset Credit System is established under Part 2 of the *Greenhouse Gas Pollution Pricing Act* (GGPPA) to provide an incentive to undertake projects that result in domestic GHG reductions that would not have been generated in the absence of the project, that go beyond legal requirements and that are not subject to carbon pollution pricing mechanisms.

Canada's GHG Offset Credit System consists of:

- The *Canadian Greenhouse Gas Offset Credit System Regulations* (the Regulations), which establish the system, implement operational aspects and set general requirements applicable to all project types;
- Federal offset protocols, included in the *Compendium of Federal Offset Protocols* (the Compendium), each containing requirements for project implementation and methods for quantifying GHG reductions for a given project type; and
- The Credit and Tracking System (CATS) to register offset projects, issue and track offset credits, and share key information through a public registry.

The Regulations apply to a proponent of a project which is of a type for which a protocol has been included in the Compendium; that aims to generate GHG reductions by preventing GHG emissions or removing GHGs from the atmosphere; and with respect to which the GHG reductions are real, additional, quantified, verified, unique and permanent. Offset credits will be issued to a proponent of a project for the period covered by a project report in the amount determined in accordance with subsection 29(2) of the Regulations if requirements of the subsection 29(1) of the Regulations are met.

This document provides emission factors and reference values that a proponent must use in conjunction with a federal offset protocol to quantify the GHG reductions achieved by a project. The document is categorized into general values and values specific to federal offset protocols included in the Compendium. The proponent may need to convert the units of the values provided in this document to align with the units presented in the quantification methodology of the relevant federal offset protocol.

Emission factors and reference values are subject to periodic updates when a new federal offset protocol is included in the Compendium, or when updated versions of the sources referenced in this document are published. Proponents must use this document, as amended from time to time.

Abbreviations and acronyms

CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
g	gram
GGPPA	*Greenhouse Gas Pollution Pricing Act*
GHG	greenhouse gas
kg	kilogram
kWh	kilowatt hour
L	litre
LFG	landfill gas
m^3	metres cubed
N_2O	nitrous oxide
SF_6	sulfur hexafluoride
t	metric tonne

General

Global warming potentials

Global warming potentials are provided in Column 2 of Schedule 3 to the GGPPA.

Emission factors

Fuel combustion

Table 1 – CO_2 emission factors for natural gas (g CO_2/m^3 natural gas)

Province / Territory	Marketable[1]*	Non-marketable[2]**
British Columbia	1966	2162
Alberta	1962	2109
Saskatchewan	1920	2441
Manitoba	1915	2401
Ontario	1921	2401
Quebec	1926	-
New Brunswick	1919	2401
Nova Scotia	1919	2494
Prince Edward Island	1919	-
Newfoundland and Labrador	1919	2202
Yukon	1966	2401
Northwest Territories	1966	2466
Nunavut	1966	-

* The term “marketable” applies to the fuel consumed by the Utility, Industry, Residential, Commercial, and Transport subsectors.

** The term “non-marketable” applies to raw/unprocessed gas consumption, mainly by natural gas producers.

[1] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-1, “CO_2 Emission Factors for Marketable Natural Gas”
[2] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-2, “CO_2 Emission Factors for Non-Marketable Natural Gas”

Table 2 – CH_4 and N_2O emission factors for natural gas (g GHG/m^3 natural gas)[3]

Source	CH_4	N_2O
Electric Utilities	0.490	0.049
Industrial	0.037	0.033
Producer Consumption (Non-marketable)	6.4	0.060
Producer Consumption (Non-marketable) – Newfoundland and Labrador	0.490	0.060
Pipelines	1.900	0.050
Cement	0.037	0.034
Manufacturing Industries	0.037	0.033
Residential, Construction, Commercial/Institutional, Agriculture	0.037	0.035

Table 3 – Emission factors for natural gas liquids (g GHG/L fuel)[4]

Fuel	CO_2	CH_4	N_2O
Propane - Residential	1515	0.027	0.108
Propane - All Other Uses	1515	0.024	0.108
Ethane	986	0.024	0.108
Butane	1747	0.024	0.108

Table 4 – Emission factors for refined petroleum products (g GHG/L fuel)[5]

Fuel	CO_2	CH_4	N_2O
Light Fuel Oil - Electric Utilities	2 753	0.18	0.031
Light Fuel Oil - Industrial	2 753	0.006	0.031
Light Fuel Oil - Producer Consumption	2 670	0.006	0.031
Light Fuel Oil - Residential	2 753	0.026	0.006
Light Fuel Oil - Forestry, Construction, Public Administration and Commercial/Institutional	2 753	0.026	0.031
Heavy Fuel Oil - Electric Utilities	3 156	0.034	0.064
Heavy Fuel Oil - Industrial	3 156	0.12	0.064
Heavy Fuel Oil - Producer Consumption	3 190	0.12	0.064

[3] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-3, "CH_4 and N_2O Emission Factors for Natural Gas"
[4] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-4, "Emission Factors for Natural Gas Liquids"
[5] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-5, "Emission Factors for Refined Petroleum Products"

Heavy Fuel Oil - Residential, Forestry, Construction, Public Administration and Commercial/Institutional	3 156	0.057	0.064
Kerosene - Electric Utilities	2 560	0.006	0.031
Kerosene - Industrial	2 560	0.006	0.031
Kerosene - Producer Consumption	2 560	0.006	0.031
Kerosene - Residential	2 560	0.026	0.006
Kerosene - Forestry, Construction, Public Administration and Commercial/Institutional	2 560	0.026	0.031
Diesel - Refineries and Others	2 681	0.078	0.022
Diesel - Upgraders	2 681	0.078	0.022
Petroleum Coke - Refineries and Others	3 877 [6]	0.12	27.5 g/m^3 [7]
Petroleum Coke - Upgraders	3 494 [6]	0.12	24.0 g/m^3 [7]
Still Gas - Refineries and Others	1 755 g/m^3 [6]	0.032 g/m^3 [8]	0.00002
Still Gas - Upgraders	2 140 g/m^3 [6]	0.000039	0.00002
Motor Gasoline	2 307	0.100	0.02

Biomass combustion

Table 5 – N_2O emission factors for LFG combustion (kg N_2O/tonne CH_4)[9]

Description	N_2O
Industrial combustion (for energy) of LFG (boiler, turbine, internal combustion engine, stations for natural gas network)	0.005
Flaring of LFG[10]	0

[6] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-6, "CO_2 Emission Factors for Petroleum Coke and Still Gas"
[7] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-7, "N_2O Emission Factors for Petroleum Coke"
[8] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-8, "CH_4 Emission Factors for Still Gas (Refineries and Others)"
[9] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.6-2, "Emission Factors for Landfill Gas Combustion"
[10] This emission factor is currently reported as "not estimated" in Canada's National Inventory Report. A value of zero has been assigned to this emission factor for the purposes of the quantification of GHG reductions.

Grid electricity GHG consumption intensity

A ‘generation intensity’ indicator is derived to reflect the GHG emissions intensity of electricity as it is delivered to the electricity grid. A ‘consumption intensity’ indicator is also derived to reflect the GHG emissions intensity of electricity as it is delivered to the consumer.

Table 6 – Electricity consumption intensity values (g CO_2e/kWh electricity consumed)[11]

Province / Territory	Consumption intensity[12]
British Columbia	15
Alberta	540
Saskatchewan	730
Manitoba	2.0
Ontario	30
Quebec	1.7
New Brunswick	300
Nova Scotia	690
Prince Edward Island[13]	300
Newfoundland and Labrador	17
Yukon	80
Northwest Territories	170
Nunavut	840

[11] *National Inventory Report 1990-2021: Greenhouse Gas Sources and Sinks in Canada*, Part 3, Table A13-2 to Table A13-14, 2021 values.
[12] Consumption intensity values are impacted by unallocated energy and SF_6 transmission emissions.
[13] Due to the high level of imports from New Brunswick, Prince Edward Island takes New Brunswick’s value.