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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Canada

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Document revision history

Revision number	Date	Summary of changes
1.0	June 8, 2022	Initial version

Introduction

Canada's Greenhouse Gas (GHG) Offset Credit System is established under Part 2 of the *Greenhouse Gas Pollution Pricing Act* (GGPPA) to encourage cost-effective domestic GHG emissions reductions from activities that are not covered by carbon pollution pricing and that go beyond legal requirements.

Canada's GHG Offset Credit System consists of:

- regulations to implement the operational aspects of the system;
- federal offset protocols that establish the approach for quantifying GHG emissions reductions for a given project type; and
- a tracking system to register offset projects, issue and track offset credits, and share key information through a public registry.

The *Canadian Greenhouse Gas Offset Credit System Regulations* (the "Regulations") apply to a proponent of a project which is of a type for which a protocol has been included in the *Compendium of Federal Offset Protocols*; that aims to generate GHG reductions by preventing GHG emissions or removing GHGs from the atmosphere; and with respect to which the reductions are real, additional, quantified, verified, unique and permanent. The Minister must issue offset credits to a proponent 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 section 7 and the subsection 29(1) of the Regulations are met.

This document provides emission factors and reference values that must be used in conjunction with a federal offset protocol to quantify the emission reductions achieved by an offset project. The document is categorized into general values and values specific to currently active federal offset protocols. Proponents 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 are subject to periodic updates when a new federal offset protocol is published, or when updated versions of the sources referenced in this document are published.

Proponents must always use the current version of this document. Amendments to this document apply on a go-forward basis and cannot be applied retroactively.

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
the “Regulations”	*Canadian Greenhouse Gas Offset Credit System Regulations*
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]**
Newfoundland and Labrador	1921	2494
Prince Edward Island	1921	-
Nova Scotia	1921	2494
New Brunswick	1921	-
Quebec	1926	-
Ontario	1921	-
Manitoba	1915	-
Saskatchewan	1920	2441
Alberta	1962	2109
British Columbia	1966	2162
Yukon	1966	2401
Northwest Territories	1966	2466
Nunavut	1966	-

* “marketable” applies to the fuel consumed by the Electric Utilities, Manufacturing Industries, Residential/commercial and Transport subsectors.

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

[1] *Canada’s National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-1, “CO_2 Emission Factors for Marketable Natural Gas”
[2] *Canada’s National Inventory Report 1990-2020: 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
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
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
Industrial	2 753	0.006	0.031
Producer Consumption	2 670	0.006	0.031
Residential	2 753	0.026	0.006
Forestry, Construction, Public Administration and Commercial/Institutional	2 753	0.026	0.031
Heavy Fuel Oil			
Electric Utilities	3 156	0.034	0.064
Industrial	3 156	0.12	0.064
Producer Consumption	3 190	0.12	0.064
Residential, Forestry, Construction, Public	3 156	0.057	0.064

[3] *Canada's National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-3, "CH_4 and N_2O Emission Factors for Natural Gas"
[4] *Canada's National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada* n, Part 2, Table A6.1-4, "Emission Factors for Natural Gas Liquids"
[5] *Canada's National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-5, "Emission Factors for Refined Petroleum Products"

Administration and Commercial/Institutional			
Kerosene			
Electric Utilities	2 560	0.006	0.031
Industrial	2 560	0.006	0.031
Producer Consumption	2 560	0.006	0.031
Residential	2 560	0.026	0.006
Forestry, Construction, Public Administration and Commercial/Institutional	2 560	0.026	0.031
Diesel			
Refineries and Others	2 681	0.078	0.022
Upgraders	2 681	0.078	0.022
Petroleum Coke			
Upgraders	3 494 [6]	0.12	24.0 g/m^3 [7]
Refineries and Others	3 859 [6]	0.12	27.5 g/m^3 [7]
Still Gas			
Refineries and Others	1 775 g/10^{3}m^3 [6]	0.032 g/m^3 [8]	0.00002
Upgraders	2 140 g/10^{3}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)	0.05
Flaring of LFG[10]	0

[6] *Canada's National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada* , Part 2, Table A6.1-6, "CO_2 Emission Factors for Petroleum Coke and Still Gas"
[7] *Canada's National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-7, "N_2O Emission Factors for Petroleum Coke"
[8] *Canada's National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada*, Part 2, Table A6.1-8, "CH_4 Emission Factors for Still Gas (Refineries and Others)"
[9] *Canada's National Inventory Report 1990-2020: 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 GHG inventory. A value of zero has been assigned to this emission factor for the purposes of the quantification.

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]
Newfoundland and Labrador	25
Prince Edward Island[13]	300
Nova Scotia	680
New Brunswick	300
Quebec	1.9
Ontario	28
Manitoba	1.2
Saskatchewan	620
Alberta	640
British Columbia	7.8
Yukon	110
Northwest Territories	180
Nunavut	800

[11] *Canada’s National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada*, Part 3, Table A13-2 to Table A13-14, 2020 values

[12] Consumption intensity values are impacted by unallocated energy and SF_6 transmission emissions,

[13] Due to high level of imports from New Brunswick, Prince Edward Island takes New Brunswick value.