CleanBC Industrial Incentive Program

Oil and Gas Sector Guidance

This guidance applies to individual facilities within reporting operations with primary NAICS codes as follows:

- NAICS – 211110: Oil and Gas Extraction (except oil sands)
- NAICS – 486210: Pipeline Transportation of Natural Gas

<table>
<thead>
<tr>
<th>Sub-Sector</th>
<th>CIIP Activity/Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas (NG) Processing (excluding compression)</td>
<td>Oil and Gas – processing, sour gas</td>
</tr>
<tr>
<td></td>
<td>Oil and Gas – processing, sweet gas</td>
</tr>
<tr>
<td>Natural Gas Compression</td>
<td>Oil and Gas – compression, centrifugal</td>
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<tr>
<td></td>
<td>Oil and Gas – compression, reciprocating</td>
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<tr>
<td>Other oil and gas</td>
<td>Oil and Gas – other</td>
</tr>
</tbody>
</table>

**NOTE:** For any one facility, a facility may have one or both types of compression. Only one type of natural gas processing activity (i.e. sweet or sour gas) will apply, as determined below:

- Sour natural gas is defined as natural gas with a hydrogen sulfide (H₂S) mole percentage greater than or equal to two percent. If input gas processed is considered sour (based on its annual average composition), the gas processing facility will be subject to a sour gas processing benchmark;
- Sweet natural gas is defined as natural gas with a hydrogen sulfide (H₂S) mole percentage below two percent.

In addition to this guidance document, to assist in calculating inputs for the CleanBC Industrial Incentive Program (CIIP) application process, the ministry provides a spreadsheet with the appropriate calculation formulas built in (available via e-mail and online).

All emissions from upstream oil and gas facilities such as aggregated facilities, batteries, gas well pads, gathering pipelines, liquid separation facilities, liquid hubs, water hubs, and pipeline aggregates must be reported. For such facilities, emissions must be allocated to compression (either reciprocating or centrifugal or both) or other oil and gas activities. Allocating emissions and reporting production amounts for these activities is described below.
Quantification and Reporting of Emissions and Related Information

Unless explicitly stated otherwise in the CIIP guidance, quantification and reporting of greenhouse gas emissions and related information under CIIP must comply with the Greenhouse Gas Industrial Reporting and Control Act (GGIRCA) and the Greenhouse Gas Emission Reporting Regulation (GGERR), including with the Western Climate Initiative (WCI) quantification methodologies referenced in GGERR.

The WCI methodologies typically applicable to natural gas processing and compression reporting operations include, but may not be limited to, the following:

- WCI.020 General Stationary Combustion
- WCI.040 Electricity Generation
- WCI.350 Natural Gas Transmission and Distribution
- WCI.360 Petroleum and Natural Gas Production and Natural Gas Processing

In addition to the information required in GGERR, applicants to CIIP must also report GHG emissions associated with purchased grid electricity and the fuel usage for ‘Vented Natural gas’ and ‘Natural gas flared’

Purchased electricity is reported under the ‘Production’ tab in the CIIP application. From the ‘Product or Service’ dropdown menu, select ‘Purchased Electricity’. Enter the amount of electricity purchased (in gigawatt hours) and the emissions associated with the purchased electricity.

- Grid electricity emissions are quantified by multiplying the published electricity emission intensity factor for grid-connected entities $E_{IF_{Grid}}^\text{Electr.}$ for the applicable reporting year by the amount of purchased grid electricity $Q_{Purchased}^\text{Electr.}$ in GWh (1 GWh = 1000 MWh):

$$E_{Grid}^\text{Electr.} = E_{IF_{Grid}}^\text{Electr.} * Q_{Purchased}^\text{Electr.}$$

Therefore, the individual facility’s emissions total for CIIP purposes is:

$$E_{CIIP} = E_{Onsite} + E_{Grid}^\text{Electr.}$$

where $E_{Onsite}$ is the reporting operation’s emissions total as required to be reported under GGIRCA and submitted in the Single Window Reporting System.

The ‘Vented Natural gas’ is reported under the ‘Fuel’ tab in the CIIP application. From the ‘Fuel name’ dropdown menu, select ‘Vented natural gas’. Enter the amount of vented natural gas (in m³) and from the emission category dropdown menu, select ‘Venting’. The fuel usage reported for ‘Vented Natural gas’ must be consistent with the volume of natural gas (Ch4) as used in WCI 353 (a), (b) and WCI 363 (a) (b) for calculating the associated emissions.

Acceptable venting emission sources to put into the fuel usage tab are:

- Venting NG Distribution: NG continuous high bleed devices venting
Venting NG Distribution: NG intermittent devices venting
Venting NG Distribution: NG pneumatic pumps venting
Venting Onshore NG Transmission Compression/Pipelines: NG continuous high bleed devices venting
Venting Onshore NG Transmission Compression/Pipelines: NG continuous low bleed devices venting
Venting Onshore NG Transmission Compression/Pipelines: NG intermittent devices venting
Venting Onshore NG Transmission Compression/Pipelines: NG pneumatic pumps venting

The ‘Natural gas Flared’ is reported under the ‘Fuel’ tab in the CIIP application. From the ‘Fuel name’ dropdown menu, select ‘Natural gas Flared’. Enter the amount of Flared natural gas (in m³) and from the emission category dropdown menu, select ‘Flaring’. The fuel usage reported for ‘Natural gas Flared’ must be consistent with the volume of natural gas (Ch4) as used in WCI 353 (d) and WCI 363 (d) for calculating the associated emissions.

The emissions associated with gas processing must include all emissions from the gas processing units except those from inlet, sales and transmission compression.

The emissions related to other compressors in gas processing such as those required for acid gas injection, vapour recovery units, or refrigeration units must be included and allocated to gas processing – these emissions must not be allocated to a compression product (either reciprocating or centrifugal).

The emissions associated with compression (either centrifugal or reciprocating) must include the emissions directly related to inlet, sales and transmission compression including compressors, inter-stage coolers, compressor room heating and lighting, and compressor related venting, fugitives and flaring, if any.

“Oil and Gas – other” is only to be used as a product in the application for all non-compression, non-processing related emissions. This would include, but may not be limited to, emissions from stationary fuel combustion, flaring, venting, and fugitives that are not connected with the processing or compression processes. Reporting of production quantity or throughput is not required in this case.

The sum of emissions allocated to processing, centrifugal compression and reciprocating compression and other oil and gas must also include those associated with the production of electricity used at the facility, and must equal the facility’s emission total for CIIP purposes:

\[ E_{CIIP} = E_{processing} + E_{centrC} + E_{recipC} + E_{other oil and gas} + E_{Electricity grid} \]

**Quantification of Processing Output and Reporting of Energy Consumption**

Applicants to CIIP will need information on the mole percentage composition of the input gas. The data will be used to distinguish between sour and sweet gas. At a minimum, the average content of the following components must be included in calculating facility output: CH₄, C₂, C₃+, H₂S, CO₂ and H₂O.
Applicants to the CIIP must report the following production and other information for each applicable facility within the reporting operation for the reporting year:

- Oil-equivalent output (m³OE), \( P_{\text{processing}} \) – reported as ‘Oil and Gas – processing, sour gas’ or ‘Oil and Gas – processing, sweet gas’;
- Energy consumed, \( P_{\text{centrC}} \), by inlet, sales, and transmission centrifugal compressors (MWh) – reported as ‘Oil and Gas – compression, centrifugal’;
- Energy consumed, \( P_{\text{recipC}} \), by inlet, sales, and transmission reciprocating compressors (MWh) – reported as ‘Oil and Gas – compression, reciprocating’.

No throughput or other activity information is required for “Oil and Gas – other”.

**Natural gas processing (\( P_{\text{processing}} \))**

\( P_{\text{processing}} \) is the sum of the quantification of natural gas and all other gas liquid products (condensates) at the gas plant outlet, and must be provided in cubic metres of oil equivalent (m³OE). Cubic metres of oil equivalent (m³OE) is a unit of energy based on the energy released by combusting one cubic metre (m³) of crude oil.

- The following conversion factors must be used to determine the oil-equivalent production of a facility:

<table>
<thead>
<tr>
<th>Product</th>
<th>Production Units</th>
<th>m³OE Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>e³m³</td>
<td>0.987*(( \text{HHV}_{\text{NG}}/38 )) (^{b})</td>
</tr>
<tr>
<td>Liquid Propane</td>
<td>m³</td>
<td>0.66</td>
</tr>
<tr>
<td>Liquid Ethane</td>
<td>m³</td>
<td>0.45</td>
</tr>
<tr>
<td>Liquid Butane</td>
<td>m³</td>
<td>0.74</td>
</tr>
<tr>
<td>NGL-mix</td>
<td>m³</td>
<td>0.72</td>
</tr>
<tr>
<td>Pentanes+</td>
<td>m³</td>
<td>0.85</td>
</tr>
</tbody>
</table>

**Compression (\( P_{\text{centrC}} \) and \( P_{\text{recipC}} \))**

The annual energy consumption for compression, in megawatt hour (MWh), must be reported for inlet, sales and transmission compressors. The methodology for calculating energy consumption depends on whether the energy input of the compressor is measured directly independent of other energy usages, or if the compressor’s measured energy input is aggregated with other energy usage.

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\(^{a}\) One barrel (42 US gallons) of crude oil is assumed to contain 5.8 MBTU, where 1 BTU = 1055.056 J. Converting to metric units yields 1 m³OE = 38.4894 GJ energy.

\(^{b}\) The conversion factor for natural gas of 0.987 is based on an HHV\(_{\text{NG}}\) of 38 GJ/e³m³ of marketable gas. If the high heating value of the gas plant outlet natural gas is different than 38 GJ/e³m³, then the reporter must modify the factor as shown. In this case, the verified natural gas HHV\(_{\text{NG}}\) must be reported.
A. If the energy input to a compressor is measured and recorded independently of other sources of energy usage on the facility, then the applicant must use the following information in order to calculate compression energy consumption:

- Compressor type (centrifugal / reciprocating);
- Electrical/mechanical power input to the compressor;
- Amount of each fuel $Fuel_i$ consumed by an engine or gas turbine that is coupled with a compressor or is generating power only for the compressor.

The energy consumed by that compressor is then calculated as follows:

\[
CIE_{CU} = \frac{0.35}{3.6} \sum_{i=1}^{N} [Q_{Fuel_i} \times HHV_{Fuel_i}] + Q_{Electr}^{CU}
\]

where

- $CIE_{CU}$ is the consumed input energy, in MWh, of a compressor unit (CU);
- 0.35 is the assumed generation efficiency of 35%;
- $Q_{Fuel_i}$ is the amount of combusted $Fuel_i$, in appropriate units;
- $HHV_{Fuel_i}$ is the HHV of combusted $Fuel_i$ (actual value if measured, or default value from Table 20-1 of WCI.020 if not), in GJ/fuel units;
- $N$ is the total number of fuels combusted to power the CU;
- $Q_{Electr}^{CU}$ is the consumed electrical energy, either purchased from the grid or generated on-site in MWh, for the CU;
- 3.6 Conversion factor for GJs to MWh

B. If independent energy measurement for a compressor is not available, then then the applicant can calculate energy consumed with the following inputs:

- Compressor rated power $RP_{CU}$ (MW);
- Compressor runtime $t_{CU}$ (hours);
- Compressor load fraction $L_{CU}$

The energy consumed by that compressor is then calculated as follows:

\[
CIE_{CU} = RP_{CU} \times L_{CU} \times t_{CU}
\]

Then, the annual energy consumption for compression is:
\[ P_{\text{centr}} = \sum_{k=1}^{N_C} CIE_{CU_k} \]
\[ P_{\text{recip}} = \sum_{m=1}^{N_R} CIE_{CU_m} \]

where

- \( N_C \) is the number of centrifugal compressors;
- \( N_R \) is the number of reciprocating compressors.

In the event that an on-site power generating unit supplies power for both natural gas processing and for compression, applicants must also outline the annual amount of expended input energy for each compressor unit that shares it, in MWh. This is calculated as follows:

\[ EN_{CU} = \frac{0.35}{3.6} \sum_{i=1}^{N} [Q_{Fuel_i} \times HHV_{Fuel_i}] + Q_{CU}^{\text{Electr.Grid}} \]

where

- \( EN_{CU} \) is the expended input energy at compressor shaft, in MWh, for a particular compressor unit (CU);
- \( Q_{Fuel_i} \) is the amount of combusted \( Fuel_i \), in appropriate units;
- \( HHV_{Fuel_i} \) is the HHV of combusted \( Fuel_i \) (actual value if measured, or default value from Table 20-1 of WCI.020 if not), in in GJ/fuel units;
- \( N \) is the total number of fuels combusted;
- \( Q_{CU}^{\text{Electr.Grid}} \) is the purchased electrical energy, in MWh, a particular compressor unit (CU).

**Emission Allocation between Products**

Applicants to CIIP must allocate GHG emissions between

- Oil and Gas – processing, sour gas
- Oil and Gas – processing, sweet gas
- Oil and Gas – compression, centrifugal
- Oil and Gas – compression, reciprocating
- Oil and Gas – other
For compressor stations, all emissions should be allocated to ‘Oil and Gas – compression, centrifugal’ or ‘Oil and Gas – compression, reciprocating’, depending on the compressor type.

For gas processing plants, where there is no input/sale compressor onsite, all emissions should be allocated to ‘Oil and Gas – processing, sour gas’ and ‘Oil and Gas – processing, depending on the gas type.

For other oil and gas facilities, where there is no input/sale compressor onsite, all emissions should be allocated to ‘Oil and Gas – other’.

For gas processing plants and other oil and gas facilities, other than compressor stations, where input/sale compression is included, the emissions should be allocated to the compression and main facility process.

Emissions allocated to ‘Oil and Gas – compression, centrifugal’ are:

\[
E_{centrC} = \sum_{k=1}^{N_{SC}} E_{Source\ Type}^{centrC} + E_{ElGen}^{centrC}
\]

where

- \(E_{Source\ Type}^{centrC}\) are emissions from a source type associated with centrifugal compression, from the facility’s GGERR emission report;
- \(N_{SC}\) is the number of source types associated with centrifugal compression in the facility’s GGERR emission report;
- \(E_{ElGen}^{centrC}\) are the portion of emissions associated with centrifugal compression out of the facility’s electricity and mechanical energy generation emissions.

If the energy from Electricity and mechanical energy Generation is shared between natural gas processing, compression and other oil and gas, the portion of \(E_{ElGen}\) emissions associated with centrifugal compression is determined by the share of expended energy out of the total for the facility:

\[
E_{ElGen}^{centrC} = \frac{\sum_{k=1}^{N_C} EN_{CUk}}{EN_{IF}} \cdot E_{ElGen}
\]

where

- \(EN_{IF}\) is net electrical plus mechanical energy generated by the generating units that power compressors, processing and/or other oil and gas, in MWh (from GGERR emissions reports).
Emissions allocated to ‘Oil and Gas – compression, reciprocating’ are:

\[ E_{\text{reciprC}} = \sum_{k=1}^{N_{SR}} E_{\text{Source Type}}^{\text{reciprC}} + E_{\text{ElGen}}^{\text{reciprC}} \]

where

\[ E_{\text{Source Type}}^{\text{reciprC}} \] are emissions from a source type associated with reciprocating compression, from the facility’s GGERR emission report;

\[ N_{SR} \] is the number of source types associated with reciprocating compression in the facility’s GGERR emission report;

\[ E_{\text{ElGen}}^{\text{reciprC}} \] are the portion of emissions associated with reciprocating compression out of the facility’s electricity and mechanical energy generation emissions;

If the energy from general stationary combustion and Electricity and mechanical energy Generation are shared between natural gas processing and compression, the portion of - \( E_{\text{Gen}} \) emissions associated with reciprocating compression is determined by the share of consumed energy out of the total for the facility:

\[ E_{\text{ElGen}}^{\text{reciprC}} = \frac{\sum_{1}^{N_F} E_{\text{Cum}}^{\text{ElC}}}{E_{\text{ElF}}^{\text{ElGen}}} \times E_{\text{ElGen}}^{\text{reciprC}} \]

Otherwise \( E_{\text{ElGen}}^{\text{reciprC}} \) and \( E_{\text{SC}}^{\text{reciprC}} \) are as in the GGERR emissions report.

Finally, emissions allocated to natural gas processing at a natural gas processing plant (‘Oil and Gas – processing, sour gas’ or ‘Oil and Gas – processing, sweet gas’) are:

\[ E_{\text{processing}} = E_{\text{CHP}} - (E_{\text{centrC}} + E_{\text{reciprC}}) \]

For gas processing units and compression stations, no emissions can be allocated to ‘Oil and Gas – other’. For facilities in this category, such as aggregated facilities, batteries, gas well pads, gathering pipe lines, liquid separation facilities, liquid hubs, water hubs, and pipeline aggregates, compression activities must be allocated to either of the compression products (reciprocating or centrifugal), with the remainder of the emissions allocated to ‘Oil and Gas – other’. At these facilities, it is assumed that no processing occurs and therefore no emissions can be assigned to processing (‘Oil and Gas – processing, sour gas’ or ‘Oil and Gas – processing, sweet gas’).

\[ E_{\text{other oil and gas}} = E_{\text{CHP}} - (E_{\text{centrC}} + E_{\text{reciprC}}) \]
The applicant must add all emissions from generated electricity and/or heat to the products produced at the facility and/or to sold electricity.

All emissions from purchased electricity and/or heat must be allocated to the facility’s products.

**Emission Intensity**

For the purposes of CIIP:

- The Emission Intensity of natural gas processing $EI_{processing}$ will be calculated as:

$$EI_{processing} = \frac{E_{processing}}{P_{processing}}$$

- The Emission Intensity of centrifugal compression $EI_{centrC}$ will be calculated as:

$$EI_{centrC} = \frac{E_{centrC}}{P_{centrC}}$$

- The Emission Intensity of reciprocating compression $EI_{reciprC}$ will be calculated as:

$$EI_{reciprC} = \frac{E_{reciprC}}{P_{reciprC}}$$