Appendix B: Greenhouse Gas Quantification Report

The Fuel Innovation Fund (FIF) requires all applicants to complete and upload a Greenhouse Gas (GHG) Quantification Report and a Quantification Workbook as a component of their project proposal, containing key quantitative data to support the GHG benefits associated with the project.

Applicants are encouraged to complete Appendix B: GHG Quantification Report prior to the GHG & Environmental Performance section in the application; the GHG & Environmental Performance section is intended to provide a summary of key points from Appendix B and to offer additional relevant narratives on the potential GHG benefits of the project. Proposals will be assessed on their ability to achieve measurable and sustainable reductions in GHG emissions and life cycle carbon intensity (CI), in alignment with Canada's Clean Fuel Regulations (CFR). Evaluation will consider direct GHG and CI reductions from project implementation, quantified using a comprehensive life cycle approach that includes direct and indirect emissions (e.g., feedstock, processing, distribution, and end-of-life). Projects must demonstrate that these reductions are verifiable and realized within five years to support CFR compliance fund timelines. Unlisted emission reductions that occur outside of Canada are reported separately. All such factors may be discussed in the Application, but the primary focus of the Appendix B Report is on the quantification of direct and indirect emissions reductions.

This document is a part-guidance part-requirement document, and the proponent should be able to find the references and recommended methodologies. All sections are to be addressed with any additional information to be provided when the report is submitted as part of the application.

The Quantification Workbook is to summarize the results in a tabulated format. Worksheets may be added to the Workbook during the proposal submission. The Workbook includes Table B.1 for the applicant to fill out, according to the instructions provided in this document. As well, example calculations are provided in the same file to illustrate a typical format used to quantify baseline and project emissions. The applicant may use this example as a starting point to develop their baseline and project conditions or develop a new emissions quantification workbook.

Project-specific files are required to validate the project GHG statement, such as Fuel LCA model exported as .zip file and CFR Data Workbook with completed "Fuel or Other Energy Sources for Vehicles (FOESV)" section. The final Appendix B Report, Workbook, and supporting documents, must be uploaded to ERA's Emissions Reduction Information Management System ("ERIMS") at http://www.eraadmin.ca/. Supporting documentation may be appended to the Appendix B files. If the applicant has any questions or requires clarification about any aspects of Appendix B, please contact the GHG Team at GHG@eralberta.ca.

Greenhouse Gas Quantification Report Guidance

Emission reductions are categorized as direct, indirect, and unlisted.

Project emission reductions are those emission reductions that result from the funded project and are based on the actual units of equipment, technology, or processes implemented during the project time frame. The project time frame includes the life of the funded project, including operation beyond the end of the contribution agreement period if the equipment, technology, or processes continue to operate. Project emissions reductions can be both **direct** (occurring on-site at the project, owned and controlled by the funding recipient) and **indirect** (emissions reductions upstream or downstream of the project that occur as a consequence of the project operations but are not owned or controlled by the funding recipient).

All projects supported through the Clean Fuel Fund (the Program) must demonstrate a clear and justified value proposition for reducing GHG emissions in Canada. Technology solutions can originate from anywhere globally but must be demonstrated or implemented in Canada during the project. **Unlisted** emissions reduction (optional to report) are those emission reductions that cannot be included in the project emissions reduction but are tracked as demonstrated emissions reduction. These could be emissions reductions that result from regulatory requirements only and are not attributed to the FIF-funded project. Unlisted emission reductions could also include emission reductions that occur outside of the country (e.g., RNG manufactured in Canada and exported to other countries). Emission reductions that occur outside of Canada are listed separately in the project emission reduction claim.

To quantify emission reductions, established protocols should be used where they exist, implementing the ISO 14064-2 principles to provide the foundation for interpretation and quality. The following hierarchy defines priority of methodology selection for GHG emission reductions:

1) CFR quantification methods
   a) *Generic Quantification Method* (GQM) – can serve as the common framework to identify SSRs, define baseline and project scenarios, and structure the quantification method
   b) Methodologies relevant to project
      i) *Quantification Method for Co-processing in Refineries*[*]
      ii) *Quantification Method for Low-Carbon Intensity-Electricity Integration*
      iii) *Quantification Method for CO_2 Capture and Permanent Storage*
      iv) *Quantification Method for Enhanced Oil Recovery with CO_2 Capture and Permanent Storage*
2) Federal OBPS or equivalent provincial system protocols
   a) Energy Efficiency / Electrification – Alberta Emission Offset System (AEOS) *Quantification Protocol for Energy Efficiency Projects*
   b) Carbon Capture and Storage – AEOS *Quantification Protocol for Carbon Dioxide Capture and Permanent Geologic Sequestration*

[*] Noted this methodology has been withdrawn from Guidance for Compliance with the Clean Fuel Regulation and will be updated here at a later date

3) Voluntary market (deemed "CCP-Eligible" by the Integrity Council for the Voluntary Carbon Market) methodologies
    a) Energy Efficiency / Electrification – United Nations Framework Convention on Climate Change (UNFCCC) *AM0091 Energy Efficiency technologies and Fuel Switching in New and Existing Buildings*
    b) Process and Fuel Switching – UNFCCC *ACM0009 Fuel Switching from Coal or Petroleum Fuel to Natural Gas*
    c) Waste and Water Management – UNFCCC *AMS-III.AJ.: Recovery and Recycling of Materials from Solid Wastes*

For projects that result in direct emission reductions, the emissions reduction is quantified as the baseline emissions minus the project emissions. However, to quantify low-carbon intensity (CI) fuel projects, the Fuel LCA model developed by Environment and Climate Change Canada (ECCC) should be used to assess the CI from cradle to grave, as outlined in the *Specifications for Fuel LCA Model CI Calculations*. The life cycle CI of the low-CI fuel developed in the project is then compared to the Reference CI for liquid fossil fuels, as prescribed by the CFR. The emissions reduction is equal to the difference between the two intensities, multiplied by the energy delivered by the low-CI fuel provider.

The following hierarchy defines priority of emission factor selection for GHG emission reduction quantifications:

1) CFR OpenLCA database and *Specifications for Fuel LCA Model CI Calculations*
2) *The Alberta Carbon Offset Emission Factors Handbook*
3) *Alberta Greenhouse Gas Quantification Methodologies (AQM)*
4) Peer-reviewed scientific sources (e.g. EPA GHG Emission Factors Hub)

Forecasted emission factors should be based on Government-provided forecasts such as ECCC electricity grid intensity forecast or other national and international agencies to ensure that all projections are based on reasonable, substantiated evidence. Reputable entities such as not-for-profit think tanks or research institutions (the Pembina Institute, the US Department of Energy National Renewable Energy Laboratory, etc.) may be considered as secondary sources for forecasting.

The Baseline

Baseline emissions represent the GHG emissions that would have occurred in the absence of implementing the project. Provide the following information for each baseline condition.

1) **Description of the baseline:** Include all relevant SSRs with the associated activity data (e.g., fuel gas consumption from combustion, flaring, venting, or other fugitive emissions, chemical processes, electricity usage, etc.). Emissions associated with SSRs that are considered to be negligible may be excluded from the baseline (refer to the Additional Information and Requirements section for the definition of negligible emissions).

    Carbon intensities applied to each SSR should incorporate the entire life cycle of the fuel, chemical or electricity, which would therefore include upstream emissions from extraction, processing, production, distribution and transportation. Relevant sources and sinks are direct (controlled by

the project applicant) and indirect (related to the project by material or energy flows or affected by the project).

2) **Quantification methods:** Recommended references noted above in the Guidance section to estimate the baseline emissions. Only the relevant quantification elements need to be applied, leaving aside unrelated program requirements.
   a) Activity data (e.g., energy consumed, fuel produced, waste generated)
      i) Determination method (e.g., directly measured, prescribed, calculated, estimated)
      ii) Monitoring frequency
      iii) Data management system
   b) Emission factors
   c) Methodology equations
   d) Uncertainty associated with method used
      i) Where there is high uncertainty in the quantification methods, a conservative approach is applied for the baseline (e.g., the estimated baseline emissions should default to lower values to avoid overestimation of emissions reduction).

3) **Baseline years,** including reasons for the selection: Per the GQM, two years of activity data is required to establish a baseline; the activity data and information used should represent normal operating conditions during the baseline period. The baseline should represent a period that is within 5 years from the submission of the proposal. For example, if the proposal is submitted in 2025, an acceptable baseline period would be at least two years between 2020 and 2024. If the baseline proposed is not within the five-year period from proposal submission, provide a justification for the use of an alternative baseline period.

4) **Annual baseline emissions**: Estimate emissions in metric tonnes of carbon dioxide equivalent (tCO_2e). Provide the annual baseline emissions in the applicable field in Table B.1 – Emissions Reduction (refer to attached Quantification Workbook). Baseline emissions that occur outside of Canada are unlisted and are reported separately in the same table. Baseline emissions do not include avoided (enabled) emissions.

For the purposes of submitting the application, it is expected that historical data should be referenced to estimate baseline emissions. Pending implementation of the project, FIF acknowledges that some projects may elect to switch to using a dynamic baseline to establish baseline emissions.

The FIF recognizes that there may be different approaches to establishing baselines. The FIF encourages applicants to reach out to the ERA GHG Team to discuss an appropriate baseline prior to submission. In all cases, the baseline condition needs to be clearly identified, detailed, and justified.

The Project

The project emissions represent those emissions that occur after the project is implemented and for the duration of the project. Provide the following information for the project:

1) **Description of the project:** Provide a description of the project including new technologies and/or processes that are implemented to reduce emissions. Include all relevant SSRs with the associated

activity data. Emissions associated with SSRs that are considered to be negligible may be excluded from the project (refer to the Additional Information and Requirements section for the definition of negligible emissions).

Carbon intensities applied to each SSR should incorporate the entire life cycle of the fuel, chemical or electricity, which would therefore include upstream emissions from extraction, processing, production, distribution and transportation. Relevant sources and sinks are direct (controlled by the project applicant) and indirect (related to the project by material or energy flows or affected by the project).

2) **Quantification methods:** The applicant is required to ensure that quantification methods are consistently applied in the baseline and project conditions. Only the relevant quantification elements need to be applied, leaving aside unrelated program requirements.
   a) Activity data: This data is key to developing the Monitoring Plan, per Schedule 21 of the CFR.
      i) Determination method
      ii) Monitoring frequency
      iii) Data management system
   b) Emission factors
   c) Methodology equations
   d) Uncertainty associated with methodology used
      i) Where there is high uncertainty in the quantification methods, a conservative approach is applied for the project (e.g. the estimated project emissions should default to higher values to avoid overestimation of emissions reduction).

3) **Annual baseline emissions**: Estimate emissions in metric tCO_2e for each year during the project period up to 2050. Provide the annual baseline emissions in the applicable field in Table B.1 – Emissions Reduction (refer to attached Quantification Workbook). Baseline emissions that occur outside of Canada are unlisted and are reported separately in the same table. Baseline emissions do not include avoided (enabled) emissions.

In Table B.1 – Emission Reductions in the Workbook, provide the following information in the applicable fields:

- Anticipated start and end date of the project in dd/mm/yyyy.

- Annual project emissions for every year of the project period based on the applicable scenarios described above. For the first and last year of the project, do not pro-rate the emissions to a full year. Instead, provide the anticipated project emissions only for the period that the project will be implemented. For example, if a project starts on June 1, 2025, the annual emissions for 2025 would only cover the period from June 1 to December 31, 2025.

- Estimated annual production and units of production, if applicable (e.g., 100,000 Liters of biodiesel).

  Note that the project emissions for each year should reflect the total number of equipment, technologies or processes operating during that year. Project emissions which occur outside of Canada are unlisted and are reported separately in the same table. Project emissions do not include enabled emissions. This information is provided separately per the section below.

- Identify whether any emission reductions that will be achieved from the project will contribute to meeting provincial or federal regulatory requirements or the generation of emission offset credits including CFR compliance credits.

GHG Statement

The GHG statement represents the estimated emission reductions associated with the implementation of the CFF project. The GHG statement must include the following information:

Emission Reductions - the annual estimated emission reductions in the quantity of CO_2e from the project and the date on which the reduction is estimated to be achieved. These values are automatically quantified in Table B.1 – Emission Reductions based on the baseline and project emissions provided in the Workbook.

Functional Equivalence

Describe the functions and services provided by the baseline and project and justify whether the baseline and the project provide the same services and products. This ensures that emission reductions are attributable to the specific project or change, rather than variations in scope or quality. This may include a description of the quality (e.g., temperature, pressure, concentration, maximum contamination levels, etc.) of the feedstock and products of the process.

Unlisted Emission Reductions (optional reporting)

Provide description and/or estimates of annual unlisted emission reductions that may be achieved with the implementation of the project during the project period up to 2050. This may include emissions reductions that are achieved outside of Canada if not already captured in Tables B.1.

GHG Risk

Provide any unusual or unanticipated uncertainties associated with the GHG measurements, estimations, or overall quantification approach. This can include assumptions within the emissions estimations, data quality and availability, etc.

Future Verifiability

FIF will verify all projects at the end of the funding to determine funding results. To ensure verifiability, provide a brief description of the activity data that will be collected during the project operation to quantify the GHG emissions reduction, the associated data management systems, key measurements for the commercial unit, and any baseline monitoring. Verifiability can include implementing a monitoring program to collect and track fuel consumption, electricity consumption, and other process related data.

Additional Information and Requirements

The following are additional information and requirements for the GHG quantification report.

General

- GHGs affected by the activities in the project primarily include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O); emissions provided are to be expressed in metric tonnes of CO_2e using Global Warming Potentials (GWPs) from the IPCC Fifth Assessment Report (AR5).

- GHG emission intensity should be expressed in tonnes CO_2e/unit of product or commercial unit, as applicable.

- Standard temperature is 15°C (59°F) and standard pressure is 101.325 kPa (14.696 psia).

- GHG emission sources that do not need to be quantified in the life cycle or emissions reduction are those with equal representation in the baseline and project (e.g., they have the same emission factor and activity level) or those that are negligible to the emission reductions. The sum of the GHG SSRs that contribute to the emissions reduction less than 5% of the CFR-specified applicable materiality quantitative threshold may be considered to be negligible. Materiality quantitative thresholds are specified by the CFR as follows:
  - In the case of a carbon intensity,
    - 1 gCO_2e/MJ, if the absolute value of the carbon intensity is less than 20 gCO_2e/MJ,
    - 5%, if the absolute value of the carbon intensity is between 20 and 100 gCO_2e/MJ, and
    - 5 gCO_2e/MJ, if the absolute value of the carbon intensity is greater than 100 gCO_2e/MJ; and
  - In any other case, 5%.

Quantification

- Where a project is related but not fully aligned with an existing protocol or method, it is best practice to start with the available documentation and determine whether appropriate deviations can be made (e.g., changes in SSRs, baseline).

- Additional GHG emission quantification workbooks may be submitted to support the proposal. This often provides information useful to the ERA reviewer as it relates to selected sources, sinks, and reservoirs, activity data, emission factors, and assumptions used in the GHG quantifications. Summary tables should still be presented in the main body of the application and in Appendix A even if the detailed workbooks are provided.

Life Cycle Approach

- A life cycle approach is required for the project emission reductions. This means emission sources from raw materials (material inputs), operation of processes and end-of-life/disposal must be considered in the GHG statement. Transportation emissions along the supply chain should also be included in both the baseline and project emissions. Erring on the side of conservatism is a reasonable justification for exclusion in the baseline but should be noted in the GHG quantification report.

- This approach also considers both upstream and downstream emissions and emission reductions, so called "embodied emissions". Embodied emissions are relevant when quantifying baseline and project for products such as construction materials (like steel, concrete, wood, etc.), as well as consumer products.

- The life cycle approach should consider land use change consistent with the CFR and the CFR LCA model. Indirect land use change may be excluded, as it is not in scope of the model.