

**2016-17 AICEP DETAILED
ENERGY ASSESSMENT
REQUIREMENTS**

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1.0 Introduction

1.1 Purpose

This document has been developed to assist with the preparation of the Detailed Energy Assessment report required for participation in the Alberta Indigenous Community Energy Program (AICEP).¹ Please note that the provisions in this document must be met in order to be eligible to participate in the AICEP pilot program.

The purpose of performing a detailed energy assessment with quantified greenhouse gas emissions reductions and energy savings is to provide both the participating Indigenous community and the government of Alberta accurate estimates of the cost, energy savings, and greenhouse gas reductions for a project.

Due to the nature and scale of the program, the greenhouse gas emission and energy reduction quantification requirements for AICEP are intended to balance accuracy and rigor with accessibility and cost. In order to achieve the full benefits of comprehensive data tracking, the Ministry of Indigenous Relations urges participants to go beyond the AICEP reporting requirements and continue with energy performance measurement and tracking over the life of the facility.

This document describes the greenhouse gas and energy savings measurement, quantification, and reporting requirements necessary for all energy efficiency measures implemented as a part of an AICEP project.

1.2 Key Definitions

Energy conservation measure (ECM): any work that is intended to reduce the energy consumption or increase the energy efficiency of a facility through equipment retrofit or installation of new energy management systems or controls. While there is a distinction between energy efficiency and energy conservation, these terms can be used interchangeably for the purposes of this document.

Possible measures: all energy conservation measures that are potentially feasible and applicable to the facility.

Recommended measures: all energy conservation measures that are feasible, applicable to the facility, cost-effective, and recommended by a qualified energy professional given the greenhouse gas abatement requirements of the AICEP program.

Project measures: all potential energy conservation measures that are included in the AICEP energy assessment report.

Measurement boundary: a conceptual boundary drawn around equipment or systems to define all elements and factors that influence the energy use for a given energy efficiency measure.

¹ This document is based on the Municipal Climate Change Action Centre's TAME+ program Detailed Energy Assessment Requirements.

Baseline: the 'baseline' case describes the energy use characteristics of the facility prior to participation in the program. It should be a fair representation of normal operating conditions and must span at least one year to capture a full operating cycle.

Post-retrofit: the 'post-retrofit' case, synonymous with 'energy efficient' case, describes the facility energy use characteristics if all energy efficiency measures from the AICEP energy assessment report have been implemented.

Abatement rate: greenhouse gas emissions abatement rate refers to the ratio of the total estimated cost of any ECMs (expressed in \$) per amount of greenhouse gas emissions (expressed in metric tonnes of CO₂e) that could be reduced or avoided through the implementation of an energy efficiency or conservation measure.

2.0 Detailed Energy Assessment Report

2.1 General Requirements

The Indigenous community is responsible for commissioning a detailed energy assessment for all buildings included in the project. The assessment will help the Indigenous communities make an informed decision about which measures to include as a part of any building retrofits.

The requirements for the detailed energy assessment are as follows:

- The assessment must be completed to a level of rigour comparable to ASHRAE Level II audit guidelines and sufficient to provide the data necessary to perform all required quantification calculations detailed in this document.
- The assessment of community-owned residential buildings must be conducted by a qualified home energy auditor that provides a comprehensive energy audit including recommendations on retrofits.
- The assessment and quantification must be completed by a qualified professional with a legal right to work in Canada. A qualified professional will be a Professional Engineer (P. Eng.), Certified Energy Manager (CEM) and/or Certified Energy Auditor (CEA). This individual is bound by legal responsibility and the professional code of conduct of their respective associations.

2.2 Requirements for Detailed Energy Assessments

An ASHRAE Level II audit will, at various levels of depth, explore all possible measures applicable to a particular facility. This analysis is completed with the intention of narrowing down a set of recommended measures that will be presented to the client in the Detailed Energy Assessment report.

For a guide on the requirements of an ASHRAE Level II audit, please refer to the document "Procedures for Commercial Building Energy Audits" (ASHRAE 2011). This document can be purchased and downloaded from the ASHRAE website.

The assessment of community-owned residential buildings must be conducted by a qualified home energy auditor that provides a comprehensive energy audit including recommendations on retrofits.

2.3 Greenhouse Gas and Energy Saving Quantification Requirements

AICEP projects must quantify and report the greenhouse gas emissions reductions and energy savings from the proposed project. This analysis applies to all project measures and must be included in the Detailed Energy Assessment Report. The detailed quantification methodologies for this analysis are provided below.

The project quantification requirements include:

- a quantified description of the facility operation and energy use prior to the AICEP project (baseline);
- a comprehensive list of all potential project energy efficiency measures;
- estimated energy savings and greenhouse gas emissions reductions from each of the potential project measures and from the project as a whole;
- cost-effectiveness assessments for the potential measures and a calculated GHG abatement rate for the project; and
- reported assumptions, references, and details on the measurement and quantification process used for all recommended potential measures

2.4 Submission and Updates

The Detailed Energy Assessment report, completed by the energy consultant, must be submitted as a part of the AICEP process.

2.5 Project Final Report

Upon project completion, a project Final Report must be submitted by the Indigenous community to the Ministry of Indigenous Relations. Please refer to the reporting requirements in the AICEP guidelines.

3.0 Quantification and Emissions Reductions Methodology

3.1 Energy Use Measurement

The Ministry of Indigenous Relations energy savings measurement and quantification process is based on the Alberta Quantification Protocol for Energy Efficiency in Commercial and Institutional Buildings and the International Performance Measurement & Verification Protocol (2010).² As outlined in these protocols, energy measurement and verification can follow one of four typical approaches, summarized below.

Table 3.1: Summary of IPMVP Measurement and Verification Options

Approach	Description
A. Retrofit Isolation: Key Parameter Measurement	<p>Engineering calculations of energy savings are completed for each measure through a combination of field measurements and estimates for key performance parameters.</p> <p>Measurement frequencies are short-term and range</p>

² These documents are publically available and may be referenced.

	from samples to continuous measurements. Non-measured values are estimated based on historical data, manufacturer's specifications and engineering judgement
B. Retrofit Isolation: All Parameter Measurement	Same process as Approach A, but with no estimation. All values calculated from field measurements.
C. Whole Facility	Savings are calculated using the measured energy use at the whole facility or sub-facility level. Continuous measure of facility energy use over a baseline year are compared to continuous measurements for at least one year post-retrofit. Adjustments are required to account for factors such as weather and occupancy.
D. Calibrated Simulation	Savings are calculated through simulation of energy use across the whole facility or sub-facility. Simulation is calibrated with hourly or monthly data.

Recognizing the unique challenges of Indigenous communities in terms of resources, capacity limitations and remote locations, the quantification requirements for AICEP are to follow a **modified Approach A**. This reduced burden of quantification is acceptable for AICEP projects as they are relatively small in scale and this assessment is not used to quantify emissions reductions on the Alberta carbon offset market.

The recommended approach and minimum requirements are described below. However, if the qualified energy professional deems that another method will be lower cost and of equal or greater accuracy, Approach B, C, or D can be employed in place of the described approach. In such cases, the energy consultant must provide a measurement and verification plan appropriate to the selected methodology to the Ministry of Indigenous Relations for approval, prior to completion of the Detailed Energy Assessment report.

3.1.1 Baseline Measurement

The baseline energy use of all energy equipment or systems within the scope of project ECMs must be quantified. The baseline measurement and quantification is completed using a combination of measured data and estimated parameters as outlined below:

Provide an overview of the site and building: in order to provide context for the baseline, provide a description of the site and building, and an overview of energy systems within the building. This must include basic physical parameters such as location, building type, total building floor area, and relevant occupancy and operational information to illustrate how the building is used. Finally, an overview of all energy systems must be provided which lists the systems and includes a physical description including the age and specifications of equipment, and an energy use break-down by system.

Define the measurement boundary: a measurement boundary must be defined for each energy efficiency measure. Doing so allows the narrowing of the scope of variables and factors that must be measured or quantified for an ECM and helps identify key metering points. Only changes to energy systems and operating variables within the measurement boundary must be included in the baseline and post-retrofit calculations. The measurement boundary also helps identify possible energy flows that may interact with other ECMs.

Determine normal operating parameters: for each ECM, determine the operating conditions that are representative of a typical facility over a full year operating cycle.

Factors will vary for each ECM but generally include: building/room occupancy patterns, operating hours, load changes and cycles, building activities, and environmental factors. Parameters should be based on measured or observed data when possible. Stipulations based on historical data or extrapolated patterns can be used when applicable.

Determine performance of existing equipment: for each ECM, determine the annual energy use for the baseline equipment and systems within the measurement boundary.

ECM Energy Use_{Baseline} is defined as the annual energy consumption within the ECM boundary prior to ECM installation, calculated for each energy type

Key energy performance parameters should be based on measured data taken at the component or system level. A single spot measurement may be sufficient for conditions with little variation. Otherwise, measurements should be short-term and may be periodic or continuous. The length of measurement period and frequency should be determined by the energy professional based on the equipment type, anticipated variation, length of operating cycles, and influence on energy consumption.

In cases where measurements are not possible or practical, stipulated data may be used to determine performance parameters or other influencing factors. Stipulations may be based on historical data, databases, engineering references, or manufacturer data.

If multiple versions of the same equipment are included within the measurement boundary, a statistically valid sample may be used in place of measuring all units.

Measured and stipulated energy performance of all equipment types and energy uses should be aggregated to the metering level and compared with metered data to validate assumptions.

Calculate baseline energy use of the project: using the equipment performance data and operating parameters, calculate the total annual energy use of the baseline equipment and systems for all ECMs in the facility.

Project baseline energy use is calculated for each energy type as:

$$\text{Equation 1: Project Energy Use}_{\text{Baseline}} = \sum \text{ECM Energy Use}_{\text{Baseline}}$$

In addition, include total annual facility energy use, based on historical utility data to be used as reference data for validation and context.

Calculate adjusted baseline energy use: the baseline is intended to be used for an equivalent comparison of a facility's energy use before and after ECM implementation. Variables that affect energy use but are unrelated to the efficiency project must be normalized to a reference condition which is held constant across the baseline and post-retrofit scenarios. Adjustments are typically made for weather-dependent measures and, in special cases, for changes to operating parameters.

All baseline energy use values for ECMs individually and for the project as a whole should be reported as 'adjusted' energy use in the final report with adjustment calculations and assumptions provided in the report appendix.

For weather dependent variables, normalize the baseline energy use to long-term average weather using a valid mathematical technique.³ Temperature (e.g. heating degree days) must be considered. Humidity, wind, and other weather variables are to be considered as deemed relevant by the energy professional. Seasonal weather should be normalized to a period no less than 5 years and should be based on the nearest available meteorological data. Weather conditions during measurement periods must be reported for weather sensitive ECMs. Below is an example of baseline weather adjustment:

$$\text{Equation 2: Energy Use}_{\text{Adjusted Baseline}} = \text{Project Energy Use}_{\text{Baseline}} \times \frac{\text{HDD}_R}{\text{HDD}_B}$$

Where:

HDD_B is heating degree days during the baseline period

HDD_R is heating degree days averaged for the reference period

If it is anticipated that operating parameters affecting any ECM will be substantially different in the post-retrofit period for reasons unrelated to the energy efficiency project, the baseline should be adjusted to reflect these conditions. Changes in conditions that result from ECMs such as controls or occupancy sensors should not be included in baseline adjustments.

Document calculations, assumptions, and stipulated data: all calculations and relevant data must be clearly documented. For stipulated parameters, include all assumptions, supporting information and data sources. A third party should be able to verify calculations and understand the rationale for assumptions. This can be included in an appendix.

3.1.2 Post-Retrofit Estimation

The post-retrofit energy use of all energy equipment or systems within the scope of project ECMs must be quantified. As these calculations are performed in advance of project implementation, measured operational data is unavailable. Therefore, these estimates should be completed with the best available information as outlined below:

Determine performance of new equipment: for each ECM, determine the annual energy use for all equipment or systems within the given measurement boundary.

ECM Energy Use_{Post-retrofit} is defined as the annual energy consumption within the ECM boundary after ECM installation, calculated for each energy type (with the effects of significant ECM interactions accounted for as described below)

Performance parameters should be based on the best available data including manufacturer specifications, measured performance of similar equipment, databases and other engineering references.

³ For guidance on weather data and assessing the validity of mathematical methods refer to section 8.9 and Appendix B of the International Performance Measurement and Verification Protocol: Concepts and Options for Determining Energy and Water Savings, Volume 1 (2010) prepared by Efficiency Valuation Organization.

ECMs that improve energy efficiency by altering use or loading cycles, for example occupancy sensors and variable frequency drives, will require the development and use of a new load profile. This should be factored into the annual energy use calculations for these measures to ensure that the full benefit of the ECM is considered.

Analyze ECM interactions: some energy efficiency measures, once implemented, can have an effect on other measures by altering the energy flow through the system or by changing the load conditions.

For all energy efficiency measures, interactions with other ECMs must be identified and a rudimentary estimation of the interaction should be performed to evaluate the significance. Any significant interaction, estimated to affect the energy use of another ECM by over 15 percent or has a greater than 5 percent effect on the total baseline energy use, must be quantified and accounted for using detailed engineering calculations. All other interactions can be identified and noted as negligible. All relevant supporting information and calculations relating to ECM interactions must be summarized in the appendix.

Calculate potential post-retrofit energy use of the project: using the performance data for new equipment, calculate the total annual post-retrofit energy use of all ECMs in the facility. Calculations should be completed using the same core facility operating parameters and weather conditions as defined in the adjusted baseline. Exceptions include operating parameters that are directly and intentionally affected by the implementation of ECMs, such as control systems and occupancy sensors.

Project post-retrofit energy use is calculated for each energy type as:

$$\text{Equation 3: Project Energy Use}_{\text{Post-retrofit}} = \sum \text{ECM Energy Use}_{\text{Post-retrofit}}$$

Document calculations, assumptions, and stipulated data: clearly document all calculations and relevant data. For stipulated parameters, include all assumptions, supporting information and data sources. A third party should be able to verify calculations and understand the rationale for assumptions. Include this information in the appendix.

Identify significant uncertainty: with the above approach, a degree of uncertainty is anticipated in the post-retrofit calculations. In some cases, uncertainty may be high due to limited data or the nature of assumptions. Uncertainty levels should be estimated and must be noted in the report for all ECMs where uncertainty in annual energy use is greater than 50 percent. If there are post-retrofit measurements that could be taken upon completion to reduce uncertainty, recommendations should be made in the report. The Ministry of Indigenous Relations will review these recommendations with the Indigenous communities and determine if any actions are necessary to enhance quantification calculations.

3.1.3 Energy Savings

Energy savings must be calculated for each measure and for the project as a whole. These calculations assume that all project measures will be implemented and that any significant interaction effects are accounted for in the energy performance of each measure.

Note: all energy savings calculations must be performed using adjusted baseline energy use values.

Annual energy savings:

Annual energy savings for each ECM are calculated for all fuel types as follows:

Equation 4:

$$ECM \text{ Energy Savings} = ECM \text{ Energy Use}_{Baseline} - ECM \text{ Energy Use}_{Post-retrofit}$$

Annual project energy savings are calculated for all fuel types as follows:

$$Equation 5: Project \text{ Energy Savings} = Project \text{ Energy Use}_{Adjusted \text{ Baseline}} - Project \text{ Energy Use}_{Post-retrofit}$$

Project lifetime energy savings:

To determine the full effect of the potential retrofit, energy savings resulting from AICEP projects must also be quantified over the life of the project. This is calculated by considering the annual energy savings from individual measures and their corresponding operational life. The expected operational life of each piece of equipment included in the project ECMs should be determined using the best available information such as, manufacturer specifications, databases, research, and other engineering references. All equipment life values used in calculations and their source must be included in the report.

Project-life energy savings for each project ECM are calculated as follows:

$$Equation 6: ECM \text{ Energy Savings}_{Project \text{ life}} = \sum ECM \text{ Energy Savings}_{Annual} \times Equipment \text{ life}$$

Where:

Equipment life is the operational life of the equipment installed for each ECM in years

Project-life emissions reductions for the project as a whole are calculated as:

$$Equation 7: Project \text{ Energy Savings}_{Project \text{ life}} = \sum ECM \text{ Energy Savings}_{Project \text{ life}}$$

Eligible energy savings:

As specified in the Quantification Protocol for Energy Efficiency in Commercial and Institutional Buildings (2010), a multiplier factor must be applied to energy savings to account for uncertainty. Accordingly, the eligible energy savings of a project are defined as:

$$Equation 8: Eligible \text{ Energy Savings} = Energy \text{ Savings} \times M$$

Where:

M is the eligibility multiplier, for all AICEP projects use a value of M = 0.90

This general equation must be applied to all energy savings calculations.

3.2 Greenhouse Gas Emissions

Greenhouse gas emission reductions must be quantified for all ECMs individually and for the project as a whole. Greenhouse gas must be calculated for all energy types affected by project ECMs. Energy types for AICEP project typically include natural gas and grid electricity, but may include others depending on the building.

3.2.1 Annual GHG Reductions

Annual emission reductions for each ECM are calculated as:

$$\text{Equation 9: ECM Emission Reduction}_{\text{Annual}} = \sum \text{ECM Eligible Energy Savings} \times \text{Emission Factor}_{\text{Energy type}}$$

Where:

*Emission Factor*_{Energy type} is the emission factor for each type energy use, expressed in tonnes of CO₂ equivalent per unit energy. Em

Annual emission reductions for the project as a whole are calculated as:

$$\text{Equation 10: Project Emission Reduction}_{\text{Annual}} = \sum \text{ECM Emission Reduction}_{\text{Annual}}$$

3.2.2 Project Lifetime GHG Reductions

To determine the full effect of the retrofit, emission reductions resulting from AICEP projects must also be quantified over the life of the project.

Project-life emission reductions for each ECM individually and for the project as a whole are calculated using the following general equation:

$$\text{Equation 11: Emission Reduction}_{\text{Project life}} = \text{Eligible Energy Savings}_{\text{Project life}} \times \text{Emission Factor}_{\text{Energy type}}$$

3.3 Cost-effectiveness Tests

Cost-effectiveness tests are used to evaluate the economics of energy efficiency projects. Various calculations and metrics are used in the design phase to select appropriate efficiency measures and to evaluate the business case for the project. Other metrics are used to assess grant effectiveness and to ensure funding is allocated appropriately.

To ensure consistency across AICEP projects, section 3.3.1 describes the requirements and methodologies for cost-effectiveness calculations that must be included in the Detailed Energy Assessment report.

3.3.1 Simple Payback

Simple payback is used to quantify the cost-effectiveness of a retrofit project from a participant perspective.

Simple payback calculations are required for all individual ECMs and for the project as a whole and are calculated using the equations below:

$$\text{Equation 12: Simple Payback (years)} = \frac{\text{Initial Capital Cost}}{\text{Annual Cost Savings}}$$

Where:

Annual cost savings are calculated using the measure or project energy savings defined in the sections above

For the purpose of the simple payback assessment, calculations should assume a constant energy price applied to the energy savings based on current rates. Initial capital cost values and energy prices should be included in the report appendix.

3.3.2 Net Present Value (NPV) Life-cycle Cost

Full life-cycle cost accounting is a cash flow analysis technique that is well suited to capture the full benefits of a potential retrofit project from a participant perspective. This approach enables comparison between the baseline and post-retrofit scenarios in a way that accounts for equipment life, replacement costs, and the value of currently installed equipment.

NPV life-cycle cost calculations comparing the baseline to the post-retrofit cases are required for all individual ECMs and for the project as a whole.

Full life-cycle cost accounting can become relatively onerous depending on the scope and detail of the analysis. In order to ensure calculations are performed consistently and efficiently, a pre-determined scope definition and required calculation assumptions are included in the methodology below.

Cash flow analysis should be expressed in net present value using the equation below:

$$\text{Equation 13: } NPV = C_0 + \sum_{t=1}^n \frac{C_T}{(1+d)^t}$$

Where:

C_0 is the initial investment cost in cashflow year zero (expressed as negative for a cost)

C_T is the sum of cash flow in year t (expressed in current dollars)

d is the discount rate (does not include inflation)

n is the number of cashflow periods (based on ECM equipment life)

t is the current time period (year)

Note: Equation 13 and the methodology outlined below can be applied to the calculation of NPV for individual ECMs. As the n value may vary across ECMs, the NPV life-cycle cost of the project as a whole should be calculated using a weighted sum of individual measures.

Required assumptions and approaches:

- The number of cash flow periods should be based on the equipment life of each ECM. The baseline and post-retrofit NPV for each measure should be calculated over the same time period.
- Baseline equipment replacement is consistent: assume for the baseline that existing equipment will be replaced by equipment types matching what is currently installed or what would be required by current codes (if applicable).
- 5% discount rate: while different discount rates can be used in NPV calculations, a set discount rate is required to ensure comparability across ECMs and projects.
- Initial energy prices should be defined by the energy consultant based on rates that reflect costs currently experience by the Indigenous communities.
- Energy prices increase 1% per year: energy prices can have a significant influence on the economics of projects over the life of the equipment. While price escalation can be assumed, it is difficult to predict future prices with any degree of accuracy. To ensure calculation consistency, assume energy prices start at current rates and increase by 1% each year, over the life of the measure. This growth rate is deliberately set to be conservative. Note: no other inflation

calculations are required for energy prices as NPV calculations express prices in present day values.

- The scope of cash flow items should include: purchase cost, installation cost, replacement cost and energy cost savings - for the baseline equipment and the post-retrofit equipment. These terms are defined below. Other items such as maintenance and disposal costs are considered out of scope.

Purchase cost: the estimated up-front capital cost required for the ECM equipment and associated materials. This does not include labour and installation. This should be included in the C_0 term of the cash flow analysis (see [Equation 13](#)).

Installation cost: the estimated cost of labour for installation of the ECM and associated materials. These costs may vary due to factors including the building type, location, and ECM installation location. This should be included in the C_0 term of the cash flow analysis.

Replacement cost - baseline: to compare the baseline NPV with the post retrofit NPV, currently installed equipment will likely require replacement one or more times over the cash flow analysis period (n). As stated above, the baseline should assume that equipment replacements will match what is currently installed or what would currently be required if the minimum standards have since changed. The replacement costs should be considered in the C_T term in the replacement year of the cash flow analysis (see [Equation 13](#)). This value should include the cost of purchase and installation for the replacement.

Energy cost savings: the cost savings associated with the energy saved in the post-retrofit scenario. The annual cost savings is defined as annual the energy savings, as calculated above, multiplied by the energy price in a given year. This should be considered in the C_T term in all years of the post-retrofit cash flow analysis (see [Equation 13](#)).

3.3.3 GHG Abatement Rate

The Ministry of Indigenous Relations uses a program-administrator cost-effectiveness test when evaluating project applications to ensure that funding resources are allocated toward projects that effectively reduce greenhouse gas emissions.

GHG abatement rate is calculated using the equation below:

$$\text{Equation 14: GHG Abatement} = \frac{\text{total estimated cost of any ECMs}}{\text{Total Emission Reduction}_{\text{project life}}}$$

The participant should work with the energy professional to compile a set of ECMs that are compatible with this target. The simple payback and NPV life-cycle cost calculations are valuable tools to evaluate which ECMs to include or exclude.

4.0 Summary of Required Detailed Energy Assessment Report Contents

This report provides the requirements and methodology for completing the required Detailed Energy Assessment report. While there is no prescribed format requirement for the report, the report must include all of the contents described in this document as a whole. The table below provides a summary of these requirements for quick reference.

Note: the report must also include all data and calculations as described in the sections above that may not be summarized in this table.

Table 4.0: Summary of Required Detailed Energy Assessment Report Contents

Section	Report Content
Background	<p>Description of the site and buildings:</p> <ul style="list-style-type: none"> • Physical description including: number of buildings, building type, building configuration, envelope characteristics, building floor area, window area • Building operation/occupancy information, including number of occupants, occupancy schedule, and primary building activities <p>Description of energy systems:</p> <ul style="list-style-type: none"> • A high-level review of all energy systems (e.g. mechanical, electrical, plug loads, etc.) • Typical annual building energy use by energy type • Typical building energy by end use (e.g. lighting, space heating, etc.) <p>Quantification team:</p> <ul style="list-style-type: none"> • Team members and qualifications • Date of report and site visit(s)
Project energy conservation measure summary	<p><i>For each individual ECM include:</i></p> <p>Measure boundary:</p> <ul style="list-style-type: none"> • A description of the scope of all equipment and measurement points in the boundary • List all potential energy flow interactions <p>Measure baseline:</p> <ul style="list-style-type: none"> • Description of existing equipment, technology, specifications, and age • Description of normal operating parameters for energy systems within boundary <p>ECM description:</p> <ul style="list-style-type: none"> • Description of potential ECM/retrofit: technology, specifications, efficiency, service lifetime, cost • Description of any changes to operation parameters or load profiles due to potential ECM <p>Energy and GHG Performance:</p> <ul style="list-style-type: none"> • Baseline adjusted annual energy use (kWh or GJ) • ECM annual energy use, adjusted for interactions (kWh or GJ) • ECM annual energy savings (kWh or GJ) • ECM Eligible annual energy savings (kWh or GJ) • ECM annual emission reduction (tonne CO₂e) • ECM simple payback (years) • Baseline NPV life-cycle cost (\$) • ECM NPV life-cycle cost (\$)
Project energy savings	Potential ECM summary

summary	<ul style="list-style-type: none"> • A table summarizing the annual baseline and ECM energy use and eligible energy savings from the section above (for quick comparison) • A table summarizing the equipment life and project-lifetime energy savings for all ECMs <p>Project totals</p> <ul style="list-style-type: none"> • Total eligible annual energy savings • Total eligible energy savings over equipment life
Project GHG emission reduction summary	<p>Potential ECM summary:</p> <ul style="list-style-type: none"> • Table summarizing the annual and project lifetime GHG emission reductions for each ECM <p>Project totals:</p> <ul style="list-style-type: none"> • Total annual GHG emission reductions • Total GHG emission reductions over project lifetime
Financial analysis summary	<p>ECM summary:</p> <ul style="list-style-type: none"> • A table summarizing the annual and project-life greenhouse gas emissions reductions for each ECM <p>Project cost-effectiveness totals:</p> <ul style="list-style-type: none"> • The simple payback and NPV life-cycle cost for the project <p>Project capital cost:</p> <ul style="list-style-type: none"> • Total estimated capital cost for each ECM (including equipment and installation) • Total capital cost for the project • Requested funding for the project under AICEP • Project GHG abatement rate
Appendix	<p>All supporting materials as required in the described methodology, including:</p> <ul style="list-style-type: none"> • Measurement processes, data sets, calculations, measure interaction estimates, measure uncertainty estimates, reference sources, assumptions, etc.

Appendix A: Emissions Factors

Greenhouse gas emissions shall be expressed in metric tonnes of CO₂ equivalent and must be calculated for all energy types affected by project ECMs. Emissions factors must be appropriately selected to reflect the operation as well as all relevant emission types.

Below are the most common emissions factors. For other emissions factors, please refer to the Carbon Offset Emission Factors Handbook (ESRD, Climate Change, 2015, No. 1).

Factor	Value	Description
Renewable electricity generation	0.64 tCO ₂ e/MWh	Distributed renewable displacement at point of use (includes line loss). Applicable to projects displacing grid electricity with distributed renewable generation at point of use.
Reduction in grid electricity usage	0.64 tCO ₂ e/MWh	Reduction in grid electricity usage (includes line loss). Applicable to energy efficiency projects resulting in decreased grid electricity usage.
Combustion of natural gas	1929 gCO ₂ e/m ³ (equivalent to 0.05 tCO ₂ e/GJ)	For residential, commercial and institutional buildings. Calculated from ESRD Handbook, Table 6 (2015, No. 1)
Combustion of propane	1540 gCO ₂ e/m ³	For other uses (institutional buildings). Calculated from ESRD Handbook, Table 6 (2015, No. 1)
Combustion of light fuel oil	2735 gCO ₂ e/L	For commercial / institutional buildings. Calculated from ESRD Handbook, Table 7 (2015, No. 1)
Combustion of diesel	2786 gCO ₂ e/L	Calculated from ESRD Handbook, Table 7 (2015, No. 1)
Combustion of motor gasoline	2295 gCO ₂ e/L	Calculated from ESRD Handbook, Table 7 (2015, No. 1)

Below are the most common global warming potential emissions factors. For other gas types, please refer to the Carbon Offset Emission Factors Handbook (ESRD, Climate Change, 2015, No. 1).

Gas type	Formula	100-year GWP
Carbon dioxide	CO ₂	1
Methane	CH ₄	25
Nitrous oxide	N ₂ O	298