ONTOLY

ONTOLY_RETROFIT_EEFS-1.0

Existing Building Methodology

Energy Efficiency and Fuel Switching for Buildings

An Approved BERS Methodology

Version 1.0 | Sectoral Scope: 03

Date of Entry into Force: 11 March 2026

This methodology shall be read in conjunction with the Building Emissions Reduction Standard (BERS) Version 1.0.

1. Introduction

This Approved BERS Methodology (the “Methodology”) establishes the quantification, monitoring, and reporting procedures for energy efficiency and fuel switching retrofit projects in existing buildings under the Ontoly Building Emissions Reduction Standard (BERS) Program.

This Methodology was developed with reference to the Clean Development Mechanism **AMS-II.E (Small-scale Methodology: Energy efficiency and fuel switching measures for buildings, Version 12.0)** and has been adapted and enhanced to meet the requirements of the BERS Standard, the Integrity Council for the Voluntary Carbon Market (ICVCM) Core Carbon Principles, and applicable ISO standards.

This Methodology shall be read in conjunction with the BERS Standard Version 1.0, which establishes the definitive rules, requirements, and procedures for the monitoring, verification, registration, and issuance of Building Emissions Reduction Units (BERUs). Where this Methodology and the BERS Standard conflict, the BERS Standard shall prevail.

1.1 Required Components Addressed

In accordance with BERS Standard Section 1.2, this Methodology addresses all required components of an Approved BERS Methodology:

- **Applicability and Eligibility Criteria** (Section 2)
- **Project Boundary** (Section 3)
- **Determination of Additionality** (Section 4)
- **Baseline Methodology** (Section 5)
- **Quantification of GHG Emission Reductions** (Section 6)
- **Conservativeness and Uncertainty** (Section 7)
- **Monitoring Requirements** (Section 8)

1.2 Methodology Review Cycle

This Methodology shall be reviewed at a minimum of every five (5) years in accordance with BERS Standard Section 1.2.2 to ensure continued relevance, scientific rigor, and alignment with the ICVCM Core Carbon Principles. Amendments may only be made through Ontoly’s formal Methodology Development and Review Process, including public consultation.

1.3 Methodology Key Elements

Element	Description
Typical Projects	Installation of, replacement of, or retrofit of existing equipment with energy efficiency measures (e.g., higher-efficiency technologies for lighting, insulation, HVAC) and optional fuel switching (e.g., natural gas to electricity) in existing residential, commercial, or institutional buildings.
Type of Mitigation	Energy efficiency: Electricity and/or fuel savings through energy efficiency improvement. Fuel switching: Fossil fuel(s) to electricity or another lower-emissions fuel.
GHG Scope	CO_2, CH_4, N_2O, and any other GHGs explicitly included. Fluorinated gases (HFCs), including refrigerant emissions (e.g., those associated with heat pump installations or refrigerant-containing equipment), are excluded from Version 1.0. This exclusion reflects: (a) the absence of reliable, publicly available data on refrigerant leakage rates by retrofit technology type at the individual building level; (b) the BERS Program's commitment to quantification based on real, metered data from utility bills rather than estimation or modelling approaches, which precludes the use of default refrigerant emission factors that cannot be verified against measured data; and (c) the conservative principle that emission sources shall not be included where they cannot be quantified with sufficient accuracy and integrity. Ontoly is committed to the highest standards of data integrity and will incorporate refrigerant emission quantification in a future version of the BERS Methodology when reliable measurement approaches and building-level data sources become available.
Geographic Scope	Canada and the United States of America (Version 1.0). Additional jurisdictions may be requested via info@ontoly.org.
Crediting Period	Maximum ten (10) years, subject to regulatory surplus assessment. Crediting period is fixed at the time of first BERU issuance.
Quantification Approach	Ex-post monitoring of actual metered utility consumption, normalized by Ontoly for weather and occupancy variables using the Ontoly GHG Quantification Model.

2. Scope, Applicability, and Eligibility

2.1 Scope

2.1.1 The scope of this Methodology includes project activities that implement energy efficiency measures (including savings of electricity and fuel) and/or fuel switching in existing residential, commercial, or institutional building units or groups of building units. A non-binding list of building categories is presented in Appendix 1.

2.1.2 New buildings are excluded from the scope of this Methodology. Only retrofit projects involving existing buildings are eligible. An existing building consists of at least twelve (12) consecutive months of operational and energy consumption data prior to the project start date.

2.1.3 This Methodology covers project activities aimed primarily at energy efficiency, including technical energy efficiency measures (such as efficient appliances, better insulation, optimal arrangement of equipment, and Building Energy Management Systems) and fuel switching measures (such as switching from natural gas to electric heating or cooling systems).

2.1.4 The technology scope requires the building to conduct a retrofit, defined as the replacement of existing incumbent physical equipment or technology with new physical equipment or technology. The incumbent technology shall be retired and shall not be transferred to another use or building, in accordance with the leakage prevention requirements in BERS Standard Section 11.

2.1.5 Ontoly conducts a granular project quantification approach—thus, to ensure data quality. the definition of aggregated buildings project is defined as a maximum of 5 buildings for Version 1 of this methodology. Further, this aggregation is only available for buildings that comform to the by definition in the BERS, which defines a ‘Aggregated Building Project’ to mean:

(a) all buildings are located within the same property boundary; and

(b) all buildings are owned by the same Building Owner; and

(c) energy consumption and performance data are reported on an aggregated basis through shared utility accounts or equivalent metered systems.

2.2 Applicability

2.2.1 This Methodology is applicable to project activities where it is possible to directly measure and record the utility energy use within the project boundary (e.g., electricity and/or fossil fuel consumption pre- and post-project implementation).

2.2.2 This Methodology is applicable to project activities where the impact of the measures implemented by the project activity can be clearly distinguished from changes in energy use due to other variables not influenced by the project activity (signal-to-noise ratio). Other variables that may affect energy and emissions reductions include, but are not limited to, weather, occupancy rate, and occupant behaviour. Ontoly shall apply standardized normalization procedures to isolate the retrofit impact from exogenous variables.

2.2.3 Project activities that involve the installation of renewable energy technologies to generate electricity for self-consumption (e.g., rooftop solar PV panels) or district energy are not eligible under this Methodology.

2.2.4 In accordance with BERS Standard Section 4.1, all project activities must result in measurable, verifiable reductions in building energy consumption and associated GHG emissions, quantified through a comparison of pre-retrofit and post-retrofit utility data.

2.3 Eligibility Criteria

To be eligible for BERU issuance under this Methodology, a project shall meet all of the following criteria:

- The building must be an existing building located within Canada or the United States of America.
- The project must involve the physical replacement or installation of energy efficiency and/or fuel switching equipment (behavioural-only programs are excluded per BERS Standard Section 4.6).
- A minimum of twelve (12) months and up to thirty-six (36) months of historical, metered pre-retrofit utility data must be available for baseline determination.
- The building must not be registered or claiming emission reductions under another carbon crediting program or compliance market (per BERS Standard Section 12).
- The project must pass the Regulatory Surplus Assessment and the NPV Financial Additionality Test as defined in the BERS Standard Sections 10.1–10.3.
- Eligible Validation Documentation (e.g., IPMVP Report, IREE certification report, or equivalent professional engineering report) must be provided as per BERS Standard Section 6.

2.4 Scientific Advisory Consultation & Entry into Force

2.4.1 An independent scientific advisory panel was engaged throughout 2025 in the development of this Methodology, led by Ontoly. The scientific advisors were engaged in the development of this Methodology through three feedback sessions. They reviewed and provided comments on a draft of this Methodology starting in early 2025 through September 2025. Their final input on this Methodology draft was collected by 24 November 2025 and incorporated by February 15 2026.

Scientific experts engaged in the advisory process include:

- Riley Beise
- Menush Akbari
- Mohammad Fakoor

These experts were selected based on their engineering backgrounds and expertise in building decarbonization design and emissions impact assessment.

2.4.2 The date of entry into force of this Methodology is 11 March 2026.

3. Project Boundary

3.1.1 The project boundary is the physical, geographical site of the building(s) and relates only to operational GHG emissions reductions.

3.1.2 In accordance with BERS Standard Section 4.5, the project boundary shall encompass all GHG sources, sinks, and reservoirs under the control of the Project Proponent that are reasonably expected to be affected by the retrofit.

3.1.3 The project boundary is limited to Scope 1 (direct fossil fuel combustion) and Scope 2 (purchased electricity) operational emissions. Scope 3 emissions (upstream and downstream) are excluded as per BERS Standard Section 11.1.5.

3.1.4 For Aggregated Building Projects, the project boundary may encompass multiple buildings subject to the conditions set out in BERS Standard Section 4.5.2, including common ownership, shared property boundary, and aggregated utility reporting.

3.1.5 The project boundary shall remain identical pre- and post-retrofit.

4. Demonstration of Additionality

Additionality is assessed at the individual building level. Additionality shall be demonstrated in accordance with the BERS Standard Sections 10.1–10.6. This Methodology adopts the BERS Standard's two-part additionality framework in full:

4.1 Regulatory Surplus Assessment

4.1.1 The project must demonstrate that the GHG emission reductions exceed any reductions required by applicable local, provincial/state, or federal laws, regulations, or legally binding mandates (BERS Standard Section 10.1.1).

4.1.2 Ontoly shall apply its Jurisdictional Regulatory Model, a continuously updated database of mandatory building codes, minimum efficiency standards, building performance standards, and climate regulation across all eligible jurisdictions. This database is verified annually by the contracted third-party Verification Body (BERS Standard Section 10.1.3).

4.1.3 The regulatory surplus evaluation shall be conducted once, evaluating legislation legally binding as of January 1 of the year the Preliminary Ex-Ante BERU Assessment Report is requested. The crediting period shall not be shortened if new or stricter regulations are implemented after the Project Start Date (BERS Standard Section 10.1.4).

4.1.4 Where BERUs are expressly recognized as an eligible compliance mechanism under an applicable regulatory program or building performance standard, such use shall not negate regulatory surplus, provided the project otherwise meets all BERS requirements (BERS Standard Section 10.1.2).

4.2 NPV Financial Additionality Test

4.2.1 Every project shall undergo a standardized Financial Additionality Assessment conducted by Ontoly, consisting of:

- **(A) NPV Financial Additionality Test (Pass/Fail):** A mandatory binary test determining whether the project is financially viable without carbon credit revenue. A project passes where the NPV of the project without carbon revenue is less than zero (NPV < 0), subject to sensitivity analysis. A project fails where the NPV of the project without carbon revenue is greater than or equal to zero (NPV ≥ 0).
- **(B) Investment Analysis Rating (1–5 Scale):** For all projects that pass the NPV test, Ontoly assigns an Investment Analysis Rating based on the NPV-adjusted payback period, providing a transparent signal of the degree of financial additionality.

4.2.2 The NPV test formula, variable definitions, and detailed procedures are set out in BERS Standard Sections 10.3.1–10.3.9. Key variables include:

- Capital cost (CAPEX), annual energy cost savings by fuel type, upfront incentives, incremental O&M costs, standardized discount rate, fuel price escalation rates, and average economic useful life.

4.2.3 All fuel types applicable to the project (e.g., natural gas, electricity, fuel oil, propane, district steam, district chilled water) shall be individually parameterized with their own unit of measurement, base year price, and escalation rate as specified in the Ontoly Public Parameter List.

4.3 Sensitivity Analysis

4.3.1 In accordance with BERS Standard Section 10.3.6 and ICVCM Core Carbon Principles Criterion 8.5, Ontoly shall conduct a standardized sensitivity analysis for every project that passes the NPV Financial Additionality Test.

4.3.2 The sensitivity analysis shall test, at minimum, the following parameters: capital cost (CAPEX), annual energy cost savings, the standardized discount rate, and upfront incentives. The specific variation

ranges applied to each parameter shall be defined in the Ontoly Public Parameter List, calibrated to reflect realistic estimation uncertainty for building retrofit projects, and reviewed as part of the minimum five-year methodology review cycle.

4.3.3 A project shall be deemed to have a robust additionality determination where the NPV remains negative (NPV < 0) for the majority of sensitivity scenarios (at least two of three sensitivity analyses) tested. Where the NPV becomes positive under more than one scenario, Ontoly shall flag the project for supplementary review (BERS Standard Section 10.3.8).

4.3.4 These sensitivity analysis parameters shall be subject to third-party verification.

4.4 Investment Analysis Rating

Payback Period	Qualitative Determination	Rating
>10 years or never	Very High Additionality: Profound financial barriers; project highly unlikely without carbon finance	5
7–10 years	High Additionality: Substantial financial barriers; technology proven but not widely adopted due to cost	4
5–7 years	High-Moderate Additionality: Marginal investment case; carbon finance is a key enabling factor	3
3–5 years	Moderate Additionality: Moderate capital constraints	2
1–3 years	Lower Additionality: Passes NPV test; capital constraints remain but could be deemed modest	1

4.5 Data Submission Requirements

4.5.1 The Building Representative shall submit the Financial Additionality Data Submission Form, including per technology retrofit measure: (a) estimated capital cost; (b) estimated annual energy savings by fuel type; (c) anticipated incentive or rebate amounts; (d) estimated annual incremental O&M costs; and (e) modeled energy reductions by utility type.

4.5.2 Financial data submitted to Ontoly shall align with the engineering design and validation documentation prepared and signed by a licensed Professional Engineer. All financial data may be subject to independent third-party verification (BERS Standard Section 10.5).

5. Baseline Methodology

5.1 Establishment of the Baseline Scenario

5.1.1 The baseline scenario represents the GHG emissions that would have occurred in the absence of the BERS project activity. The baseline is calculated using twelve (12) to thirty-six (36) months of actual, historical, metered utility data for the building, drawn from the period most immediately preceding the Project Start Date and reflective of the building's normal operating conditions.

5.1.2 Where baseline data from the period immediately preceding the Project Start Date is unavailable, incomplete, or not representative of normal building operations (e.g., due to extended vacancy, major renovation, pandemic-related shutdowns, or metering failures), Ontoly may, at its sole discretion and following a documented reasonableness assessment, accept utility data from an alternative period that more accurately reflects the building's typical operational profile. Any substitution shall be clearly disclosed in the public Project Description Report on the Ontoly Registry.

5.1.3 The baseline shall be established in a conservative manner, consistent with ICVCM requirements, including by: (a) considering existing government policies and legal requirements in determining the baseline scenario; and (b) ensuring that the overall degree of conservativeness in baseline quantification is proportionate to the level of overall uncertainty.

5.2 Monitoring & Verification

5.2.1 Ex-post (after the retrofit is complete), the Building Representative is required to monitor and report fuel and electricity consumption annual averages to Ontoly on a yearly basis for: (a) a minimum of twelve (12) months pre-project (baseline period); and (b) annually thereafter post-project for the entirety of the crediting period (up to ten years of post-retrofit data reporting).

5.2.2 The Building Representative shall also complete all forms required by Ontoly, including accurate quantitative reporting of Gross Floor Area (in m^2) and annual average occupancy rates for the building (expressed as a percentage of use).

5.2.3 Building Representatives may be required to provide evidence of all quantitative variables, including proof of occupancy or square footage.

5.2.4 Utility bill samples shall be required as evidence and must be submitted to Ontoly according to the timelines outlined in the BERS Standard (Annual Monitoring Report due by March 31; see BERS Standard Section 5.5.1).

5.2.5 Building Representatives may be selected for verification audit to confirm the accuracy of actual utility performance data by the Verification Body, based on a sampling approach identified by the Verification Body.

5.3 Baseline Determination for Retrofit Projects

5.3.1 For project activities involving the retrofit of an existing building, for example unit j, the baseline electricity consumed (EC_BL,j) and the baseline fuel consumed (ECF_BL,j) are, respectively, the average electricity and the average energy content of the fuel consumed by the existing building unit over the twelve (12) months immediately prior to the Project Start Date.

5.3.2 If twelve (12) months of data is not representative of the building's typical performance, the Building Representative may, by request, provide up to thirty-six (36) months of utility data to Ontoly for standardized baseline assessment.

5.3.3 If the baseline building consumes more than one type of fuel, the parameter EF_CO2,f,BL shall represent the weighted average CO_2 emission factor of the different fuels.

5.3.4 Data on the type of fuel and quantities consumed by existing buildings shall be submitted to Ontoly through the Ontoly Portal. Building Representatives are required to submit all forms and supporting

documentation as outlined in the portal for Ontoly to complete Project Description Reports on the Building Representative's behalf, in accordance with the BERS Standard and ICVCM requirements.

5.4 Conditions for Fixed Baseline Parameters

5.4.1 The baseline parameters EC_BL,j and ECF_BL,j shall remain fixed throughout the project lifetime provided all of the following conditions are met:

- **Occupancy (Residential):** For residential building units, the building unit's j average number of occupants per year (Occupancy_j,y) during the crediting period is within ±10% of the average baseline building unit's j occupancy (Occupancy_j,BL) over the last three (3) years prior to the Project Start Date.
- **Operating Hours (Commercial/Institutional):** For commercial and institutional building units, the average yearly operating hours (h_OP,y) of the unit j is at least 30 hours per week.
- **Cooling Degree Days:** The CDDs of the region where the building unit j is located, observed during each year of the crediting period (CDD_y), are within ±10% of the average CDD over the last three (3) years prior to the Project Start Date (CDD_BL).
- **Heating Degree Days:** The HDDs of the region where the building unit j is located, observed during each year of the crediting period, are within ±10% of the average HDD over the last three (3) years prior to the Project Start Date (HDD_BL).

5.4.2 Where any of the above conditions are not met, the baseline parameters shall be adjusted using the standardized weather and occupancy normalization procedures described in Appendix 2, consistent with ASHRAE Guideline 14 and the International Performance Measurement and Verification Protocol (IPMVP) Option C for whole-building energy analysis.

5.5 Occupancy and Use Change Attestation

5.5.1 The Building Representative shall provide an annual attestation of occupancy and use changes as part of each Annual Monitoring Report. This attestation shall include:

- The current occupancy rate expressed as a percentage of the baseline occupancy.
- Disclosure of any material changes in building use, tenant mix, or operating patterns that may affect energy consumption.
- Where the occupancy rate has changed by more than ±10% from the baseline, a detailed explanation of the change and its expected impact on energy consumption.

5.5.2 Where occupancy changes exceed the ±10% threshold, Ontoly shall apply the standardized occupancy normalization procedure described in Appendix 2 to adjust the baseline parameters, ensuring that credited emission reductions are attributable to the retrofit activity and not to changes in occupancy or use.

5.5.3 The Verification Body may request evidence of occupancy data, including but not limited to lease records, property management reports, or building access data. Failure to substantiate occupancy claims may result in conservative adjustments to credited emission reductions.

6. Quantification of GHG Emission Reductions

The Ontoly GHG Quantification Model conducts standardized emission reductions calculations for ex-post fuel and electricity consumption data. All quantification is centralized and performed by Ontoly using standardized formulas and verified datasets, in accordance with BERS Standard Section 2.1.2.

6.1 Total Emission Reductions

Emissions reductions are determined as the sum of the emission reductions associated with the savings of electricity, savings of fuel, and fuel switching by the project building j during the crediting period y, compared to the baseline period:

Equation 1:

$$Er_y = \sum_j ((EC\_BL,j - EC\_normalized,j,y) \times EF\_EL,k + (FC\_BL,j - FC\_normalized,j,y) \times (EF\_CO_2,k + EF\_CH_4,k \times GWP\_CH_4 + EF\_N_2O,k \times GWP\_N_2O))$$

Where:

- EC_BL,j = baseline electricity consumption for building unit j (kWh)
- EC_normalized,j,y = weather-normalized electricity consumption in year y (kWh)
- FC_BL,j = baseline natural gas consumption for building unit j (m^3)
- FC_normalized,j,y = weather-normalized natural gas consumption in year y (m^3)
- EF_EL,k = electricity emissions factor for province k (tCO_2e/kWh), fixed at baseline assessment date
- EF_CO_2,k, EF_CH_4,k, EF_N_2O,k = natural gas emission factors for province k
- GWP_CH_4, GWP_N_2O = 100-year global warming potential values per IPCC Sixth Assessment Report (AR6)
- k = province of the project
- j = building unit
- y = crediting period

6.2 Emission Reductions from Electricity Savings

Emission reductions from electricity savings are calculated as the difference between the electricity that would have been consumed by the baseline building unit (EC_BL,j) and the electricity consumed by building unit j during the crediting period, multiplied by the CO_2 emission factor:

Equation 2:

$$ER\_Elec\ Savings,j,y = (EC\_BL,j - EC\_normalized,j,y) \times EF\_EL,k$$

Where:

- EC_BL,j = Electricity that would have been consumed by the baseline building unit j (kWh), determined as the average of annual electricity consumption across up to three baseline years, each comprising a minimum of 12 months of metered data prior to the Project Start Date.

- EC_normalized,j,y = Weather-normalized electricity consumed by project building unit j in year y (kWh), adjusted to baseline-average HDD and CDD conditions in accordance with Section A2.1.3.
- EF_EL,k = Weighted average CO_2e emission factor from jurisdiction k that supplies electricity to building unit j (tCO_2e/kWh), excluding renewable energy technologies. The emission factor is fixed at the value established at project registration and does not update annually, to ensure no double counting of Scope 2 electricity emission reductions with electric utility providers.

The electricity sources in jurisdiction k shall be from the electric grid tied to the building. The EF_EL,k,y shall be collected from reputable government agency sources by Ontoly.

Note: The grid electricity emission factor for a given jurisdiction shall remain constant throughout the crediting period to ensure no double counting of Scope 2 emissions reductions attributable to grid decarbonization (BERS Standard Section 12.1.4). Transmission and distribution losses are excluded from the quantification framework, as the methodology uses site-level metered consumption data, which inherently reflects energy delivered to the building boundary.

6.3 Emission Reductions from Fuel Savings

Emission reductions from fuel savings are calculated as the difference between the energy content of the fuel that would have been consumed by the baseline building unit (ECF_BL,j) and the energy content of the fuel(s) consumed by building unit j during the crediting period, multiplied by the CO_2e emission factor:

Equation 3:

$$ER\_Fuel\ Savings, j, y = \sum_{f} [(FCF\_BL, f, j - FCF\_normalized, f, j, y) \times (EF\_CO_2, f, k \times GWP\_CO_2 + EF\_CH_4, f, k \times GWP\_CH_4 + EF\_N_2O, f, k \times GWP\_N_2O)]$$

Where:

- FCF_BL,f,j = energy content of fuel type f consumed by baseline building unit j (GJ), averaged over the baseline period
- FCF_normalized,f,j,y = weather-normalized energy content of fuel type f consumed by project building unit j in year y (GJ)
- EF_CO_2,f,k = CO_2 emission factor for fuel type f in jurisdiction k (tCO_2/GJ)
- EF_CH_4,f,k = CH_4 emission factor for fuel type f in jurisdiction k (tCH_4/GJ)
- EF_N_2O,f,k = N_2O emission factor for fuel type f in jurisdiction k (tN_2O/GJ)
- GWP_CH_4, GWP_N_2O = 100-year global warming potential values per IPCC Sixth Assessment Report (AR6)
- f = fuel type (e.g. natural gas, propane, fuel oil). If the project does not monitor the consumption of different fuels separately, the source with the lowest CO_2e emission factor shall be used (conservative approach).
- k = jurisdiction

6.4 Emission Factors by Source

6.4.1 All emission factors used in the quantification of GHG emission reductions under this Methodology are sourced, maintained, and annually updated by Ontoly. The specific data sources and citation references for each emission factor parameter are published in the Ontoly Public Parameters List, which is subject to annual QA/QC by the contracted third-party Verification Body (BERS Standard Section 7.7).

7. Conservativeness and Uncertainty

In accordance with BERS Standard Section 1.3.1 (Conservativeness principle) and ICVCM Core Carbon Principles, where uncertainties cannot be fully eliminated, conservative assumptions, values, and procedures shall be used to ensure that GHG emission reductions are not overestimated.

7.1 Systematic Approach to Conservativeness

7.1.1 In accordance with ICVCM Assessment Framework requirements, this Methodology employs a systematic approach to ensuring the conservativeness of quantification. The following approaches are considered to enable conservativeness and robust quantification:

- **Conservative Emission Factors:** Where fuel consumption cannot be monitored by type separately, the fuel source with the lowest CO_2e emission factor shall be used in calculations (emissions factor will be same for baseline and project emissions scenarios),
- **Conservative Baseline:** The baseline scenario is derived from actual metered historical utility data, not estimates or models. Where adjustments are required (e.g., due to occupancy changes), normalization procedures are applied with conservative assumptions.
- **Weather and Occupancy Normalization:** Ontoly applies standardized weather and occupancy normalization procedures consistent with ASHRAE Guideline 14 and the International Performance Measurement and Verification Protocol (IPMVP) Option C for whole-building energy analysis. Baseline and monitoring-period energy consumption are weather-normalized using Heating Degree Day (HDD) and Cooling Degree Day (CDD) regression analysis, with additional occupancy and operational variables incorporated where relevant. This regression-based approach isolates retrofit impacts from climate variability and occupancy fluctuations, ensuring credited reductions reflect measurable improvements in building performance attributable to the retrofit (see Appendix 2).

7.2 Overall Uncertainty Assessment

7.2.1 The overall uncertainty of emission reductions shall be assessed considering all causes of uncertainty, including: (a) assumptions (e.g., baseline scenario); (b) estimation equations or models; (c) parameters (e.g., representativeness of default values); and (d) measurements (e.g., accuracy of utility metering). The overall uncertainty shall be assessed as the combined uncertainty from individual causes.

7.2.2 It is likely that quantified emission reductions from projects using this Methodology are not overestimated, taking into account overall uncertainty. It is very unlikely that emission reductions can be very significantly overestimated, consistent with ICVCM quantification requirements.

7.3 Attributability

7.3.1 In accordance with ICVCM requirements for attributability of quantified emission reductions to the mitigation activity, this Methodology ensures that credited emission reductions result from the implementation of the retrofit activity and not from changes in exogenous factors unrelated to the project (e.g., weather patterns, grid decarbonization, occupancy shifts). The quantification methodology and related program documents ensure that the credited emission reductions result from the implementation of the mitigation activity and not from changes in exogenous factors that are not related to the mitigation activity. This is achieved through:

- Annual occupancy and use change attestation by the Building Representative.
- Standardized weather and occupancy normalization procedures, aligned with ASHRAE Guideline 14 and IPMVP Option C, applied when threshold conditions are exceeded (see Appendix 2).
- Fixed grid emission factors throughout the crediting period, so grid decarbonization is not credited (BERS Standard Section 12.1.4).

7.4 Quality Assurance and Quality Control

7.4.1 In accordance with BERS Standard Section 7.7, Ontoly shall conduct internal QA/QC procedures on all submitted monitoring data, including automated completeness checks, cross-referencing against public benchmarks and weather data, and flagging of anomalous patterns for manual review.

7.4.2 All Ontoly-managed datasets (emission factors, HDD/CDD data) shall be subject to annual QA/QC by the contracted third-party Verification Body.

7.4.3 A plan for conservative treatment and deduction of emission reductions shall be applied in case of unexpected interruption or errors in monitoring equipment or procedures, as follows: Where monitoring data is incomplete or unreliable, Ontoly shall apply the most conservative available data or reduce credited emission reductions proportionally to the extent of the data gap.

8. Monitoring Methodology

8.1 Monitoring Obligations

8.1.1 In accordance with BERS Standard Sections 5.5 and 7, the Building Representative shall establish an operational and management plan for monitoring that addresses the assignment of responsibilities and the operational process of monitoring. This plan shall be documented as part of the project registration process.

8.1.2 The Building Representative shall collect and submit an Annual Monitoring Report to Ontoly via the Ontoly Portal no later than March 31 of the calendar year immediately following the monitoring year.

8.1.3 All data submitted shall consist solely of actual metered performance data, submitted without weather normalization or other adjustments. Ontoly applies all required normalizations using standardized methodologies.

8.1.4 Monitoring data may be submitted using the Annual Monitoring Report template or through ENERGY STAR Portfolio Manager where the data meets all BERS requirements (see BERS Standard Section 5.3.2).

8.2 Monitoring Report Content

8.2.1 Each Annual Monitoring Report shall include, at minimum:

- Actual metered utility or energy consumption data for the full monitoring period (calendar year basis).
- Sub-metered or building-level energy data where applicable.
- Disclosure of percentage change in occupancy levels compared to the baseline period.
- Disclosure of any non-routine adjustments, operational changes, fuel source changes, or known data gaps.

8.3 Mandatory Attestations

8.3.1 Each Monitoring Report shall include a signed declaration that the submitted data are complete, true, and accurate, and the following mandatory attestations:

- **Leakage Prevention:** All replaced or displaced equipment has been permanently retired or disposed of sustainably and was not resold for continued use elsewhere (per BERS Standard Section 11.1.4).
- **Permanence of Measures:** Installed GHG-reducing equipment has remained installed and operational and has not been reversed or replaced with higher-emitting alternatives (per BERS Standard Section 11.1.2).
- **Change of Ownership:** Attestation of whether the property has changed ownership during the monitoring period (per BERS Standard Section 7.6).
- **No Double Counting:** The project does not and will not issue carbon credits under another program for the same emission reductions, and no utility provider, government agency, or other program is claiming credit for the same reductions (per BERS Standard Section 12).
- **Occupancy and Use Change:** Annual attestation of occupancy/use changes as described in Section 5.5.

8.4 Evidence Requirements

8.4.1 The Building Representative shall retain supporting records, including utility bills, meter data, and occupancy data, for a period of no less than seven (7) years, and must supply copies upon request from Ontoly or the Verification Body (BERS Standard Section 7.5).

8.4.2 Failure to provide requested evidence within thirty (30) calendar days may result in verification suspension and denial of BERU issuance.

8.5 Change of Ownership During Monitoring

8.5.1 If legal ownership of the building changes during the monitoring period, the Building Representative must notify Ontoly in writing within ninety (90) days. Ongoing participation is contingent upon continuous designation of a valid Building Representative and acceptance of all BERS obligations by the new owner (BERS Standard Section 7.6).

8.6 Late or Interrupted Monitoring

8.6.1 Projects that fail to submit the Annual Monitoring Report by March 31 may be suspended. Late submissions may be permitted at Ontoly's sole discretion (BERS Standard Section 5.5.6).

8.6.2 Where specific monitoring data inputs are unavailable due to circumstances beyond the Building Representative's reasonable control (e.g., utility provider delays, metering failures), Ontoly may accept alternative data inputs in accordance with BERS Standard Section 5.5.5.

8.6.3 Where monitoring is interrupted, Ontoly shall apply conservative treatment, reducing credited emission reductions.

9. Monitoring Data Parameters

The following tables define all parameters required for the quantification of emission reductions under this Methodology, including their data sources, monitoring frequency, and QA/QC procedures.

Table 9.1: Electricity Consumption

Data / Parameter	EC_j,y / EC_BL,j
Data Unit	MWh
Description	EC_j,y: Electricity consumed by the project building unit j in year y. EC_BL,j: Electricity that would have been consumed by the baseline building unit j.
Source of Data	Submitted by the Building Representative via the Ontoly Portal.
Measurement Procedures	Utility bills or direct utility provider data submission to Ontoly. ENERGY STAR Portfolio Manager submissions are accepted per BERS Standard Section 5.3.2.
Monitoring Frequency	Annually, for 12-36 months pre-project (baseline) and for all years post-project for the entirety of the crediting period.
Verification Procedures	Ontoly requires utility bill evidence. The Verification Body shall conduct sampling-based audits of input data.
Comments	Electricity consumption shall be reported separately for each building where a group of buildings is involved. EC_BL,j is fixed at baseline and does not require ex-post monitoring.

Table 9.2: Grid Electricity Emission Factor

Data / Parameter	EF_EL,k,y
Data Unit	tCO_2e/MWh
Description	Weighted average CO_2e emission factor of jurisdiction k that supplies electricity to the building unit j in year y.
Source of Data	Ontoly collects and manages a dynamic dataset of grid electricity factors for all eligible jurisdictions.
Measurement Procedures	Data reported by provincial and state government agencies, annually.
Monitoring Frequency	Ontoly annually updates electricity emission factors. If an emission factor is adjusted retroactively, Ontoly does not apply retroactive adjustments to prior calculations.
QA/QC Procedures	The Verification Body conducts annual QA/QC of electricity grid factors to ensure compliance with the BERS Standard and this Methodology.

Table 9.3: Fuel Emission Factors

Data / Parameter	EF_CO2,f,BL / EF_CO2,AVG-f,y
Data Unit	tCO_2e/GJ
Description	EF_CO2,f,BL: Average CO_2e emission factor of baseline fuel types. EF_CO2,AVG-f,y: Average CO_2e emission factor of fuel types consumed in year y.
Source of Data	Ontoly collects and manages a dynamic dataset of fuel emission factors.
Measurement Procedures	Data collected from national government agencies.
Monitoring Frequency	Ontoly annually updates emission factors. No retroactive adjustments applied to prior calculations.
QA/QC Procedures	The Verification Body conducts annual QA/QC of emission factors.

Table 9.4: Fuel Consumption

Data / Parameter	FC_f,j,y
Data Unit	Mass or volume units
Description	Quantity of fossil fuel type f consumed by the building unit j in year y.
Source of Data	Reported by the Building Representative.
Measurement Procedures	Direct submission via Ontoly Portal or ENERGY STAR Portfolio Manager.
Monitoring Frequency	Annually, as defined by 12-month intervals after the retrofit project is complete.
Verification Procedures	The Verification Body may sample buildings for audit verification of fuel consumption data.

Table 9.5: Baseline Occupancy

Data / Parameter	Occupancy_j,BL
Data Unit	percentage of use)
Description	Baseline occupancy of the building unit j.
Source of Data	Reported by the Building Representative.
Measurement Procedures	Direct submission via Ontoly Portal.
Monitoring Frequency	Determined once and fixed through the project lifetime.
QA/QC Procedures	The Verification Body may request evidence of occupancy data during sampling audits.

Table 9.6: Annual Occupancy

Data / Parameter	Occupancy_j,y
Data Unit	Percentage of use
Description	Average yearly occupancy of the building unit j in year y.
Source of Data	Reported by the Building Representative.
Measurement Procedures	Direct submission via Ontoly Portal.
Monitoring Frequency	Annually. The Building Representative is responsible for reporting changes exceeding ±10% from the baseline.
QA/QC Procedures	The Verification Body may conduct sampling audits and request evidence of this parameter.

Table 9.7: Operating Hours

Data / Parameter	h_OP,y
Data Unit	Hours
Description	Average yearly operating hours of the commercial/institutional building unit j.
Source of Data	Reported by the Building Representative.
Monitoring Frequency	Annually.

Table 9.8: Cooling Degree Days

Data / Parameter	CDD_y / CDD_BL
Data Unit	Degree-days
Description	CDD_y: Cooling Degree Days of the region where building unit j is located during year y. CDD_BL: Baseline Cooling Degree Days.
Source of Data	Ontoly collects and manages a dynamic dataset of CDD for all regions. Source: degreedays.net or equivalent.
Monitoring Frequency	CDD_y: Annually. CDD_BL: Fixed through the project lifetime.
Comments	The base temperature used to determine CDD_y and CDD_BL shall be the same.

Table 9.9: Heating Degree Days

Data / Parameter	HDD_y / HDD_BL
Data Unit	Degree-days
Description	HDD_y: Heating Degree Days of the region where building unit j is located during year y. HDD_BL: Baseline Heating Degree Days.
Source of Data	Ontoly collects and manages a dynamic dataset of HDD for all regions. Source: degreedays.net or equivalent.

Monitoring Frequency	HDD_y: Annually. HDD_BL: Fixed through the project lifetime.
Comments	The base temperature used to determine HDD_y and HDD_BL shall be the same.

Table 9.10: TMY Cooling Degree Days

Data / Parameter	CDD_TMY
Data Unit	Degree-days
Description	Typical Meteorological Year (TMY) Cooling Degree Days for the region where building unit j is located. TMY is a synthetic statistical year representing long-term average weather conditions, distinct from observed-year CDD_y and baseline-period CDD_BL.
Source of Data	Ontoly applies a TMY dataset appropriate to the building's location. Source: Canadian Weather for Energy Calculations (CWEC) for Canadian projects; TMY3 or NSRDB TMY for US projects.
Monitoring Frequency	Fixed at validation. Re-applied unchanged each monitoring year.
Comments	The base temperature used to determine CDD_TMY shall be the same as that used for CDD_y and CDD_BL. CDD_TMY is applied to electricity regressions only.

Table 9.11: TMY Heating Degree Days

Data / Parameter	HDD_TMY
Data Unit	Degree-days
Description	Typical Meteorological Year (TMY) Heating Degree Days for the region where building unit j is located. TMY is a synthetic statistical year representing long-term average weather conditions, distinct from observed-year HDD_y and baseline-period HDD_BL.
Source of Data	Ontoly applies a TMY dataset appropriate to the building's location. Source: Canadian Weather for Energy Calculations (CWEC) for Canadian projects; TMY3 or NSRDB TMY for US projects.
Monitoring Frequency	Fixed at validation. Re-applied unchanged each monitoring year.
Comments	The base temperature used to determine HDD_TMY shall be the same as that used for HDD_y and HDD_BL.

10. Crediting Period

10.1 Crediting Period Duration

10.1.1 In accordance with BERS Standard Sections 10.7, the standard crediting period shall be ten (10) years or less. The crediting period commences on the Project End Date (retrofit completion date).

10.1.2 In future versions of the BERS, the crediting period may be restricted due to Ontoly's assessment of legally mandated technologies or building performance standards applicable to the building's jurisdiction.

10.1.3 To provide financial certainty, the length of the crediting period is fixed at the time of the first BERU issuance. Ontoly evaluates regulatory surplus only once—at the start of the retrofit project—and does not shorten the crediting period if new laws or building performance standards are introduced later (BERS Standard Section 10.1.4).

10.1.4 Version 1.0 does not provide for crediting period renewal.

10.1.5 The average economic useful life of the retrofit technology, as required for NPV calculations, shall be defined in the Ontoly Public Parameter List for this Methodology.

11. Validation Requirements

11.1.1 In accordance with BERS Standard Section 6, the BERS Program relies on professional engineering assessments already performed as part of the building retrofit design process, rather than requiring a separate third-party ex-ante validation audit.

11.1.2 The Building Representative shall submit Eligible Validation Documentation as part of project registration, which may include:

- An IPMVP Report prepared by a licensed Professional Engineer.
- An IREE certification report or equivalent engineering analysis.
- Other professional engineering documentation demonstrating equivalent methods for projected utility savings.

11.1.3 Ontoly may, at its sole discretion, accept validation reports other than those listed above, provided the Building Representative demonstrates that such documentation is materially equivalent in scope, rigor, and methodological approach (BERS Standard Section 6.2.2).

11.1.4 Ontoly's review of Eligible Validation Documentation is limited to documentation completeness and eligibility alignment. Ontoly does not independently recreate engineering models or re-perform engineering calculations (BERS Standard Section 6.3).

11.1.5 Validation confirms the reasonableness of project retrofit design and projected GHG reductions. Only successful ex-post verification enables BERU issuance. No BERUs may be issued based on projected savings or modelled estimates (BERS Standard Section 6.4).

12. Leakage

12.1.1 In accordance with BERS Standard Section 11, leakage risk is managed through the following provisions:

- **Equipment Retirement:** Transferring incumbent building technology to another activity is prohibited. Building Representatives shall attest, as part of each Annual Monitoring Report, that incumbent technology has been permanently retired or disposed of in an environmentally responsible manner and has not been resold, relocated, or redeployed for continued operational use at another facility. Ontoly reserves the right to request supporting evidence of equipment disposal.
- **Activity-Shifting Leakage:** Because BERUs are issued exclusively on the basis of actual, metered utility performance data within the project boundary, any increase in energy consumption resulting from activity shifting would be reflected in the monitored data and would reduce or eliminate BERU issuance for the affected period.
- **Market Leakage:** Not applicable to building retrofit projects. Building retrofits do not displace economic activity to other locations or create market-driven increases in emissions elsewhere.
- **Ecological Leakage:** Not applicable. Building retrofits do not involve land-use changes or ecosystem disturbance.

13. Roles and Responsibilities

13.1 Building Representative Responsibilities

The Building Representative (or Building Owner where no secondary party is designated) shall be responsible for:

- Completing all forms and data submissions as mandated by Ontoly in the Ontoly Portal, including the Building Intake Form with detailed building attribute and owner information.
- Submitting annual, average pre- and post-retrofit utility data for electricity and fossil fuel consumption.
- Submitting the Financial Additionality Data Submission Form and the Data Quality & Safeguard Attestation Form.
- Providing Eligible Validation Documentation (e.g., IPMVP Report, IREE Report, or equivalent).
- Providing the Building Owner Attestation & Representative Authorization (per BERS Standard Section 2.7).
- Submitting Annual Monitoring Reports by March 31 each year with all required attestations.
- Retaining supporting records for a minimum of seven (7) years and cooperating with verification audits.
- Notifying Ontoly within ninety (90) days of any change in building ownership.

13.2 Ontoly Responsibilities

The Building Representative shall acknowledge that Ontoly will conduct the following assessments on the Building Owner's behalf, using standardized formulas, internal datasets, and analysis tools aligned with the BERS Standard and verified by the third-party Verification Body:

- **Ontoly GHG Quantification Model:** To determine the standardized baseline and calculate emission reductions for energy efficiency and fuel switching measures, including calculation of baseline and project CO_2 emissions from fossil fuel combustion and electricity consumption, and calculation of greenhouse gas emission factors.
- **Ontoly Financial Model:** To calculate financial additionality of project activities in accordance with BERS Standard Sections 10.2–10.3.
- **Ontoly Jurisdictional Regulatory Model:** To calculate regulatory surplus of project activities in accordance with BERS Standard Section 10.1.
- **Weather and Occupancy Normalization:** All required normalizations using standardized methodologies (BERS Standard Section 5.5.2).
- **Internal QA/QC:** Automated and manual quality assurance checks on all submitted monitoring data (BERS Standard Section 7.7).

13.3 Verification Body Responsibilities

Ontoly shall hire and contract an independent, accredited third-party Verification Body (per BERS Standard Sections 2.1.3 and 8). The Verification Body shall be responsible for:

- Reviewing Ontoly's standardized formulas, models, parameters, and datasets for alignment with the BERS Standard and applicable ISO standards.
- Conducting verification of annual ex-post utility data submitted by the Building Representative, through a sampling approach as determined by the Verification Body.
- Annual QA/QC of Ontoly-managed datasets including electricity emission factors, fuel emission factors, and weather data.

- Annual verification of Ontoly's Jurisdictional Regulatory Model, utility price datasets, and sensitivity analysis parameters.
- Producing Verification Reports for each Verification Cohort in accordance with BERS Standard Section 8.4.

14. Environmental and Social Safeguards

14.1.1 In accordance with BERS Standard Section 13, the Building Representative shall complete and submit the Data Quality & Safeguard Attestation Form declaring conformance with all applicable safeguard principles, including: labour rights and working conditions, land acquisition and resettlement, sustainable management of resources, indigenous peoples and cultural heritage, fair treatment and non-discrimination, resource efficiency and pollution prevention, gender equality, and stakeholder consideration.

14.1.2 Where the Building Representative has assessed that the project poses risks of negative environmental and/or social impacts, information on mitigation measures shall be included in each Monitoring Report.

14.1.3 Projects shall assess the compatibility of the retrofit with the transition to net zero by reference to the net zero objectives of the host country, in accordance with BERS Standard Section 13.5.

15. Definitions

In addition to the definitions contained in the BERS Standard Section 3, the following definitions apply for the purpose of this Methodology:

Building Unit: A distinct space in a building allotted to a specific user (tenant or owner). If a building has more than one tenant/owner, a building unit is a subordinate structure rented by one tenant or used by an owner. If a building is used by a single tenant/owner, the building unit is equal to the entire building. For example, schools occupied by a single owner (e.g., municipality) are treated as a single building unit.

Gross Floor Area (GFA): Area occupied by internal walls and partitions of a building unit, reported in m². If a building unit contains common service areas within its physical boundary (meeting rooms, corridors, lift wells, plant and machinery), include GFA of common service areas. Otherwise, exclude them.

Heating Degree Days (HDD): A measure of how much (in degrees), and for how long (in days), the outside air temperature was below a certain level. Ontoly controls for HDD in models relating to the energy consumption required to heat buildings.

Cooling Degree Days (CDD): A measure of how much (in degrees), and for how long (in days), the outside air temperature was above a certain level. Ontoly controls for CDD in models relating to the energy consumption required to cool buildings.

Appendix 1: List of Building Unit Categories

The following provides recommended criteria for building unit types eligible under this Methodology.

A1.1 Residential Building Units

Building units used for dwelling purposes:

- **Single-family (low-rise or high-rise):** Bungalows, cottages, stand-alone houses, semi-detached houses, town houses, and row houses.
- **Multi-family (low-rise or high-rise):** Apartments in buildings comprising more than two units, sub-divided by: 1–5 units; 5–10 units; 10–20 units; and more than 20 units.

A1.2 Commercial Building Units

Building units used for commercial activities:

- **Office:** Administrative and professional offices, government offices, banks and financial institutions.
- **Hotel:** Hotels, motels, guest houses.
- **Warehouse & Storage:** Distribution and shipping centres.
- **Mercantile & Service:** Retail (shopping stores, showrooms), food sales (grocery stores, convenience stores), service (auto repair, post offices, beauty parlours), and other mercantile.
- **Food Service:** Restaurants, cafeterias, fast food, bars, reception halls, catering services.
- **Entertainment:** Cinemas, sports arenas, casinos, night clubs.

A1.3 Institutional Building Units

Building units used for not-for-profit services in the public interest:

- **Education:** Preschools, day-care centres, schools, colleges, universities, vocational training.
- **Public Assembly:** Community centres, meeting halls, convention centres, museums, theatres, religious worship, recreation facilities.

- **Health Care:** Hospitals, clinics, rehabilitation centres, nursing homes, assisted living centres.
- **Public Order and Safety:** Police and fire stations, prisons, courthouses.
- **Institutional Lodging:** Retirement homes, shelters, military barracks.

Appendix 2: Guidance for Normalization

This Appendix sets out the standardized normalization procedures Ontoly applies to adjust baseline and monitoring-period energy consumption data for weather variability and occupancy changes. These procedures are aligned with ASHRAE Guideline 14-2023 (Measurement of Energy, Demand, and Water Savings) and the International Performance Measurement and Verification Protocol (IPMVP) Option C for whole-building energy analysis, and are consistent with ENERGY STAR Portfolio Manager weather normalization methods.

A2.1 Weather Normalization Procedure

Weather normalization adjusts a building's measured energy consumption to account for the impact of variations in heating and cooling demand compared to long-term average climate conditions. This procedure enables comparison of energy performance across different monitoring years by isolating efficiency improvements from weather-related consumption fluctuations, consistent with the regression-based change-point model methodology in ASHRAE Guideline 14-2023 and IPMVP Option C.

A2.1.1 Ontoly shall obtain Heating Degree Day (HDD) and Cooling Degree Day (CDD) data for the weather station nearest to the building's location from a recognized source (e.g., degreedays.net or the equivalent national meteorological service). The same base temperature of 18°C shall be used for all HDD and CDD calculations across the baseline and monitoring periods.

A2.1.2 Regression Model

Regressions shall be developed separately for each fuel type for which the building has metered consumption. Per-fuel regression accommodates the different weather sensitivities of electric and combustion loads and is consistent with ASHRAE Guideline 14-2023, §4.3.2.1.

The regression form shall be specified by fuel type as follows:

- Heating fuels: $E = \alpha + \beta \cdot HDD$. Cooling Degree Days are not included in heating-fuel regressions because heating-fuel consumption does not respond to cooling load.
- Electricity: $E = \alpha + \beta_1 \cdot HDD + \beta_2 \cdot CDD$. Both heating- and cooling-driven electrical loads are modelled. Where the HDD or CDD coefficient fails the sign or significance tests in §A2.1.4, the affected variable shall be dropped, and the regression re-fit as a single-variable model.

Each per-fuel regression shall be developed using a minimum of nine (9) valid monthly data points after the application of the outlier removal procedure described in §A2.1.4. Regressions developed on fewer than 9 valid data points per fuel shall not be used. Where insufficient valid data points remain, the project shall extend the baseline window or apply the ratio method per §A2.1.4. This minimum is consistent with ASHRAE Guideline 14-2023.

A2.1.3 Weather-Normalized Project Consumption

Weather normalization shall be performed using the Performance Pathway approach specified in ASHRAE Guideline 14-2023, §4.3.2.2. Normalized savings shall be calculated by applying Typical Meteorological Year (TMY) weather data to both the baseline regression model (developed under §A2.1.2 and validated under §A2.1.4) and a separate post-retrofit regression model fit to the monitoring-period data and validated under the same procedure.

The normalized savings form is fuel-specific, consistent with §A2.1.2:

For heating fuels:

$$E_{baseline\_TMY,j} = \alpha_{BL,j} + \beta_{BL,j} \times HDD_{TMY}$$

$$E_{post\_TMY,j,y} = \alpha_{PR,j,y} + \beta_{PR,j,y} \times HDD_{TMY}$$

$$E_{normalized\_savings,j,y} = E_{baseline\_TMY,j} - E_{post\_TMY,j,y}$$

For electricity:

$$E\_baseline\_TMY,elec = \alpha\_BL,elec + \beta_1\_BL,elec \times HDD\_TMY + \beta_2\_BL,elec \times CDD\_TMY$$

$$E\_post\_TMY,elec,y = \alpha\_PR,elec,y + \beta_1\_PR,elec,y \times HDD\_TMY + \beta_2\_PR,elec,y \times CDD\_TMY$$

$$E\_normalized\_savings,elec,y = E\_baseline\_TMY,elec - E\_post\_TMY,elec,y$$

Where:

- α, β, β_1, β_2 are the regression coefficients of the relevant baseline-period (BL) or post-retrofit-period (PR) regression for fuel j;
- HDD_TMY and CDD_TMY are the Typical Meteorological Year heating and cooling degree days for the building's location, and
- E_normalized_savings,j,y is the weather-normalized energy savings for fuel j in monitoring year y.

Both the baseline and post-retrofit regressions shall be developed and validated independently using the same procedure (§A2.1.2 and §A2.1.4). For electricity regressions where either weather variable fails the sign or significance tests, that variable shall be dropped and the regression re-fit. Where either regression fails validation after such adjustments, §A2.1.4 governs the remedy.

A2.1.4 Regression Model Adequacy

Each per-fuel regression developed under §A2.1.2 (baseline regression) and under §A2.1.3 (post-retrofit regression) shall pass all of the validation tests set out below before it may be used to compute normalized savings.

1. Coefficient signs. The HDD coefficient shall be greater than or equal to zero. For electricity regressions only (heating fuels do not include CDD per §A2.1.2), the CDD coefficient shall be greater than or equal to zero.

2. Coefficient significance. All retained coefficients shall have p-values less than 0.05.

3. CV(RMSE). The coefficient of variation of the root mean squared error shall be ≤ 25%, consistent with ASHRAE Guideline 14-2023, §4.2.11.3.

4. |NMBE|. The absolute value of the normalized mean bias error shall be ≤ 5%, consistent with ASHRAE Guideline 14-2023, §4.2.11.3.

5. Outlier removal cap. The cumulative proportion of months removed shall not exceed 25% of the original baseline data points, consistent with ASHRAE Guideline 14-2023, §4.3.2.2.b.

6. Valid data points. After outlier removal, each per-fuel regression shall be developed using at least nine (9) valid monthly data points, consistent with ASHRAE Guideline 14-2023, §4.3.2.1.c.

7. Weather range check. The TMY HDD and CDD totals applied under §A2.1.3 shall each fall within 90% to 110% of the corresponding baseline-period range, consistent with ASHRAE Guideline 14-2023, §4.3.1.c.

8. Savings uncertainty. The fractional savings uncertainty, computed under ASHRAE Guideline 14-2023, §4.2.11.4 (Equation 4-8), shall not exceed 50% of the reported savings at a 90% confidence level.

9. R^2 (secondary diagnostic). The coefficient of determination shall be reported for each regression but is not a pass/fail gate.

Test Failures and Remedies.

Where any of tests 1 through 8 fails, the ratio method shall be applied as the operational default. As exceptions to the default, Ontoly may instead:

- Extend the baseline window and re-run the affected test(s), where additional baseline data is available and would materially improve regression validity. This exception is typically applicable to failures of tests 3 (CV(RMSE)), 4 (|NMBE|), 5 (outlier cap), 6 (valid data points), 7 (weather range check), or 8 (savings uncertainty).

- Determine the project ineligible for BERU issuance under the current data, where the ratio method is also inappropriate.

The choice of remedy and the supporting rationale shall be recorded in the project file and made available to the Verification Body.

Regression-vs-Ratio QA Check.

As a secondary check on regression validity, the regression-normalized savings result shall be compared against the ratio method result. A difference of 10% or less is considered strong agreement. Where the two results differ by more than 20%, the project shall be flagged for supplementary review by the Verification Body.

A2.2 Occupancy Normalization Procedure

Occupancy normalization adjusts the baseline energy consumption to account for material changes in building occupancy or use patterns that are not attributable to the retrofit activity. This procedure is consistent with the multivariable regression approach in ASHRAE Guideline 14-2023 and IPMVP Option C, which accommodate occupancy and operational variables alongside weather parameters.

A2.2.1 Where the annual occupancy rate for building unit j in year y (Occupancy_j,y) deviates by more than ±10% from the baseline occupancy (Occupancy_j,BL), as reported under Section 5.5, Ontoly shall adjust the baseline energy consumption proportionally using the following occupancy scaling factor:

$$OSF\_j,y \; = \; (Occupancy\_j,y \; / \; Occupancy\_j,BL)$$

The adjusted baseline is then: E_BL,adj,j,y = E_BL,j × OSF_j,y. For buildings where the weather normalization procedure (A2.1) has also been triggered, the occupancy scaling factor shall be applied after weather normalization.

A2.2.2 For commercial and institutional buildings, where average yearly operating hours (h_OP,y) fall below 30 hours per week, an operating hours multiplier shall be applied consistent with ASHRAE Guideline 14-2023 and ASHRAE Standard 100-2024. The multiplier adjusts baseline Energy Use Intensity (EUI) targets to reflect reduced operational schedules.

A2.3 Non-Routine Adjustments

A2.3.1 In exceptional circumstances where non-routine events materially affect building energy consumption (e.g., major water damage requiring partial vacancy, fire damage, or significant change in building use classification), Ontoly may engage a qualified decarbonization engineer to evaluate whether a non-routine adjustment to the baseline is warranted.

A2.3.2 Any non-routine adjustment shall be fully substantiated with documentary evidence, transparently disclosed in the quantification calculations, and subject to review by the Verification Body. Non-routine adjustments shall only be approved where the Building Representative provides clear evidence that the event was beyond reasonable control and had a material impact on energy consumption.

A2.4 Normative References

- ASHRAE Guideline 14-2023, Measurement of Energy, Demand, and Water Savings (regression-based change-point model methodology for weather normalization and M&V).
- International Performance Measurement and Verification Protocol (IPMVP), Efficiency Valuation Organization (EVO), 2022 (Option C: Whole Facility methodology for weather and occupancy adjustments).
- ANSI/ASHRAE/IES Standard 100-2024, Energy Efficiency in Existing Buildings (normative EUI target tables and normalization factors for floor area, building type, climate, and operating hours).
- LEED v5 Operations and Maintenance (O+M), EA Credit: Optimized Energy Performance (weather-normalized site and source energy benchmarking for existing buildings).
- ENERGY STAR Portfolio Manager Technical Reference: Climate and Weather (weather normalization algorithm using monthly regression of energy consumption against HDD/CDD).

Document History

Version	Date	Description
0.1	15 September 2025	Pilot Version: Energy efficiency and fuel switching measures for buildings.
1.0	11 March 2026	Updated to align with BERS Standard Version 1.0. Incorporated ICVCM requirements for monitoring, conservativeness, uncertainty, and attributability. Added occupancy/use attestation requirements, sensitivity analysis parameters, QA/QC procedures, and expanded roles and responsibilities.
1.0	11 May 2026	Added clarification on weather normalization statistical analyses. No major revisions, Version 1.0 is still accurate.

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