ENERGY AUDIT REQUIREMENTS

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This document describes the requirements for the completion of energy audits through MCCAC programs, including the methodology and requirements for the quantification of project energy savings and greenhouse gas emissions reductions.

Municipal Climate Change Action Centre

CONTENTS

1.0 Program Overview 3
1.1 Overview 3
1.2 Using Existing Energy Audits 3
1.3 Simplified Retrofits and CEC Energy Audit Funding ... 3
1.4 Minimum Number of Energy Conservation Measures 3
2.0 Key Definitions 3
3.0 Energy Units and Emission Factors 4
4.0 Energy Audits 5
4.1 General Requirements 5
4.2 Quote Requirements 6
4.3 Application Process 6
4.4 Energy Audit Report Structure 6
4.5 Additional Requirements 9
5.0 Appendix 10
Appendix A: Energy Savings and GHG Reductions Table 10
Appendix B: Financial Analysis Summary Table 10
Appendix C: ECM Analysis Summary Table 11
Appendix D: ECM Estimated Useful Life (EUL) Guide 11

1.0 Program Overview

1.1 Overview

This document serves to provide the minimum requirements for delivering energy audits as part of MCCAC programs. The purpose of performing an Energy Audit is to provide both the participating municipality and the MCCAC accurate estimates of the cost, energy savings, and greenhouse gas (GHG) reductions for a variety of projects that could be funded through an MCCAC program. This information is required for approval. This document describes the greenhouse gas and energy savings measurement, quantification, and reporting requirements necessary for all energy efficiency measures outlined as a part of an energy audit. Program Allies are the designated energy auditing contractors that deliver Energy Audits for MCCAC programs. Each Program Ally has agreed to meeting these requirements and will be held to this standard.

1.2 Using Existing Energy Audits

Municipalities may proceed directly to an MCCAC funding program, provided they have the appropriate energy, cost, and GHG reduction information required. Municipalities may use equivalent Energy Audits completed prior to the launch of MCCAC programs to provide the required information. The accuracy of the energy, cost, and GHG reduction information will be assessed through a technical review.

1.3 Simplified Retrofits List and CEC Program Energy Audit Funding

Simplified Retrofits may proceed directly with a Retrofit Project application without completing an Energy Audit due to the predictability of the energy savings achieved by these types of projects. Complex Retrofit Projects are those that are not featured on the Simplified Retrofit List and will require an Energy Audit to estimate the energy and GHG savings prior to applying. Program Allies are permitted to include simple projects in their Energy Audits, but they **must include a minimum of 4 capital ECMs that are not featured on the Simplified Retrofit List.**

In the CEC program, municipalities will receive a 25% rebate to a maximum of $3,750 upon completion of the Energy Audit. The remaining 25% will be reserved as an incentive to encourage the municipality to pursue a project listed in Energy Audit and must be a project that is **not** listed on the Simplified Retrofits List.

1.4 Minimum Number of Energy Conservation Measures

Energy Audits must include a minimum of:

- A minimum of 2-3 no or low-cost measures (installed costs equal to or below $1,000)
- A minimum of 4 capital measures that are not listed on the Simplified Retrofits List.

Any number of measures on the Simplified Retrofits List and solar photovoltaics may be included within the Energy Audit, but neither will count toward the minimum requirements.

2.0 Key Definitions

(a) **Abatement rate:** Greenhouse gas emissions abatement rate refers to the ratio of the total equipment and installation cost of a measure (expressed in $) per amount of greenhouse gas emissions (expressed in metric tonnes of CO_2e) that are reduced or avoided through the implementation of an ECM over the course of the ECMs estimated useful life.

(b) **Baseline:** The 'baseline' case describes the energy use characteristics of the building prior to implementing ECMs. It should be a fair representation of normal operating conditions and must span at least one year to capture a full operating cycle.

(c) **Capital measure:** Defined as an ECM with an implementation cost greater than one thousand dollars ($1,000).

(d) **Complex project:** Defined as a single project application for large measures with variable operation and inconsistent energy drivers. Complex custom projects include but are not limited to boilers over 2,500,000 BTU,

variable frequency drives in non-HVAC applications or over 50HP, compressor upgrades (excl. <75hp air compressor), ice plant measures, and building envelope measures if a defined modeling tool is not used by the participant. Complex measures are expected to be any measure that is not listed on the Simplified Retrofits List, including lighting projects.

(e) **Energy conservation measure (ECM):** Any work that is intended to reduce the energy consumption or increase the energy efficiency of a building through equipment retrofit or installation of new energy management systems or controls. Routine equipment maintenance is not eligible for consideration under this program. While there is a distinction between energy efficiency and energy conservation, these terms can be used interchangeably for the purposes of this document.

(f) **Estimated useful life (EUL):** The estimated operating life of an ECM. The maximum estimated useful life for any measure in the CEC program is 25 years due to uncertainty in facility operations and the advancement of technology over that period. See Appendix D: ECM Estimated Useful Life (EUL) Guide for a generally accepted list of EULs for different technologies.

(g) **Low-cost measure**: Defined as an ECM with an implementation cost less than one thousand dollars ($1,000).

(h) **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.

(i) **Possible measures:** All ECMs that are feasible and applicable to the building.

(j) **Post-retrofit:** The 'post-retrofit' case, synonymous with an 'energy efficient' case, describes the building energy use characteristics after all ECMs from the CEC project have been implemented.

(k) **Project measures:** All ECMs that are included in the CEC project application.

(l) **Recommended measures:** All ECMs that are feasible, applicable to the building, cost-effective, and recommended by a qualified energy professional given the requirements of the CEC program.

(m) **Simple project:** May include measures bundled into one project application to meet program incentive application threshold criteria. Simple measures are defined as ECMs that have predictable energy savings and consistent operating profiles. This includes all projects on the Simplified Retrofits List.

3.0 Energy Units and Emission Factors

All Energy Audits must use metric units. The following table provides units for each energy source.

Table 1.0: Energy Units

Energy Source	Units
Electricity	kWh
Electrical Demand	kW
Natural Gas	GJ
Propane	Litre
Diesel	Litre
Gasoline	Litre
Light Fuel Oil	Litre
Heavy Fuel Oil	Litre

GHG emission estimations must be calculated with the emission factors from the Carbon Offset Emission Factors Handbook. The most common emission factors are below. For other emissions factors, please refer to the latest version of the Alberta Government's Carbon Offset Emission Factors Handbook.

Table 2.0: Emissions Factors

Factor	Value	Description
Renewable electricity generation	See Table 4 for applicable value	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	See Table 4 for applicable value	Reduction in grid electricity usage (includes line loss). Applicable to energy efficiency measures resulting in decreased grid electricity usage.
Combustion of natural gas	1928 gCO_2e/m^3 (equivalent to 0.05 tCO_2e/GJ)	For residential, commercial, and institutional buildings. Calculated from COEF Handbook, Table 6 (2023, Version 3.1)
Combustion of propane	1515 gCO_2e/L	For other uses (institutional buildings). Calculated from COEF Handbook, Table 6 (2023, Version 3.1)
Combustion of light fuel oil	2753 gCO_2e/L	For commercial / institutional buildings. Calculated from Calculated from COEF Handbook, Table 7 (2023, Version 3.1)
Combustion of diesel	2681 gCO_2e/L	Calculated from COEF Handbook, Table 7 (2023, Version 3.10)
Combustion of motor gasoline	2307 gCO_2e/L	Calculated from COEF Handbook, Table 7 (2023, Version 3.1)

Table 3.0: 2024-2029 Emissions Factor Schedule

Factor	2024 Value	2025 Value	2026 Value	2027 Value	2028 Value	2029 Value
Renewable electricity generation	0.52 tCO_2e/MWh	0.4907 tCO_2e/MWh	0.4588 tCO_2e/MWh	0.4271 tCO_2e/MWh	0.3952 tCO_2e/MWh	0.3633 tCO_2e/MWh
Reduction in grid electricity usage	0.52 tCO_2e/MWh	0.4907 tCO_2e/MWh	0.4588 tCO_2e/MWh	0.4271 tCO_2e/MWh	0.3952 tCO_2e/MWh	0.3633 tCO_2e/MWh

4.0 Energy Audits

4.1 General Requirements

Energy Audits help inform the municipality of the energy-saving opportunities within their building and recommend which measures to pursue as part of a Retrofit Project. Should a municipality proceed with an Energy Audit, the municipality is then responsible for commissioning the Energy Audit with a Program Ally contractor. The Energy Audit will provide enough detail to quantify the energy, GHG, and financial savings of a potential project, which is needed to proceed with a Retrofit Project. The requirements for the detailed energy assessment are as follows:

- The Energy Audit must be sufficient to provide the data necessary to perform all required quantification calculations detailed in this document. Energy Audits are expected to have a minimum +/- 30% accuracy with regards to GHG reduction and associated project cost estimates.

- The Energy Audit and quantification must be completed by a Program Ally with a legal right to work in Canada. Energy Audits are expected to be completed by qualified professionals representing the Program Ally. Program Allies must have a Professional Engineer (P.Eng), Certified Energy Manager (CEM), or Certified Energy Auditor (CEA) involved in the Energy Audit process. This individual is bound by legal responsibility and the professional code of

conduct of their respective associations.

4.2 Quote Requirements

All quotes for Energy Audits prepared by Program Allies shall include the following:

- Customer name, address, contact name(s), telephone number(s)
- Building address (if different than above)
- Building type (e.g. arena, town hall, library, etc.)
- Brief building description including space types, gross floor area estimate, hours of operation, seasonal/occupancy fluctuations, and dates of construction and renovations, if any
- Detailed description of systems under review
- Proposed methodology for estimating/analyzing the ECMs
- Information of person responsible for signing off on the Energy Audit
- Itemized cost breakdown by tasks, roles, hours, and hourly rates (excl. taxes)
- List estimated audit disbursements/expenses separately
- Overall scope of Energy Audit and limitations of quote and system(s) excluded
- Estimated date of completion

4.3 Application Process

All Energy Audit applications will be tracked and reviewed by the MCCAC. All applications submitted by municipalities or Program Allies (on behalf of municipalities) will be screened for necessary completeness of the information provided. The application intake process, technical review, and approval will be conducted by the MCCAC. The application process includes the following steps:

1. Application Intake & Administrative Review

Apply online by filling out an application from the MCCAC website and submit the application and required information to contact@mccac.ca or to the designated MCCAC representative. At a minimum the application will be verified for:

- Completeness and accuracy of municipal information
- Eligibility criteria including eligibility of the applicant and their building
- A minimum of 12 months of energy consumption and energy cost data from utility providers for all energy sources used in the facility including electricity, natural gas, and any other energy source.
- Costs and proposed project completion time

2. Technical Screening Review

During this process, the application and the supporting documentation will be reviewed by the MCCAC for approval. MCCAC may follow up with the municipality and/or Program Ally to request additional information, as needed.

3. Energy Audit Approval

A Funding Agreement will be sent to the municipality upon approval. To reserve program funds and begin the Energy Audit the municipality must return a signed copy of the Funding Agreement to the MCCAC.

4.4 Energy Audit Report Structure

This section describes the minimum requirements and minimum content that shall be included in the Energy Audit. This information is required to create a standard format for all program participants. The intent is not to

limit or prescribe the services provided, but to ensure the completeness and quality of the information presented to the respective MCCAC program.

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 Energy Audit Contents

Section	Report Content
Background	Description of the site and buildings: • 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 Description of energy systems: • A review and description of all energy systems (e.g. mechanical, electrical, plug loads, etc.) • Major equipment and load list • Typical annual building energy use by energy type • Typical building energy by end use (e.g. lighting, space heating, etc.) Quantification team: • Team members and qualifications • Date of report and site visit(s) Customer Information: • Site contact information • Municipality name • Building name, type • Unique site identifier or facility address • Utility account numbers Utility Analysis: • Billing Analysis (12-months minimum, 36-months preferred) • Annual utility rate analysis (monthly energy use breakdown) • Facility baseline GHG emissions (tCO2e) Energy End-Use Breakdown: • Detailed building energy end-use breakdown by fuel/energy type • Independent variables affecting energy use (weather, occupancy, other)

Summary of energy conservation measures (refer to the Appendix)	Summary of at least 2 low cost ECMs and 4 capital ECMs within a table(s) including: Energy Savings and GHG Reductions Summary Table (see Appendix A for detail) • ECM number • ECM name • ECM electrical savings (kWh/year) • ECM electrical demand savings (kWh/year) • ECM natural gas savings (GJ/year) • ECM other fuel savings (ex. L/year) • ECM annual GHG reduction (tonnes CO2e/year) • ECM lifetime emission reduction (tonnes CO2e/lifetime) • ECM expected lifespan (years, max 25) Financial Analysis Summary Table (see Appendix B for detail) • ECM capital cost of equipment and installation ($) • ECM annual cost savings ($/year) • ECM simple payback (years) • ECM expected CEC rebate ($) • ECM lifetime abatement rate ($/tonneCO2e lifetime) See Appendix for more details
Project energy conservation measures	*For each individual ECM include:* ECM description: • Description of ECM/retrofit: technology, specifications, efficiency, service lifetime, cost • Description of any changes to operation parameters or load profiles due to ECM • Assumptions made in calculating savings • Describe any non-energy benefits of ECMs Measure boundary: • A description of the scope of all equipment and measurement points in the boundary • List all potential energy interactions Measure baseline: • Description of existing equipment, technology, specifications, and age • Description of normal operating parameters for energy systems within boundary Energy and GHG Performance ECM Analysis Summary Table (see Appendix C for detail) • Baseline adjusted annual energy use (kWh or GJ) • ECM annual energy use adjusted for interactions (kWh or GJ) • ECM electrical savings (kWh/year) • ECM electrical demand savings (kW/year) • ECM natural gas savings (GJ/year) • ECM other fuel savings (ex. L/year) • ECM annual GHG reduction (tonnes CO2e/year) • ECM lifetime emission reduction (tonnes CO2e/lifetime) • ECM expected lifespan (years, max 25) • ECM cost savings ($/year) • ECM capital cost of equipment and installation ($) • ECM simple payback (years) • ECM expected CEC rebate ($) • ECM lifetime abatement rate ($/tonneCO2e lifetime)
Conclusion	Summary of Recommendations and Next Steps • ECM implementation recommendation • Other recommendations as required

Appendix	All supporting materials as required in the described methodology, including: • Measurement processes, data sets, calculations, measure interaction estimates, measure uncertainty estimates, reference sources, assumptions, etc.

4.5 Additional Requirements

The following information must be included with the submission of the Energy Audit:

- A minimum of 2-3 no or low-cost measures (installed costs equal to or below $1,000)
- A minimum of 4 capital measures that are not listed on the Simplified Retrofits List.
    - Any number of measures on the Simplified Retrofits List and solar photovoltaics may be included within the Energy Audit, but neither will count toward the minimum requirements.
- Fully accessible native electronic copies of the ECM analysis/calculations
- Analysis/calculations shall be systematic and easy to follow/review (workbooks with only values and no explanation how values are derived will be rejected)
- Methodology shall be clear and based on sound engineering principles
- All assumptions shall be stated and explained
- Any supporting documentation (i.e. site measurements, shop drawings, vendor and installation quotes, etc.)

The interactive effects between different energy sources shall be included in the analysis and report. The interactive effects between ECMs must also be accounted for and included in the analysis and report.

Sub-metering is NOT specifically required. The expectation is that measurements will be taken to substantiate assumptions made when estimating load factor, runtimes, thermal loads, mass flow, etc. Available information from plant control systems, building schedules or logs can be used to support calculations.

5.0 Appendix

Appendix A: Energy Savings and GHG Reductions Summary Table

ECM	ECM Name	Annual electricity savings	Electricity demand savings	Annual natural gas savings	Annual other fuel savings (include as needed)	Annual GHG reductions	Lifetime GHG reductions	Expected ECM Lifespan
#		kWh/yr	kW/year	GJ/yr	Unit/yr	tCO_2e/yr	tCO_2e	Years
1								
2								
3								
4								
5								
6								
...								
ECM Totals								

Appendix B: Financial Analysis Summary Table

ECM	Description	Total equipment and installation cost	Annual cost savings	Simple payback without incentive	Expected EC rebate	Simple payback with incentive	Lifetime abatement rate
#		$	$/yr	years	$	years	$/$tCO_2e$
1							
2							
3							
4							
5							
6							
...							
ECM Totals							

Appendix C: ECM Analysis Summary Table

ECM Description	Units	Electricity	Electrical Demand	Natural gas	Other fuel	Total (GJ)
ECM energy use – baseline	kWh, kW, GJ, L					
ECM energy use – post retrofit	kWh, kW, GJ, L					
Annual energy savings	kWh, kW, GJ, L					
Eligible annual energy savings	kWh, kW, GJ, L					
Annual GHG reductions	tCO_2e/yr					
Annual energy cost savings	$/yr					

ECM Description	Units	Total
Measure life (max 25 years)	years	
Lifetime GHG reductions	tCO_2e	
ECM unit cost (include when applicable)	$	
Number of units (include when applicable)	#	
ECM total cost	$	
Simple payback without incentive	years	
Expected CEC rebate	$	
Simple payback with incentive	years	
Lifetime abatement rate (Using total installed cost)	$/$tCO_2e$	

Appendix D: ECM Estimated Useful Life (EUL) Guide

Please note, the maximum EUL for any measure funded by the CEC program is 25 years. This is to ensure a conservative estimate and account for uncertainty and the advancement of technology and system efficiencies over this period.

Measure	EUL (years)
Air Compressor - VFD	15
Boiler - Heat Recovery	15
Boiler- Upgrade	25
Boiler - Heat Additive	8
Building Envelope - Insulation	20
Building Envelope - Door Seals & Sweeps	10
Building Envelope - Other	25

Building Envelope - Reduce Air Infiltration	20
Building Envelope - Windows	20
CHP	20
Controls Upgrades - Smart Thermostats, BMS, Other	15
DHW - Instantaneous Water Heater	20
DHW - Pipe Insulation	15
DHW - Tank Insulation	24
DHW - Upgrade	15
Fan - VFD	15
Furnace - Upgrade	18
Ice Canvas	15
Ice Plant - Heat Recovery	25
Ice Plant - Upgrade - CO2 System	25
Ice Plant - Upgrade - Ammonia System	25
Ice Plant - Refrigerant Additive	15
Lighting	Variable
Pump - Replacement	20
Pump, HVAC - VFD	15
Pump, Pool - VFD	15
REALice	15
Rooftop Unit - Upgrade	15
Unit Heaters - Gas and Electric	13
Unit Heaters - Hot Water and Steam	20
Low E Ceiling	20
Pool Cover	10
Hand Dryers	10