GUIDANCE FOR ENERGY MODELLING COMPLIANCE DOCUMENTATION IN LEED® CANADA

LEED® Canada Supplement

CANADA GREEN BUILDING COUNCIL • CONSEIL DU BÂTIMENT DURABLE DU CANADA •

PREFACE FROM THE CaGBC

The built environment has a profound impact on our natural environment, economy, health, and productivity. Breakthroughs in building science, technology, and operations are now available to designers, builders, operators, and owners who want to build green and maximize both economic and environmental performance.

The green building movement offers an unprecedented opportunity to respond to the most important challenges of our time, including global climate change, dependence on non sustainable and expensive sources of energy, and threats to human health. The work of innovative building professionals is a fundamental driving force in the green building movement. Such leadership is a critical component to achieving the Canada Green Building Council's (CaGBC's) vision of a transformed built environment leading to a sustainable future.

CaGBC Membership

The CaGBC's greatest strength is the diversity of our membership. CaGBC is a balanced, consensus based not-for-profit with more than 1,600 member companies and organizations. Since its inception in 2002, CaGBC has played a vital role in providing a leadership forum and a unique, integrating force for the building industry. CaGBC's programs have three distinguishing characteristics:

Committee-based

The heart of this effective coalition is our committee structure, in which volunteer members work with staff and expert consultants to design and implement strategies. Our committees provide a forum for members to resolve differences, build alliances, and forge cooperative solutions for influencing change in all sectors of the building industry.

Member-Driven

Membership is open and balanced and provides a comprehensive platform for carrying out important programs and activities. We target the issues identified by our members as the highest priority. We conduct an annual review of achievements that allows us to set policy, revise strategies, and devise work plans based on members' needs.

Consensus-Focused

We work together to promote green buildings and, in doing so, we help to foster greater economic vitality and environmental health at lower costs. We work to bridge ideological gaps between industry segments to develop balanced policies and programs that benefit the entire industry.

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INTRODUCTION

Energy efficiency reduces the environmental burdens associated with producing and using energy. Building energy simulation plays a key role in the integrated design of high performance buildings to minimize such environmental impacts. The creation of complete and relevant documentation detailing the methods and assumptions used in building energy simulation is vital to understanding the results of the simulation models. Hence, energy modelling compliance documentation forms the basis for awarding Energy and Atmosphere prerequisite 2 (EAp2) Minimum Energy Performance and Energy and Atmosphere credit 1 (EAc1) Optimize Energy Performance points in the certification reviews by the Canada Green Building Council (CaGBC). Such compliance documentation demonstrates the quality of the energy modelling and review work done by the professionals involved and contributes to the integrity of the LEED Canada review process. In addition, the review process is highly valuable to the green building industry; the formal compliance documentation as well as the informal exchange of knowledge that takes place during the review process fuels the growth and evolution of the modelling community in Canada.

Purpose of this document

This guidance document is intended for use by professionals creating whole building energy simulations (commonly known as energy models) using *Approved Energy Simulation Software for LEED Canada* to document compliance for LEED Canada EAp2 - Minimum Energy Performance, and EAc1 - Optimize Energy Performance, in the following LEED Canada Rating Systems:

LEED Canada for New Construction and Major Renovations 1.0 (NC 1.0)

LEED Canada for Core and Shell Development 1.0 (CS 1.0)

LEED Canada for New Construction and Major Renovations 2009 (NC 2009)

LEED Canada for Core and Shell Development 2009 (CS 2009)

This guidance document is intended to standardize energy modelling compliance documentation used in the above LEED Canada Rating Systems. As such, this guidance document is applicable to all LEED Canada projects using the above rating systems. All projects are encouraged to adopt this guidance document in the production of energy modelling and review reports as it provides an outline of the elements required for LEED Canada certification review of EAp2 and EAc1. Energy modelling documentation not in compliance with this guidance document may be accepted at the CaGBC's discretion.

The following sections describe the elements that should be included in energy modelling compliance documentation created for projects pursuing LEED Canada certification. While the level of technical details provided in each section of the documentation may be left to the discretion of the energy modeller or 3rd party reviewer creating the reports, sufficient detail should be provided in these reports to allow another building energy modeller to thoroughly understand the simulation process undertaken to arrive at the projected energy performance being claimed for EAp2 and EAc1. Technical details, clarifications and back up documentation may be requested during the LEED Canada certification review as necessary.

This document is not intended to be a comprehensive guide to documenting building energy simulation work or creating building energy simulation files for LEED Canada certification, and is intended to be independent of the energy simulation software being utilized.

Structure of this document

This guidance document consists of two major parts intended for use by individuals with different roles in LEED Canada projects.

Part 1 (Guidance for writing building energy modelling reports) is intended for use by energy modellers creating an energy modelling report for review by another individual in the following situations related to LEED Canada certification:

- Independent third party review by an individual on *CaGBC's Experienced Modellers List*
- CaGBC full energy model review during LEED certification review - available to LEED Canada NC and CS version 1.0 projects only
- CaGBC certification review using the Experienced Modeller Submittal path - available to LEED Canada NC/CS version 2009 projects, and to LEED Canada NC/CS version 1.0 projects adopting the allowance provided in Credit Interpretation Request (CIR) 839.
- CaGBC certification review using the Energy Modeller Submittal path - available to LEED Canada NC/CS version 2009 projects only, as per the allowance provided in CIR 1255.

Part 1 describes what information sections are typically included in energy modelling reports created for LEED Canada certification.

Part 2 (Guidance for writing 3rd party building energy modelling review reports) is intended for use by energy modellers on *CaGBC's Experienced Modellers List* that are assuming the role of an independent 3rd party energy modelling reviewer for projects pursuing LEED Canada certification.

Part 2 provides details of what sections are typically included in third party energy modelling review reports submitted for LEED Canada certification.

Appendix 1 provides a sample energy modelling report.

Appendix 2 provides sample summaries of monthly energy consumption by end use.

Appendix 3 lists the output file requirements for projects pursuing EAp2/c1 using the Experienced Modeller and Energy Modeller Submittal path.

Note that the terminology 'building energy simulation' and 'energy modelling' are used interchangeably throughout this guidance document.

The energy modelling process

Preliminary building energy simulation provides the greatest value if commenced during the design stage. This allows the modelling process to provide the project team with timely guidance and performance information for the various design options under consideration. However, energy models and/or 3rd party model reviews for the purposes of LEED Canada certification must be based on a reasonable representation of the completed building(s). This final model may be described by as-built drawings, or by issued-for-construction drawings in combination with stamped shop drawings of modelled system components.

Energy simulation professionals (commonly known as energy modellers) are expected to have an intermediate or advanced level of energy modelling skills as well as knowledge of the referenced codes and standards. At a minimum, energy modellers are expected to be familiar with the latest versions of the following documents:

- Relevant energy codes such as Model National Energy Code for Buildings (MNECB) and ASHRAE 90.1 Energy Standard for Buildings
- Reference guides for various LEED Canada Rating Systems, including any addenda and Application Guides
- Natural Resources Canada EE4 Software Version 1.7 Modelling Guide (or updated versions)
- Natural Resources Canada ecoENERGY Submission Checklist for Validation of New Building Designs
- LEED Canada 2009 Supplementary Energy Modelling Guidelines
- LEED Canada 2009 Interpretation Guide for District Energy Systems (April 2012) and/or Interpretation Guide for District Energy Systems (March 2008)
- Guidance for Non-Traditional Fuels in LEED Canada [note: Only projects registered prior to July 1, 2015 may use this guidance document. All projects registered on or after July 1, 2015 must follow CIR 1235 - How should purchased renewable energy and purchased biofuels be treated in the energy model]
- The Canada Green Building Council's Credit Interpretation Request (CIR) database

Energy modelling professionals are encouraged to refer to additional resources and seek continuous training and development opportunities in order to remain informed of the latest developments in the building simulation industry. Additional resources related to LEED Canada certification and energy modelling for LEED Canada certification are available on the CaGBC's website (www.cagbc.org).

The role of individuals on *CaGBC's Experienced Modellers List*

Individuals on *CaGBC's Experienced Modellers List* (the *List*) may assume the following roles in LEED Canada certification of a project:

- Perform an independent 3rd party review of the energy simulation to be submitted for CaGBC review under the LEED Canada NC/CS 1.0 or LEED Canada NC/CS 2009 rating systems.
- Create the energy simulation model(s) to be submitted for CaGBC review using the Experienced Modeller Submittal path for EAp2/c1 under the LEED Canada NC/CS 1.0 or LEED Canada NC/CS 2009 rating systems.

For review and model creation work following one of the two paths described above to be accepted under LEED Canada, the work must be done while the individual is included on the *List*[1]. Therefore, individuals must have been evaluated by the CaGBC and accepted to the *List*, in order to solicit or accept work as 3rd party energy model reviewers. Refer to the *Responsibilities and Code of Ethics for Individuals on CaGBC's Experienced Modellers List* on *CaGBC's Experienced Modellers List* for further details.

LEED Canada NC/CS 1.0 projects that do not engage an individual on *CaGBC's Experienced Modellers List* to create or review the energy simulation model(s) can submit the model(s) to the CaGBC for review during LEED certification for an additional fee. This submittal path is not available to LEED Canada NC/CS 2009 projects.

[1] For LEED Canada NC/CS 2009 projects, individuals not on *CaGBC's Experienced Modellers List* may also create models and compliance documentation with the intent to submit during certification review for EAp2/c1. See CIR 1255 for more details.

PART 1 GUIDANCE FOR WRITING BUILDING ENERGY MODELLING REPORTS

Complete building energy modelling reports, commonly known as energy modelling reports, should thoroughly describe the project and allow another energy modeller to fully understand the project building and the simulation process taken to arrive at the final projected energy performance. Typical reports should include the information listed in sections 1.1 to 1.4, 1.8, 1.9, and 1.10 below, at a minimum. The remaining sections are only necessary if they are applicable to the project.

1.1 Front End

- Include the project name, CaGBC project number, LEED Canada Rating System pursued, energy model baseline code/standard used, and name, title and contact information of the energy modelling professional(s) involved in creating the simulation files.
- For LEED Canada NC/CS 1.0 projects pursuing the Experienced Modeller Submittal path as per CIR 839, include the signature of the individual on CaGBC's Experienced Modeller's List (the *List*) and the date that the final simulation files were completed. Note that for this submittal path, the Experienced Modeller must have created the energy model and the modelling report, or have had a direct supervisory role throughout the creation of the energy model and the modelling report, as per the *Responsibilities and Code of Ethics for Individuals on CaGBC's Experienced Modellers List*. In addition, this work must be done during the time period where their name appears on the *List*. Refer to *CaGBC's Experienced Modellers List* for details.
- For LEED Canada NC/CS 2009 projects using the Experienced Modeller Submittal path or the Energy Modeller Submittal path (as per CIR 1255), include the signature of the energy modeller and the date that the final simulation files were completed. Note that for this submittal path, the energy modeller must have created the energy model and the modelling report.
- Include the name of the final simulation file(s). This should match the name of the final simulation file(s) submitted to the 3rd party reviewer for review, or to the CaGBC for full energy model review during LEED Canada certification.

1.2 Proposed Building Energy Simulation Overview

- General information about the project – location, use/occupancy, gross floor area, number of storeys.
- Building energy simulation software and version used, weather file used.
- The building floor area being simulated. Provide a breakdown of floor areas for situations where the project is a combination of new construction and a major renovation, or where multiple buildings are being certified as a single LEED project, or where any project areas are excluded from the building energy simulation.
- Summary of key energy efficiency/conserving/production measures in the project including an overview of the building heating, ventilation and cooling systems, connection to district energy systems, renewable energy systems, etc.
- Modelling method for lighting (Space type or Building type).
- Description of schedules as they apply to key areas of the project. Note any special schedules for significant end uses (if any).

- Declaration that all applicable MNECB or ASHRAE 90.1 mandatory requirements/provisions have been met or are not applicable to the proposed design. Append all signed mandatory checklists to the simulation report. Where applicable mandatory requirements/provisions are not met by the proposed design, the project team is directed to refer to the CaGBC Credit Interpretation Request (CIR) database for previously allowed exemptions. If exemptions to the mandatory requirements/provisions have been provided through a CIR, include details of the project's applicability and the CIR number. If exemptions have not been provided through a CIR, the project team should submit a new CIR detailing the project circumstances and the potential impact on the project's energy performance for CaGBC review. Note that only the CaGBC may provide exemptions to MNECB and/or ASHRAE mandatory requirements/provisions for the purposes of LEED Canada certification.
- Where guidance from CaGBC CIRs have been applied to the energy model or used in calculating the project's energy performance, provide the CIR number, a copy of the CIR, a description of how it applies to the project, and all required submittal material. Additional details should be provided in the applicable sections of the modelling report below.

1.3 Proposed Building Simulation Details

- Plant
  - Description of building plant equipment. Plant level equipment may include, but are not limited to the following: boilers and/or furnaces, chillers, cooling towers, system pumps, central heat pumps, and service water heaters.
  - Where the project is connected to a District Energy System, include the section titled "District Energy System Details".
  - Where the project is connected to renewable energy systems, include the section titled "Renewable Energy Systems Details".
- HVAC Secondary Systems
  - Description of HVAC secondary configuration(s), including key areas served and major features such as heat recovery, economizers, humidification/dehumidification, zone control, and control systems (local or building level).
  - Description of methodology used to determine and simulate ventilation, the ventilation standard(s) used, including justification for any deviations from Indoor Environmental Quality (IEQ) Prerequisite 1 – Minimum Indoor Air Quality Performance calculations.
- Zoning
  - Description of mechanical zoning and system boundaries, or append typical zoning diagrams overlaying mechanical drawings. These drawings should clearly designate zone and system boundaries, as well as applicable space functions (e.g., for baseline lighting).
- Envelope description and thermal performance for typical opaque assemblies (such as wall, roof, floor, balcony) and window assemblies. Include the method or 3rd party software used to determine these thermal performance values.
- Interior lighting systems, lighting controls, typical lighting power densities, and plug loads. Describe methodology for calculating any lighting control savings or the software used.
- Model workarounds in proposed building simulation
  - Where the simulation software is unable to accurately model a system component or its function, provide a description of the workaround implemented, including calculations and methodology used. Provide this information within the appropriate section of the report.

1.4 Baseline Building Generation

- For the baseline building, provide details for each category listed in Section 1.3 above, in addition to the information listed below.
- Explanation of any differences in overall ventilation quantities between the proposed and baseline building in accordance with the *LEED Canada 2009 Supplementary Energy Modelling Guidelines*.
- Description of the source of baseline plant and building system equipment parameters, and the steps taken to size the baseline building plant.
- Description and justification for any unusual or atypical baseline building lighting power densities (e.g., space types that are not covered under ASHRAE 90.1 or the MNECB).

1.5 District Energy System Details

This section is required for projects connected to a District Energy System (DES).

- Description and calculations for connected DES, including major equipment components, equipment efficiency parameters, distribution system/pumping power losses. If the DES performance is based on actual monitored data, provide the applicable system energy input/output ratios (e.g., input gas and electricity use versus delivered heat) and/or overall system efficiency. For projects using the *LEED Canada 2009 Interpretation Guide for District Energy Systems*, note which Performance (energy simulation) Path is pursued: either Method 1 (streamlined path) or Method 2 (full accounting).
- Description of how the proposed DES was represented in the proposed building simulations. (e.g., work-arounds, custom functions, post-processing, etc.)
- Refer to the *LEED Canada 2009 Interpretation Guide for District Energy Systems* and/or *Interpretation Guide for District Energy Systems* (March 2008) for details on additional documentation requirements for projects connected to a DES.

1.6 Renewable Energy System Details

This section is required for projects connected to renewable energy systems.

- Description of renewable energy features, including system type, size and performance. Include an explanation of any additional calculations to estimate the amount of energy produced by these systems.

1.7 Additional Calculations

This section is required if additional calculations are used in the energy simulation or the energy performance calculations.

- Details and calculations of additional energy savings being claimed for the LEED Canada project that are outside the scope of the modelling software capability. For example, exceptional calculation methods and additional process load savings.
- Exceptional calculation methods:
    - Where the simulation program does not adequately model a design, material, or device, describe an exceptional calculation method to demonstrate energy performance using this method. Include documentation of the calculations performed and theoretical and/or empirical information supporting the accuracy of the method.
- Process load savings:
    - Provide details of methodology for calculating process load savings, referencing the applicable standards for the type of load.

1.8 Utility Rates

- Description of utility rates and the rate structure used in the baseline and proposed energy simulations, and append any supporting documentation from the utility provider to this report.
- For projects using non-traditional fuels, provide relevant methodologies and calculations used in the energy cost savings calculations. Refer to the *Guidance for Non-Traditional Fuels in LEED Canada* for additional details.

1.9 Warnings, Errors, Troubleshooting

- Explanation of major errors reported by the simulation software, and an assessment of unmet heating and/or cooling load hours.

1.10 Building Energy Simulation Results

- Completed and signed EAp2/EAc1 LEED letter template for the LEED Canada Rating System pursued. For projects where EAc1 points cannot be shown accurately by the letter template, provide additional calculations detailing the number of EAc1 points pursued. This may include projects connected to a DES, projects combining new construction and major renovation scopes, or multiple building projects. In such cases, include additional LEED letter templates and explanations as required.
- Summary of energy consumption by monthly (see Appendix 2) or annual end uses for the proposed and baseline buildings. If this information doesn't correspond with the LEED letter template, provide an explanation.
- For LEED Canada NC/CS 1.0 and LEED Canada NC/CS 2009 projects using the Experienced Modeller Submittal path or LEED Canada NC/CS 2009 projects using the Energy Modeller Submittal path (as per CIR 1255), include the simulation output files for the proposed and reference models in electronic format with the project submission. Refer to Appendix 3 of this guidance document for details.

1.11 Appendices

The following items are typically included in the appendices of the modelling report or otherwise included in the submission package for a 3rd party energy model review or for CaGBC full energy model review during LEED Canada certification review. Additional backup documentation for other sections of the report may also be appended for clarity and completeness at the modeller's discretion.

- Zoning diagrams.
- Supporting documentation for utility rates.
- Supporting documentation for major HVAC, and lighting equipment, and envelope components.
- Signed mandatory requirements/provisions checklists (MNECB or ASHRAE).
- Outdoor air calculation spreadsheets.
- Calculations for model work-arounds, exceptional calculations, process energy savings, renewable energy systems, district energy systems, etc.
- Supporting documentation for final energy model:
    - issued-for-construction drawings along with shop drawings of modelled system components, or as-built drawings; and
    - specifications for building systems being modelled, along with controls sequence of operation.

PART 2 GUIDANCE FOR WRITING 3RD PARTY BUILDING ENERGY MODELLING REVIEW REPORTS

A building energy modelling review report, commonly known as 3rd party review report, should detail the quality review process undertaken by the individual on *CaGBC's Experienced Modeller List* (in the role of the independent 3rd party reviewer) in the review of a simulation file(s) for LEED Canada certification purposes. It should provide the CaGBC with an understanding of the changes and modifications made to the simulation files during the review process to arrive at the final energy savings value verified by the 3rd party reviewer.

A typical review report should include the sections listed below as applicable. Alternatively, the 3rd party reviewer may append the original modelling report (written by the energy modeller as per the Part 1 guidance) to the review report, and make reference to the appended modelling report in the appropriate sections.

This report must be signed by the 3rd party reviewer (i.e., individual on the *CaGBC's Experienced Modellers List*) with the completion date that the final review of the simulation file.

2.1 Front End

- Include the project name, CaGBC project number, LEED Canada Rating System pursued, energy model baseline code/standard used, and name, title and contact information of the energy modelling professional(s) involved in creating the simulation files.
- Include the name, title, and contact information of the individual on *CaGBC's Experienced Modellers List* performing the review of the simulation files and creating the review report.
- Simulated energy performance (energy and cost savings) before and after the review.

2.2 Proposed Building Energy Simulation Overview

- Comment on missing information and/or changes made to the information listed in Part 1, Section 1.2.
- Confirm that all applicable MNECB or ASHRAE 90.1 mandatory requirements/provisions have been signed by the appropriate professionals and are met, or are not applicable to the proposed design. Where applicable mandatory requirements/provisions are not met by the proposed design, the project team is directed to refer to the CaGBC CIR database for previously allowed exemptions. If exemptions to the mandatory requirements/provisions have been provided through a CIR, confirm the applicability and appropriate use of the CIR. If exemptions have not been provided through a CIR, the project team should submit a new CIR detailing the project circumstances and the potential impact on the project's energy performance for CaGBC review. Note that only the CaGBC may provide exemptions to MNECB and/or ASHRAE mandatory requirements/provisions for the purposes of LEED Canada certification.

2.3 Proposed Building Simulation Details Review

- Comment on missing information and/or changes made to the information listed in Part 1, Section 1.3.
- Confirm that the proposed building was represented appropriately in the energy model, or, if changes were made, provide details in section 2.9.

2.4 Baseline Building Generation Review

- Comment on missing information and/or changes made to the information listed in Part 1, Section 1.4.
- Confirm that the baseline building was represented appropriately in the energy model, or, if changes were necessary, provide details in Section 2.9.

2.5 District Energy Systems Review

This section is required for projects connected to a District Energy System (DES).

- Comment on missing information and/or changes made to the information listed in Part 1, Section 1.5.
- Confirm that the DES was represented appropriately in proposed building energy model and comment on the system parameters and additional calculations reviewed. If changes were necessary, provide details in section 2.9.
- For projects using the *LEED Canada 2009 Interpretation Guide for District Energy Systems*, confirm the Performance (energy simulation) Path submittal method pursued: either Method 1 (streamlined path) or Method 2 (full accounting).

2.6 Renewable Energy System Review

This section is required for projects connected to renewable energy systems.

- Comment on missing information and/or changes made to the information listed in Part 1, Section 1.6.
- Confirm that the renewable energy system(s) was represented appropriately in the proposed building model, and comment on the system parameters and additional calculations reviewed. If changes were necessary, provide details in section 2.9.

2.7 Additional Calculations Review

This section is required if additional calculations are used in the energy simulation or the energy performance calculations.

- Comment on missing information and/or changes made to the information listed in Part 1, Section 1.7.
- Where additional calculations are used, confirm their validity and whether they have been represented appropriately in the baseline and proposed building simulation files. Provide additional comments as necessary.

2.8 Utility Rates Review

- Comment on the validity of the utility rates and rate structures reviewed.
- For projects using non-traditional fuels, confirm the calculations reviewed. Refer to the *Guidance for Non-Traditional Fuels in LEED Canada* document for further details.

2.9 Changes made to the simulation files

- List of modifications made to the simulation files during the review process as a result of differences in interpretation or errors, along with explanations. Alternatively, provide the explanations in the applicable review sections.

2.10 Building Energy Simulation Results

- Completed EAp2/EAc1 LEED letter template for the LEED Canada Rating System pursued. For projects where EAc1 point calculation is not straightforward, provide additional calculations indicating the EAc1 points pursued. This includes projects connected to a DES, projects combining new construction and major renovation scopes, or multiple building projects. In such cases, include additional LEED letter templates and explanations as required.
- Summary of monthly (see Appendix 2) or annual energy consumption by end use for the proposed and baseline buildings. If this information doesn't correspond with the LEED letter template, provide an explanation.

2.11 Additional Review Notes

- Description of any other modelling issues not covered in other sections.
- Where guidance from CaGBC CIRs has been applied in the energy model or used in calculating the project's energy performance, provide confirmation that the CIRs are applicable to the project and have been used appropriately.

2.12 Appendices

- Modelling report.
- Any additional back up documentation for other sections of the report may be appended for clarity and completeness at the 3rd party reviewer's discretion.

APPENDIX 1: SAMPLE ENERGY MODELLING REPORT

Below is a sample energy modelling report to be submitted to the CaGBC for review or to a 3rd party reviewer. Additional information that may be included in an appendix for this report has not been included here in this guidance document. This sample report is not a template, as it does not fully follow the format identified or provide all the information referenced in this guidance document. It is provided as guidance only.

Project Name: Sample Building XYZ
CaGBC project #: #####
Rating System: LEED Canada-NC 1.0
Baseline: MNECB 1997 baseline
Date: YYYY-MM-DD
Simulator(s): Name of simulator(s)
[Signature of simulator(s)]

Energy Performance: XX%
Energy Cost savings: XX%

Simulation Files:

SampleBuildingXYZ-Pro.* - Energy performance simulation files for Proposed Design
SampleBuildingXYZ-Ref.* - Energy performance simulation files for MNECB-CBIP Baseline Case

Overview:

The following list of building characteristics provides a side-by-side comparison of the building characteristics for the Proposed Design versus the MNECB+CBIP Baseline using EE4v1.7. In summary, the following are the key design characteristics which provide for superior energy performance as compared to the Baseline Case:

- Exterior wall R-value nearly 80% higher than the Baseline
- Roof R-value about 40% higher than the Baseline
- Overall window conduction about 16% lower than the Baseline
- Overall lighting load about 40% lower than the Baseline, including credit for occupancy and daylighting controls
- In-floor radiant heating
- Variable-speed control of main air handling unit, providing for air delivery below minimum 0.4 cfm/sf level of the Baseline
- Heat wheel exhaust air heat recovery at 72.9% effectiveness
- Sea-water source heat pump system providing heating at a seasonal efficiency of COP-3.9 and cooling at over EER-26.
- Sea-water source heat pump system providing service water heating at a seasonal efficiency of COP-4.0.
- Low-flow faucets and showerheads providing 73% lower service water load than for the Baseline.

All MNECB mandatory requirements have been met or are not applicable to the proposed design. See attached signed MNECB checklists.

Table 1. Summary of Models

Baseline Case (MNECB - Region C)	**Proposed Design**
Modeling Software: Proposed design completed in DOE2.1e (release Ec133), using EE4 to set up about 95% of the initial Proposed Design. EE4 used exclusively for the Baseline Case. **Schedules:** Schedules are identical between the Baseline and Proposed Design cases, using MNECB default schedule 'A', which is fairly representative of what is expected for small office type of use. **Space Use Classification:** By space function **Principal Heating Source:** Per MNECB Code Supplement, "heat pump" is the principal heating source. **Conditioned Floor Area:** 10837 sf (1007 m²)	
Building Envelope	
Exterior Walls • From Table 3.3.1.1.A MNECB, Opaque exterior walls at R_o-7 (fossil or heat pump heating).	***Exterior Walls*** • R_o-13 (RSI-2.3) for wood stud walls with 3" rigid polystyrene insulation with Z-girts. • R_o-18 (RSI-3.1) for concrete block walls with 3" rigid polystyrene insulation.
Roof • From Table 3.3.1.1.A MNECB, Type III roof at R_o-12.1 (fossil or heat pump heating).	***Roof*** • R_o-16.9 (RSI-3.0) for metal roof type and with 3" polyiso insulation, mostly with Z-girt thermal bridging.
Glazing • Window area same as for proposed design, up to a fenestration-to-wall ratio (FWR) limit of 0.40, including skylights in calculation of FWR. • From Table 3.3.1.2 MNECB, windows at $U_o = U_o$-0.56 for fixed windows and U_o-0.60 for operable.[2] • From 5.3.5.5, CS, window shading coefficient set to be same as proposed, instead of set at 0.74 as allowed by the MNECB to weigh benefit of beneficial solar gains versus comfort issues. • From 5.3.5.5, CS, window shading coefficient is adjusted by 80% derating for internal shading, dirt, etc. • No overhangs or fins; self-shading same as for proposed (although EE4 does not provide for).	***Glazing*** • Glazing at 21.7% of vertical wall area • Windows input at overall U-value of 0.45 for a mix of $^2/_3{}^{rds}$ fixed and $^1/_3{}^{rd}$ operable windows with thermally broken aluminum framing (determined using FramePlus). Garage door window at – double glazing in non-thermally broken aluminum frames at $U_o = 0.70$. • SHGC at 0.50 for clear low-e windows including frames; garage door windows at 0.51. • Overhangs not included for same reasons as for setting shading coefficient same in baseline and proposed; that is, overhangs provide for comfort but shows an inappropriate penalty because building is not cooled.

[2] Note that EE4 does not set the window U-value and does not match intended value in DOE2, but the discrepancy is consistent between Baseline and Proposed.

Infiltration • From 5.3.5.9 Code Supplement, background infiltration rate of 0.05 cfm/ft^2 of gross wall area, applied 24 hours/day to exterior zones.	***Infiltration*** • Same as for baseline. Note that EE4 erroneously doesn't apply infiltration to unconditioned spaces, which I have corrected.
Lighting	
• Lighting density based on function of zone. Average lighting density is 1.45 W/sf (15.6 W/m²). • 3 kW exterior lighting load, per SSc8.	• Average adjusted space lighting density at 0.87 W/sf (9.3 W/m²), including credit for occupancy sensors and daylighting controls. • 2 kW exterior lighting load.
Appliances and Plug Loads	
• Equipment density based on function of zone. Average daily peak diversified equipment density from MNECB defaults is 0.32 W/sf (3.5 W/m²). • Additional diversified process loads added to server and electrical rooms.	• Must be same as the baseline. • Process loads same as the baseline.
HVAC Equipment.	
System • For multiple zone system (effectively defined by source of ventilation), central VAV with reheat modeled as baseboards. • Single zone systems with constant volume systems	***System*** • AHU-1: Variable volume central air handler serving induction diffusers (except for meeting and boardrooms), with terminal in-floor radiant heating. • Remaining systems not served by AHU-1 as constant volume single zone systems.
Supply and Ventilation Air • Supply air for AHU-1 sized by EE4 at just over 4600 cfm (2200 l/s) based on taking the larger of (1) the outside air requirements or (2) minimum required 0.4 cfm/sf. • Minimum flow rate set at 0.4 cfm/sf after final sizing completed. • Minimum design outside air level same as for proposed. • For multiple zone systems without hydronic cooling (AHU-1), 3.0" for supply and 0.6" for return. Single zone with DX or without cooling (FCU-2), 1.3" for supply and no return; with hydronic cooling (FCU-3), 2.0" for supply and 0.6" for return. • For multiple zone systems without hydronic cooling, 45% for supply efficiency and 25% for return efficiency. Single zone with DX or without cooling, 40% for supply (no return); with hydronic cooling, 50% for supply and 25% for return. • For VAV, use of the appropriate type of fan curve. • No exhaust air heat reclaim.	***Supply and Ventilation Air*** • Supply air flow for AHU-1 at nearly 5900 cfm (2800 l/s) overall. • Minimum supply air rate at 60% of peak supply. • Minimum outside air (O/A) at ASHRAE 62 levels, controlled at 100% of supply (although FCU-1 served by AHU-1 technically may provide for some minor amount of mixed air in simulation). • Fan power at 3.8 kW, based on performance specs (shop drawings) for main AHU-1 and mechanical schedules for remaining fan coils and unit heaters. • Variable speed drive on AHU-1. • Exhaust air heat recovery at 72.9% overall effectiveness for heat wheel, including adjustment for amount of exhaust returned to AHU-1 (see notes).

Control • Heating setpoint at MNECB defaults of 22° / 18°C for zones served by radiant heating[3] (AHU-1); setpoints and schedule same as proposed for remaining zones. • Cooling setpoints, setback temperatures, and schedules same as proposed design. • Enthalpy economizer for mechanically cooled zone. • OA scheduled off to zones that do not require OA during unoccupied periods. • Minimum supply air temperature at 55°F, reset based on warmest zone. • No demand ventilation.	***Control*** • Heating setpoints at 20° / 19°C for zones served by radiant heating (see notes on credit for radiant heating); 22°C / 17°C otherwise, except for core open zone which is allowed to float (indirectly conditioned). • Cooling setpoints: 24°C (MNECB default). • Drybulb economizer in the form of hybrid ventilation tied to DDC control, but is not implemented because of how EE4 inappropriately restricts cooling control of non-mechanically cooled zones. Server zone without economizer control. • OA scheduled off during unoccupied periods. • Minimum supply air temperature at 61°F (16°C), with outside air reset. • No demand controlled ventilation, although CO2 sensors installed, but only to monitor indoor air quality and provide alarms if IAQ is unsatisfactory.
Heating Plant • One electric resistance boiler since proposed has 100% GSHP system. Unfortunately, EE4 does not allow the specification of "heat pump" principal heating source in the zone *and* allow for use of an electric resistance boiler. Hence, the baseline had to be modified manually in DOE2. • Temperature drop through the hot water loop of 29°F. • Constant flow hot water circulation. • Hot water circulation same as proposed (40 ft. is default).	***Heating Plant*** • Baseline with sea water source heat pumps (SWHPs), with hot water reset[4], a seasonal average COP of 3.87 from Water Furnace specs. • Temperature drop of 7.2°C • Constant flow hot water circulation • Hot water circulation at 285 kPa head overall, including sea water heat rejection pumping[5].

[3] When a more typical setback schedule is introduced, many of the zones are underheated for more the 100 hours because of having inadequate capacity to handle the pick-up load. As this is not the case for the actual proposed design with a more constant temperature profile, the baseline baseboard capacities are modified as necessary to provide for MNECB-compliant requirements of having <100 under-heated hours in any zone (which ends up conservative compared to proposed design since the reference still has more under-heated hours).

[4] Hot water reset outside of EE4 using DOE2 since it directly provides this capability.

[5] DOE2 requires that all pumps be represented using a single equivalent set of pump characteristics.

Cooling • Central reciprocating chiller at COP 3.8 for hydronic cooling. Temperature rise of 5.6°C. • Circulation head same as proposed. • Constant flow chilled water circulation. • Two cell cooling tower with 85°F – 95°F temperature rise, and a constant speed fan with cycling control and 5.9 hp/1000 MBH. Constant speed tower pump at 60 ft head and combined efficiency of 70%. • Mechanical cooling scheduled off same as for proposed design[6].	***Cooling*** • Cooling at 26.4 EER from sea water-to-water heat pumps. • Temperature rise of 2°C. • Circulation head at 0 feet since pumping from same pumps as for heating (and already accounted for). • Constant flow chilled water circulation. • Only server room mechanically cooled (FCU-3).
Domestic Hot Water (DHW)	
• Since proposed is all electric, then electric resistance. • Load same as Proposed.	• Service water heating provided from sea water source heat pump (WW-5) at COP of 4.0. • Load set corresponding to MNECB defaults, reduced with 0.5 gpm faucets and 1.5 gpm shower (per shop drawings).
Renewable Energy Systems	
• No renewable energy applies.	• Photovoltaic system providing 8800 kWh/year, determined using RETScreen (see EAc2 documentation).
Utility Rates	
• Electricity rate same as Proposed.	• Electricity Rates set at BC Hydro 1220 tariff of 6.8 ¢/kWh.

Additional Simulation Notes:

Roof Air Space: High ceiling is open and exposed to entire first floor and open centre core and the load is effectively …

Radiant Heating Credit: From the LEED Canada New Construction 1.0 Reference Guide, credit for radiant heating may be provided if "HVAC systems are controlled based on …

Exhaust Heat Recovery Effectiveness is applied in DOE2 for central (non-zonal) systems using DOE2's heat recovery capability. This adjusts for …

[6] Note that EE4 does not provide for this, but can be specifically represented in DOE2.

APPENDIX 2: SAMPLE SUMMARIES OF MONTHLY ENERGY CONSUMPTION BY END USE

Below are sample summaries of monthly energy consumption by end use. These summaries may be included in the modelling report or the 3rd party review report in addition to annual end use summaries. The samples below are not automatically generated by the energy modelling software, they are custom generated to facilitate the modelling and review process to further understand the building's energy performance. These summaries are not intended to be templates, and are provided as guidance only.

Table 1: Summary of monthly energy consumption by end use, Proposed building

File: C:\PROJECTS\SAMPLEPROPOSED **Title:** SAMPLE PROJECT - LEED NC 1.0 EAc1 Proposed
Date: 21-Jan-13
Area: 700,702 ft²

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	kWh/ft²
ELECTRICITY	Lights	kWh	115858	97688	105163	102377	105477	93503	100346	101830	100385	111539	110759	114420	1,259,345	1.80
		kW	450.9	442	433.2	391.9	433.2	300.3	376.2	397.7	399.8	424.3	433.2	468.7	468.7	0.67
	Equipment	kWh	184409	162754	180046	181571	188789	172827	184409	184426	177191	188789	177208	175649	2,158,068	3.08
		kW	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	0.75
	Cooling	kWh	8072	3221	4822	11843	26052	42591	63819	58458	35389	16947	6083	3546	280,843	0.40
		kW	607.6	78.5	58.8	607.6	607.6	715.9	806	607.6	607.6	607.6	97.9	57.3	806.0	1.15
	Heating	kWh	2368	2053	1833	1393	1002	767	721	738	834	1313	1636	2107	16,765	0.02
		kW	14	14	9.5	9.5	5.7	3.8	1.9	1.9	3.8	7.6	9.5	9.5	14.0	0.02
	Heat Rejection	kWh	0	0	0	0	0	0	0	0	0	0	0	0	-	0.00
		kW	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0.1	0.00
	Pumps	kWh	6409	5831	7020	7216	7909	8011	8016	8039	7216	7580	6738	6145	86,130	0.12
		kW	24.3	24.5	23.8	22.4	21.7	22	24.6	25.4	21.7	21.3	22.2	23.8	25.4	0.04
	Fans	kWh	80424	70072	78497	85500	99629	104711	122039	120130	101173	90770	78452	73708	1,105,105	1.58
		kW	344.2	357.5	326.1	441.2	465	476.8	488.1	471.3	467.4	430.8	350.3	278.1	488.1	0.70
	DHW	kWh	19378	17000	18800	19163	19956	18008	19378	19378	18585	19956	18585	18223	226,410	0.32
		kW	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	0.10
	Exterior Lights	kWh													-	0.00
		kW													-	0.00
	Exterior Misc	kWh													-	0.00
		kW													-	0.00
	All end uses	kWh	416,918	358,619	396,181	409,063	448,814	440,418	498,728	492,999	440,773	436,894	399,461	393,798	5,132,666	7.33
		kW	1323.7	1325.8	1311.5	1379.7	1404.3	1412.5	1433.5	1446.4	1416.3	1367.6	1349.4	1380.6	1,446.4	0.0021
		Energy charge	30844	26530	29310	30263	33205	32583	36898	36474	32610	32323	29553	29134	$ 379,727	$ 0.54
		Demand	12078	12078	12078	12078	12078	12078	12078	12078	12078	12078	12078	12078	$ 144,936	$ 0.21
		Fixed charge	0	0	0	0	0	0	0	0	0	0	0	0	$ -	$ -
		Total charge	$ 42,922	$ 38,608	$ 41,388	$ 42,341	$ 45,283	$ 44,661	$ 48,976	$ 48,552	$ 44,688	$ 44,401	$ 41,631	$ 41,212	$ 524,663	$ 0.75
		$/kWh	$ 0.103	$ 0.108	$ 0.104	$ 0.104	$ 0.101	$ 0.101	$ 0.098	$ 0.098	$ 0.101	$ 0.102	$ 0.104	$ 0.105	$ 0.102	
FUEL	Heating	GJ	3251.5	2814.6	1983.0	1083.6	376.6	83.9	41.9	51.3	198.9	823.3	1523.2	2661.1	14,892.8	5.91
		GJ/hr	19.72	20.13	18.71	16.16	8.22	3.58	2.55	3.21	5.95	12.22	15.40	18.69	20.13	7.98
	Cooling	GJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.00
		GJ/hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DHW	GJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.00
		GJ/hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	All end uses	GJ	3251.5	2814.6	1983.0	1083.6	376.6	83.9	41.9	51.3	198.9	823.3	1523.2	2661.1	14,892.8	5.91
		GJ/hr	523.3	534.3	496.5	428.8	218.2	95	67.8	85.3	158	324.4	408.7	496.1	534.30	
		GJ/hr	523.30	534.30	496.50	428.80	218.20	95.00	67.80	85.30	158.00	324.40	408.70	496.10	534.30	211.86
		Energy charge	19907	17251	12196	6729	2404	563	290	352	1299	5141	9401	16318	$ 91,851	$ 0.13
		Fixed charge	0	0	0	0	0	0	0	0	0	0	0	0	$ -	$ -
		Total charge	$ 19,907	$ 17,251	$ 12,196	$ 6,729	$ 2,404	$ 563	$ 290	$ 352	$ 1,299	$ 5,141	$ 9,401	$ 16,318	$ 91,851	$ 0.13
		$/GJ	$ 6.12	$ 6.13	$ 6.15	$ 6.21	$ 6.38	$ 6.71	$ 6.92	$ 6.87	$ 6.53	$ 6.24	$ 6.17	$ 6.13	$ 6.17	
	Total	Energy (ekWh)	1,320,318	1,140,624	947,148	710,147	553,445	463,718	510,363	507,243	496,048	665,645	822,673	1,133,159	9,270,532	13.23
		Charge ($)	$ 62,829	$ 55,859	$ 53,584	$ 49,070	$ 47,687	$ 45,224	$ 49,266	$ 48,904	$ 45,987	$ 49,542	$ 51,032	$ 57,530	$ 616,514	$ 0.88

Less Non-Regulated (Equipment):	$220,599
Net:	$395,915
MNECB/CBIP EAc1 Baseline:	$879,418
Savings:	54.98%

Table 2: Summary of monthly energy consumption by end use, MNECB baseline building

File: C:\PROJECTS\SAMPLEBASELINE **Title:** SAMPLE PROJECT MNECB/CBIP LEED NC 1.0 EAc1 Baseline
Date: 21-Jan-13
Area: 700,733 ft²

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	kWh/ft²
ELECTRICITY	Lights	kWh	294709	256960	284131	292738	305321	271548	294709	294743	282125	305321	282160	273485	3,437,950	4.91
		kW	1030.1	1030.1	1030.1	1030.1	1030.1	1030.1	1030.1	1030.1	1030.1	1030.1	1030.1	1030.1	1,030.1	1.47
	Equipment	kWh	184409	162754	180046	181571	188789	172827	184409	184426	177191	188789	177208	175649	2,158,068	3.08
		kW	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	528.6	0.75
	Cooling	kWh	0	0	0	6594	42452	109902	195427	172522	73031	19533	814	0	620,275	0.89
		kW	0	0	0.3	597.8	712.2	1188.7	1171	1207.6	971.3	578.8	169.6	0	1,207.6	1.72
	Heating	kWh	9192	8322	8987	7660	5589	2934	2319	2470	3782	7368	8369	9127	76,119	0.11
		kW	13	13	13	13	13	13	13	13	13	13	13	13	13.0	0.02
	Heat Rejection	kWh	0	0	64	2181	13253	29589	43393	40138	19212	6205	385	0	154,420	0.22
		kW	0	0	64.3	89.7	155.9	199.5	202	203.5	182.5	90	64.9	0	203.5	0.29
	Pumps	kWh	20263	18436	20034	19204	30084	40139	44583	43135	31718	23745	18643	20177	330,161	0.47
		kW	28.5	28.5	28.5	132.7	132.7	132.7	132.7	132.7	132.7	132.7	132.7	28.5	132.7	0.19
	Fans	kWh	121658	105993	118262	128224	143282	143485	161908	160711	139052	133554	117285	111490	1,584,904	2.26
		kW	425.5	429.6	432	521.7	502.5	524.6	545	537.7	536.9	512.6	444.6	403.9	545.0	0.78
	DHW	kWh	19378	17000	18800	19163	19956	18008	19378	19378	18585	19956	18585	18223	226,410	0.32
		kW	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	0.10
	Exterior Lights	kWh													-	0.00
		kW													-	0.00
	Exterior Misc	kWh													-	0.00
		kW													-	0.00
	All end uses	kWh	649,609	569,465	630,324	657,335	748,726	788,432	946,126	917,523	744,696	704,471	623,449	608,151	8,588,307	12.26
		kW	2091.8	2088	2100.4	2967.4	3059.2	3536.4	3558.6	3558.9	3404.1	2862.3	2438.3	2075.6	3,558.9	0.0051
		Energy charge	48063	42133	46637	48635	55398	58336	70006	67889	55100	52123	46128	44996	$ 635,444	$ 0.91
		Demand	29717	29717	29717	29717	29717	29717	29717	29717	29717	29717	29717	29717	$ 356,604	$ 0.51
		Fixed charge	0	0	0	0	0	0	0	0	0	0	0	0	$ -	$ -
		Total charge	$ 77,780	$ 71,850	$ 76,354	$ 78,352	$ 85,115	$ 88,053	$ 99,723	$ 97,606	$ 84,817	$ 81,840	$ 75,845	$ 74,713	$ 992,048	$ 1.42
		$/kWh	$ 0.120	$ 0.126	$ 0.121	$ 0.119	$ 0.114	$ 0.112	$ 0.105	$ 0.106	$ 0.114	$ 0.116	$ 0.122	$ 0.123	$ 0.116	
FUEL	Heating	GJ	4212.2	3648.2	2891.6	1878.2	975.7	298.6	211.5	227.5	465.6	1457.3	2320.9	3637.1	22,224.5	8.81
		GJ/hr	22.51	22.84	21.44	18.54	9.91	4.90	3.66	4.07	7.51	14.24	17.75	21.55	22.84	9.05
	Cooling	GJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.00
		GJ/hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DHW	GJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.00
		GJ/hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	All end uses	GJ	4212.2	3648.2	2891.6	1878.2	975.7	298.6	211.5	227.5	465.6	1457.3	2320.9	3637.1	22,224.5	8.81
		GJ/hr	597.5	606.1	569.1	492	263.1	130.1	97	107.9	199.4	377.9	471.1	572	606.10	
		GJ/hr	597.50	606.10	569.10	492.00	263.10	130.10	97.00	107.90	199.40	377.90	471.10	572.00	606.10	240.32
		Energy charge	25747	22318	17719	11558	6071	1922	1379	1482	2956	9000	14249	22251	$ 136,652	$ 0.20
		Fixed charge	0	0	0	0	0	0	0	0	0	0	0	0	$ -	$ -
		Total charge	$ 25,747	$ 22,318	$ 17,719	$ 11,558	$ 6,071	$ 1,922	$ 1,379	$ 1,482	$ 2,956	$ 9,000	$ 14,249	$ 22,251	$ 136,652	$ 0.20
		$/GJ	$ 6.11	$ 6.12	$ 6.13	$ 6.15	$ 6.22	$ 6.44	$ 6.52	$ 6.51	$ 6.35	$ 6.18	$ 6.14	$ 6.12	$ 6.15	
	Total	Energy (ekWh)	1,819,949	1,583,093	1,433,724	1,179,170	1,019,828	871,404	1,004,889	980,741	874,063	1,109,365	1,268,291	1,618,702	14,763,219	21.07
		Charge ($)	$ 103,527	$ 94,168	$ 94,073	$ 89,910	$ 91,186	$ 89,975	$ 101,102	$ 99,088	$ 87,773	$ 90,840	$ 90,094	$ 96,964	$1,128,700	$ 1.61
													Less Non-Regulated (Equipment):		$249,282	
													Net:		$879,418	

APPENDIX 3: GUIDANCE FOR SUBMISSION OF OUTPUT FILES FOR THE EXPERIENCED MODELLER AND ENERGY MODELLER EAp2/EAc1 SUBMITTAL PATHWAYS

For projects pursuing EAp2 and EAc1 under the Experienced Modeller Submittal path or the Energy Modeller Submittal path, the following are considered output files for the below listed pieces of approved simulation software for LEED Canada. Note this list is not exhaustive and the information provided here is a guideline only and may change based on simulation software updates. For the complete list of approved energy simulation software, refer to the document *Approved Energy Simulation Software for LEED Canada*.

Note that output files should be submitted in a searchable format wherever possible (such as .txt, .xls, or .doc files).

DOE based software (EE4, DOE-2, eQuest, Visual DOE, EnergyPro etc.):

- .bld files, for EE4, EnergyPro
- Output (sim) files containing at least BEPS, BEPU and ES-D reports
- Summary portion of LV-D reports
- SV-A, PS-C and PS-E reports

IES-VE:

- Collection of reports including the following:
    - General information
    - Space summary
    - Advisory messages, includes number or hours heating/cooling loads not met, errors, warnings, overridden defaults
    - Comparison of proposed vs. baseline energy model inputs
    - Energy type summary
    - On-site renewable energy (if applicable)
    - Exceptional calculation measure summary (if applicable)
- Performance rating method compliance reports
    - Baseline performance by end use and fuel types, plus annual loads
    - Baseline energy costs by utility type
    - Performance rating table: energy performance of proposed and baseline cases by end use, fuel type and demand, and annual totals and % savings
    - Energy cost and consumption by energy type

HAP:

- LEED 2009 EAp2 credit form generated by the software. This report contains the following information:
    - Energy use and peak demand by end-use component, and total energy use for the proposed building, all four baseline building orientations, and the baseline average
    - Energy cost for the proposed building, all four baseline buildings, and the baseline average
    - Unmet load hours for cooling and heating
    - Energy-use intensity
- Annual Cost Summary report
- Energy Cost Budget by System Component Report
- Zone Temperature Report and Unmet load reports (for plants and systems)
- Monthly Energy Use by Component report
- Monthly Air system Simulation Results and Monthly Plant Simulation Results reports