Savings by Design (SBD) – Part 3 Buildings

Energy Modelling Guide – 2020

For use in the SBD Commercial and SBD Affordable Housing Programs

Prepared by

Sustainable Buildings Canada

Acknowledgements

Sustainable Buildings Canada (SBC) has prepared this Guide as a resource for energy modellers participating in the Enbridge Savings by Design (SBD) program. SBC wishes to thank all modellers participating in the program for their continuing support for the program and their active involvement in improving the program and the critical energy modelling science that supports it.

SBC would like to thank Ryan Evans and the team from EVNA Services for their significant contributions to the development of this Guide. Any errors or omissions are purely the responsibility of Sustainable Buildings Canada.

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1.0 INTRODUCTION

The Enbridge Savings by Design (SBD) program as delivered by Sustainable Buildings Canada (SBC) includes an integrated design process (IDP) component to help builders improve energy and environmental performance in their new construction projects. The program is offered to commercial, multi-unit residential and affordable housing projects falling under Part 3 of the OBC. The program may also be applied for Part 10/11 or similar major retrofit programs as determined by Enbridge. Enbridge offers the SBD program under 2 separate initiatives – SBD Commercial (SBD-Comm) and SBD Affordable Housing (SBD-AH) where the primary distinction is the nature of the incentives provided to the proponent. The energy modelling requirements are the same for each.

For the SBD-Comm program, qualifying projects must be located within the Enbridge service area, are required to have a minimum floor area of 50,000 ft², must comply with Ontario Building Code (OBC) Supplementary Standard SB-10, and be intended for commercial, institutional, industrial or multi-family residential occupancy. Note that Enbridge will make exceptions to the 50,000 ft^2 requirement on a case by case basis. Projects are further required to use natural gas in the final design. The SBD-AH program does not have a minimum size requirement but does require the use of natural gas in the final design.

The program includes a 1-day design workshop where builder teams and subject matter experts (SMEs) collaborate on ways to improve the energy and environmental performance of the proposed building. Energy modelling is used to demonstrate and estimate the energy performance potential for various design and equipment improvements. Follow-on incentive funding is available for projects designed and built to meet an annual energy performance level consistent with the requirements of the SBD-Comm and SBD-AH programs.[1] Details on those incentives can be found here:

- Commercial, Institutional, MURBs: http://commercial.savingsbydesign.ca/
- Affordable Housing: https://energy-savings-programs.ca/savings-by-design/

1.1 Purpose of this Energy Modelling Guide

This energy modelling Guide is intended for use by professionals creating whole building energy simulations (commonly referred to as energy models) using approved SBD Energy Modelling Software, as found in Section 3.2 of this document who are participating in the SBD program and who may subsequently apply for SBD incentive funding for their qualified construction projects.

This Guide aims to standardize the energy models submitted to the SBD-Comm and SBD-AH programs. It describes the energy modelling processes and supporting documents that are required for a clear assessment of the measures implemented in the various design models, and the energy simulation process undertaken to achieve the energy performance results claimed.

This document also identifies additional energy modelling resources and guidance for claiming credit for Energy Conservation Measures (ECMs) not recognized by the OBC Supplementary Standard SB-10 and is to be considered independent of the energy modelling software being utilized.

The document also includes "Condensed Guidelines" as Appendix I. These have been provided for Advanced Users who already have familiarity with the SBD modelling requirements.

[1] While the modelling requirements are the same, the eligibility requirements and incentive structures are different for each program.

2.0 SAVINGS BY DESIGN PROGRAM

The SBD program consists of three separate phases that are purposely aligned with the building's construction process, with the objective that an Integrated Design Approach is adopted by the project's design team in the initial design phases and continued until the project's completion. The following flow charts provide a detailed illustration of the SBD process at each of the three program stages:

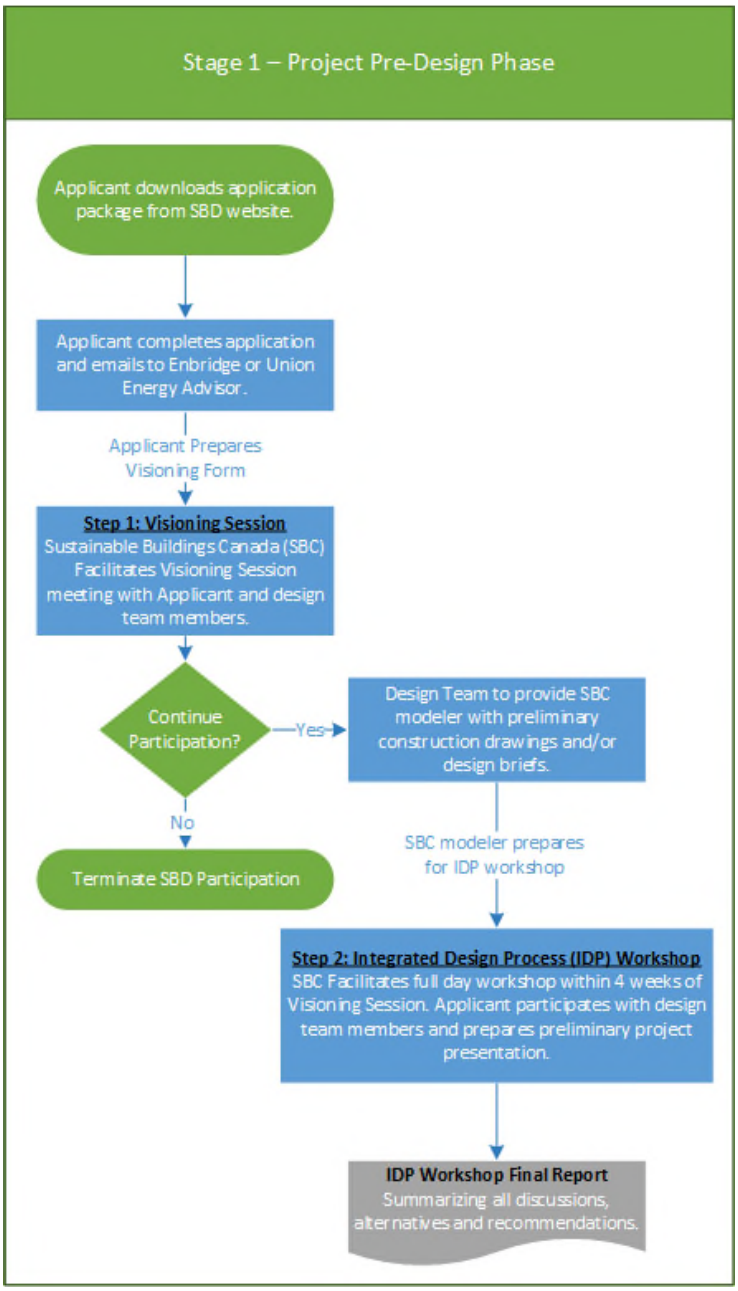
Stage 1 – Pre-Design Phase

A Proponent wishing to participate in the SBD program must first download/complete an application form and submit to their Enbridge Energy Advisor or representative.

A preliminary Visioning (planning) Session is facilitated by SBC that is intended to define the project requirements. It also identifies the priority issues to be covered in the IDP workshop and the required attendees.

With the Visioning Session completed, the Proponent's design team provides the energy modeller with design drawings for the purposes of creating the required energy models. The IDP workshop is typically scheduled within 4 weeks of the Visioning Session.

On the day of the IDP workshop, the proponent's development team and the assigned subject matter experts (SMEs) collaborate on a guided discussions focused on specific components of the building design. The energy modeller may conduct real time simulations to quantify the energy savings associated with the Energy Conservation Measures (ECMs) identified by the SMEs. (Note that SBC typically requests the SMEs to provide recommended ECMs in advance of the workshop in the expectation that much of the modelling can be done before the workshop. Real time modelling may be only for the purpose of the final SBD measure selection).



The energy modeller presents the simulation results, and the incremental energy savings for each of the proposed ECMs. As part of this presentation, the energy modeller is expected to describe the ECM and how it impacts energy use. The energy modeller must also denote ECMs that might require a change to the Reference Case.

Following the IDP workshop, a Final Report is prepared for the Proponent, summarizing all the design alternatives and related discussions and recommended ECMs used to achieve the SBD energy performance target. The energy modeller prepares a "Workshop Simulation Results Summary" using the official SBD templates as part of this Report. It is expected that this Report will be provided within 3 weeks of the IDP workshop..

Stage 2 – Project Design Phase

Following the IDP Workshop, the design team will continue working on the project's design.

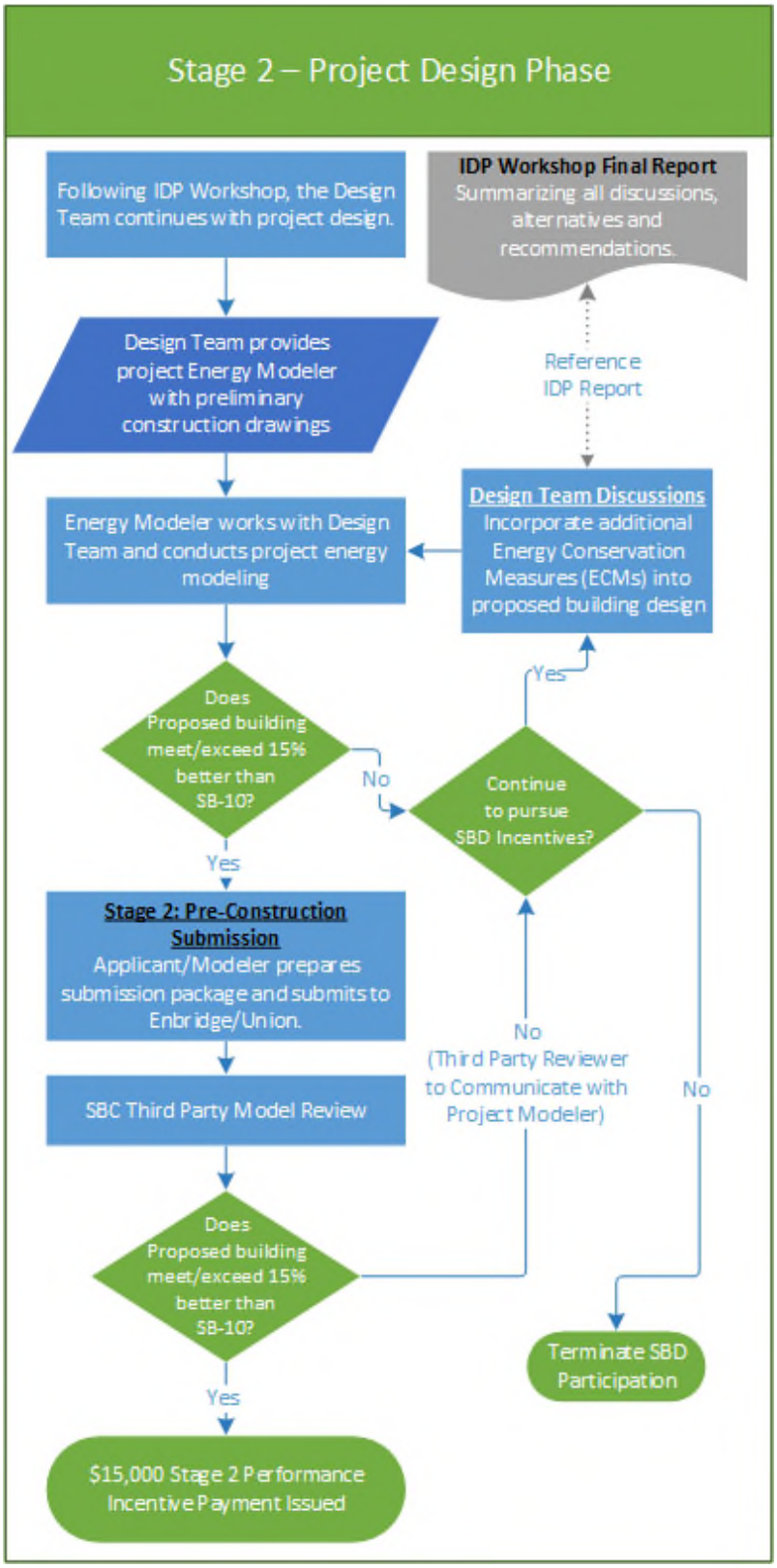
At this phase of the project, the design team engages an energy modeller (who might be the same modeller used for the IDP whose role is to prepare "As-Designed" energy models as guided by the project design team, to ensure the project meets the Proponent's desired energy performance target.

As the design team prepares the project for building permit submission, the energy modeller ensures that the Baseline Building design meets or exceeds the SBD energy target to qualify for the Stage 2 Performance Incentive.

For projects that meet the SBD performance requirement, the Proponent and energy modeller prepare the Stage 2: Pre-Construction Submission package (refer to Section 2.1.2 below for details) and submit these to Enbridge for review.

A Third Party Reviewer verifies that the project meets the SBD program requirements; a Project Design Approval Recommendation Report is issued to Enbridge and the Stage 2 Incentive is processed for payment.

In the event the Third Party Reviewer determines that the project does not meet the program performance requirements, the design team has an opportunity to consider implementing other ECMs to meet the performance target.



Phase 3 – Post-Construction (Commissioning) Phase

Following a successful third-party review and receipt of the Stage 2 Project Design Incentive, the project's SBD application is put on hold until the construction is complete.

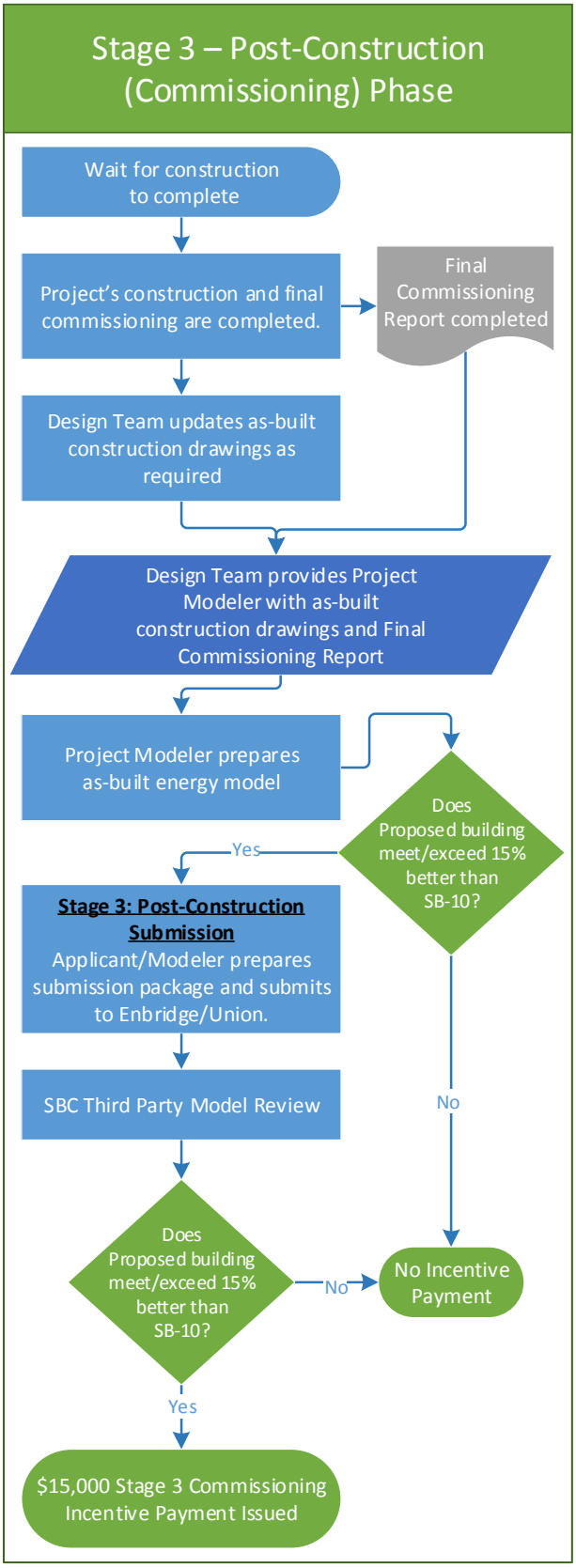
Once the project construction is complete, which is typically determined by the building occupancy permit and final commissioning report, the energy modeller makes the necessary updates to the energy models to reflect the as-built design drawings.

As part of this update, the energy modeller must ensure that the as-built building meets or exceeds the SBD performance target to qualify for the Stage 3 Commissioning Incentive.

For projects that meet the SBD performance requirement, the Proponent or energy modeller prepares the Stage 3: Post-Construction Submission package (refer to Section 2.1.3 below for details) and submits to their Enbridge representative for review.

A Third Party Reviewer verifies that the project meets the SBD program requirements, a Project Completion Report is issued to Enbridge and the Stage 3 Commissioning Incentive is processed for payment.

In the event the Third Party Reviewer determines that the project does not meet the program's performance requirements, the project will not receive the Stage 3 Commissioning incentive.



2.1 Savings by Design (SBD) Submission Forms

The following sections summarize the required documents for each of the SBD process stages.

2.1.1 Stage 1: Pre-Design Phase

The Proponent is required to submit a completed **Application Form** (available on the SBD links provided above). Once the application form has been submitted and approved by Enbridge, the Proponent, with the assistance of the various design team members, should complete as much of the project's **Visioning Form** as possible in preparation for the Visioning Session (available on the SBD links provided above).

Although not necessary, it is recommended that the Proponent engage an energy modeller as a member of the design team during the project's pre-design phase. Having an energy modeller on the design team in the early stages of the project's design is an important consideration in high performance building designs. It will also ensure the project meets the necessary Municipal and Provincial energy regulations and presents synergies between modelling done for compliance and modelling done for the SBD program.

In the event that the design team does not have an energy modeller on their team, SBC will assign one from the roster of approved energy modelling firms. This energy modeller is engaged purely for the energy modelling as relates to the SBD IDP activity.

2.1.2 Stage 2: Project Design Phase (Pre-Construction)

A new SBD submission form has been created to assist with conducting third-party modelling reviews and processing incentive application submissions for payment.

The form consists of a Project Summary page for the Proponent/Energy Modeller to complete the Required Documentation Checklist, itemizing all the necessary supporting documents that must be included in each of the Proponent's Stage 2 submission package. Note that the energy modelling undertaken for the Stage 2 and Stage 3 submissions is undertaken by the proponent with a contracted energy modeller who may or may not be the same modeller who was engaged for the purposes pf the IDP.

The following documents must be submitted to constitute a complete Stage 2 Pre-Construction submission package:

<u>Supporting documentation required by the Proponent:</u>

- Building Construction Permit Application including a copy of the municipal receipt
  - *This is required to verify the OBC SB-10 version and compliance path followed*
- Working As-Designed Energy Models
  - *This includes SB-10 Reference Building and as-designed Baseline/Proposed Building models*
- Energy Modelling Report issued for permit
  - *This is the report prepared by the project's energy summarizing the as-designed modelling methodologies and assumptions, model input, energy performance results and SB-10 compliance*
- Take-off Calculations issued for permit
  - *These are the energy modellers external calculations to support the model input*
- Architectural Drawings and Specifications (issued for permit)
- Mechanical Drawings and Specifications (issued for permit)
- Electrical Drawings and Specifications (issued for permit)
- Note: Additional documentation may be required upon request by the GDC.

2.1.3 Stage 3: Post-Construction (Commissioning) Phase

The Proponent or Proponent's energy modeller is required to submit the following documents after project completion/occupancy permit date to constitute a complete Post-Construction submission package (*Note, submit updated as-built documentation if it differs from the pre-construction documentation).*

Supporting documentation required by the Proponent:

- Building Permit (issued by municipality)
- Occupancy Permit (issued by municipality)
- Working As-built Energy Model
  - *This includes SB-10 Reference Building and as-built Baseline/Proposed Building models*
- Final As-built Energy Modelling Report
  - *This is the report prepared by the project's energy modeller summarizing the as-built modelling methodologies, model input, energy performance results and SB-10 compliance*
- Take-off Calculations
  - *These are the energy modeller 's external calculations to support the as-built model input*
- Architectural Drawings and Specifications (issued for construction/as-built)
- Mechanical Drawings and Specifications (issued for construction/as-built)
- Electrical Drawings and Specifications (issued for construction/as-built)
- Product cut sheet(s) / spec sheet(s) / shop drawings for installed energy efficient measure(s)
- ***Recommended:*** Commissioning Report by accredited commissioning agent[2]
- Note: Additional documentation may be required upon request by the GDC

2.2 Definitions and Abbreviations

Applicable Building Code : means (a) the "building code" as defined in the Building Code Act, 1992 (Ontario), as may be amended; and (b) any other applicable building code imposed by a municipality, if any, to the extent that it supplements the building code referred to in (a) or any part thereof.

Application: means the application completed by the Proponent and includes all submitted supporting documentation**.**

Baseline/Proposed Building: (i.e. 'Proposed Design' references the building as designed using the Eligible Measures specified in the Application. For the SBD program, the Baseline/Proposed building represents the design team's current design – the design that is the starting point for the IDP workshop. In some cases, it could be the same as the Reference design. At the IDP workshop, it is expected that the energy modeller will present the energy model results for this case along with the Reference and SBD Buildings.

Building: A wholly enclosed structure used or intended for supporting or sheltering any use or occupancy. Buildings that are subject to the practices outlined in this modelling guide include buildings under Part 3 of the Ontario Building Code and Supplementary Standard SB-10.

Building Permit Application: means the initial construction building permit application submitted to the municipality to obtain a building permit.

[2] While not required for securing the incentive, proponents are encouraged to complete a commissioning activity and Enbridge reserves the right to request the commissioning report as part of a post project evaluation activity.

Clear Field Assembly: An opaque wall or roof assembly with uniformly distributed thermal bridges, which are not practical to account for on an individual basis for U-value calculations. Examples of thermal bridging included in the Clear Field are brick ties, girts supporting cladding, and structural studs. The heat loss associated with a Clear Field assembly is represented by a U- value (heat loss per unit area).

CWEC (2016): normalized Canadian weather data for energy calculations, which includes up to 30 years of data through 2014, available for download here: climate.onebuilding.org

Dormitory: consists of individual bedrooms with individual or common/shared bathrooms, common areas, and either a shared common kitchen or no kitchen at all. For the purpose of the SBD program, the Dormitory space type shall not be used in place of a Dwelling Unit space type (see Residential Dwelling Unit).

Energy Conservation Measure (ECM): is any type of design change or technology recommendation that improves a building's energy performance. Under the SBD program, an ECM reduces the energy use of SBD Building relative to the Reference Building. (It is noted that ECMs may not always improve the energy performance – utility cost, comfort or other factors can influence the recommended ECM selection.

Energy Modelling Report: means a report to be submitted by a Proponent's energy modeller summarizing the methodology and assumptions used with the Approved Modelling Software, in accordance with the required report templates. The Energy Modelling Report is a separate document from the report prepared following the IDP Workshop (which is referred to as the IDP Workshop Report and is prepared by SBC).

Energy-Recovery Ventilator (ERV): A heat-recovery ventilator designed to transfer heat and moisture.

Energy Savings: means the aggregate of all energy savings expressed in consistent units of ekWh/yr AND GJ/yr and as a percentage of the total annual energy consumption for the Project (calculated as the aggregate of all energy consumption in the Reference Building, minus all energy consumption in the Proposed Building, divided by the energy consumption in the Reference Building). The reporting spreadsheet templates provided by SBC include the required formulae.

Note that for the purposes of ensuring consistent reporting, SBC will provide the conversion factors to be used for the various energy calculations.

Heat-recovery ventilator (HRV): A factory-assembled packaged unit including fans or blowers that transfers heat between two isolated airstreams.

Interface Details: Thermal bridging related to the details at the intersection of building envelope assemblies and/or structural components. Interface details interrupt the uniformity of a *clear field assembly* and the additional heat loss associated with interface details can be accounted for by linear and point thermal transmittances (heat loss per unit length or heat loss per occurrence, respectively). Examples of linear interface details include intermediate floor junctions, balconies, wall to roof transitions, and window to wall transitions. Examples of point interface details include structural columns and beams that protrude from the building envelope.

Integrated Design Process (IDP): a full day session wherein Proponents and their team participate with team of industry experts and energy modellers who focus on specific topics related to the Proponent's project, with the aim of achieving the energy performance target for the SBD Program.

IDP Workshop Report which represents a summary of the workshop highlights and includes the energy simulation results which incorporate additional ECMs to the Baseline/Proposed Building.

Lighting Power Density (LPD): the amount of lighting power in Watts per unit area.

Measurement and Verification (M&V): the project review process conducted by the Project Evaluator to verify that the modeled energy savings claimed by the Proponent follow the SBD program rules and achieve the performance target.

Modelled Floor Area: is the total modelled area of the building including appropriate conditioned spaces as identified in the drawings (where conditioned space is fully heated)

Proponent: also referred to as the SBD applicant, the proponent is the project owner that is the key recipient of the IDP Workshop Summary Report and Stage 2 – Energy Performance & Stage 3 – Commissioning incentive funding from Enbridge.

Reference Building: (i.e. 'Reference Model'): means that the new construction subject to the Application would be completed and would meet minimum requirements of the Applicable Building Code (i.e. OBC and SB-10). The equivalent ASHRAE 90.1 terminology is 'Budget'. At the IDP workshop, it is expected that the energy modeller will present the energy model results for this case along with the Baseline and SBD Buildings.

Residential Dwelling Unit: also referred to as residential suites in a multifamily building, contains a separate full kitchen and bathroom. A 'full kitchen' consists of a refrigerator, stove/oven, plumbed sink and range hood. A mini fridge with a microwave and hot plate do not constitute a full kitchen.

Retirement Home/Residence: a building or part of a building that is a retirement home as defined in subsection 2 (1) of the Retirement Homes Act, 2010.

SBD Building: (i.e. 'SBD Model') means the building design that represents a path toward the SBD target. At the IDP workshop, it is expected that energy modeller will present the energy model results for this case along with the Reference and Baseline Buildings.

Secondary System: means a system that provides air for the purposes of ventilating, heating and cooling a zone or group of zones.

Sensible heat-recovery efficiency (SRE): The apparent effectiveness adjusted per clause 9.3.3 of CSA C439–09 equation 12 to take into account fan energy, leakage (exhaust air transfer), mass and flow imbalance, frost control, and certain other external and internal energy gains and losses.

Site: The building(s) and all associated area where energy is used or generated. A site may include one or more buildings, either as independent structures or interconnected, but the buildings must have a minimum area of 50,000 ft^2 to meet the eligibility requirement of the SBD program. In certain cases and as determined by Enbridge there may be exceptions to this requirement. Multiple building projects require separate signed applications for each.

Site Energy Use: All energy used on site including all end-uses, such as heating, cooling, domestic hot water, fans, pumps, elevators, parkade lighting and fans, plug and process energy, interior and exterior

lighting, among others. It incorporates all site efficiencies, including the use of heat pumps or re-use of waste heat, but does not include energy generated on site.

Stage 2 Energy Performance (Pre-Construction): Incentive provided for a completed "As Designed Energy Model" which demonstrates that the building has been designed to achieve the SBD program energy performance target energy reduction versus OBC SB-10 (2017) Division 3.

Stage 3 Commissioning (Post-Construction): Incentive provided for a completed "As Constructed Energy Model" which demonstrates that the building construction has completed and achieves the SBD program energy performance target energy reduction versus OBC SB-10 (2017) Division 3.

SBD Minimum Threshold Area: the total above and below grade enclosed floor area of the building, measured from the exterior of the main wall of each floor level, excluding unconditioned parking areas for transport vehicles (e.g. cars, trucks, bicycles, etc.). All other spaces, including semi-heated spaces[3], unconditioned spaces[4], and semi-heated or conditioned[5] parking areas shall be included in the SBD Minimum Threshold Area. The SBD program's minimum threshold area is used when determining a project's eligibility with respect to the 50,000 ft² area requirement.

Third Party Reviewer or Project Evaluator: an individual of a third-party service provider to Enbridge and who is responsible for conducting reviews of the Proponent's Stage 2 Energy Performance and Stage 3 Commissioning incentive submissions.

Total energy-recovery efficiency (TRE): The apparent total (enthalpy) effectiveness adjusted per clause 9.3.3 of CSA C439–09 equation 13 to account for fan energy, leakage (exhaust air transfer), mass and flow imbalance and certain other external and internal gains and losses.

Toronto Green Standard (TGS): The Toronto Green Standard is Toronto's sustainable design requirements for new private and city-owned developments. The Standard consists of tiers (Tiers 1 to 4) of performance measures with supporting guidelines that promote sustainable site and building design. Tier 1 of the Toronto Green Standard is a mandatory requirement of the planning approval process.

Visioning Session: is a preliminary meeting that helps to define the project requirements, identify the priority issues to be covered in the IDP workshop, and determine which SMEs should attend the IDP workshop.

[3] Semi-heated space: a space with a design setpoint temperature of less than 15°C.
[4] Unconditioned space: an enclosed space within a building that is not a conditioned space or a semi-heated space.
[5] Conditioned space: means any space within a building, the temperature of which is controlled to limit variation in response to the exterior ambient temperature by the provision, either directly or indirectly, of heating or cooling over substantial portions of the year.

2.3 Reference Documents

The SB-10 (2017) [1], ASHRAE 90.1-2013 [2] and NECB 2015 [3] are frequently referenced in this document.

Unless otherwise noted, ASHRAE 90.1-2013 is referring to the Energy Cost Budget path (Section 11) and NECB 2015 is referring to the Energy Performance Compliance path (Part 8).

1. Building and Development Branch of the Ministry of Municipal Affairs (Ontario), 22 December 2016, 'MMA Supplementary Standard SB-10: Energy Efficiency Requirements', accessed March 20, 2019, http://www.mah.gov.on.ca/AssetFactory.aspx?did=15944.
2. ASHRAE, 2013 'Energy Standard for Buildings Except Low-Rise Residential Buildings', accessed March 20, 2019, https://www.techstreet.com/ashrae/standards/ashrae-90-1-2013-i-p?gateway_code=ashrae&product_id=1865966.
3. National Research Council Canada, 2015, 'National Energy Code of Canada for Buildings', accessed March 20, 2019, https://www.nrc-cnrc.gc.ca/eng/publications/codes_centre/2015_national_energy_code_buildings.html.
4. City of Toronto, February 1 2019, 'Energy Efficiency Report Submission & Modelling Guidelines For the Toronto Green Standard (TGS) Version 3' accessed March 20, 2019, https://www.toronto.ca/wp-content/uploads/2019/02/93d5-CityPlanning_V3-Energy-Modelling-Guidelines-Feb-2019.pdf.
5. BC Hydro, September 2018, 'Bridging Envelope Thermal Bridging Guide, Version 1.2,' accessed March 20, 2019, https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/business/programs/building-envelope-thermal-bridging-guide-version-1.2.pdf.
6. Illuminating Engineering Society, 2011, 'The Lighting Handbook, 10th Edition', accessed March 20, 2019, https://www.ies.org/product/the-lighting-handbook-10th-edition/.
7. ENERGY STAR, 2015, 'Multifamily High Rise Program Simulation Guidelines, Version 1.0, Revision 03', accessed March 20, 2019, https://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/mfhr/ENERGY%20STAR%20MFHR%20Simulation%20Guidelines_Version_1%200_Rev03.pdf?fb0f-a63c.
8. ENERGY STAR, 2017, 'Multifamily High Rise Program Simulation Guidelines – Appendix G 90.1-2016, Version 1.0', accessed March 20, 2019, https://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/mfhr/ENERGY_STAR_MFHR_Simulation_Guidelines_AppG2016.pdf?d52a-0856

3.0 SBD QUALIFICATION PROTOCOL FOR CLAIMING INCENTIVES

3.1 Admissible Energy Code

For the purposes of the SBD program, all building projects must model the Reference Building in compliance with one of the following two energy codes specified in SB-10 (2017) Division 3 Sentence 1.1.2.1.(1) and Sections 5.0 and 6.0 of this modelling guide:

1. ASHRAE 90.1-2013, Section 11, as modified by Division 3, Chapters 1 and 2, or,
2. NECB 2015, Part 8, as modified by Division 3, Chapters 1 and 3.

3.2 Approved SBD Energy Modelling Software

In Ontario, whole-building energy modelling software is a multipurpose tool that is now used in new building and major renovation design for provincial/municipal government energy code compliance (i.e. OBC SB-10 and the Toronto Green Standard), green certifications/designations such as LEED, and utility incentive programs including the SBD program.

For the SBD program, approved energy modelling software means any of the following 8,760-hour whole-building simulation software (tested to ASHRAE 140 Standard), the output of which is the Modelling Results Report which is used to establish the annual energy consumption:

- eQUEST version 3.65 build 7173 or higher,
- CAN-QUEST version 1.1 rev 3268 or higher,
- IES Virtual Environment version VE 2016 or higher, or,
- EnergyPlus version 8.6 or higher.

For reference, ASHRAE Standard 140 specifies a standard method of test for evaluating the technical capabilities and applicability of software used in calculating the thermal performance of buildings and their HVAC systems. These test procedures can then be used to identify/diagnose predictive differences from whole-building energy simulation software that may be caused by algorithmic differences, modelling limitations, faulty coding, inadequate documentation, or input errors.

3.3 Qualifications of IDP Workshop Energy Modellers

While SBC does not have a formal qualification process, it is expected that participating energy modellers must have the qualifications to undertake the modelling activities as described in the Guide, including preparation of Reference, Baseline and SBD Building energy simulation models using approved hourly load simulation software, the ability to correctly include and assess various ECMs and design changes and to participate in the IDP workshops as otherwise required by SBC. Participating energy modellers must also use the reporting templates as provided by SBC and adhere to the arrangements established as part of the Contract with SBC.

3.4 Project Commissioning (as a preferred component of the Stage 3 Incentive)

The program encourages the use of post construction commissioning and reporting as part of the Stage 3 incentive process. Project commissioning must be performed by a Commissioning Agent who has been certified by either ASHRAE, Association of Energy Engineers (AEE), or Building Commissioning Association (BCA). In general, they are expected to follow the procedure for commissioning a new building as described in a commissioning standard issued by their certifying association, or by another standard's writing organization. One such example is ASHRAE Standard 202-2013, Commissioning Process for Buildings and Systems.

4.0 SAVINGS BY DESIGN IDP WORKSHOP MODELLING PROTOCOL

The following section applies to Part 3 SBD-Comm and SBD-AH construction projects participating in the IDP workshop and is intended to define the modelling approach for IDP workshops per the 2019 Protocol established by SBC.

4.1 IDP Workshop Background

The SBD program includes a 1-day design workshop wherein Proponents and their team work with a team of Subject Matter Experts (SMEs) who focus on specific topics related to the Proponent's project, with the aim of achieving an energy performance consistent with the requirements of the SBD program versus the requirements of the current Ontario Building Code.

The focus of the workshop is primarily the identification of best practices, materials, and technologies, which is consistent with the original intent of the program – to educate and demonstrate potential pathways to higher performance.

4.2 Approach to Workshop Modelling and ECM Selection

SBC will solicit the prioritized SBD ECMs from the SMEs (in advance of the workshop), given discussions with the client, their individual expertise and the specifications provided. Each SME shall rank their recommended ECMs based on their expertise. The "priority" ECMs may reflect the best practices - measures with minimal impact on cost, drawings, submissions etc. In some cases, the ECMs may include measures that were specifically identified by the proponent as part of the Visioning Session. As well, energy modellers may be asked to model certain design changes or ECMs on a more standard basis – notably modifications to Window to Wall ratio in 5% increments, and energy modellers may also wish to assess certain ECMs based on their own experience.

In addition to the Reference and Baseline Building models, the energy modeller will produce a SBD Building model based on the SME's "priority" ECMs, which is expected to meet the performance goals of the program.

At the end of the workshop, the energy modeller will present the list of ECMs that have been modelled and the energy simulation results. The SMEs and energy modelling team will summarize their recommendations in a concluding discussion. The proponent may have opinions as relates to the ECMs and these will be noted. Collectively, attendees will seek to confirm the suite of ECMs that will meet or exceed the SBD target. It is understood that the proponent may wish to consider other measures and that the energy modeller may undertake subsequent modelling after the workshop that affects the final package of measures. In these instances, the energy modeller will provide the revised SBD package to the SBC report writer as part of the standard reporting package. SBC will continue to provide the comprehensive list of measures as part of the IDP Workshop Report.

4.3 Note to Participating Energy Modelers Regarding Timing of Results/Reports

With the above-mentioned change in modelling approach, SBC expects that final SBD energy models will be delivered within 3 weeks of the Workshop.

5.0 BUILDING ENERGY MODELLING METHODOLOGY

The following sections are intended to define the energy modelling methodology, requirements and best practices for projects wishing to pursue incentive funding through the SBD program. Energy modellers experienced with the program may wish to refer to Appendix I for a condensed summary of the Guidelines

5.1 Carbon Emissions Calculations

Per the Savings by Design Bulletin 180501, projects submitted to the SBD program for incentive funding after December 31, 2016 shall use the SB-10 (2017) Division 3 CO_2e emission factors listed in Table 1.1.2.2.

Table 1.1.2.2.
CO_2e Emission Factors
Forming Part of Sentences 1.1.2.2.(1) and (5)

Building Energy Source	Emission Factor
Stationary Sources	
Electricity (average for 2014)	0.050 $kgCO_2e$ / kWh
Natural Gas	1.899 $kgCO_2e$ / m^3
Propane	1.548 $kgCO_2e$ / L
Heating Oil	2.755 $kgCO_2e$ / L
Column 1	2

5.2 Weather Files

Per the Savings by Design Bulletin 180501, new projects submitted to the SBD program for incentive funding after April 30, 2018 shall use the Ontario CWEC 2016 weather file that best reflects the projects location and weather conditions.

The Ontario CWEC 2016 weather files can be downloaded from climate.onebuilding.org.

As an additional resource, please refer to Environment Canada's Map of Active Weather Stations. This will assist with choosing the most appropriate weather file for the project. The weather files will be requested as part of the Stage 2 and Stage 3 incentive application review. It is expected that the IDP Workshop Energy Model Report identify the Zone and Weather file, e.g. Climate zone 5, Vineland Station RCS CWEC 2016.

5.3 Building Envelope

5.3.1 Opaque Assemblies

The building envelope is the most important building system in a project's design, as it is a critical component to the building's aesthetic and landmarking value while concurrently establishing the basis for the building's overall energy performance. Building envelopes with poor thermal performance (e.g. high window to wall ratios, opaque assemblies with low R-Values) impede the overall building energy performance when compared to current SB-10 Code requirements and the ability to demonstrate positive relative energy savings.

Despite its importance, some design teams sacrifice thermal performance of building envelopes at the expense of designing a 'Marketable' building and then depend heavily on the mechanical and electrical

systems to over-compensate for the performance gap. This practice is especially true with Multi-Unit Residential Buildings, where high window to wall ratios are more desirable than buildings with large amounts of opaque wall areas.

An example of an energy compliant building envelope wall with respect to SB-10 (2017) Division 3 consists of 40% window to wall ratio, with the opaque wall assembly having an effective thermal resistance value of R-20.

One aspect of opaque assemblies that historically have been underestimated in energy simulations are the effects of thermal bridging on the effective thermal transmittance (i.e. U-Value) of the opaque assembly. Thermal bridging materially impacts building envelope performance, as it commonly occurs in opaque assemblies through repetitive structural members (i.e. studs, joists, mullions, and exposed structural projections) and significantly decreases the effective U-value of the opaque assembly.

> For example, the nominal U-value of an opaque wall assembly might be U-0.049 (i.e. R-20), however when the effects of thermal bridging through the steel wall studs are factored, the effective U-value can be reduced to U-0.083 (i.e. R-12) or less.

Exposed structural projections (e.g. balconies, and canopies) can also negatively impact the thermal performance of opaque wall assemblies, reducing the overall thermal performance of the assembly when the ratio of the total cross-sectional area of the exposed element to the total surface area of the exterior building envelope is significant. According to SB-10 (2017) Division 3, the effects of thermal bridging for exposed structural projections must be accounted for where the total cross-sectional area exceeds 2% of the exterior building envelope surface area.

It is important that the energy modeller be aware of thermal bridging effects and account for their impacts in the energy model(s).

5.3.1.1 Opaque Assemblies – Baseline/Proposed Building

The effective thermal transmittance (i.e. U-value) of the Baseline/Proposed Building's opaque assemblies shall include the effects of thermal bridging by considering the heat loss of both the Clear Field Assembly and Interface Details except where it can be proven to be insignificant (see below). The calculation of the effective U-value shall include the following thermal bridge elements:

- Closely spaced repetitive structural members (e.g. studs and joists),
- Closely spaced ancillary members (e.g. lintels, sills and plates),
- Structural wall penetrations (e.g. floor slabs, beams, girders, columns, curbs),
- Structural roof penetrations and ornamentation or appendages that substantially or completely penetrate the insulation layer,
- Interface junctions between building envelope assemblies (e.g. roof to wall junctions and glazing to wall/roof junctions),
- Cladding structural attachments (e.g. shelf angles, girts, clips, fasteners and brick ties), and
- The edge of walls/floors that intersect the building enclosure and substantially or completely penetrate the insulation layer.

The following lists industry accepted methods for calculating effective U-values of opaque assemblies:

- BC Hydro's Building Envelope Thermal Bridging Guide (BETBG) version 1.2 | 2018: follow the calculation methodology outlined in Section 3.4 within the guide using the BETBG defined performance data for Clear Field Assembly and Interface Details. The BETBG provides calculation

examples in Section 5 and a calculation spreadsheet (Enhanced thermal performance spreadsheet) is available at bchydro.com,

- BETBG methodology with alternate performance data: follow the calculation methodology outlined in Section 3.4 within the guide using the performance data for Clear Field Assembly and Interface Details from other reliable resources such as:
  - ASHRAE 90.1-2013, Appendix A, or
  - ISO 14683:2017 Thermal bridges in building construction – Linear thermal transmittance – Simplified Methods and default values,
- ASHRAE Handbook – Fundamentals,
- Two- or three-dimensional thermal modelling simulation tools, or
- Laboratory tests performed in accordance with ASTM C 1363, "Thermal Performance of Building materials and Envelope Assemblies by Means of a Hot Box Apparatus," using an average temperature of 24±1°C and a temperature difference of 22±1°C.

Please note that the following can be excluded from effective U-value calculations:

- Mechanical penetrations (e.g. pipes, ducts, through-the-wall equipment venting, packaged terminal air conditioners or heat pumps).
- The impact of minor thermal bridge elements not mentioned above can be considered insignificant and excluded from the effective U-value calculations when the expected cumulative heat transfer through these thermal bridge elements are low enough that the calculated effective U-value of the opaque assembly would not change by more than 10% if they were included in the calculation.

5.3.1.2 Opaque Assemblies – Reference Building

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):

In addition to the modelling requirements prescribed in ASHRAE 90.1-2013 Table 11.5.1, the building envelope requirement values shown in SB-10 (2017) Division 3, Chapter 2 Tables SB 5.5.-5-2017 to SB 5.5-7-2017 shall be considered effective U-values which include all thermal bridging effects. Please note that exceptions provided in SB-10 (2017) Division 3, Chapter 2 Section 1.1.1.4. apply.

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

In addition to the prescriptive requirements of Section 3.2 of Division B of the NECB 2015, the overall thermal transmittance values shown in SB-10 (2017) Division 3, Chapter 3 Table SB 3.2.2.2. shall be considered effective U-values and include all thermal bridging effects. Please note that SB-10 only supersedes Table 3.2.2.2. in NECB 2015 and exceptions provided in Sentences 3.2.2.2.(3) and 3.2.2.2.(4) and Sentence 3.2.1.2.(1) of Division B of NECB 2015 apply.

The Energy Simulation Results Summary should present, at a minimum, the *Effective* thermal transmittance values in both imperial and metric. Ideally the modeller should use the same terminology/definition as the SME uses in the presentation of the ECMs.

5.3.2 Fenestration and Doors

To ensure that heat transfer is modelled properly for windows, skylights and doors, the surface areas for each must include all glazing, frame, sashes and mullions areas. For building designs where the window is not all in the same plane, the area should be measured along the surface of the glass.

For the purpose of the SBD program, a door consisting of 50% glazing or more should be modelled as an operable window with an area equal to the total area of the door. Following this conservative approach will ensure the thermal performance is not overestimated.

SB-10 (2017) Division 3 prescribes a maximum vertical window-to-wall-ratio (WWR) allowance of 40%. Designing a building's envelope with a vertical WWR of 40% or less will avoid an energy use penalty relative to the Reference Building and will typically improve the overall performance of the building envelope.

5.3.2.1 Fenestration and Doors – Baseline/Proposed Building

The effective thermal transmittance (i.e. U-value) of the Baseline/Proposed Building's fenestration and doors shall be modelled according to their intended actual performance, which includes framing.

The following approach shall be used to determine the effective U-value for fenestration and doors:

- NFRC 100, "Determining Fenestration Product U-factors", with the following limitations:
    - The thermal transmittance for fenestration shall be based on the actual area of the windows and not the standard NRFC 100 size for the applicable product type,
    - It is acceptable to area-weight the modelled fenestration U-value based on the relative proportions of fixed and operable windows and window sizes, or
    - It is also acceptable to simplify the calculations by assuming the worst case by using the highest window U-value for all fenestration specified on the project.

- If the NFRC 100 does not cover the Baseline/Proposed fenestration or door product, then the effective U-value shall be based on:
    - Calculations performed following the procedures defined in ASHRAE Handbook – Fundamentals, or
    - Laboratory tests performed in accordance with ASTM C 1363, "Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus," using an indoor air temperature of 21±1°C and an outdoor air temperature of -18±1°C measured at the mid-height of the fenestration or door.

Please note for projects following the NECB 2015 path, when calculating the total vertical fenestration and door area to wall ratio (FDWR), the wall area shall be the gross above-ground wall area including window and door openings.

5.3.2.2 Fenestration and Doors – Reference Building

<u>SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):</u>

SB-10 (2017) Division 3, Chapter 2 Article 1.1.1.4. prescribes enhancements and additional requirements to ASHRAE 90.1 Section 5.

The overall thermal transmittance values shown in SB-10 (2017) Division 3, Chapter 2 Tables SB 5.5.-5-2017 to SB 5.5-7-2017 shall be considered effective U-values which include all thermal bridging effects for windows and doors. Please note that exceptions provided in SB-10 (2017) Division 3, Chapter 2 Section 1.1.1.4. apply.

To clarify, the total fenestration area of the Reference Building shall be equal to the Baseline/Proposed Building or 40% of the gross above-grade exterior wall area, whichever is less. If the Baseline/Proposed

Building's fenestration area exceeds 40%, then the Reference Building's window area must be reduced proportionally along each exterior exposure until it equals 40%.

The total skylight area of the Reference Building shall be equal to the Baseline/Proposed Building or 3% of the total skylight area to gross roof area ratio, whichever is less. If the skylight area of Baseline/Proposed Building exceeds 3% of the gross roof area, then the Reference Building's skylight area shall be set to 3% of the gross roof area. Skylight orientation and placement in the Reference Building shall be the same as the Baseline/Proposed Building.

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

SB-10 (2017) Division 3, Chapter 3 Article 1.1.1.6. prescribes enhancements to Division B, Part 3 of the NECB 2015.

The overall thermal transmittance values shown in SB-10 (2017) Division 3, Chapter 3 Tables SB 3.2.2.3. and SB 3.3.3.4. shall be considered effective U-values and include all thermal bridging effects for windows and doors respectively. Please note that SB-10 only supersedes Tables 3.2.2.3. and 3.2.2.4. in the NECB 2015 and exceptions provided in Articles 3.2.2.3 and 3.2.2.4. of the NECB 2015 apply.

SHGC compliance requirements provided in Table SB 3.2.2.3.A. are added to Article 3.2.2.3. of Division B of the NECB 2015 per SB-10 (2017) Division 3, Chapter 3 Sentence 1.1.1.6.(4).

For the purpose of the SBD program, SB-10 (2017) Division 3, Chapter 3 Sentences 1.1.1.6.(6) and 1.1.1.6.(7) shall not apply, as energy models submitted to the SBD Program follow the Performance Path (NECB 2015 Part 8).

Where the vertical total fenestration and door area to gross wall area ratio (FDWR) of the Baseline/Proposed Building is less than the maximum FDWR permitted in Sentence 3.2.1.4.(1) of the NECB 2015, the FDWR of the Reference Building shall be equal to the Baseline/Proposed Building. If the Baseline/Proposed Building's FDWR exceeds the maximum FDWR permitted, then the Reference Building's FDWR must be reduced proportionally along each exterior exposure until it equals the maximum FDWR permitted.

Where the total skylight area to gross roof area ratio (SRR) of the Baseline/Proposed Building is less than 5%, the SRR of the Reference Building shall be equal to the Baseline/Proposed Building. If the Baseline/Proposed Building's SRR exceeds 5%, then the Reference Building's SRR must be reduced proportionally for each exterior roof exposure until it equals 5%.

The Energy Simulation Results Summary should present, at a minimum, the *Effective* thermal transmittance values in both imperial and metric. Ideally the modeller should use the same terminology/definition as the SME uses in the presentation of the ECMs.

The modeller should also identify any ECMs that would require a corresponding change to the Reference Building energy model.

5.3.3 Air Leakage

Air leakage, also known as 'air infiltration', is commonly used when referring to uncontrolled air flow through a building envelope system, be it the whole building or individual building assemblies. The principal causes for air leakage are due to inadequate sealing between building envelope elements and pressure differences between the building's interior and exterior caused by wind on the building surfaces or large variations in temperature between the indoor and outdoor air.

Air leakage negatively impacts building performance, resulting in reduced thermal comfort, increased energy consumption, premature degradation of building envelope material and possible indoor air quality degradation.

Installing a continuous air barrier system is a common air sealing method for reducing air leakage. SB-10 (2017) requires Baseline/Proposed Buildings be designed and constructed with a continuous air barrier. Unfortunately, despite regulatory initiatives to curb air infiltration, a building's airtightness (i.e. the ability to resist inward or outward air leakage) remains highly variable.

Please note that SB-10 (2017) does not credit energy savings associated with reducing air leakage (i.e. air sealing); Similarly, the SBD program does not recognize air sealing as an approved ECM, ***however,*** *energy modellers are encouraged to simulate the effects of improved air tightness and present these results as "High performance Measures" at the workshop.*

The following outlines the modelling approach that is to be followed for modelling air leakage rates under the SBD program.

5.3.3.1 Air Leakage – Baseline/Proposed Building

Neither SB-10 (2017) Division 3 nor ASRHAE 90.1-2013 Section 11 specifically prescribe air leakage rates for Baseline/Proposed Buildings. Only the NECB 2015 prescribes an air leakage rate of 0.25 L/(s·m²) at 5Pa [0.0492 cfm/ft² at 0.104 psf] of total gross above-ground wall and roof areas according to Sentence 8.4.3.3.(3).

For the purpose the SBD program, the Baseline/Proposed Building's air leakage shall be modelled with a constant value of 0.25 L/(s·m²) at 5Pa [0.0492 cfm/ft² at 0.104 psf] of total gross above-ground wall (including windows and doors) and roof areas. This air leakage rate is intended to capture the air leakage for the whole building.

5.3.3.2 Air Leakage – Reference Building

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013) & Chapter 3 (NECB 2015):

The Reference Building's air leakage rate shall be modelled equal to the Baseline/Proposed Building, using a constant value of 0.25 L/(s·m²) at 5Pa [0.0492 cfm/ft² at 0.104 psf] of total gross above-ground wall and roof areas. This air leakage rate is intended to capture the air leakage for the whole building.

5.4 Internal Loads

5.4.1 Space Types

Space types shall be representative of the Baseline/Proposed Building's type or space function. The Reference Building's space type shall be modelled as being identical to the Baseline/Proposed Building.

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):

The building type or space type classifications (not a combination of the two) shall be chosen in accordance with SB-10 (2017) Division 3, Chapter 2 Tables SB 9.5.1-2017 and SB 9.6.1-2017 respectively.

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

The building type or space type classifications (not a combination of the two) shall be chosen in accordance with SB-10 (2017) Division 3, Chapter 3 Tables SB 4.2.1.5.-2017 and SB 4.2.1.6.-2017 respectively.

5.4.2 Operating Schedules

Operating schedules shall be representative of the Baseline/Proposed Building's type or space function. The Reference Building's operating schedules shall be modelled as being identical to the Baseline/Proposed Building.

Where actual operating schedules are unknown at the time of the energy modelling (e.g. IDP workshop, Stage 2 pre-construction, etc.), the following shall apply:

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):

ASHRAE 90.1-2013 Section 11 – Energy Cost Budget Method does not prescribe default operating schedules. To improve consistency between SBD applications, the NECB 2015 default operating schedules found in Tables A-8.4.3.2.(1)-A through A-8.4.3.2.(1)- K shall be used for the applicable space type (as defined in Subsection 5.4.1 above) in both the Reference and Baseline/Proposed Building models.

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

Default operating schedules found in NECB 2015 Tables A-8.4.3.2.(1)-A through A-8.4.3.2.(1)- K shall be used for the applicable space type (as defined in Subsection 5.4.1 above) in both the Reference and Baseline/Proposed Building models.

Dwelling Units:

ASHRAE 90.1-2013 Section 11 – Energy Cost Budget Method does not prescribe default operating schedules. To improve consistency between SBD applications, the NECB 2015 default operating schedules found in Tables A-8.4.3.2.(1)-G shall be used for dwelling unit space types in both the Reference and Baseline/Proposed Building models.

SBD Prescribed Schedules for Specific Space Types:

Space Type	Building Type	NECB 2015 Schedule	SBD Amendment
Stairwells	Residential	Table A-8.4.3.2.(1)-G	Lighting - 13.2 hours per day
	Office	Table A-8.4.3.2.(1)-A	Lighting - 6 hours per day
	Retail	Table A-8.4.3.2.(1)-C	Lighting - 9.6 hours per day
	Hotel	Table A-8.4.3.2.(1)-F	Lighting - 18 hours per day
	Other	Table A-8.4.3.2.(2)-A	SBD Modelling Guide - Appendix III
Mechanical & Electrical Rooms	All	Table A-8.4.3.2.(1)-A	Lighting - 2.75 hours per day
Storage Rooms (All sizes)	All	Table A-8.4.3.2.(1)-E	Lighting - 5.2 hours per day
Corridors	Residential	Table A-8.4.3.2.(1)-G	Lighting - 24 hours per day
	Office	Table A-8.4.3.2.(1)-A	Lighting - 8 hours per day
	Retail	Table A-8.4.3.2.(1)-C	Lighting - 10.6 hours per day
	Hotel	Table A-8.4.3.2.(1)-F	Lighting - 24 hours per day
	Other	Table A-8.4.3.2.(2)-A	SBD Modelling Guide - Appendix III
Parking Garages	All	Table A-8.4.3.2.(1)-K	Lighting - 24 hours per day Fans - 4 hours per day
Exterior Lighting	All	n/a	Schedule on at night via photocell (Annual average ~ 12 hour per day)

5.4.3 Occupancy Density

Occupancy density shall be representative of the Baseline/Proposed Building's type or space function. The Reference Building's occupancy density shall be modelled as being identical to the Baseline/Proposed Building.

Where actual occupancy densities are unknown at the time of the energy modelling (e.g. IDP workshop, Stage 2 pre-construction, etc.), the following shall apply:

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):

ASHRAE 90.1-2013 Section 11 – Energy Cost Budget Method does not prescribe default occupancy loads. To improve consistency between SBD applications, the NECB 2015 default occupancy loads found in Table A-8.4.3.2.(2)-B shall be used for the applicable space type (as defined in Subsection 5.4.1 above) in both the Reference and Baseline/Proposed Building models.

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

Default occupancy loads found in NECB 2015 Table A-8.4.3.2. (2)-B shall be used for the applicable space type (as defined in Subsection 5.4.1 above) in both the Reference and Baseline/Proposed Building models.

Residential Dwelling Units:

ASHRAE 90.1-2013 Section 11 – Energy Cost Budget Method does not prescribe default occupancy loads. To improve consistency between SBD applications, the NECB 2015 default occupancy load of 25 m^2/occupant (269 ft^2/occupant) found in Table A-8.4.3.2. (2)-B shall be used for dwelling unit space types in both the Reference and Baseline/Proposed Building models.

5.4.4 Electrical Receptacles

Internal receptacle loads shall be representative of the Baseline/Proposed Building's type or space function. Receptacle loads are not regulated by SB-10; the Reference Building's receptacle loads shall be modelled as being identical to the Baseline/Proposed Building.

For the purpose of the SBD program, the following receptacle loads shall apply:

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):

ASHRAE 90.1-2013 Section 11 – Energy Cost Budget Method does not prescribe default receptacle loads. To improve consistency between SBD applications, the NECB 2015 peak receptacle loads listed in Table A-8.4.3.2.(2)-B shall be used for the applicable space type (as defined in Subsection 5.4.1 above) in both the Reference and Baseline/Proposed Building models, except for residential dwelling units.

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

Peak receptacle loads found in NECB 2015 Table A-8.4.3.2. (2)-B shall be used for the applicable space type (as defined in Subsection 5.4.1 above) in both the Reference and Baseline/Proposed Building models, except for residential dwelling units.

Residential Dwelling Units:

ASHRAE 90.1-2013 Section 11 – Energy Cost Budget Method does not prescribe default receptacle loads. To improve consistency between SBD applications, the NECB 2015 peak receptacle load of 5

W/m² found in Table A-8.4.3.2.(2)-B for space type 'Dwelling Units – General' shall be used for dwelling unit space types in both the Reference and Baseline/Proposed Building models when no energy savings associated with in-suite major appliances (e.g. dishwashers, clothes washers, dryers, refrigerators, and ranges) are being claimed by the Proponent. For projects that include high efficiency ENERGY STAR rated major appliances within dwelling units, please refer to Section 6.4 below for details on how to model receptacle loads.

5.4.5 Lighting

The following outlines the modelling approach that is to be followed for simulating lighting systems under the SBD program.

Please note that SB-10 (2017) does not credit lighting savings associated with dwelling unit lighting systems. For the purpose of the SBD program, please refer to Section 6.2 below for guidelines on claiming credit for lighting systems within dwelling units.

A lighting control ECM should only claim credit in the SBD program when the Code does not require one for a given space type. Example: all-off switch is required in hotel/motel guest rooms, so this would not be a valid ECM. Code required lighting controls prescribed for the various space types need to be verified prior to recommending an ECM.

5.4.5.1 Lighting – Baseline/Proposed Building

The Baseline/Proposed Building shall be modelled with the as-designed or as-constructed LPD input for Stage 2 and Stage 3 SBD submissions respectively. Unlit areas with a lower than recommended illuminance in the space (such as rooms left to a tenant to furnish) shall have a LPD input equal to the LPDs prescribed by SB-10 (2017) Division 3. No credit can be claimed for lighting systems in these unlit areas.

5.4.5.2 Lighting – Reference Building

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):

The calculation of the Reference Building's lighting power allowance shall be based on the LPD given in Table SB 9.5.1-2017 or Table SB 9.6.1-2017, for the respective space type (as defined in Subsection 5.4.1 above).

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

The calculation of the Reference Building's lighting power allowance shall be based on the LPD given in Table SB 4.2.1.5.-2017 or Table SB 4.2.1.6.-2017, for the respective space type (as defined in Subsection 5.4.1 above).

5.5 Energy Recovery

The following outlines the modelling approach that is to be followed for simulating energy recovery systems under the SBD program.

5.5.1 Energy Recovery – Issue Regarding SB-10 (2017) Division 3, Chapter 3 (NECB 2015)

SB-10 (2017) Division 3, Chapters 2 and 3 prescribe additional requirements for Energy Recovery systems, however there is an issue with respect to Division 3, Chapter 3 (NECB 2015). There is an omission in SB-10 Division 3, Chapter 3, Sentence 1.1.1.8.(1), Clause 5.2.10.1.(3)(b).

SB-10 Sentence 5.2.10.1.(3) does not include either an “or” or an “and” at the end of Clause (b).

The Sentence is reproduced here, exactly as shown in SB-10:

> “(3) The systems need not comply with Sentence (1), where the system
>
> (a) is a specialized exhaust system, such as one that is used to exhaust smoke, grease- laden vapours, or toxic, flammable, paint, or corrosive fumes or dust,
> (b) serves spaces that are not cooled and are heated to less than 16°C,
> (c) is designed in such a way that the largest source of air exhausted at a single location at the building exterior is less than 75% of the design outdoor airflow rate.”

NECB 2015 Definition:

The NECB 2015 Preface, Page xi, sets forth this definition:

“Meaning of the words “and” and “or” between the Clauses and Subclauses of a Sentence

Multiple Clauses and Subclauses are connected by the word “and” or “or” at the end of the second last Clause in the series. Although this connecting word appears only once, it is meant to apply to all the preceding Clauses or Subclauses within that series.

For example, in a series of five Clauses – (a) to (e) - in a Code Sentence, the appearance of the word “and" at the end of Clause (d) means that all Clauses in the Sentence are connected to each other with the word "and." Similarly, in a series of five Clauses - (a) to (e) - in a Code Sentence, the appearance of the word "or" at the end of Clause (d) means that all Clauses in the Sentence are connected to each other with the word “or."

In all cases, it is important to note that a Clause (and its Subclauses, if any) must always be read in conjunction with its introductory text appearing at the beginning of the Sentence.”

Conclusion and Interpretation:

From this statement, Clause 5.2.10.1.(3)(b) is missing either “and” or “or" at the end.

Consultation with the Ministry of Municipal Affairs, Building and Development Branch confirmed that the missing word is “or” and that this will be corrected in the next publication of SB-10.

For all applications under the SBD Program, SB-10 (2017) Division 3, Chapter 3, Sentence 5.2.10.1.(3) shall be modified to include the word “or” at the end of Clause (b). The Sentence is reproduced here, with this modification:

> “(3) The systems need not comply with Sentence (1), where the system
>
> (a) is a specialized exhaust system, such as one that is used to exhaust smoke, grease- laden vapours, or toxic, flammable, paint, or corrosive fumes or dust,
> (b) serves spaces that are not cooled and are heated to less than 16°C, **or**
> (c) is designed in such a way that the largest source of air exhausted at a single location at the building exterior is less than 75% of the design outdoor airflow rate.”

The intent of exception 5.2.10.1.(3)(c) amended by SB-10 Sentence 1.1.1.8.(1) is to account for the impracticality of recovering energy from a system with a single outdoor air intake and numerous exhaust outlets. An example of this could be a MURB building with a central MUA unit supplying outdoor air to the dwelling units via corridor pressurization with no central exhaust riser. The only source of exhaust is from the many dwelling unit kitchen and washroom exhaust fans. In a design scenario such as this, the Reference Building's MUA is not required to have energy recovery.

5.5.2 Energy Recovery – Baseline/Proposed Building

The Baseline/Proposed Building shall be modelled with energy recovery systems according to the project's mechanical design, having an energy recovery effectiveness and outdoor air supply/exhaust rate per the mechanical design documentation for the Stage 2 SBD submission and the manufacturer's specifications for the Stage 3 SBD submission.

5.5.3 Energy Recovery – Reference Building

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):

According to SB-10 Sentence 1.1.1.5.(4), exhaust air energy recovery system required by ASHRAE 90.1 Section 6.5.6.1. shall be modeled with an energy recovery effectiveness of at least 55%.

For the purpose of the SBD program, Section 6.5.6.1 exception (8) applies to systems serving all space types, except residential dwelling units (see below).

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

According to SB-10 Sentence 1.1.1.8.(1), exhaust air energy recovery system required by Sentence 5.2.10.1.(1) shall be modeled with an energy recovery effectiveness of at least 55%.

For the purpose of the SBD program, exception 5.2.10.1.(3)(c) amended by SB-10 Sentence 1.1.1.8.(1) as explained above applies to systems serving all space types, except residential dwelling units (see below).

Residential Dwelling Units:

For the purpose of the SBD program, the Reference Building shall be equipped with in-suite exhaust air energy recovery systems having a minimum energy recovery effectiveness of at least 55%, regardless of the compliance path followed by the project.

This means that projects following the ASRHAE 90.1-2013 compliance path, Section 6.5.6.1 exceptions (6 - 10) shall not be applied to dwelling unit space types.

Projects following the NECB 2015 compliance path, exceptions 5.2.10.1.(3)(c) and 5.2.10.1.(4) amended by SB-10 Sentence 1.1.1.8.(1) shall not be applied to dwelling unit space types.

Example: Following the NECB 2015 compliance path, a Multi-Unit Residential Building (MURB) is equipped with a Make Up Air (MUA) unit supplying 100% outdoor air directly to all the corridor spaces at a rate of 0.06 cfm/ft² and indirectly to all the dwelling unit spaces at a rate of 100 cfm/suite. There are no energy recovery systems within the dwelling units.

Per the SBD modelling guide, NECB 2015 exceptions 5.2.10.1.(3)(c) and 5.2.10.1.(4) amended by SB-10 Sentence 1.1.1.8.(1) do not apply to dwelling unit space types, therefore the Reference Building is modeled with in-suite energy recovery systems with a effectiveness of 55% and a supply/exhaust rate of 100 cfm/suite.

The Reference Building's MUA now serves only the corridor spaces at a rate of 0.06 cfm/ft². Per the SBD modelling guide, NECB 2015 exception 5.2.10.1.(3)(c) amended by SB-10 Sentence 1.1.1.8.(1) applies to the Reference Building's MUA serving only the corridor spaces and no energy recovery system is required.

Please note that SB-10 (2017) does not credit energy savings associated with reducing ventilation rates. Similarly, the SBD program does not recognize reduced ventilation rates as an approved ECM, ***however,*** *energy modellers are encouraged to simulate the effects of reduced ventilation rates and present these results as "High performance Measures" at the workshop.*

5.6 Hot Water (HW) Space Heating

For the purpose of the SBD program, the following outlines the modelling approach that is to be followed for simulating gas-fired heating boilers in addition to the mandatory modelling requirements specified in SB-10 (2017) Division 3 and ASHRAE 90.1-2013 and the NECB 2015.

5.6.1 HW Gas-Fired Boilers – Baseline/Proposed Building

The Baseline/Proposed Building's gas-fired boilers shall be modelled according to the as-designed mechanical specifications for the Stage 2 Energy Performance (Pre-Construction) submission.

For Stage 3 Commissioning (Post-Construction) submissions, the boiler input shall be updated in the model according to the manufacturer's specifications and the Project's Sequence of Controls documentation.

5.6.2 HW Gas-Fired Boilers – Reference Building

5.6.2.1 Heating Capacity less than 733 kW (2,500 MBH)

SB-10 (2017) Division 3, Chapters 2 and 3 prescribe additional requirements for the minimum equipment efficiency of a gas-fired boiler with a heating capacity less than 733 kW (2,500 MBH). The amendments align the two compliance standards (i.e. ASHRAE 90.1-2013 and NECB 2015), setting the minimum equipment efficiency equal for both.

The following table summarizes the amended minimum equipment efficiency for gas-fired boilers with a heating capacity less than 733 kW (2,500 MBH):

Equipment	Heating Capacity kW (Btu/h)	SB-10 Performance Required ASHRAE 90.1-2013	SB-10 Performance Required NECB 2015
Gas boilers, hot water	< 88 (< 300,000)	90% AFUE	
	≥ 88 and < 733 (≥ 300,000 and < 2,500,000)	90% E_t	

The NECB 2015 performance curve for Condensing Boiler (NECB 2015 Table 8.4.4.21.-A) shall be applied when the efficiency is ≥ 88%.

5.6.2.2 Heating Capacity greater than or equal to 733 kW (2,500 MBH)

SB-10 (2017) Division 3 does not prescribe any additional requirements when the boiler capacity is greater than or equal to 733 kW (2,500 MBH). For boilers of this capacity, it is implied that the minimum equipment efficiency prescribed by ASRHAE 90.1-2013 and NECB 2015 shall be used. However, there is a small efficiency discrepancy between the two standards.

For the purpose of the SBD Program, the equipment efficiency prescribed by ASRHAE 90.1-2013 for gas-fired boilers with a capacity greater than or equal to 733 kW (2,500 MBH), will be set equal to the NECB 2015. The following table summarizes the amended minimum equipment efficiency for gas-fired boilers with a heating capacity greater than or equal to 733 kW (2,500 MBH):

Equipment	Heating Capacity kW (Btu/h)	Performance Required ASHRAE 90.1-2013	Performance Required NECB 2015
Gas boilers, hot water	≥ 733 (≥ 2,500,000)	83.3% E_c	

The NECB 2015 performance curve for Modulating Boiler (NECB 2015 Table 8.4.4.21.-A) shall be applied when the heating capacity is ≥ 733 kW.

5.7 Service Hot Water (SHW) Heating

For the purpose of the SBD program, the following outlines the modelling approach that is to be followed for simulating gas-fired service hot water boilers/heaters in addition to the mandatory modelling requirements specified in SB-10 (2017) Division 3 and ASHRAE 90.1-2013 and the NECB 2015.

5.7.1 SHW Gas-Fired Boilers – Baseline/Proposed Building

The Baseline/Proposed Building's SHW gas-fired boilers/heaters shall be modelled according to the as-designed mechanical specifications for the Stage 2 Energy Performance (Pre-Construction) submission.

For Stage 3 Commissioning (Post-Construction) submissions, the boiler/heater input shall be updated in the model according to the manufacturer's specifications and the Project's Sequence of Controls documentation.

5.7.2 SHW Gas-Fired Boiler/ Heaters – Reference Building

5.7.2.1 Heating Capacity ≤ 22 kW

SB-10 (2017) Division 3, Chapters 2 and 3 prescribe additional requirements for the minimum equipment efficiency of a gas-fired storage service water heater with a heating capacity less than or equal to 22 kW (75 MBH). The amendments align the two compliance standards (i.e. ASHRAE 90.1-2013 and NECB 2015), setting the minimum equipment efficiency equal for both.

The following table summarizes the amended minimum equipment efficiency for gas-fired storage service water heaters with a heating capacity of 22 kW (75 MBH) or less:

Equipment	Heating Capacity kW (Btu/h)	SB-10 Performance Required ASHRAE 90.1-2013	SB-10 Performance Required NECB 2015
Gas-fired, storage-type	≤ 22 (≤ 75,000)	0.7-0.00189V (V in U.S gallon) EF 0.7-0.0005V (V in Litres) EF	

The NECB 2015 performance curve for Fuel-fired Service Water Heater (NECB 2015 Table 8.4.4.21.-G) shall be applied.

5.7.2.2 Heating Capacity > 22 kW (75 MBH)

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013) does not prescribe additional requirements for gas-fired storage service water heaters with a capacity greater than 22 kW (75 MBH). For boilers/heaters of this capacity, it is implied that the minimum equipment efficiency prescribed by ASRHAE 90.1-2013 shall be used.

SB-10 (2017) Division 3, Chapter 3 (NECB 2015) does not prescribe additional requirements for gas-fired service water heaters with a capacity greater than 22 kW (75 MBH) and less than 293 kW (1,000 MBH). For boilers/heaters of within these capacities, it is implied that the minimum equipment efficiency prescribed by NECB 2015 shall be used. However, for a service hot water system with a total installed gas water heating input capacity of 293 kW (1,000 MBH) or greater, SB-10 (2017) Division 3, Chapter 3 (NECB 2015) requires the gas-fired service water heating equipment to have a minimum thermal efficiency (E_t) of 90%, except where 25% of the annual service water heating requirement is provided by site-recovered energy and except for water heaters installed in individual dwelling units.

For the purpose of the SBD Program, the equipment efficiency prescribed by ASRHAE 90.1-2013 for gas-fired service water heaters with a capacity greater than or equal to 293 kW (1,000 MBH), will be set equal to the amended SB-10 (2017) Division 3, Chapter 3 (NECB 2015) requirement when the exceptions do not apply.

The following table summarizes the amended minimum equipment efficiency for gas-fired storage service water heaters with a heating capacity greater than 22 kW (75 MBH):

Equipment	Heating Capacity kW (Btu/h)	Performance Required ASHRAE 90.1-2013	Performance Required NECB 2015
Gas-fired, storage-type without 25% site-recovered energy, or without individual dwelling unit heaters	> 22 and < 293 (> 75,000 and < 1,000,000)	80% E_t	80% E_t
	≥ 293 (≥ 1,000,000)	90% Et	
Gas-fired, storage-type with 25% site-recovered energy, or with individual dwelling unit heaters	> 22 (> 75,000)	80% E_t	80% E_t
	> 117 (> 400,000)		80% E_t (V_t< 37.8 L/10 USgal)
			77% E_t (V_t> 37.8 L/10 USgal)

The NECB 2015 performance curve for Condensing Boiler (NECB 2015 Table 8.4.4.21.-A) shall be applied when the efficiency is ≥ 88%. When the efficiency is < 88%, the performance curve for Non-Condensing Boiler shall be applied.

Example: Following the NECB 2015 compliance path, where a building is equipped with two 146.5 kW (500 MBH) gas-fired storage service water heaters and two 1,890 L (500 U.S gal) storage tanks, the total installed service hot water heating input equals 293 kW. There is no site-recovered energy included in the scope of this project, and this building is not equipped with individual dwelling unit heaters.

In this scenario, the minimum equipment efficiency of the reference building's gas-fired storage service water heaters shall be 90% E_t and not 77% E_t as prescribed by NECB 2015 Table 6.2.2.1.

5.8 Elevators

Elevators can account for up to approximately 10% of a building's total energy use. To improve the accuracy of building simulations submitted to the SBD Program, elevator loads shall be included in both the Reference and Baseline/Proposed Building models.

The SBD Program shall reference elevator modelling assumptions and schedules from the NREL's public report "US Department of Energy Commercial Reference Building Models of the National Building Stock", and BC Hydro's March 2016 Energy Modelling Guideline.

Elevators shall be modelled using acceptable industry standard methodology and good engineering practice.

Neither ASHRAE 90.1-2013 Section 11 – Energy Cost Budget Method, nor NECB 2015 Part 8, prescribe default elevator loads. To improve consistency between SBD applications, where the quantity of elevators and elevator motor power details are not specified at the time of the project's SBD Stage 2 (Pre-Construction) submission, the total number of installed elevators and associated motor power shall be modelled according to the following table for the appropriate building area type:

Building Area Type	Total Number of Elevators	Motor Power (kW/motor)
Medium Office	2	14.6
Large Office	12	18.5
Secondary School	2	14.6
Small Hotel	2	14.6
Large Hotel	6	18.5
Hospital	8	18.5
Outpatient Healthcare	3	14.6
Mid-rise MURB	2	14.6
High-rise MURB	3	18.5

For buildings with fewer than six stories (including the basement), it's assumed that elevators use hydraulic motors without counter weighting and have a mechanical efficiency of 58%. Associated heat gain will be applied to a first-floor core zone.

For following buildings six stories and higher, it's assumed that elevators use traction motors with counter weighting and have a mechanical efficiency of 64%. Associated heat gain will be applied to a top floor core zone.

For the purpose of the SBD program, the following operating schedules shall be used for elevators in both the Reference and Baseline/Proposed Building models:

Medium and Large Office Buildings:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
M-F	0	0	0	0	0	0	0	0.35	0.7	0.4	0.4	0.4	0.6	0.5	0.37	0.4	0.5	0.6	0.1	0	0	0	0	0
Sat	0	0	0	0	0	0	0	0.16	0.1	0.2	0.2	0.3	0.2	0.1	0.08	0	0.1	0.1	0	0	0	0	0	0
Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Secondary School:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
M-F	0	0	0	0	0	0	0	0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0	0	0	0	0	0	0	0
Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Small and Large Hotel:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
All	0.1	0.1	0.1	0.1	0	0	0	0.5	0.5	0.4	0.2	0.2	0.2	0.2	0.15	0.2	0.4	0.5	0.5	0.4	0.4	0.3	0	0

Hospital:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
M-F	0.2	0.2	0.2	0.2	0	0	0	0.5	0.8	1	1	1	0.8	1	1	1	1	1	0.5	0.5	0.5	0.3	0	0
Sat	0.2	0.2	0.2	0.2	0	0	0	0.4	0.5	0.7	0.7	0.7	0.5	0.5	0.51	0.5	0.5	0.3	0.2	0.2	0.2	0.2	0	0
Sun	0.2	0.2	0.2	0.2	0	0	0	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0	0

Outpatient Healthcare:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
M-F	0.1	0.1	0.1	0.1	0	0	0	0.5	0.8	1	1	1	0.8	1	1	1	1	1	0.5	0.5	0.5	0.3	0	0
Sat	0.1	0.1	0.1	0.1	0	0	0	0.4	0.5	0.7	0.7	0.7	0.5	0.5	0.51	0.5	0.5	0.3	0.1	0.1	0.1	0.1	0	0
Sun	0.1	0.1	0.1	0.1	0	0	0	0.05	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.1	0.1	0.1	0.1	0	0

Mid and High-rise Multi-Unit Residential Buildings (MURBs):

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
All	0.1	0.1	0.1	0.1	0	0	0	0.5	0.5	0.4	0.2	0.2	0.2	0.2	0.15	0.2	0.4	0.5	0.5	0.4	0.4	0.3	0	0

6.0 SBD APPROVED ENERGY CONSERVATION MEASURES NOT RECOGNIZED BY SB-10

The following section provides details on the modelling methodologies to be followed to claim energy savings credit for Energy Conservation Measures (ECMs) recognized under the SBD program, that are currently not recognized by SB-10 (2017) Division 3 and its associated energy standards.

6.1 Service Hot Water / Domestic Hot Water Heating

ASHRAE 90.1-2013 does not recognize energy savings credit for a reduction in Service Hot Water (SHW) or Domestic Hot Water (SHW/DHW) loads (e.g. a Baseline/Proposed Building equipped with low flow water fixtures), requiring energy modellers to simulate the Reference Building's SHW/DHW load equal to the Baseline/Proposed Building's SHW/DHW load.

The NECB 2015 also does not recognize energy savings credit for a reduction in SHW/DHW loads, per Sentence 8.4.4.2.(2); the Reference Building's service water heating loads shall be modelled as being identical to those determined for the Baseline/Proposed Building.

For the purpose of the SBD program, for the Proponent to claim energy credits for SHW/DHW load reduction through low flow water fixtures, the following modelling methodology shall be applied to the Reference and Baseline/Proposed Building models.

6.1.1 SHW/DHW – Baseline/Proposed Building

To calculate the Baseline/Proposed reduction in SHW/DHW load, the LEED BD+C v4 Indoor Water Use Reduction methodology shall be used to calculate the percent SHW/DHW load reduction relative to the OBC's maximum prescribed fixture flow rates listed in OBC Subsection 7.6.4.

Please note, it is assumed for the purpose of the SBD program that the Service Water Heating Loads prescribed in NECB 2015 Table A-8.4.3.2. (2)-B are reflective of the maximum flow rates listed in OBC Subsection 7.6.4.

The Baseline/Proposed Building's SHW/DHW load shall be the difference between the NECB 2015 default Service Water Heating Load simulated in the Reference Building and the calculated SHW/DHW load reduction.

> Example: The NECB 2015 default DHW load for a residential dwelling unit is 500 W/person, which is used in the Reference Building. In this example, the calculated percent DHW load reduction following the LEED BD+C v4 Indoor Water Use Reduction methodology equals 25%. Following the methodology noted above, the Baseline/Proposed Building's DHW load equals 500 W/person x (1 – 0.25) = 375 W/person.

6.1.2 SHW/DHW – Reference Building

<u>SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013) & Chapter 3 (NECB 2015):</u>

The Reference Building shall use the default Service Water Heating Load values specified in NECB 2015 Table A-8.4.3.2.(2)-B for the appropriate space type, as it is assumed that these default loads are reflective of the OBC's maximum prescribed fixture flow rates listed in OBC Tables 7.6.4.1, 7.6.4.2.A and 7.6.4.2.B.

6.2 Dwelling Unit Lighting

SB-10 (2017) does not recognize energy savings associated with lighting systems within dwelling units. ASHRAE 90.1-2013 does not regulate dwelling unit lighting power as stated in Section 9.1.1, which excludes lighting within dwelling units from the scope of Section 9.

NECB 2015 Clause 4.1.1.2.(2)(b) excludes lighting within dwelling units from Part 4, however, energy modellers are required to simulate a LPD of 5 W/m² (0.46 W/ft²) for dwelling unit space types in both the Baseline/Proposed and Reference Buildings according to Sentences 8.4.3.4.(1) and 8.4.4.5.(2) respectively.

For the purpose of the SBD program, for a Proponent to claim energy credit for lighting systems within the dwelling, the following modelling methodology shall be applied to the Reference and Baseline/Proposed Buildings.

6.2.1 Dwelling Unit Lighting – Baseline/Proposed Building

The Baseline/Proposed Building shall be modelled with the as-designed/as-constructed LPD input, as long as a complete dwelling unit lighting design for the project is provided in the Proponent's submission packages (e.g. Stage 2 or Stage 3 submission). Areas with a lower than recommended illuminance within the dwelling unit space (such as under illuminated rooms, rooms with capped connections or left to the tenant through electrical outlets) shall have an LPD input of 5 W/m² (0.46 W/ft²).

6.2.2 Dwelling Unit Lighting – Reference Building

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013) & Chapter 3 (NECB 2015):

The Reference Building's dwelling unit spaces shall be modelled with a LPD of 5 W/m² (0.46 W/ft²).

6.3 Dwelling Unit Major Appliances (Receptacle Load)

SB-10 (2017) does not recognize energy savings associated with receptacle loads for all building/space types, which includes high efficiency dwelling unit appliances.

ASHRAE 90.1-2013 Table 11.5.1 no 12. specifies that receptacle loads shall be assumed to be identical in the Baseline/Proposed and budget building designs. During the early stages of the design these receptacle loads are typically unknown and ASHRAE 90.1 does not prescribe any default load values.

NECB 2015 Sentence 8.4.4.2.(2) specifies that internal loads (which includes receptacle loads) shall be modeled as being identical to those determined for the Baseline/Proposed Building in Sentence 8.4.3.2(2). The Baseline/Proposed Building's internal loads shall be based on Tables A-8.4.3.2.(2)-B for the appropriate space type when actual values are unknown.

According to Table A-8.4.3.2. (2), the peak receptacle load for general dwelling unit space types is 5 W/m², which is assumed to include all associated receptacle loads for a dwelling unit space including major appliances (e.g. dishwashers, clothes washers, dryers, refrigerators, and ranges). If the dwelling unit is equipped with gas-fired cooking appliances, then a load of 1 W/m² shall be assigned to gas and the remaining 4 W/m² shall be assigned to electricity.

For the purpose of the SBD program, a Proponent may claim energy credit for high efficiency ENERGY STAR rated major appliances within dwelling units, provided that the appliances use less energy than their respective ENERGY STAR® requirements in force at the time of the building permit application. To

claim credit, the following modelling methodology shall be applied to the Reference and Baseline/Proposed Buildings.

6.3.1 Dwelling Unit Major Appliances (Receptacle Load) – Baseline/Proposed Building

Credit for energy savings associated with the Baseline/Proposed Building's major appliances are to be accounted for based on the relative savings between the ENERGY STAR minimum kWh rating threshold and the project's actual appliance kWh ratings, by proportionally reducing the 5 W/m² peak receptacle load.

> Example: ENERGY STAR® minimum kWh ratings for suite appliances – 1,000 kWh
> Project's energy use (kWh) for selected in-suite appliances – 900 kWh
> Reduction in plug load = 5 W/m² x 900/1000 = 4.5 W/m²

Given that ENERGY STAR® is a moving target, the ENERGY STAR®/Energuide rating documentation for the major appliances seeking energy saving credits must be submitted as part of the SBD submission package (i.e. Stage 2 & Stage 3 submissions). In order to assess the ENERGY STAR® minimum kWh rating, the latest version[6] of the ENERGY STAR® Appliance Calculator must be used and submitted with the SBD submission package.

6.3.2 Dwelling Unit Major Appliances (Receptacle Load) – Reference Building

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013) & Chapter 3 (NECB 2015):

The Reference Building's dwelling unit spaces shall be modelled with a EPD of 5 W/m² (0.46 W/ft²).

[6] Latest ENERGY STAR® Appliance Calculator version is based on the calculator version available at the time of the project's Stage 2 submission. This same calculator version shall be used for the project's Stage 3 submission.

APPENDIX I CONDENSED MODELING GUIDELINES – ADVANCED ENERGY MODELLERS

A5.0 BUILDING ENERGY MODELLING METHODOLOGY

A5.1 Carbon Emissions Calculations

Per the Savings by Design Bulletin 180501, projects submitted to the SBD program for incentive funding after December 31, 2016 shall use the SB-10 (2017) Division 3 CO_2e emission factors listed in Table 1.1.2.2.

A5.2 Weather Files

New projects submitted to the SBD program for incentive funding after April 30, 2018 shall use the Ontario CWEC 2016 weather file that best reflects the projects location and weather conditions.

A5.3 Building Envelope

A5.3.1 Opaque Assemblies

A5.3.1.1 Opaque Assemblies – Baseline/Proposed Building

The effective thermal transmittance (i.e. U-value) of the Baseline/Proposed Building's opaque assemblies shall include the effects of thermal bridging by considering the heat loss of both the Clear Field Assembly and Interface Details except where it can be proven to be insignificant.

A5.3.1.2 Opaque Assemblies – Reference Building

SB-10 (2017) Division 3, Chapter 2:

The building envelope requirement values shown in SB-10 (2017) Division 3, Chapter 2 Tables SB 5.5.-5-2017 to SB 5.5-7-2017 shall be considered effective U-values which include all thermal bridging effects. Exceptions provided in SB-10 (2017) Division 3, Chapter 2 Section 1.1.1.4. shall apply.

SB-10 (2017) Division 3, Chapter 3:

The overall thermal transmittance values shown in SB-10 (2017) Division 3, Chapter 3 Table SB 3.2.2.2. shall be considered effective U-values and include all thermal bridging effects. Exceptions provided in Sentences 3.2.2.2.(3) and 3.2.2.2.(4) and Sentence 3.2.1.2.(1) of Division B of NECB 2015 shall apply.

A5.3.2 Fenestration and Doors

A5.3.2.1 Fenestration and Doors – Baseline/Proposed Building

The effective thermal transmittance (i.e. U-value) of the Baseline/Proposed Building's fenestration and doors shall be modelled according to their intended actual performance, which includes framing.

A5.3.2.2 Fenestration and Doors – Reference Building

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013):

The overall thermal transmittance values shown in SB-10 (2017) Division 3, Chapter 2 Tables SB 5.5.-5-2017 to SB 5.5-7-2017 shall be considered effective U-values which include all thermal bridging effects for windows and doors. Exceptions provided in SB-10 (2017) Division 3, Chapter 2 Section 1.1.1.4. shall apply.

SB-10 (2017) Division 3, Chapter 3 (NECB 2015):

The overall thermal transmittance values shown in SB-10 (2017) Division 3, Chapter 3 Tables SB 3.2.2.3. and SB 3.3.3.4. shall be considered effective U-values and include all thermal bridging effects for windows and doors respectively. Exceptions provided in Articles 3.2.2.3 and 3.2.2.4. of the NECB 2015 shall apply.

A5.3.3 Air Leakage

A5.3.3.1 Air Leakage – Baseline/Proposed Building

For the purpose the SBD program, the Baseline/Proposed Building's air leakage shall be modelled with a constant value of 0.25 L/(s·m²) at 5Pa [0.0492 cfm/ft² at 0.104 psf] of total gross above-ground wall and roof areas.

A5.3.3.2 Air Leakage – Reference Building

SB-10 (2017) Division 3, Chapter 2 (ASHRAE 90.1-2013) & Chapter 3 (NECB 2015):

The Reference Building's air leakage rate shall be modelled equal to the Baseline/Proposed Building, using a constant value of 0.25 L/(s·m²) at 5Pa [0.0492 cfm/ft² at 0.104 psf] of total gross above-ground wall and roof areas.

A5.4 Internal Loads

A5.4.1 Space Types

Space types shall be representative of the Baseline/Proposed Building's type or space function. The Reference Building's space type shall be modelled as being identical to the Baseline/Proposed Building.

A5.4.2 Operating Schedules

Operating schedules shall be representative of the Baseline/Proposed Building's type or space function. The Reference Building's operating schedules shall be modelled as being identical to the Baseline/Proposed Building.

The NECB 2015 default operating schedules found in Tables A-8.4.3.2.(1)-A through A-8.4.3.2.(1)- K shall be used when actual operating schedules are unknown.

The following table summarizes the SBD prescribed schedules for specific space types:

Space Type	Building Type	NECB 2015 Schedule	SBD Amendment
Stairwells	Residential	Table A-8.4.3.2.(1)-G	Lighting - 13.2 hours per day
	Office	Table A-8.4.3.2.(1)-A	Lighting - 6 hours per day
	Retail	Table A-8.4.3.2.(1)-C	Lighting - 9.6 hours per day
	Hotel	Table A-8.4.3.2.(1)-F	Lighting - 18 hours per day
	Other	Table A-8.4.3.2.(2)-A	SBD Modelling Guide - Appendix III
Mechanical & Electrical Rooms	All	Table A-8.4.3.2.(1)-A	Lighting - 2.75 hours per day
Storage Rooms (All sizes)	All	Table A-8.4.3.2.(1)-E	Lighting - 5.2 hours per day
Corridors	Residential	Table A-8.4.3.2.(1)-G	Lighting - 24 hours per day
	Office	Table A-8.4.3.2.(1)-A	Lighting - 8 hours per day
	Retail	Table A-8.4.3.2.(1)-C	Lighting - 10.6 hours per day
	Hotel	Table A-8.4.3.2.(1)-F	Lighting - 24 hours per day
	Other	Table A-8.4.3.2.(2)-A	SBD Modelling Guide - Appendix III
Parking Garages	All	Table A-8.4.3.2.(1)-K	Lighting - 24 hours per day Fans - 4 hours per day
Exterior Lighting	All	n/a	Schedule on at night via photocell (Annual average ~ 12 hour per day)

A5.4.3 Occupancy Schedules

Occupancy density shall be representative of the Baseline/Proposed Building's type or space function. The Reference Building's occupancy density shall be modelled as being identical to the Baseline/Proposed Building.

The NECB 2015 default occupancy loads found in Table A-8.4.3.2.(2)-B shall be used when actual occupancies are unknown.

A5.4.4 Electrical Receptacles

Internal receptacle loads shall be representative of the Baseline/Proposed Building's type or space function. Receptacle loads are not regulated by SB-10; the Reference Building's receptacle loads shall be modelled as being identical to the Baseline/Proposed Building.

The NECB 2015 peak receptacle loads listed in Table A-8.4.3.2.(2)-B shall be used for the purposed of the SBD program, except for residential dwelling units.

For residential dwelling units, the NECB 2015 peak receptacle load of 5 W/m² found in Table A-8.4.3.2.(2)-B for space type 'Dwelling Units – General' shall be used when no energy savings associated with in-suite major appliances are being claimed by the Proponent. Please refer to Section A6.4 below for details.

A5.4.5 Lighting

A5.4.5.1 Lighting – Baseline/Proposed Building

The Baseline/Proposed Building shall be modelled with the as-designed or as-constructed LPD input for Stage 2 and Stage 3 SBD submissions respectively. Unlit areas with a lower than recommended illuminance in the space (such as rooms left to a tenant to furnish) shall have a LPD input equal to the LPDs prescribed by SB-10 (2017) Division 3. No credit can be claimed for lighting systems in these unlit areas.

A5.4.5.2 Lighting – Reference Building

SB-10 (2017) Division 3, Chapter 2: The Reference Building's lighting power allowance shall be determined according to Table SB 9.5.1-2017 or Table SB 9.6.1-2017.

SB-10 (2017) Division 3, Chapter 3: The Reference Building's lighting power allowance shall be determined according to Table SB 4.2.1.5.-2017 or Table SB 4.2.1.6.-2017.

A5.5 Energy Recovery

A5.5.1 Energy Recovery – Issue Regarding SB-10 (2017) Division 3, Chapter 3 (NECB 2015)

For all applications under the SBD Program, SB-10 (2017) Division 3, Chapter 3, Sentence 5.2.10.1.(3) shall be modified to include the word "or" at the end of Clause (b).

A5.5.2 Energy Recovery – Baseline/Proposed Building

The Baseline/Proposed Building shall be modelled with energy recovery systems according to the project's mechanical design, having an energy recovery effectiveness and outdoor air supply/exhaust rate per the mechanical design documentation for the Stage 2 SBD submission and the manufacturer's specifications for the Stage 3 SBD submission.

A5.5.3 Energy Recovery – Reference Building

SB-10 (2017) Division 3, Chapter 2: Exhaust air energy recovery system required by ASHRAE 90.1 Section 6.5.6.1. shall be modeled with an energy recovery effectiveness of at least 55%. For the purpose of the SBD program, Section 6.5.6.1 exception (8) applies to systems serving all space types, except residential dwelling units (see below).

SB-10 (2017) Division 3, Chapter 3: Exhaust air energy recovery system required by Sentence 5.2.10.1.(1) shall be modeled with an energy recovery effectiveness of at least 55%. For the purpose of the SBD program, exception 5.2.10.1.(3)(c) amended by SB-10 Sentence 1.1.1.8.(1) shall apply to systems serving all space types, except residential dwelling units (see below).

Residential Dwelling Units:

For the purpose of the SBD program, the Reference Building shall be equipped with in-suite exhaust air energy recovery systems having a minimum energy recovery effectiveness of at least 55%, regardless of the compliance path followed by the project.

The following modelling exceptions shall not be applied to dwelling unit space types:

- ASRHAE 90.1-2013 Section 6.5.6.1 exceptions (6 - 10), and
- NECB 2015 exceptions 5.2.10.1.(3)(c) and 5.2.10.1.(4) amended by SB-10 Sentence 1.1.1.8.(1).

A5.6 Hot Water (HW) Space Heating

A5.6.1 HW Gas Fired Boilers – Baseline/Proposed Building

Gas-fired boilers shall be modelled according to the as-designed mechanical specifications for the Stage 2 Energy Performance submission. For Stage 3 Commissioning submissions, the boiler input shall be updated in the model according to the manufacturer's specifications and the Project's Sequence of Controls documentation.

A5.6.2 HW Gas Fired Boilers – Reference Building

A5.6.2.1 Heating Capacity < 733 kW (2,500 MBH)

The following table summarizes the amended minimum equipment efficiency for the Reference Building's gas-fired boilers with a heating capacity less than 733 kW (2,500 MBH). The NECB 2015 performance curve for Condensing Boiler (NECB 2015 Table 8.4.4.21.-A) shall be applied when the efficiency is ≥ 88%.

Equipment	Heating Capacity kW (Btu/h)	SB-10 Performance Required ASHRAE 90.1-2013	SB-10 Performance Required NECB 2015
Gas boilers, hot water	< 88 (< 300,000)	90% AFUE	
	≥ 88 and < 733 (≥ 300,000 and < 2,500,000)	90% E_t	

A5.6.2.2 Heating Capacity ≥ 733 kW (2,500 MBH)

For the purpose of the SBD Program, the equipment efficiency summarized in the following table shall be used for gas-fired boilers with a heating capacity ≥ 733 kW (2,500 MBH). The NECB 2015 performance curve for Modulating Boiler (NECB 2015 Table 8.4.4.21.-A) shall be applied when the heating capacity is ≥ 733 kW.

Equipment	Heating Capacity kW (Btu/h)	Performance Required ASHRAE 90.1-2013	Performance Required NECB 2015
Gas boilers, hot water	≥ 733 (≥ 2,500,000)	83.3% E_c	

A5.7 Service Hot Water (SHW) Heating

A5.7.1 SHW Gas-Fired Boilers – Baseline/Proposed Building

The Baseline/Proposed Building's SHW gas-fired boilers/heaters shall be modelled according to the as-designed mechanical specifications for the Stage 2 Energy Performance submission. For Stage 3 Commissioning submissions, the boiler/heater input shall be updated in the model according to the manufacturer's specifications and the Project's Sequence of Controls documentation.

A5.7.2 SHW Gas-Fired Boiler/ Heaters – Reference Building

A5.7.2.1 Heating Capacity ≤ 22 kW

For the purpose of the SBD Program, the equipment efficiency summarized in the following table shall be used for gas-fired storage service water heaters with a heating capacity of 22 kW (75 MBH) or less. The NECB 2015 performance curve for Fuel-fired Service Water Heater (NECB 2015 Table 8.4.4.21.-G) shall apply.

Equipment	Heating Capacity kW (Btu/h)	SB-10 Performance Required ASHRAE 90.1-2013	SB-10 Performance Required NECB 2015
Gas-fired, storage-type	≤ 22 (≤ 75,000)	0.7-0.00189V (V in U.S gallon) EF 0.7-0.0005V (V in Litres) EF	

A5.7.2.2 Heating Capacity > 22 kW (75 MBH)

For the purpose of the SBD Program, the equipment efficiency summarized in the following table shall be used for gas-fired storage service water heaters with a heating capacity greater than 22 kW (75 MBH). The NECB 2015 performance curve for Condensing Boiler (NECB 2015 Table 8.4.4.21.-A) shall be applied when the efficiency is ≥ 88%. When the efficiency is < 88%, the performance curve for Non-Condensing Boiler shall be applied.

Equipment	Heating Capacity kW (Btu/h)	Performance Required ASHRAE 90.1-2013	Performance Required NECB 2015
Gas-fired, storage-type without 25% site-recovered energy, or without individual dwelling unit heaters	> 22 and < 293 (> 75,000 and < 1,000,000)	80% E_t	80% E_t
	≥ 293 (≥ 1,000,000)	90% Et	
Gas-fired, storage-type with 25% site-recovered energy, or with individual dwelling unit heaters	> 22 (> 75,000)	80% E_t	80% E_t
	> 117 (> 400,000)		80% E_t (V_t< 37.8 L/10 USgal)
			77% E_t (V_t> 37.8 L/10 USgal)

A5.8 Elevators

Where the quantity of elevators and elevator motor power details are not specified at the time of the project's SBD Stage 2 submission, the total number of installed elevators and associated motor power shall be modelled according to the following table for the appropriate building area type:

Building Area Type	Total Number of Elevators	Motor Power (kW/motor)
Medium Office	2	14.6
Large Office	12	18.5
Secondary School	2	14.6
Small Hotel	2	14.6
Large Hotel	6	18.5
Hospital	8	18.5
Outpatient Healthcare	3	14.6
Mid-rise MURB	2	14.6
High-rise MURB	3	18.5

For the purpose of the SBD program, the following operating schedules shall be used for elevators in both the Reference and Baseline/Proposed Building models:

Medium and Large Office Buildings:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
M-F	0	0	0	0	0	0	0	0.35	0.7	0.4	0.4	0.4	0.6	0.5	0.37	0.4	0.5	0.6	0.1	0	0	0	0	0
Sat	0	0	0	0	0	0	0	0.16	0.1	0.2	0.2	0.3	0.2	0.1	0.08	0	0.1	0.1	0	0	0	0	0	0
Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Secondary School:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
M-F	0	0	0	0	0	0	0	0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0	0	0	0	0	0	0	0
Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Small and Large Hotel:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
All	0.1	0.1	0.1	0.1	0	0	0	0.5	0.5	0.4	0.2	0.2	0.2	0.2	0.15	0.2	0.4	0.5	0.5	0.4	0.4	0.3	0	0

Hospital:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
M-F	0.2	0.2	0.2	0.2	0	0	0	0.5	0.8	1	1	1	0.8	1	1	1	1	1	0.5	0.5	0.5	0.3	0	0
Sat	0.2	0.2	0.2	0.2	0	0	0	0.4	0.5	0.7	0.7	0.7	0.5	0.5	0.51	0.5	0.5	0.3	0.2	0.2	0.2	0.2	0	0
Sun	0.2	0.2	0.2	0.2	0	0	0	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0	0

Outpatient Healthcare:

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
M-F	0.1	0.1	0.1	0.1	0	0	0	0.5	0.8	1	1	1	0.8	1	1	1	1	1	0.5	0.5	0.5	0.3	0	0
Sat	0.1	0.1	0.1	0.1	0	0	0	0.4	0.5	0.7	0.7	0.7	0.5	0.5	0.51	0.5	0.5	0.3	0.1	0.1	0.1	0.1	0	0
Sun	0.1	0.1	0.1	0.1	0	0	0	0.05	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.1	0.1	0.1	0.1	0	0

Mid and High-rise Multi-Unit Residential Buildings (MURBs):

Day	Times of day																							
	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	11p	12
All	0.1	0.1	0.1	0.1	0	0	0	0.5	0.5	0.4	0.2	0.2	0.2	0.2	0.15	0.2	0.4	0.5	0.5	0.4	0.4	0.3	0	0

A6.0 SBD APPROVED ECMS NOT RECOGNIZED BY SB-10

A6.1 Reserved

A6.2 Service Hot Water / Domestic Hot Water Heating

A6.2.1 SHW/DHW – Baseline/Proposed Building

The LEED BD+C v4 Indoor Water Use Reduction methodology shall be used to calculate the percent SHW/DHW load reduction relative to the OBC's maximum prescribed fixture flow rates listed in OBC Subsection 7.6.4.

A6.2.2 SHW/DHW – Reference Building

The Reference Building shall use the default Service Water Heating Load values specified in NECB 2015 Table A-8.4.3.2. (2)-B for the appropriate space type.

A6.3 Dwelling Unit Lighting

A6.3.1 Dwelling Unit Lighting – Baseline/Proposed Building

The project's as-designed/as-constructed LPD input shall be modelled if a complete dwelling unit lighting design is included in the submission packages. Areas with a lower than recommended illuminance[7] within the dwelling unit space shall have a LPD input of 5 W/m² (0.46 W/ft²).

A6.3.2 Dwelling Unit Lighting – Reference Building

The Reference Building's dwelling unit spaces shall be modelled with a LPD of 5 W/m² (0.46 W/ft²).

A6.4 Dwelling Unit Major Appliances (Receptacle Load)

A6.4.1 Dwelling Unit Major Appliances (Receptacle Load) – Baseline/Proposed Building

Credit for energy savings associated with major appliances are to be accounted for based on the relative savings between the ENERGY STAR minimum kWh rating threshold and the project's actual appliance kWh ratings, by proportionally reducing the 5 W/m² peak receptacle load.

The latest version[8] of the ENERGY STAR® Appliance Calculator must be used and submitted with the SBD submission package along with the ENERGY STAR®/Energuide rating documentation for the major appliances seeking energy saving credits.

A6.4.2 Dwelling Unit Major Appliances (Receptacle Load) – Reference Building

The Reference Building's dwelling unit spaces shall be modelled with a EPD of 5 W/m² (0.46 W/ft²).

[7] Illuminance levels shall be based on the 9th edition of the Illuminance Engineering Society's Lighting Handbook

[8] Latest ENERGY STAR® Appliance Calculator version is based on the calculator version available at the time of the project's Stage 2 submission. This same calculator version shall be used for the project's Stage 3 submission.

APPENDIX II – SAVINGS BY DESIGN BULLETIN 180501

Savings by Design Bulletin 180501
(Effective May 01, 2018)

To all Designers and Energy Modelers,

The following bulletin is to clarify the modeling methodologies for the below mentioned issues, discussed/agreed upon during Sustainable Building's Canada Modelers Forum held on May 01, 2018, to be followed by participants and energy modelers when submitting new projects to the Savings by Design (SBD) program for incentive funding submitted after April 30, 2018.

Issue 1) SB-10 (2017) Division 3 Reference Building – MURB Exhaust Air Heat Recovery

SBD Modeling Methodology: The SB-10 (2017) Division 3 reference building shall be equipped with exhaust air heat recovery regardless of the compliance path followed by the project.

- Division 3, Chapter 2 (projects following the ASRHAE 90.1-2013 compliance path): exhaust air heat recovery shall be modeled for each fan system according to Section 11.5.2(d).
  - *Please note that Section 6.5.6.1 exceptions (6 - 10) shall not be applied to MURB type buildings applying for SBD incentive funding.*
- Division 3, Chapter 3 (projects following the NECB 2015 compliance path): exhaust air heat recovery shall be modeled for each fan system according to SB-10 (2017) Division 3, Chapter 3, Sentence 1.1.1.8.(1).
  - *Please note that exceptions 5.2.10.1.(3)(c) and 5.2.10.1.(4) amended by Sentence 1.1.1.8.(1) shall not be applied to MURB type buildings applying for SBD incentive funding.*

Issue 2) CWEC 2016 Weather files

SBD Modeling Methodology: New projects submitted to the Savings by Design (SBD) program for incentive funding after April 30, 2018 shall use the Ontario CWEC 2016 weather file that best reflects the projects location and weather conditions.

The Ontario CWEC 2016 weather files can be downloaded from climate.onebuilding.org.

As an additional resource, please refer to Environment Canada's Map of Active Weather Stations. This will help the modeler with choosing the most appropriate weather file for the project.

Issue 3) Carbon Dioxide Emission Factors

SBD Modeling Methodology: Projects submitted to the Savings by Design (SBD) program for incentive funding after December 31, 2016 shall use the SB-10 (2017) Division 3 CO_2e emission factors listed in Table 1.1.2.2.

APPENDIX III – BC HYDRO MODELLING GUIDELINE (OCT 2018) APPENDIX B

NECB 2015 Building Area Type lighting annual operating hours (for non-dwelling unit spaces).

NECB 2015 Building Area Type	Annual Hours	Corridor & Elv. Lobby	Washroom	Locker Room	Stairway
Automotive facility	3210	3880	3100	3100	2910
Convention centre	3530	3880	3100	3100	2910
Courthouse	2820	2930	2340	2340	2200
Dining: bar lounge/ leisure	4740	5220	4180	4180	3920
Dining: cafeteria/ fast food	4590	5220	4180	4180	3920
Dining: family	4750	5220	4180	4180	3920
Dormitory	3870	8760	2380	2380	5260
Exercise centre	2820	2950	2360	2360	2660
Fire station	5880	8760	7010	7010	6570
Gymnasium	2870	2950	2360	2360	2660
Health-care clinic	3290	2930	2340	2340	2200
Hospital	4720	8760	7010	7010	6570
Hotel	3310	8760	1630	1630	6570
Library	3610	3880	3100	3100	3490
Manufacturing facility	3760	3880	3100	3100	3490
Motel	3620	8760	1630	1630	6570
Motion picture theatre	2620	2980	1740	1740	2680
Multi-unit residential building	6210	8760	7010	7010	4820
Museum	3500	3880	3100	3100	3490
Office	2870	2930	2340	2340	2200
Parking garage	5760	8760	7010	7010	5260
Penitentiary	4450	8760	2340	2340	5260
Performing arts theatre	1940	2980	830	830	2680
Police station	4100	8760	7010	7010	6570
Post office	3140	3880	3100	3100	2910
Religious building	2350	2180	1740	1740	1960
Retail area	3750	3880	3100	3100	3490
School/ university	2580	2930	2340	2340	2200
Sports arena	4170	5220	4180	4180	4700
Town hall	3040	3370	2700	2700	2530
Transportation	5190	8760	7010	7010	7880
Warehouse	2830	2830	2260	2260	2120
Workshop	3580	3880	3100	3100	2910

Reference: BC Hydro New Construction Program's Energy Modelling Guideline (October 2018)

NECB 2015 Common Space Type lighting annual operating hours (for non-dwelling unit spaces).

NECB 2015 Common Space Types	Annual Hours
Atrium	3880
First 13m in height - per m (height)	3880
Height above 13m - per m (height)	3880
Audience/seating area - permanent	
for auditorium	2980
for motion picture theatre	2180
for performing arts theatre	1040
Classroom/lecture/training	2330
Conference/meeting/multipurpose	3370
Corridor/transition	*
≥2 4 m wide	*
<2 4 m wide	*
Dining area	
for bar lounge/leisure dining	5220
For family dining	5220
Dining other	5220
Dressing/fitting room for performance arts theatre	2800
Electrical/mechanical	1000
Food preparation	5220
Laboratory	
Lab for classrooms	2420
Lab for medical/Industrial/research	2930
Lobby	
For elevator	*
For motion picture theatre	2950
For performing arts theatre	2950
Lobby other	3880
Locker room	*
Lounge/recreation	5220
Office	
Office enclosed	2300
Office open plan	2930
Sales area	3880
Stairway	*
Storage	1910
Washroom	*
Workshop	3880

Reference: BC Hydro New Construction Program's Energy Modelling Guideline (October 2018)

NECB 2015 Building-Specific Space Type lighting annual operating hours (for non-dwelling unit spaces).

NECB 2015 Building-Specific Space Types	Annual Hours	NECB 2015 Building-Specific Space Types	Annual Hours
Automotive repair garage	3880	Library	
Bank - banking activity area	2930	card file and cataloging	3880
Convention centre		reading area	3880
audience seating	3880	stacks	3880
Convention - exhibit space	3880	Manufacturing	
Courthouse/police station/penitentiary		corridor/transition area ≥2 4 m wide	3880
courtroom	2930	corridor/transition area <2 4 m wide	3880
confinement cell	5820	detailed manufacturing	3880
judges' chambers	2930	equipment room	3880
penitentiary audience seating	2930	extra high bay (> 15 m floor-to-ceiling height)	3880
penitentiary classroom	2260	high bay (7 5 m to 15 m floor-to-ceiling height)	3880
penitentiary dining	5220	low bay (<7 5 m floor-to-ceiling height)	3880
Dormitory - living quarters	2970	Museum	
Fire station		general exhibition	3880
engine room	8760	restoration	2930
sleeping quarters	2970	Parking garage - garage area	6730
Gymnasium/fitness centre		Post office - sorting area	2930
Fitness area	2950	Religious building	
Gymnasium - audience seating	2950	Religious audience seating	2180
Play area	2950	fellowship hall	2180
Hospital		worship pulpit, choir	2180
Hospital corridor/transition area ≥2 4 m wide	8760	Retail	
Corridor/transition area <2 4 m wide	8760	retail dressing/fitting room	3680
Emergency	8760	mall concourse	3880
Exam/treatment	3880	retail sales area	3880
Laundry - washing	3880	Sports arena	
Hospital lounge/recreation	5220	Sports audience seating	2950
Medical supply	8760	Court sports arena - class 4	2950
Nursery	8760	Court sports arena - class 3	2950
Nurses' station	8760	Court sports arena - class 2	2950
Operating room	8760	Court sports arena - class 1	2950
Patient room	5820	Ring sports arena	2950
Pharmacy	3880	Transportation	
Physical therapy	3880	Air/train/bus - baggage area	8760
Radiology/imaging	8760	Airport - concourse	8760
Recovery	8760	Seating area	8760
Hotel/motel		Terminal - ticket counter	8760
hotel dining	5220	Warehouse	
hotel guest rooms	2040	Fine material storage	2830
hotel lobby	8760	Medium/bulky material	2830
highway lodging dining	5220	Medium/bulky material with permanent shelving that is >60% of ceiling height	2830
highway lodging guest rooms	2040		

Reference: BC Hydro New Construction Program's Energy Modelling Guideline (October 2018)