Review Tips for NECB Energy Modelling Guidance under LEED v4/4.1

Canada Green Building Council | Conseil du Bâtiment Durable du Canada

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Projects in Canada have the option under LEED v4 to utilize the National Energy Code for Buildings (NECB) 2011 through a Canadian specific Alternative Compliance Path (ACP). Canadian project teams can also utilize an energy code version that is similar to their local code adoption through the pilot ACP EApc143 Zero Energy Performance Index (zEPI) (LEED v4 or LEED v4.1). The zEPI ACP allows project teams to utilize NECB 2015, 2017 or 2020.

Occasionally project teams have reached out to CAGBC for modelling guidance on LEED v4/4.1 with NECB. Additionally, while the Canadian ACP for NECB 2011 provides a number of descriptive conditions for LEED models, the zEPI ACP has more limited guidance, and project teams have raised these challenges to CAGBC. CAGBC's Energy & Engineering Technical Advisory Group (TAG) have responded with the following direction for project teams encountering these issues within their energy models. Project teams which feel their energy models cannot accommodate this direction should reach out to the CAGBC in advance of submitting to ensure a smooth review process.

The following issues are addressed:

Additionally, note that there was previous guidance for NECB 2011 Hydronic Pump modelling provided in January 2023 through CAGBC's Technical Bulletin to members and website.

Issue Title	Summary of Issue	Direction
NECB 2011 Radiant Effects (NECB 2011 8.4.4.17. Space Temperature Control)	The issue concerns this direction within NECB : “If an in-floor, in-ceiling or in-wall radiant heating and/or cooling system is used in the proposed building, each conditioned thermal block in the reference building shall be modeled using heating and/or cooling temperature schedules, as applicable, that are 2°C warmer and 2°C cooler respectively than those used for the proposed building....” When NECB 2011 was released, energy modeling software was not able to account for the radiant effects. However, current software may now account for these effects. Applying this NECB allowance using current software that accounts for radiant effects already can double count the radiant effects in the reference case.	For LEED v4/4.1 energy modeling, where the modelling software accounts for radiant effects, models using NECB should avoid double counting radiant effects by only modelling a temperature relaxation if radiant effects cannot be directly modeled by the energy modelling software. If a temperature relaxation is modeled rather than a direct modelling of radiant effects, the relaxation should be applied to the proposed building, rather than tightening the setpoints of the reference building, to avoid reference building heating and cooling setpoints conflicting with each other. Design teams should consider how the radiant asymmetry has been mitigated, as well as how the temperature is controlled by accounting for the mean radiant temperature.
NECB 2017 – Outdoor Air Rates	There was a change from NECB 2011 to NECB 2017 regarding the allowance to take credit for demand control ventilation. NECB 2017 removed the clause addressing ventilation rates that were significantly higher or lower than those specified in the National Building Code (NBC), that you might see with variable occupancy (e.g., school gyms with occasional tournament events). This inflates the reference case energy use with a constant speed fan system running at full occupancy mode year-round rather than normal occupancy rates.	In a case where there is an infrequent excursion condition where additional ventilation is required, such as a school gym with an occasional assembly or tournament, the demand-controlled ventilation in the proposed design shall be considered as the increase, rather than the decrease of outdoor air. The typical operating condition of the proposed and the code minimum of the reference model at typical occupancy conditions shall be used to represent typical operating conditions. The reference building outdoor air may increase based on economizer operation.
Ventilation and Supply Flow Rates where owner has higher minimum air change rates	Some owners have higher minimum Total Air Change Per Hour rates (i.e. mixed or total air flow rates) required in their projects. In this case, do the owner requirements become the reference case, or does the reference remain the code reference.	The reference systems must model the supply airflow rate to a thermal block as described in the Supply Air Systems section of NECB Part 8. (8.4.4.19 in NECB 2011; 8.4.4.18 in NECB 2015, NECB 2017 and NECB 2020). Thermal blocks that are required to meet CSA Standard Z317.2 airflow rates in the proposed design can be modeled with identical rates in the NECB reference. Note that for laboratories, there may be additional health and safety requirements, but these air changes could come under process exhaust. These laboratory project teams, with specific air change requests, can present their case within a CIR.
HVAC System Selection in stairwells, and similar spaces	There are spaces that may require additional heating through unit heaters, baseboards, and fan coils, such as stairwells, vestibules, and other spaces adjacent to the envelope. How should this heating be handled in the model? Can it be modelled as a process load?	Heating in spaces such as stairwells and vestibules should not be treated as process loads. These are typically modelled as System 3 but without outdoor air (where not required by code). For the reference model, fans should not turn on; only baseboards should turn on to heat the space in the reference model.

Service Hot Water Flow Rates	Under NECB 2011, hot water demand savings from low-flow fixtures can be derived from WE prerequisite or credit Indoor Water Use Reduction calculations. The LEED v4 Minimum Energy Performance Calculator included a worksheet to facilitate the calculation. However, under the zEPI ACP, project teams are directed to local NECB code version or Part 8 of the NECB, which has prescriptive values for flow fixture rates.	To keep in line with other LEED v4/4.1 projects, teams can continue to use the LEED v4/4.1 WE Indoor Water Use Reduction Calculator to assist with calculating their hot water savings for energy modelling. This approach aligns with the LEED v4/4.1 LEED Minimum Energy Performance Calculator. Project teams should be sure to account for process water savings that are not addressed in the LEED water use calculator (e.g., janitor and other utility sinks, dishwashers, clothes washers, commercial kitchens, etc.)
Heating Fuel Switching (within NECB 2017 and similar)	Clarification is needed on the reference case for projects with central air source heat pump providing hot water to HW loop at outdoor air temperatures above -10C and use natural gas boilers at outdoor air temperatures below -10C. Which NECB 2017 reference applies in this case? NECB 8.4.4.13.2, 8.4.4.9.4, or 8.4.4.9.5?	Project teams are referred to NECB 2017, Section 8.4.4.13. Heat Pumps. (See same section within NECB 2015 and 2020 as well). Per Table 8.4.4.13, reference systems 1 and 3 to 6 are modelled with packaged unitary rooftop heat pumps. The rooftop unit has supplementary heating, and the thermal block has baseboards. The energy type of the supplementary heating and baseboards is determined per 8.4.4.13 (2) (g).
NECB 2017 Reference Energy Recovery System	NECB 2017 and NECB 2020 requires energy recovery systems to have at least 50% energy recovery effectiveness, E, determined as a change in the enthalpy of the outdoor air supply equal to 50% of the difference between the outdoor air and return air enthalpies at design conditions. Can systems in the NECB 2017 and 2020 reference model include a preheat coil when the design has a preheat coil for frost control?	Frost control is to be modeled as per proposed design. Reference building is to be modeled without frost controls.
Handling modeling of envelope for a Major Renovation using NECB 2015, 2017, or 2020 under the zEPI ACP.	For a project undergoing a major renovation, but focusing only on upgrading the interior architecture, mechanical, and electrical systems, and leaving the exterior envelope largely unchanged, how is the building envelope treated in the reference building?	Where projects are a major renovation of an existing building (see LEED definition), and are not touching the building envelope, (such as may be the case with a MEP system replacement and a complete interior fit-out), the proposed and reference building could be considered “performance-neutral”. If anything is changed in the building envelope, though, the modelling would have to consider the prescriptive measures as outlined in whatever version of NECB is utilized for the LEED v4/4.1 project. This approach brings the assessment in line with ASHRAE 90.1. Project teams using NECB for LEED v4/4.1 assessment are welcome to adopt the approach from ASHRAE 90.1-2019: 5.1.3 Envelope Alterations for this issue. Note that this allowance only applies to the building envelope and does not apply to other systems, such as lighting. Design teams are encouraged to consider improvement to the building envelope for energy performance when considering major renovations.

Modelling small fans under NECB path	Under NECB (e.g., 8.4.4.19 of NECB 2020, subsection 5), there is a requirement for the proposed building's secondary system, not meeting a fan motor rating of 10 kW or more, to have the reference building's secondary system modelled as having identical fan power demand. This implies that there is no energy credit (or penalty) on these small fan systems. This approach may be of concern for project teams with smaller buildings, or alternatively, larger buildings with distributed air systems.	This requirement to hold the energy of small fans in the reference building the same as the proposed, has been in place over multiple NECB versions. However, this issue was raised in the May 2015 Release Notes for CAN-QUEST v1.0 from Natural Resources Canada: "This stipulation was not implemented for two reasons: (1) it conflicts with NECB 8.4.4.19 (3) and 8.4.4.19 (4) which state the applicable static pressures and fan efficiencies that are to be set for the reference case and (2) the disconnect between zones and systems for the proposed versus reference buildings makes the application of this provision illogical." Therefore, project teams should apply the energy credit (or penalty) for modelling small fans (less than 10 kW) when using the NECB path for LEED v4/4.1.
Modeling Snow Melt under NECB	How are snow melting systems modeled under NECB and how can project teams take credit for snow melting systems that move beyond status quo?	Systems for melting snow are to be considered as process loads in the energy model and must follow NECB 2017 Section 5.2.8.7 to allow the system to shut down when not required either through automatic controls or readily accessible manual controls. Credit for improved efficiency can be modelled through the exceptional calculation method. This is outlined under LEED v4 EAp Minimum Energy Performance, Further Explanation, Exceptional Calculation Method, Documentation for nonregulated loads in the LEED v4 BD+C Reference Guide. The project team must provide supporting evidence to substantiate that the snow-melting system in the reference case represents conventional practice. Examples of acceptable documentation include: • A recent study with researched tabulations or monitored data establishing a standard practice for the given application in similar newly constructed facilities • A new-construction utility or government program that provides incentives for the measure • A document showing the systems used to perform the same function in similar facilities built within the past five years; these systems are treated as the baseline system in the analysis, and evidence must show how the energy use for the baseline and proposed buildings is determined