The National Energy Code - Hope and Peril

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NECB 2011

- History
- Policy
- Structure
- Part 3 – Building Envelope
- Part 8 – Building Energy Performance Compliance
- 2015 Code Cycle Initiatives
- Implications for the Design Professional
- Resources

Discussion Topics

History

- NECB 2011 is the second edition of the National Energy Code of Canada for Buildings.
- First Edition was MNECB 1997.
- MNECB 1997 was never adopted by any Province.
- After publication, the Standing Committee that wrote the document was disbanded.

History

While never adopted, MNECB 1997 was:

- used in CBIP program administered by NRCan;
- referenced as a baseline for LEED NC 1.0;
- often referenced in specifications for projects (Government buildings, large national corporations); and
- EE4 (the building energy modeling program which was available free from NRCan) used MNECB rule set for the reference building.

NECB 2011 Timeline

- 2007 - Business case put forward by the Provincial and Territorial Policy Advisory Committee on Codes (PTPACC) to the to revise the 1997 MNECB.
- CCBFC approved the task.
- Funding and other support was provided by NRCan.
- Standing Committee on Energy Efficiency in Buildings (SCEEB) was re-established in August 2007.

History

NECB 2011 Timeline

- July 2008 - the Council of the Federation (Canada's 13 Premiers) issue a statement requesting an improvement of 25% over the levels set by the MNECB 1997.
- National Public Review was held October 4 to November 26, 2010.
- NECB 2011 was published in November 2011.

History

NECB 2011 Timeline

- Next Edition will be 2015, on same 5-year cycle as the other model codes.
- “Model” dropped from the name as all national code documents are “model” or “progeny” documents.

History

Objective-Based Code

- Single new Objective – OE Environment
- OE1 Resources
- OE1.1 – excessive use of energy

Policy

Policy Approved by CCBFC

Assembly Constructions

- NECB 2011 addresses energy used by the building. There is no exemption within the prescriptive requirements for any assembly construction.

Policy

Compliance Paths

- NECB 2011 offers three methods of compliance (all deemed as “Acceptable Solutions”.
- Prescriptive Path
- Trade-Off Path
- Performance Path

Policy

Control Devices for Lighting

- Lighting of unoccupied interior spaces is an unnecessary use of energy. The NECB 2011 requires the installation of automatic lighting controls for many applications.

Policy

Costing

- Simple payback method used.
- Baseline was current construction, rather than assemblies specified in MNECB 1997.
- Energy rates were blended average, weighted by population.

Policy

Energy Sources

- No differentiation of requirements for energy sources.
- NECB is silent on greenhouse gas emissions, carbon footprint, supply and demand of energy sources and other such high profile issues.
- NECB is silent on alternate energy sources and renewables.

Policy

Policy

Farm Buildings

- Farm buildings remain excluded from the scope of the NECB 2011 (as they were from the MNECB 1997).

Fenestration and Door to Wall Ratio (FDWR)

- NECB 2011 sets maximum FDWR per climate zone, on a scale from 20% to 40% of wall area.

Heat Recovery

- NECB 2011 has provisions regarding installation of heat recovery equipment for many occupancies types.
- HRVs are required in the upper climate zones – 7 and 8.

Policy

HVAC and Service Water Heating Equipment

- Equipment efficiencies set to either industry standard, or minimum level under the Energy Efficiency Act.
- Trade-off path allows for trade-offs for system efficiencies.

Policy

Occupancies

- NECB 2011 does not set different levels of thermal performance for building envelope based on occupancy.
- Guiding Principal - “A wall is a wall, a roof is a roof”

Policy

Unconditioned and Semi-Heated Spaces

- Applies to buildings that have space conditioning systems or have provisions for future installation.
- Output capacity > 10 W/m^2
- Semi-heated buildings handled through trade-off path.

Policy

Vestibules

- Vestibules are required for most doors that separate conditioned space from the exterior.

Policy

Envelope Requirements based on Climate Zones

Climate Zones based on HDD

- Zone 4 <3000 HDD
- Zone 5 3000 – 3999
- Zone 6 4000 – 4999
- Zone 7A 5000 – 5999
- Zone 7B 6000 – 6999
- Zone 8 ≥ 7000

Policy

NECB 2011 Structure is set up the same as the other National Code Documents

- Division A – Compliance, Objectives and Functional Statements
- Division B – Acceptable Solutions
- Division C – Administrative Requirements

Structure

Division B – Acceptable Solutions

- Part 1 General Requirements
- Part 2 Reserved for Future Use
- Part 3 Building Envelope
- Part 4 Lighting
- Part 5 HVAC
- Part 6 Service Water Heating
- Part 7 Electrical Power and Motors
- Part 8 Building Energy Performance Compliance path

Structure

3.1 General Provisions

- Application and Compliance
- Thermal Characteristics of Building Assemblies
- Calculation of Fenestration and Door areas
- Calculation of Overall Thermal Transmittance

Part 3 – Building Envelope

3.2 Prescriptive Path

- 3.2.1.1 Protection of Insulation Materials
- 3.2.1.2. Continuity of Insulation
- 3.2.1.3. Spaces Heated to Different Temperatures
- 3.2.1.4 Allowable Fenestration and Door Area

Part 3 – Building Envelope

3.2.2.1 Vestibule requirements

Vestibules required for most “Main Entry” doors. Exceptions:

- Revolving doors.
- Material handling doors.
- Service or emergency exits (secondary doors).
- Seasonal use; as to a patio.
- Individual dwelling units.
- Retail < 200 m2, other uses <150 m2
- Buildings under 5 stories where HDD < 3500

Part 3 – Building Envelope

3.2.2.2 Thermal Characteristics of Opaque Building Assemblies

Requirements given on chart
Above ground – Walls, Roofs, Floors

Winnipeg Zone 7A

- Walls U=0.210 [R-27]
- Roof U=0.162 [R-35]
- Floors U=0.162 [R-35]

Part 3 – Building Envelope

3.2.2.2. Thermal Characteristics of Above-ground Opaque Building Assemblies

1) Except as provided in Sentences (2) and (3) and in Sentence 3.2.1.3.(1), the *overall thermal transmittance* of above-ground *opaque building assemblies* shall be not more than that shown in Table 3.2.2.2. for the *building* or part thereof enclosed by the *opaque building assembly*, for the applicable heating-degree day category. (See Appendix A.)

Table 3.2.2.2.
Overall Thermal Transmittance of Above-ground Opaque Building Assemblies
Forming Part of Sentences 3.2.2.2.(1) and (2)

Above-ground *Opaque Building Assembly*	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4:(2) < 3000	Zone 5:(2) 3000 to 3999	Zone 6:(2) 4000 to 4999	Zone 7A:(2) 5000 to 5999	Zone 7B:(2) 6000 to 6999	Zone 8:(2) ≥ 7000
	Maximum *Overall Thermal Transmittance*, in W/(m²·K)					
Walls	0.315	0.278	0.247	0.210	0.210	0.183
Roofs	0.227	0.183	0.183	0.162	0.162	0.142
Floors	0.227	0.183	0.183	0.162	0.162	0.142

Notes to Table 3.2.2.2.:
(1) See Sentence 1.1.4.1.(1).
(2) See Appendix A.

Part 3 – Building Envelope

3.2.2.3 Thermal Characteristics of Fenestration

- Zone 7A U=2.2
- Zone 7B U=2.2
- Zone 8 U=1.6

Part 3 – Building Envelope

3.2.2.3. Thermal Characteristics of Fenestration

1) For the purposes of this Article, use of the term "*fenestration*" does not include doors, which are covered in Article 3.2.2.4.

2) Except as provided in Sentences (3) and 3.2.1.3.(1), the *overall thermal transmittance* of *fenestration*, shall be not more than that shown in Table 3.2.2.3. for the applicable heating-degree-day category, as determined in accordance with Article 3.1.1.5.

3) *Skylights* whose *overall thermal transmittance* exceeds the values shown in Table 3.2.2.3. are permitted, provided that

a) the total area of such *skylights* does not exceed 2% of the gross roof area calculated in accordance with Article 3.1.1.6., and

b) the *overall thermal transmittance* of such *skylights* is not more than 3.4 W/(m²·K).

(See Appendix A.)

Table 3.2.2.3.
Overall Thermal Transmittance of Fenestration
Forming Part of Sentences 3.2.2.3.(2) and (3)

Component	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4:(2) < 3000	Zone 5:(2) 3000 to 3999	Zone 6:(2) 4000 to 4999	Zone 7A:(2) 5000 to 5999	Zone 7B:(2) 6000 to 6999	Zone 8:(2) ≥ 7000
	Maximum *Overall Thermal Transmittance*, in W/(m²·K)					
All *fenestration*	2.4	2.2	2.2	2.2	2.2	1.6

Notes to Table 3.2.2.3.:
(1) See Sentence 1.1.4.1.(1).
(2) See A-Table 3.2.2.2. in Appendix A.

Part 3 – Building Envelope

3.2.2.4 Thermal Characteristics of Doors and Access Hatches

- Zone 7A U=2.2
- Zone 7B U=2.2
- Zone 8 U=1.6

- Exclusion for doors less than 2% of wall area, if U<4.4

Part 3 – Building Envelope

3.2.2.4. Thermal Characteristics of Doors and Access Hatches

1) Except as provided in Sentences (2), (4) and 3.2.1.3.(1), the *overall thermal transmittance* of doors shall be not more than that shown in Table 3.2.2.4. for the applicable heating-degree-day category, as determined in accordance with Article 3.1.1.5.

Table 3.2.2.4.
Overall Thermal Transmittance of Doors
Forming Part of Sentence 3.2.2.4.(1)

Component	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4:(2) < 3000	Zone 5:(2) 3000 to 3999	Zone 6:(2) 4000 to 4999	Zone 7A:(2) 5000 to 5999	Zone 7B:(2) 6000 to 6999	Zone 8:(2) ≥ 7000
	Maximum *Overall Thermal Transmittance*, in W/(m²·K)					
All doors	2.4	2.2	2.2	2.2	2.2	1.6

Notes to Table 3.2.2.4.:
(1) See Sentence 1.1.4.1.(1).
(2) See A-Table 3.2.2.2. in Appendix A.

2) Doors need not comply with Sentence (1) where
a) their total area does not exceed 2% of the gross wall area calculated in accordance with Article 3.1.1.6., and
b) their *overall thermal transmittance* does not exceed 4.4 W/(m²·K).

Part 3 – Building Envelope

3.2.3 Building Assemblies in Contact with Ground

Requirements given on chart

Above ground – Walls, Roofs, Floors

Winnipeg Zone 7A

- Walls U=0.284 [R-20]
- Roof U=0.284 [R-20]
- Floors U=0.757 for 1.2 m [R-7.5]

Part 3 – Building Envelope

3.2.3. Building Assemblies in Contact with the Ground

3.2.3.1. Thermal Characteristics of Walls in Contact with the Ground

1) Except as provided in Sentence (2), the *overall thermal transmittance* of walls or portions thereof that are below the exterior ground level and are part of the *building envelope* shall be not greater than that shown in Table 3.2.3.1. for the applicable heating-degree-day category.

Table 3.2.3.1.
Overall Thermal Transmittance of Building Assemblies in Contact with the Ground
Forming Part of Sentences 3.2.3.1.(1), 3.2.3.2.(1) and 3.2.3.3.(1) to (3)

Assembly in Contact with the Ground	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4:(2) < 3000	Zone 5:(2) 3000 to 3999	Zone 6:(2) 4000 to 4999	Zone 7A:(2) 5000 to 5999	Zone 7B:(2) 6000 to 6999	Zone 8:(2) ≥ 7000
	Maximum *Overall Thermal Transmittance*, in W/(m²·K)					
Walls	0.568	0.379	0.284	0.284	0.284	0.210
Roofs	0.568	0.379	0.284	0.284	0.284	0.210
Floors	0.757 for 1.2 m	0.757 for 1.2 m	0.757 for 1.2 m	0.757 for 1.2 m	0.757 for 1.2 m	0.379 for full area

Notes to Table 3.2.3.1.:
(1) See Sentence 1.1.4.1.(1).
(2) See A-Table 3.2.2.2. in Appendix A.

2) Where radiant heating cables or heating or cooling pipes or membranes are embedded in the surface of a wall or portion thereof that is below the exterior ground level and that separates *conditioned space* from the ground, the wall shall have an *overall thermal transmittance* no greater than 80% of that required by Sentence (1). (See A-3.2.2.2.(3) in Appendix A.)

3) Insulation on walls or portions thereof that are in contact with the ground shall extend 2.4 m down from ground level or to the bottom of the wall, whichever is less. (See Appendix A.)

4) Where the top of the footing is less than 0.6 m below the exterior ground level, the same level of insulation stated in Sentence (1) shall be placed on the top or bottom surface of the floor for a distance not less than 1.2 m from the perimeter.

Part 3 – Building Envelope

3.2.4 Air Leakage

- Air barrier assembly is required for all opaque assemblies.
- Air leakage rates specified for fenestration and doors, in accordance with AAMA standards (NAFS).
- All loading dock doors must have a seal.

3.3 Trade-Off Path

- Some Limitations
- Simple Trade-off Path $\Sigma UA = \Sigma UA$
- Detailed Trade-off Path

Part 3 – Building Envelope

Detailed Trade-off Path

- Basically a simplified Energy Model method.
- Can be used for Semi-heated buildings.
- Energy modeling must be done.
- Thermal mass must be accounted for.
- Effect of Solar radiation to be accounted for.
- Solar radiation through Fenestration to be accounted for.

Part 3 – Building Envelope

Semi-Heated Buildings

- Reference set-point is 18º C.
- Capacity of installed heating equipment cannot exceed the building's heating load by more than 5%.

Part 3 – Building Envelope

Performance Path

- Part 8 was updated from 1997 MNECB.
- Clauses that were not written in “code language” were moved to Appendix or to the User’s Guide.
- Modeling should be performed by a professional that is familiar with energy modeling procedures and software.

Part 8 – Building Energy Performance Compliance Path

2015 NECB Initiatives

- Introduction of Energy Use Intensities (EUI) as a compliance path.
- Strengthened Air Barrier Requirements, Including Testing.
- Prescriptive Requirements for Semi-Heated Buildings.

2015 Code Cycle Initiatives

What you will Need to Know

- How to calculate an Assembly Overall Thermal Transmittance (U-value).
- How to get information on Fenestration U-values.
- How to perform simple trade-off calculations.
- How to specify and detail air barrier systems.

Implications for the Design Professional

Appendix C
Method for Calculating the Thermal Properties of Building Assemblies

Assemblies With Wood Framing

Where the overall thermal transmittance of a building envelope assembly containing wood framing cannot be determined from the tables in Appendix B, the procedure described herein shall be used.

This procedure is described in the ASHRAE Handbook of Fundamentals[1] for parallel path heat flow. It involves first calculating two sums of the thermal resistances of the various materials incorporated in the assembly —

- along a line that goes through the framing, RSI_F, and
- along a line that goes through the insulated portion, RSI_I.

The two sums are then combined, in proportion to the relative areas of framing and insulation, to calculate an effective thermal resistance, RSI_T, using the following formula:

$$RSI_T = \frac{100}{\frac{\%\text{ area with framing}}{RSI_F} + \frac{\%\text{ area w/o framing}}{RSI_I}}$$

Finally, the reciprocal of the effective thermal resistance is calculated to yield the overall thermal transmittance. Typical percentages of areas with and without framing are obtained from Table C-1 at the end of this appendix. RSI values for various materials are obtained from Table C-2.

[1] Calculating Overall Thermal Resistances, page 24.2 of the 1997 ASHRAE Handbook

Implications for the Design Professional

Resources

- Online webinars are available on the CCC website (Hyperlink is on MBEC website)

http://www.nationalcodes.nrc.gc.ca/eng/presentations/2011_necb_presentations.shtml

- NECB User's Guide will be published in Nov-Dec 2013.
- NRCan is working on CanQuest modeling software. Expected to be available with NECB ruleset early next year.

Resources

Resources

- AutoDesk Green Design Studio (subscription) and Ecotect (web-based service).
- Third Party Software Programs.

Resources

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Questions?