



NECB Roadmap - Part 1

To Assist in the Review of Proposed Changes to the National Energy Code for Buildings

September 2010

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Note: This Roadmap had been prepared for the use of CHBA members. It is intended to assist members in compiling information to support comments they may wish to submit on proposed changes to the NECB. The Roadmap has not been prepared to solicit information from members.

I. Introductory Information

1. Status of the NECB, Major Concerns and the Need for Your Input

Status of the NECB

The provinces and territories are supporting the up-dating of the National Energy Code for Buildings (NECB) with a view to adoption. The Code is scheduled to be published later in 2011.

Proposed changes relative to the 1997 edition of the Code will be published for public comment in October 2010.

Major Concerns

In the development of the proposed changes, there has been no comprehensive compilation of data or analysis that would allow our industry to understand what the overall **construction and cost impacts** will be.

The Need for Input from Builders of Larger Residential Buildings

If you build larger residential buildings, the NECB could have a big impact on your business.

Only by providing comments during the fall public review can builders influence the requirements in this Code. **This is effectively the last opportunity to improve the clarity and practicality of the new Code.**

Comments coming directly from builders and developers, who can best determine how they will be affected, can make a substantial and significant difference. The CHBA is encouraging members to review the proposed changes as soon as they are released, and let the Canadian Commission on Building and Fire Codes (CCBFC) know how they will affect you and your customers.

2. Background - Application, Scope and Structure of the Code, and Options for Compliance

Application of the NECB

The NECB applies to all buildings that do not fall within the application of Part 9 of the National Building Code. For residential buildings, this means all buildings that are

- more than 600 m² in building area,
OR
- more than 3 storeys in building height.

The Code also applies to energy-consuming elements on the building property, such as landscape lighting.

Scope of the NECB

The NECB provides requirements that address:

- heat loss (thermal transmission and air leakage through the building envelope),
- lighting,
- heating, ventilating and air-conditioning systems and equipment,
- service water heating,
- electrical systems and motors.

Options for Compliance

Aside from alternative solutions that may always be proposed for compliance with national model codes, the NECB provides three approaches to compliance:

- Prescriptive Path – “simple” prescriptive requirements (Division B, Parts 1 to 7)
- Trade-Offs – allowed between related building elements (e.g., higher roof insulation levels may be traded off against lower wall insulation levels)
- Performance Compliance Paths – full-building energy-use modeling

The prescriptive path is the simplest approach to complying with the Code but some requirements may prove to be overly restrictive in terms of constructability, cost or market acceptability. In these cases, a different approach will need to be followed.

3. Why a Roadmap, Scope and Structure of Part 1, Next Iterations

Why a Roadmap

Reviewing the new Code is a large undertaking that will require significant time and effort. CHBA has developed this Roadmap to assist in this process.

Scope and Structure of Roadmap – Part 1

Roadmap – Part 1 identifies areas of major concern where the submission of substantive comments depends on compilation of considerable information on your current construction methods. This Roadmap presents proposed requirements for the Building Envelope and for Lighting in the order that they will appear in the NECB.

For each of these two subject areas, introductory information is provided followed by a table that identifies:

- the requirements that raise the greatest concerns,
- the degree of concern by colour from very high (red), significant (orange), potentially significant (yellow),
- what the requirements specify,
- information that you need to compile in order to determine the implications of the requirement on your business and for your customers.

One worksheet is provided in Annex A to help in the compilation of information on exterior lighting.

Keep the answers to the questions; you will need them to provide substantive comments during public review. If you build for different markets, compilation of data for both a simpler sample building and a more up-scale building will help in providing informative comments.

The Next Iterations

There are more proposed changes to the Code that warrant comment than those identified in this Roadmap – Part 1. Once all proposed changes have been published for public review, CHBA will issue additional components.

II. The Roadmap - Part 1

NECB Part 3 - Building Envelope

Climate Zones The prescriptive requirements for thermal transmission specify increasing levels of building envelope performance for each of six climate zones, defined by heating degree days (DD).

Climate Zones and Example Locations

| Zone | Degree Days, DD | Example Locations in Zone |
|---------|-----------------|---|
| Zone 4 | < 3,000 | Victoria and Greater Vancouver, BC |
| Zone 5 | 3,000 to 3,999 | Kamloops and Kelowna, BC; Sarnia to Hamilton, Greater Toronto, ON; Liverpool, NS |
| Zone 6 | 4,000 to 4,999 | Ottawa, ON; Fredericton and Saint John, NB; Nova Scotia except Liverpool, Prince Edward Island; St. John's, NL |
| Zone 7A | 5,000 to 5,999 | Calgary and Edmonton, AB; Regina and Saskatoon, SK; Winnipeg, MB; |
| Zone 7B | 6,000 to 6,999 | Fort McMurray, AB; Whitehorse, YK |
| Zone 8 | ≥ 7,000 | Churchill, MB; Yukon except Whitehorse; Northwest Territories; Nunavut |

Note: Data excerpted from Appendix C of the 2010 National Building Code. Some values differ from the 2005 Edition.

Calculating Thermal Transmission All thermal performance levels are specified in terms of “overall thermal transmittance” in SI units. Note that lower levels are more stringent. Effective thermal resistance (RSI) is the inverse of overall thermal transmittance and takes into account all of the elements in the assembly; it is not simply the nominal thermal resistance of the insulation.

Engineering expertise or a copy of Appendix B Thermal Characteristics of Common Building Assemblies of the 1997 Model National Energy Code for Buildings (MNECB) is needed to compile information on overall thermal transmittance. Copies of the MNECB 1997 can be obtained from the National Research Council’s Virtual Store [<http://www.nrc-cnrc.gc.ca/eng/ibp/irc/codes/97-energy-code-buildings.html>]. Note that the MNECB 1997 Appendix B does not provide information on EIFS assemblies.

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications |
|--|--|--|
| | | <p><u>Note:</u> If you build for different markets, compile information for a simple building and a more up-scale building.</p> |
| <p>3.1.1.5. Calculations (of overall thermal transmittance)</p> | <p>In the calculation of overall thermal transmittance, a number of elements may be excluded but these are limited. For example, major structural penetrations such as balcony slabs are excluded only to the point where the sum of the cross-sectional areas does not exceed 2% of the above-ground building envelope area.</p> | <ul style="list-style-type: none"> • Determine if floor slabs and other elements extend to the exterior in the buildings you currently build. <i>If not, skip to the next item (3.2.1.4.).</i> • If so, determine if the cross-sectional area exceeds 2% of the above-ground building envelope area. <i>If not, skip to the next item (3.2.1.4.).</i> <p><i>If so, then:</i></p> <ul style="list-style-type: none"> • Determine if these areas can be reduced to meet the 2% limit and at what cost (cost for the building / price increase attributed to each dwelling unit). • If the cross-sectional area of slab extensions remains above 2%, include this in calculation of overall thermal transmittance for opaque building envelope elements (see item 3.2.2.2. below). |

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---|
| 3.2.1.4. Allowable Areas of Fenestration and Doors | <p>The total area for vertical fenestration (windows) and doors must not exceed a certain percentage of the gross wall area. This percentage is determined according to a quadratic equation based on heating degree days (DD):</p> $\text{FWR} = 2.590\text{E}^{-8} * \text{DD}^2 - 3.516\text{E}^{-4} * \text{DD} + 1.392$ <p>For selected DD values, this results in:</p> <table border="1" data-bbox="522 695 873 1255"> <thead> <tr> <th>DD</th> <th>Max FWR</th> </tr> </thead> <tbody> <tr><td>4000</td><td>0.40</td></tr> <tr><td>4250</td><td>0.37</td></tr> <tr><td>4500</td><td>0.33</td></tr> <tr><td>4750</td><td>0.31</td></tr> <tr><td>5000</td><td>0.28</td></tr> <tr><td>5250</td><td>0.26</td></tr> <tr><td>5500</td><td>0.24</td></tr> <tr><td>5750</td><td>0.23</td></tr> <tr><td>6000</td><td>0.21</td></tr> <tr><td>6250</td><td>0.21</td></tr> <tr><td>6500</td><td>0.20</td></tr> <tr><td>6750</td><td>0.20</td></tr> <tr><td>7000</td><td>0.20</td></tr> </tbody> </table> | DD | Max FWR | 4000 | 0.40 | 4250 | 0.37 | 4500 | 0.33 | 4750 | 0.31 | 5000 | 0.28 | 5250 | 0.26 | 5500 | 0.24 | 5750 | 0.23 | 6000 | 0.21 | 6250 | 0.21 | 6500 | 0.20 | 6750 | 0.20 | 7000 | 0.20 | <ul style="list-style-type: none"> • Measure your typical “window + door” to wall area ratios (FWRs) in the buildings you currently build. <i>If these are comparable to or lower than the proposed maximum FWR for your DD area, skip to the next item (3.2.2.2.).</i> <i>If they are higher than the proposed limits, then:</i> <ul style="list-style-type: none"> • Determine the implications of reducing the window area to meet the maximum FWR. • Determine the implications of exceeding the maximum FWR; i.e., having to use the trade-off or the performance compliance path (consultant costs). • Determine the cost of increasing the thermal resistance of opaque building envelope elements to make up for the higher heat losses through fenestration and doors. (See item 3.2.2.2. below on opaque elements.) |
| DD | Max FWR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4000 | 0.40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4250 | 0.37 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4500 | 0.33 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4750 | 0.31 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5000 | 0.28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5250 | 0.26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5500 | 0.24 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5750 | 0.23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6000 | 0.21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6250 | 0.21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6500 | 0.20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6750 | 0.20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7000 | 0.20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications |
|---|--|--|
| <p>3.2.2.2. Thermal Characteristics of Opaque Components of the Building Envelope</p> | <p>Maximum overall thermal transmittance of opaque above-ground building envelope assemblies must not exceed the values shown in the table below. These may be significantly lower than the overall thermal transmittance provided in current construction and have significant implications with respect to cost, constructability, durability.</p> | <ul style="list-style-type: none"> Determine the thermal transmittance of the opaque areas of the above ground building envelope in your buildings (walls, roofs, floors). <p><i>If consistent with or lower than the proposed levels, skip to the next item (3.2.2.3.).</i></p> <p><i>If higher, then:</i></p> <ul style="list-style-type: none"> Determine the percentage reduction between your current levels and the proposed NECB levels. Identify the technical challenges, if any, that arise as a result of reducing overall thermal transmittance to NECB levels. (E.g., significant changes to detailing including structural support of cladding or air/vapour barrier materials or location; complete change in type of building envelope assembly.) Determine the cost of adding thermal insulation to achieve the lower overall thermal transmittance limits (cost for the building / price increase attributed to each dwelling unit). |

Opaque Components of the Building Envelope Elements Above Ground

| | Heating Degree-Days of Building Location, Celsius degree-days | | | | | |
|--------|---|----------------------|----------------------|-----------------------|-----------------------|---------------------------------------|
| | Zone 4: Less than 3000 | Zone 5: 3000 to 3999 | Zone 6: 4000 to 4999 | Zone 7A: 5000 to 5999 | Zone 7B: 6000 to 6999 | Zone 8: Greater than or equal to 7000 |
| | Maximum Overall Thermal Transmittance (W/m ² ·K) | | | | | |
| Walls | 0.315 (R18) | 0.278 (R20) | 0.247 (R23) | 0.210 (R27) | 0.210 (R27) | 0.183 (R31) |
| Roofs | 0.227 (R21) | 0.183 (R31) | 0.183 (R31) | 0.162 (R35) | 0.162 (R35) | 0.142 (R40) |
| Floors | 0.227 (R21) | 0.183 (R31) | 0.183 (R31) | 0.162 (R35) | 0.162 (R35) | 0.142 (R40) |

Note:
R-values are equivalent effective imperial thermal resistance values

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications |
|--|---|--|
| 3.2.2.3. Thermal Characteristics of Fenestration | <p>Maximum overall thermal transmittance of fenestration (windows and skylights) must not exceed the values shown in the table below.</p> <p>These may be significantly lower than the overall thermal transmittance values provided by fenestration in current construction and lead to cost increases.</p> | <ul style="list-style-type: none"> Determine the overall thermal transmittance levels of windows and skylights used in current construction. <i>If consistent with or lower than the proposed levels, skip to the next item (3.2.3.2.).</i> <i>If they are higher, then:</i> <ul style="list-style-type: none"> Determine the percentage reduction between your current levels and the proposed NECB levels. Determine the cost of reducing the overall thermal transmittance of fenestration to the proposed levels (cost for the building / price increase attributed to each dwelling unit). |

Fenestration

| | Heating Degree-Days of Building Location, Celsius degree-days | | | | | |
|--------------|---|----------------------|----------------------|-----------------------|-----------------------|---------------------------------------|
| | Zone 4: Less than 3000 | Zone 5: 3000 to 3999 | Zone 6: 4000 to 4999 | Zone 7A: 5000 to 5999 | Zone 7B: 6000 to 6999 | Zone 8: Greater than or equal to 7000 |
| | Maximum Overall Thermal Transmittance (W/m ² ·K) | | | | | |
| Fenestration | 2.4 | 2.2 | 2.2 | 2.2 | 2.2 | 1.6 |

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications |
|--|---|--|
| 3.2.3.2. (Thermal Characteristics of) Building Assemblies in Contact with the Ground - Walls | <p>Maximum overall thermal transmittance of below-ground exterior walls must not exceed the values shown in the table below for a depth of not less than 2.4 m or the height of the wall, whichever is less. Where there are heating or cooling systems embedded in these walls, the overall thermal transmittance is reduced further.</p> <p>These levels may be significantly lower than the overall thermal transmittances provided in current construction and lead to cost increases.</p> | <ul style="list-style-type: none"> Determine the overall thermal transmittance levels provided by current construction for below ground walls. <p><i>If consistent with the proposed levels, skip to the next item (3.2.3.3.).</i></p> <p><i>If higher, then:</i></p> <ul style="list-style-type: none"> Determine the percentage reduction between your current levels and the proposed NECB levels. identify the technical challenges, if any, that arise as a result of reducing overall thermal transmittance to NECB levels. Determine the cost of reducing the overall thermal transmittance to the proposed levels (cost for the building / price increase attributed to each dwelling unit). |

Building Assemblies in Contact with the Ground

| | Heating Degree-Days of Building Location, Celsius degree-days | | | | | | Note: R-values are equivalent effective imperial thermal resistance values |
|--------|---|-------------------------|--------------------------|--------------------------|--------------------------|---------------------------------------|--|
| | Zone 4: Less than 3000 | Zone 5: 3000 to 3999 | Zone 6: 4000 to 4999 | Zone 7A: 5000 to 5999 | Zone 7B: 6000 to 6999 | Zone 8: Greater than or equal to 7000 | |
| | Maximum Overall Thermal Transmittance (W/m ² ·K) | | | | | | |
| Walls | 0.568 (R10) | 0.379 (R15) | 0.284 (R20) | 0.284 (R20) | 0.284 (R20) | 0.210 (R27) | |
| Roofs | 0.568 (R10) | 0.379 (R15) | 0.284 (R20) | 0.284 (R20) | 0.284 (R20) | 0.210 (R27) | |
| Floors | 0.568 (R10) for 0.6 m | 0.56 (R10) for 0.6 m | 0.568 (R10) for 0.6 m | 0.568 (R10) for 0.6 m | 0.568 (R10) for 0.6 m | 0.284 (R20) full slab | |

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications |
|---|---|---|
| <p>3.2.3.3. (Thermal Characteristics of Building Assemblies in Contact with the Ground) Floors</p> | <p>Maximum overall thermal transmittance of floors on ground must not exceed the values shown in the table above where the floor is less than 0.6 m below ground level.</p> <p>Floors with embedded heating or cooling systems must be insulated over the full area.</p> <p>These levels may be significantly lower than the overall thermal transmittance values provided in current construction and lead to notable cost increases.</p> | <ul style="list-style-type: none"> • Determine the overall thermal transmittance levels provided by current construction for below ground floors. • Determine what distance from the perimeter is insulated. <p><i>If the overall thermal transmittance is consistent with or lower than the proposed limits, AND the distance from the perimeter is consistent with or greater than the proposed limits, skip to the next item (Lighting).</i></p> <p><i>If the overall thermal transmittance is higher OR the distance from the perimeter is less than the proposed limits, then:</i></p> <ul style="list-style-type: none"> • Determine the percentage reduction between your current levels and the proposed NECB levels. • Identify the technical challenges, if any, that arise as a result of reducing overall thermal transmittance to NECB levels or increasing the distance from the perimeter. • Determine the cost of reducing the overall thermal transmittance to the proposed levels or increasing the distance from the perimeter (cost for the building / price increase attributed to each dwelling unit). |

NECB Part 4 - Lighting

Application – Exception for dwelling units

Note that the lighting requirements do not apply to lighting within dwelling units.

Limits

Limits are specified in terms of maximum lighting power. Note that lower levels are more stringent.

Approaches for Establishing Interior Lighting Power

For interior lighting, not within dwelling units, two approaches are provided:

- building area method
- the space-by-space method.

If 10% or more of the gross lighted area of the building can be classified as a different building type (e.g., parking garage), the space-by-space method must be used. Note that the gross lighted area would not include the area within the dwelling units.

For the space-by-space method, the power allowances in individual spaces may be exceeded provided the total installed power does not exceed the total allowed for all of the spaces.

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications |
|--------------|--------------------------------------|--|
| | | <u>Note:</u> If you build for different markets, compile information for a simple building and a more up-scale building. |

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications |
|--|---|---|
| <p>4.2.1.5 Calculation of Interior Lighting Power Allowance Using the Building Area Method</p> | <p>Where the building area method is followed, the interior lighting power allowance is 6.5 W multiplied by the gross lighted area of the building.</p> | <p>Determine the total power used for lighting interior spaces other than in the dwelling units. <i>If consistent with or lower than the proposed levels, skip to 4.2.3. Exterior Lighting.</i></p> <p><i>If higher, then:</i></p> <ul style="list-style-type: none"> • Determine the percentage reduction between your current levels and the proposed NECB levels. • Determine if these levels can be achieved by installing energy efficient lamps or lighting fixtures. • If so, determine the cost of reducing interior lighting power to the proposed levels (cost for the building / price increase attributed to each dwelling unit). • If not (energy efficient lamps and fixtures are already used), determine if the space-by-space method provides a more acceptable alternative. (See item 4.2.1.6. below) |

| | | |
|--|--|--|
| <p>4.2.1.6. Calculation of Interior Lighting Power Allowance Using the Space-by-Space Method</p> | <p>Where the space-by-space method is used, the interior lighting power densities for the various types of spaces in the building are multiplied by the gross lighted areas of those spaces and the total of these values provides the interior lighting power allowance for the building.</p> <p>Lighting power densities for spaces typically found in multi-family residential buildings are provided in the table below.</p> | <p>In current construction, determine the standard power densities for interior lighting in spaces other than dwelling units. See Table below. <i>If consistent with or lower than the proposed levels, skip to the next item (4.2.3.).</i></p> <p><i>If higher, then:</i></p> <ul style="list-style-type: none"> • Determine the average percentage reduction between your current levels and the proposed NECB levels. • Determine if these levels can be achieved by installing energy efficient lamps or lighting fixtures. • If so, determine the cost of reducing interior lighting power to the proposed levels (cost for the building / price increase attributed to each dwelling unit). • If not (energy efficient lighting is already used), note that interior lighting will have to be reduced. |
|--|--|--|

Lighting Power Densities for Interior Spaces using the Space-by-Space Method

| Common Space Types | Lighting power Density (W/m ²) | | % Reduction |
|-----------------------------------|--|----------------------|-------------|
| | NECB Limits | Current Construction | |
| Atrium - First 13 m in Height | 0.10 per m (height) | | |
| Atrium - Height above 13 m | 0.07 per m (height) | | |
| Conference/Meeting/Multipurpose | 13.2 | | |
| Corridor/Transition >= 2.4 m wide | 7.1 | | |
| Corridor/Transition < 2.4 m wide | 8.4 | | |
| Electrical / Mechanical | 13.4 | | |
| Lobby | 9.7 | | |
| For Elevator | 6.9 | | |
| Locker Room | 9.8 | | |
| Lounge/Recreation | 9.4 | | |
| Office - Enclosed | 11.9 | | |
| Washrooms | 10.5 | | |
| Stairway | 7.4 | | |
| Storage | 6.8 | | |
| Workshop | 17.1 | | |
| Gymnasium/Fitness Centre | | | |
| Fitness Area | 9.8 | | |
| Playing Area | 12.9 | | |
| Parking Garage - Garage Area | 2.0 | | |
| Average % Reduction | | | |

| Requirements | Critical Aspects of the Requirements | Information needed to determine implications |
|---------------------------------------|--|--|
| <p>4.2.3. Exterior Lighting Power</p> | <p>For exterior lighting, a base allowance is specified. This can be added to based on the building and site elements that are lighted.</p> <p>The base allowance for residential is 600 W.</p> <p>Limits are specified for lighting power densities for particular exterior elements:</p> <ul style="list-style-type: none"> - 0.7 W/m² parking areas and drives - 2.3 W/m walkways less than 3 m wide - 1.5 W.m² walkways 3 m wide or more and for plaza and special feature areas - 11.0 W/m² stairways - 0.5 W/m² landscape lighting - 66 W/m door width for entry and exit doors - 2.7 W/m² entry canopy area | <p>A. Determine the total power needed to light the exterior building and site elements in the buildings you currently construct.</p> <p>B. Determine the total exterior power allowance for the same buildings using the proposed NECB limits. (Sum of exterior power allowances listed in the column to the left plus 600 W; see also worksheet in Annex A.)</p> <p><i>If B (total) is consistent with or lower than A, disregard the following.</i></p> <p><i>If B is higher than A, then:</i></p> <ul style="list-style-type: none"> • Determine the average percentage reduction between your current levels and the proposed NECB levels. • Determine if the NECB levels can be achieved by installing energy efficient lamps or lighting fixtures. • If so, determine the cost of reducing exterior lighting power to the proposed levels (cost for the building / price increase attributed to each dwelling unit) • If not (energy efficient lamps and fixtures are already used), note that exterior lighting will need to be reduced. |

Annex A - Calculation of Exterior Lighting Power

If you design/build buildings for different markets, complete calculations for both a basic building and a more up-scale building.

| Element | Area or length, m ² or m | Lighting Power Allowance | Power, W (Area or Length * Lighting Power Allowance) |
|--|--|-----------------------------|--|
| parking areas and drives | m ² | 0.7 W/m ² | |
| walkways less than 3 m wide | m | 2.3 W/m | |
| walkways 3 m wide or more, plazas, special feature areas | m ² | 1.5 W.m ² | |
| stairways | m ² | 11.0 W/m ² | |
| landscape lighting | m ² | 0.5 W/m ² | |
| entry and exit doors | m | 66 W/m of door width | |
| entry canopy area | m ² | 2.7 W/m ² | |
| | | Add | 600 |
| | | TOTAL | |