Comparison of the Model National Energy Code of Canada for Houses to the Manitoba Building Code

Canadian Home Builders' Association

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Introduction

This report compares the major material, labour and cost implications of the Model National Energy Code of Canada for Houses 1997 (MNECH) to the Manitoba Building Code 1998 (MBC) for typical residential applications. The National Building Code of Canada (NBCC) 1995 is adopted as the building code in Manitoba subject to the amendments contained in the Manitoba Building Code.

The requirements of the MNEHC are tailored to 34 different climatic zones in Canada and three methods of heating including natural gas. For simplicity, this comparison focuses on Manitoba, Region A. This is the southern region of Manitoba where the heating demand is less than 6500 degree-days and includes Winnipeg, Brandon, Swan Lake, Portage land other areas (the 53rd parallel passes close to Grand Rapids (near the northern end of Lake Winnipeg).

This comparison is based on both "Natural Gas" and "Electricity, Oil, Propane, Other" as the principal heating sources. In Manitoba, the southern part of the province is heated mainly with natural gas and in the smaller centre, electricity is used but is being substituted with gas as service is added.

How the comparison was made

First, a detailed review was made of the MNECH to identify clauses that appeared to exceed the requirements of Part 9 of the Manitoba Building Code and the National Building Code of Canada. A comparison of code clauses is located in Appendix A. Checks of referenced CSA Standards were made to see whether a difference existed between the MNEHC and the MBC.

Where helpful, use was made of a model house (Appendix B) to estimate the quantities of materials needed to meet the MNEHC. Last, a cost estimate of the additional MNEHC requirements was made by estimating the quantities of materials affected and consulting a professional quantity-surveying firm to develop the costs.

Scope

This comparison compares the differences between the MNEHC and the MBC for typical construction. There are many building methods and features covered by the MNEHC that are not included in this comparison. However, the format of this comparison should facilitate comparisons for other climatic regions, heating systems or building systems.

Table 1 shows the sections of the two codes that were examined.

Table 1 Parts Compared (bold)

Model Energy Code of Canada for Houses 1997	**National Building Code of Canada**
Part 1 Scope and Definitions	**Part 9 Housing and Small Buildings**
Part 2 General Requirements	
Part 3 Building Envelope	
Part 4 Lighting	
Part 5 Heating, Ventilating and Air-Conditioning Systems	**Manitoba Building Code**
Part 6 Service Water Heating Systems	**Amendments to Part 9**
Part 7 Electrical Power	
Part 8 Building Energy Performance Compliance	
Part 9 Manufactured Housing	

Conclusions

The Model National Energy Code for Houses provides prescriptive requirements for 34 climatic regions and three primary heating sources. This report has looked at but one climatic region, Southern Manitoba, for both electric and natural gas heating. The detailed comparison of the MNEHC to the Manitoba Building Code 1997 and associated national Building Code of Canada results in the following conclusions:

1. By far, the major effects of the MNEHC stem from the move from *nominal* insulating values to *effective* insulating values.
2. For the parameters examined, meeting the MNEHC in South Manitoba will result in the following;

   Case 1 – Electric Heating
   - Increased wall insulation
   - Increased attic insulation

   Case 2 - Natural gas heating
   - Increased wall insulation
   - Increased attic insulation
   - Increased foundation insulation

3. Some upgrading of windows and doors may be required to meet MNEHC requirements
4. The MNEHC requirements are zero or minimal for the following aspects of house construction: electrical, ventilation, domestic hot water, caulking and sealing.

5. The information required for permit application and progress approval will be substantial for small builders operating in jurisdictions that have not required the submission of comprehensive plans for the work intended.

These conclusions apply to typical Canadian residential construction. Other less typical forms of construction may result in additional cost for builders and their customers. For example, the installation of electrical heating or radiant floor heating brings insulating and heat recovery requirements that were not examined. For heating systems other than gas, the MNEHC requires heat recovery from mechanically vented air.

The cost implications of the additional labour and materials for the model house (Appendix B) are shown in Tables 2 and 3.

Table 2 Cost Implications of meeting the MNEHC for a typical house in Southern Manitoba

Case 1 - Electric Heating

	Material	Labour	Total
1. Effective R Value			
1a Wall insulation			
Delete 1,983 ft^2 OSB sheathing	($775)	($654)	($1,429)
Add 1,983 ft^2 1-3/4" EPS Type 1 insulation to outside of exterior walls	$1,507	$599	$2,106
Net cost increase			$677
1b Ceiling (Attic over ceiling) insulation			
Add 100 mm (4") batt insulation over 1,098 ft^2	$360	$171	$531
Net cost increase			$531
1c Ceiling (no attic - cathedral and over garage) insulation			
Net cost increase - none			0
1d Foundation walls insulation			
Net cost increase-none			0
1e Slab-on-ground (garage)			
Net cost increase-none			0
2. Windows and doors			
Net cost increase	0 to $600 depending on builder practices		
3. Reporting requirements			
Net cost increase			
Small builders		$560 per house	
High-volume builders		$200 per house	

Table 3 Cost Implications of meeting the MNEHC for a typical house in Southern Manitoba

Case 2 - Natural Gas Heating

	Material	Labour	Total
2. Effective R Value			
1a Wall insulation			
Delete 220 2x4 studs	($720)	($951)	($1,671)
Replace with 220 2x6 studs	$1,401	$951	$2,352
Delete 1,700 lf 2x4 plates	($901)	($952)	($1,853)
Replace with 1,700 lf 2x6 plates	$1,402	$952	$2,354
Delete 1,983 ft2 R-12 (4") batt	($650)	($310)	($960)
Replace with 1,983 ft2 R-20 (6") batt	$1,061	$412	$1,473
Net cost increase			$1,695
1b Ceiling (Attic over ceiling) insulation			
Net cost increase-none			0
1c Ceiling (no attic - cathedral and over garage) insulation			
Net cost increase-none			0
1d Foundation walls insulation			
Delete 1,276 ft2 2x4 framing and 100mm batt insulation	($1,253)	($1,074)	($2,352)
Replace with 1,276 ft2 2x6 framing and 150m insulation	$1,977	$1,140	3,117
Net cost increase			$790
1e Slab-on-ground			
Net cost increase-none			0
2. Windows and doors			
Net cost increase	0 to $600 depending on builder practices		
4. Reporting requirements			
Net cost increase			
Small builders		$560 per house	
High-volume builders		$200 per house	

Electric Heating Case

The additional cost of building a new house with gas heating in southern Manitoba to meet the MNEHC ranges from $1,500 to $2,400 depending on builder practices and preferences.

Natural Gas Heating Case
The additional cost of building a new house with gas heating in southern Manitoba to meet the MNEHC ranges from $2,700 to $3,600 depending on builder practices and preferences.

For the cost estimate, spot checks of prices were made in Winnipeg as follows:

1. Labour: rate of $30 per hour including overhead
2. Materials:7/16" OSB sheathing - $10 per sheet; 2" EPS rigid insulation $19.52 per sheet; 4" batt insulation, $0.33 per ft^2; 6" batt insulation, $0.53 per ft^2; 2x4 framing, $0.53 per foot; 2x6 framing, $0.825 per foot.

Appendix A – Detailed Comparison

MNEHC Part 3 Building Envelope

This section is the most significant in terms of changes that affect housing. It includes requirements for insulation and infiltration and requirements for windows and doors.

1. Effective R Value

MNEHC	MBC

3.2.1.2. Continuity of insulation

1) Except as provided in Sentences (2) *t6* (9), interior components that meet components of the *building envelope* and major structural members that partly penetrate the *building envelope* shall not break the continuity of the insulation and shall not reduce the *effective thermal resistance* at their projected area to less than that required in Section 3.3. (see Appendix E).

2) In calculating the thermal resistance of assemblies for purposes of comparison with the prescriptive requirements in Section 3.3., the thermal bridging effect of closely-spaced, repetitive structural members such as studs and joists, and of ancillary members such as lintels, sills and plates, shall be accounted for as described in Appendices B and C.

3) Where a *foundation wall, firewall or party wall* built of concrete or masonry penetrates an exterior wall or insulated roof or ceiling and breaks the cavity of the *building envelope,* it shall be insulated

a) on both of its sides inward from the *building envelope* for a distance equal to 4 times the uninsulated thickness of the penetrating wall, and

b) to an *effective thermal resistance* no less than that required for the exterior wall.

Section 3.3 Prescriptive Compliance

3.3.1. Above-ground Components of the Building Envelope

3.3.1.1. Thermal Characteristics of Opaque Components of the Building Envelope

1) Except **as** provided in Sentences (3) and (4) and in Articles 3.3.1.2. and 9.2.1.l., the *effective thermal resistance* of above ground *opaque components* of the *building envelope* shall be not less than that shown in Table A-3.3.1.1. of Appendix A for the administrative region considered and for the *principal heating source* for the *building* or part of the building enclosed by the component (see Appendix E). (**See Table 5 below**).

9.25.5.2 Thermal Resistance Value

(1) Except as provided in Sentence (2), the thermal resistance of the building envelope shall conform to Table 9.25.5.2 (**See Table 4 below**).

3.3.2.1. Walls

1) Except as provided in Sentence (2), the *effective thermal resistance* of walls that are below the exterior ground level and that separate heated space from the ground shall be not less than that shown in Table A-3.3.2.1. of Appendix A for the administrative region considered and for the *principal heating source* for the *building* or part of the *building* enclosed by the component.

Table 4 Excerpt from MBC Table 9.25.5.2
Minimum Thermal Resistance for the Building Envelope
Forming Part of Article 9.25.5.2

Building Assembly	**Southern Manitoba(1)**	**Northern Manitoba(2)**
Foundation Walls(3),(4) -Interior	RSI-2.1 (R-12)(5) RSI-3.5 (R-20)(6)	RSI-4.2 (R-24)
-Exterior	RSI-2.1 (R-12)	RSI-3.0 (R-17)
Floors on Ground -Heated	RSI-0.88 (R-5) Full Area	RSI-0.88 (R-5) Full Area
-Unheated (less than 0.6 m below grade)	RSI-0.88 (R-5) 1m Perimeter	RSI-0.88 (R-5) 1m Perimeter
-Unheated (0.6 m or more below grade)	No requirement	No requirement
Floors above Unheated Space	RSI-5.6 (R-32)	RSI-5.6 (R-32)
Walls above Grade	RSI-3.5 (R-20)	RSI-4.6 (R-26)
Roofs -Attics	RSI-7.0 (R-40)	RSI-8.8 (R-50)
-Sloped Ceilings	RSI-7.0 (R-40) Trusses/I-joists RSI-4.9 (R-28) Solid Lumber	RSI-7.0 (R-40) Trusses/I-joists RSI-4.9 (R-28) Solid Lumber

Notes to Table 9.25.5.2.:
(1) South of the 53rd Parallel
(2) At or North of the 53rd Parallel
(3) See Sentence 9.25.5.3.(1) for minimum depth of insulation below grade
(4) See Sentence 9.25.5.4.(1) for foundation walls that extend more than 1.2 m above ground level
(5) For dwellings using natural gas as the heating source
(6) For dwellings using other than natural gas (e.g. electricity, oil, propane, wood) as the principal heating source.

Table 5 Excerpt from MNEHC Table A-3.3.1.1.
(Region A – South of the 53rd parallel (<6500 Degree-days)
Prescriptive Requirements - Above-ground Building Assemblies
Forming Part of Sentence 3.3.1.1.(1)
Minimum Effective Thermal Resistance (**RSI-value**)

	Principal Heating Source	
	Electricity, Oil Propane, Other	Natural Gas, Ground Source Heat Pump
Assembly Description		
Roofs (See Appendix Note A-3.3.1.l.):		
Type 1 - attic-type roofs	8.80	7.00
Type 11 - all other roofs (e.g., sawn lumber joists, parallechord trusses and wood I-joists)	4.30	4.30
Walls	4.10	3.00
Floors	4.60	4.60
Foundation Walls (Table A-3.3.2.1)(full area)	3.10	3.10
Type II Floor-on-ground (perimeter only)	1.08	1.08

Discussion

General: Many building codes have established insulation needs by means of minimum nominal insulating values (R – values) for the insulating assemblies. Because insulating assemblies are not uniform throughout, some codes, including the MNEHC are moving toward requirements for effective insulating value. This means building assemblies must meet minimum insulation requirements after accounting for the fact that some areas of exterior walls and roofs have less insulating value than others. For example, the area where framing members partially or totally penetrate the insulated space reduces the overall insulating ability of the assembly.

This is a major change and this comparison pays particular attention to the impact of moving from nominal R value requirements to effective R-value requirements.

Case 1 - Electric Heating

1a Walls: (framed walls above ground): For this comparison case (Southern Manitoba - Electricity, Oil, Propane, and Other heating systems), the MBC requires walls to have a *nominal* RSI (R) Value of 3.5 (R 20), taking into account the thermal bridging effect of framing members. The MNEHC requires an effective RSI Value of 4.10.

The MBC requirement can be achieved with 6" of glass/mineral fibre batts.

The MNEHC requirement of RSI 4.10 can be met by adding RSI 1.14 sheathing to the outside of the wall assemble (for example, 44mm of EPS board type 1 – expanded polystyrene (bead board)).

1b Ceiling: For this comparison, the MBC requires a nominal insulating value of RSI 7.0 (R40). The MNEHC calls for an effective RSI of 8.80. In the case of the model house

(Appendix B), there are no extraordinary disruptions of the ceiling insulation that result in a need to supplement the insulating assemblies to achieve the required effective value.

The MBC requirement can be achieved with 265 mm (10.5") of glass/mineral fibre batts.

The MNEHC requirement of RSI 8.8 can be met by combining 152 and 222 mm batts (based on 2"x4" truss chords as ceiling joists at 24" o/c and ½" drywall). Therefore, an additional 109 mm (4") of insulation is required.

1c Roof assembly without attic or roof space: If the area over the family room/dinette for the model house were a cathedral ceiling rather than a truss roof, the MNEHC would require that area to have an effective RSI of 4.30 rather than the nominal 4.9 required by the MBC.

The MBC requirement can be achieved with 202 mm (8") of glass/mineral fibre batts. Assuming framing at 16", 2x10 framing will allow room for ventilation above the insulation.

The MNEHC requirement of effective RSI 4.3 can also be achieved with 202 mm (8") of glass/mineral fibre batts. For this case, there is no cost increase

1d Foundation walls: For the comparison case, the MBC requires foundation walls to have a nominal insulating value of RSI-3.5 (R-20) for the full area of the basement walls. The MNEHC (Table A-3.3.2.1) requires foundation walls to have a minimum effective thermal resistance of 3.10 for the full wall area.

The MBC requirement can be achieved with 2x6 framing @16" and 200 mm (6") of glass/mineral fibre batts.

The MNEHC requirement of effective RSI 3.1 can also be achieved with 2x6 framing @16" and 200 mm (6") of glass/mineral fibre batts. For this case, there is no cost increase.

1e Slab-on ground: For the comparison case, neither the MNEHC nor the MBC require insulation below a basement floor slab where the floor is more than 2' below ground. However, if the basement floor slab contains heating ducts or pipes (radiant heating slabs), RSI 1.6 is required under the floor.

For the model house, the garage is deemed to be heated space. The MBC requires an RSI RSI-0.88 (R-5) Full Area. This can be achieved by a 100mm floor slab and RSI 1.32 insulation (2" EPS board Type 1).

The MNEHC requires an effective RSI of 1.08 around the perimeter only. In this case, the Manitoba Building Code is more stringent than the Model National Energy Code.

Case 2 - Natural Gas Heating

1a Walls: (framed walls above ground): For the comparison case (Southern Manitoba - Natural Gas heating), the MBC requires walls to have a *nominal* RSI (R) Value of RSI-2.1

(R-12) , taking into account the thermal bridging effect of framing members. The MNEHC requires an effective RSI Value of 3.00.

The MBC requirement can be achieved with 4" of glass/mineral fibre batts.

The MNEHC requirement of effective RSI 4.10 can be met by increasing the stud size from 2x4 to 2x6 and adding 6" of glass/mineral fibre batts.

1b Ceiling: The MBC requires a nominal insulating value of RSI 7.0 (R40). The MNEHC calls for an effective RSI of 7.0. In the case of the model house (Appendix B), there are no extraordinary disruptions of the ceiling insulation that result in a need to supplement the insulating assemblies to achieve the required effective value.

The MBC requirement can be achieved with 265 mm (10.5") of glass/mineral fibre batts.

The MNEHC requirement of effective RSI 7.0 can also be met 265 mm (10.5") of glass/mineral fibre batts (based on 2"x4" truss chords as ceiling joists at 24" o/c and ½" drywall).

1c Roof assembly without attic or roof space: If the area over the family room/dinette for the model house were a cathedral ceiling rather than a truss roof, the MNEHC would require that area to have an effective RSI of 4.30 rather than the nominal **RSI-4.9 (R-28)** required by the MBC.

The MBC requirement can be achieved with 202 mm (8") of glass/mineral fibre batts. Assuming framing at 16", 2x10 framing will allow room for ventilation above the insulation.

The MNEHC requirement of effective RSI 4.3 can also be achieved with 202 mm (8") of glass/mineral fibre batts. For this case, there is no cost increase

1d Foundation walls: For the comparison case, the MBC requires foundation walls to have a nominal insulating value of RSI-2.1 (R-12) for the full area of the basement walls. The MNEHC (Table A-3.3.2.1) requires foundation walls to have a minimum effective thermal resistance of 3.10 for the full wall area.

The MBC requirement can be achieved with 2x4 framing @16" and 150 mm (4") of glass/mineral fibre batts.

The MNEHC requirement of effective RSI 3.1 can also be achieved with 2x6 framing @16" and 200 mm (6") of glass/mineral fibre batts.

1e Slab-on ground: For the comparison case, neither the MNEHC nor the MBC require insulation below a basement floor slab where the floor is more than 2' below ground. However, if the basement floor slab contains heating ducts or pipes (radiant heating slabs), RSI 1.6 is required under the floor.

For the model house, the garage is deemed to be heated space. The MBC requires an RSI RSI-0.88 (R-5) Full Area. This can be achieved by a 100mm floor slab and RSI 1.32 insulation (2" EPS board Type 1).

The MNEHC requires an effective RSI of 1.08 around the perimeter only. In this case, the Manitoba Building Code is more stringent than the Model National Energy Code.

Impact

For above-ground assemblies, the Model National Energy Code is more stringent than the Manitoba Building Code. The cost implications for the model house (Appendix B) are shown in Tables 2 (Page 4) and 3 (Page 5).

2. Airtightness - General

MNEHC	NBCC
3.2.4.1. General **1)** Air barrier systems shall be provided in accordance with the appropriate provincial, territorial or municipal building regulations or, in the absence of such regulations, or where air barrier systems are not covered by such regulations, with Section 9.25. of the National Building Code of Canada. **2)** Except as provided in Sentence (3), any location where there is a possibility of air leakage into or out of a heated space through the *building envelope* shall be caulked', gasketed or otherwise sealed in accordance with good practice such as that described in "Air Barrier Systems for Houses," published by the Canadian Commission on Building and Fire Codes (see Appendix E). **3)** A *building envelope* that is constructed so that its normalized leakage area does not exceed 2.0 cm^2/M^2 when tested in accordance with CAN/CGSB-149.10, 'Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method," need not -comply with Sentence (2) (see Appendix E).	**9.25.3.3 Continuity of the Air Barrier System** (1) Where the air barrier system consists of an air-impermeable panel-type material, all joint shall be sealed to prevent leakage. (2) Where the *air barrier system* consists of flexible sheet material, all joints shall be (a) sealed, or (b) lapped not less than 100 mm (4 in) and clamped, such as between framing members, furring or blocking and rigid panels. **(3)** Where an interior wall meets an exterior wall, ceiling, floor or roof required to be provided with an air barrier protection, the *air barrier system* shall extend across the intersection. **(4)** Where an interior wall projects through a ceiling or extends to become an exterior wall, spaces in the wall shall be blocked to provide continuity across those spaces with the *air barrier system* in the abutting walls or ceiling. **(5)** Where an interior floor projects through an exterior wall or extends to become an exterior floor, continuity of the *air barrier system* shall be maintained from the abutting walls across the floor assembly. **(6)** Penetrations of the *air barrier system*, such as those created by the installation of doors, windows, electrical wiring, to maintain the integrity of the *air barrier system* over the entire surface. **(7)** Access hatches installed through assemblies constructed with an *air barrier system* shall be weatherstripped around their perimeters to prevent air leakage.

Discussion:

Both the MNEHC and the MBC and the National Building Code require the continuity of the air barrier.

Impact:

No impact is seen as a result of this section of the MNEHC.

3. Airtightness - Windows

MNEHC	NBCC
3.2.4.2. Windows 1) Windows shall comply with the relevant federal, provincial or territorial appliance or equipment energy-efficiency act or, in the absence of such an act, or where windows are not covered by such an act, windows other than those meeting the *energy rating* (ER) requirement of Sentence 3.3.1.3.(1) shall comply with at least the A2 air leakage classification of CAN/CSA-A440-M, "Windows.'	**9.7.2.1 Window Standard** (1) Windows shall conform to CAN CSA-A440M, “Windows” but need notmmet the air tightness , watertightness, and windload resistance requirements more stringent than those for classifications A1, B1, and C1 in CAN/CSA A-440-M.

Discussion:

The A2 leakage rate [1.65 $(m3/h)m^{-1}$] stipulated by the MNEHC is more stringent than the 0.775 dm^3/s for each metre stipulated by the MBC (this is essentially an A1leakage rate).

Impact:

A builder in rural Manitoba claims to build only with triple glaze windows with gas and e coating. From this, it is likely that few builders are providing the minimum allowable in windows and most are meeting or exceeding the MNEHC requirements.

4. Airtightness - Doors

MNEHC	NBCC
3.2.4.3. Doors 1) Except as provided in Sentence (2), door assemblies other than the *energy rating* (ER) requirement of .3.1.4.(1)(a) shall a) be designed to limit the rate of air leakage to no more than 0.82 L/s for each metre of door crack when tested in conformance with ASTM E 283, 'Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen," at a static air pressure difference of 75 Pa, or b) be weather-stripped on all edges. **2)** Insulated steel doors prehung in a wood or steel *frame* other than those meeting the *energy rating* (ER) requirement of Clause 3.3.1.4.(1)(a) shall conform to the air leakage requirements of CAN/CGSB-82.5-M, 'Insulated Steel Doors."	**9.6.5.1. Exterior Wood Doors** (1) Exterior wood doors shall conform to CAN/CSA O132.2-M, “Wood Flush Doors”. **9.6.5.2. Sliding Doors** 1) Sliding doors shall conform to CAN/CGSB-82.1-M, “Sliding Doors”.

3) Garage doors that separate heated garages from unheated space or the exterior shall be weather-stripped on all edges.

3.2.4.4. Fireplace Doors

1) Fireplaces shall be equipped with doors or enclosures to restrict air movement in the chimney when the fireplace is not in use.

Discussion

For exterior doors, the MNEHC specifies maximum air leakage rates and specifies weather stripping. The NBCC is silent on weather stripping, does not require fireplace doors and does not refer to air leakage around doors.

The garage in the model home is heated. For garage doors that separate a heated garage from the exterior, the MNEHC requires that garage doors be weather stripped.

Impact

This section could result in increased cost depending on builder practices.

5.Thermal Characteristics – Windows

MNEHC	MBC
3.3.1.3. Thermal Characteristics of Windows and Other Glazed Areas **1)** Except as provided in *Article* 9.2.1.l., windows and sliding glass doors that are within the scope of CSA Standard A440.2, 'Energy Performance Evaluation of Windows and Sliding Glass Doors," shall have a label indicating an energy *rating* (ER) not less than shown in Table A-3.3.1.3. of Appendix A for the administrative region considered and for the *principal heating source* for the *building* or part of the *building* enclosed by the component (see Appendix E). **2)** For windows and other glazed **areas** not included in Sentence (1) and except as provided in Sentence (3) and Article 9.2.1.l., the *overall thermal transmittance* of the whole assembly including frame, as measured according to Article 2.2.2.9., shall not exceed that shown in Table A-3.3.1.3. of Appendix A for the administrative region considered and for the *principal heating source* for the *building* or part of the building enclosed by the component (see Appendix E). **3)** Where the *skylight-to-roof ratio* does not exceed 2%, *skylights* need not comply with Sentence (2), provided that a) they are at least double-glazed and their *frames*, if metallic, are provided with *thermal breaks*, or b) they have an *overall thermal transmittance* of not more than 3.4 $W/m^2.°C$ (see Appendix E).	9.38.4.1 Thermal Resistance of Glazing (1) Except as provided in Articles 9.38.4.2.and 9.38.4.4, all glazing that separates heated space from unheated space or the exterior shall have a thermal resistance of at least 0.30 $m^2°C/W$ (1.79 $ft^2.h.F/Btu$

Discussion

The energy ratings (ER) for windows stipulated in Table A-3.3.1.3 means that windows need be comprised of double glazed, low-e coated windows that are argon filled.

Impact

Many builders and already use low-e argon-filled windows. The additional cost of meeting the higher requirements is about 8%, or for the model house, in the range of $600.

6. Thermal Characteristics - Doors

MNEHC	MBC
3.3.1.4 Doors and Access Hatches	9.6.5.1 Exterior Wood Doors
1) Except as provided in Sentences (2) to (4), separate heated space from exterior and are within the scope of CSA Standard A453, 'Energy Performance Evaluation of Swinging Doors," shall have a label indicating a) an *energy rating* (ER) of not less than -20, or b) an *overall thermal transmittance* of not more than 1.2 $W/m^2 \cdot {}^\circ C$, or c) where protected by a storm door, an *energy rating* (ER) of not less than -27, or an *overall thermal transmittance* of not more than 1.5 $W/m^2 \cdot {}^\circ C$.	(1) Exterior wood doors shall conform to CAN/CSA O132.2-M
2) In any *dwelling unit,* one door that separates heated space from unheated space or the that does not comply with Sentence (1) provided that its *overall thermal* is not more than 2.6 $W/m^2 \cdot {}^\circ C$ (See Appendix E)	
3) Storm doors need not comply with Sentences (1) and (2).	
4) Garage doors that separate heated spaces from unheated space or the exterior shall have a thermal resistance of no less than 0.38 $W/m^2 \cdot {}^\circ C$.	
5) Access hatches from heated space to unheated space such as an *attic* or a crawl space shall . be insulated to a level equivalent to that required for the component of the *building envelope* in which they are installed.	

Discussion

The information label required by the MBC does not include the energy rating or the thermal transmittance required by the MNEHC label

Impact

The model house is not detailed to a level that would indicate if higher quality doors would be necessitated by the MNEHC relative to present door manufacturing standards the meet the MBC requirements. But like windows, it is expected this section would result in some cost increase.

7. Total Area of Windows and Glazing

MNEHC NBCC

3.3.1.5.Total Area of Windows and Other Glazed Areas

1) Subject to the provisions of Sentences (2) and (3), the total exposed surface area of windows and other glazed areas that separate heated space from unheated space or the exterior, as determined in accordance with Article 2.2.2.9., shall not exceed 20% of the *floor surface area* of the *building*, where the *ftoor surface area* is calculated, excluding:

(a) *storage garages*,
(b) rooms or spaces with less than 2.1 m dear height
(c) rooms or spaces with less than 20% of their exterior wall area above ground.

2) Except as provided in Sentence (3), the area of clear glass or other glazing material that has *a solar heat gain coefficient* of more than 0.61, that is unshaded at noon on December 21 and that faces a direction within 45' of due South, may be assumed to count as 50% of its unshaded area in calculating the maximum area of glass in Sentence (1), provided the *building* is designed so that it is capable of distributing the solar heat gain from such glazed areas throughout the *building* (see Appendix E).

3) Sentence (2) does not apply where the *building* is designed to be *cooled* in summer, unless that glass or other glazing material is also shaded at noon on June 21 with exterior devices (see Appendix E).

Discussion

The MNEHC specifies that total window area not exceed 20% of the floor area. For the model house (Appendix B), the allowable window area is 396.6 ft^2 while the actual window area is 333.5 ft^2. If the model house is indeed fairly typical of Canadian housing and homeowner expectations, it would appear that the MNEHC is fairly generous in allowances for window area.

The effective R values in MNEHC Table B apply up to the specified maximum window area. If there is more window area than the allowance, the effective insulating value of the wall is negatively affected. To rectify this, additional insulation would be required in the non-glazed areas. For example, if the window area exceeds the allowance, the OSB sheathing in the model house would, as a minimum be replaced by an RSI 0.88 sheathing to increase the insulating value of the wall assembly.

Impact

It would seem that the MNEHC provides the flexibility to allow, without additional insulating requirements, the window areas of typical housing and that additional requirements would apply to housing that have above-average areas of glazing.

8- Part 4 Lighting

MNEHC	NBCC
4.2.1.1. High-efficacy Exterior Lighting for Common Areas 1) Except as provided in Sentence.(2), lamps *for exterior lighting* serving common areas of *multiple-unit residential buildings or building* complexes shall have an initial *luminous efficacy of* not less than 40 hn/W, determined according to accepted good practice.	No companion clause.
4.2.1.2. Exterior Lighting Power for Common Areas **1)** Except as provided in Sentence (2), lighting shall comply with the maximum power densities specified in Table 4.2.1.2., where that lighting is a) lighting for common *exterior exits* and *exterior entrances of multiple-unit residential buildings*, and b) *facade lighting of multiple-unit residential buildings.* (For example, the Maximum Power Density for an exterior exit is 82 W/lin m of threshold)	9.34.2.7. Public and Service Areas 1) E very public or service are in *buildings* shall be provided with lighting outlets with fixt ures controlled by a wall switch or panel to illuminate every portion of such areas.
4.2.3.2. Lighting Power in Dwellings 1) Lighting within *dwelling units* is exempt from allowances and limits on *interior lighting* power (see Appendix E).	

Discussion

MNEHC requirements for lighting mainly affect common areas for multiple-unit residential units with requirements for energy-efficient fixtures and automatic controllers to turn off non-emergency lighting when it is not required.

Interior lighting for single and multiple unit dwellings must have manual, automatic, or programmable controls.

Impact

These requirements will have some cost impact for multiple-unit complexes, but it is likely many of these provisions are already being met through good design.

9. Part 6 – Service Water Heating Systems

MNEHC	MBC
6.2.3.2 Insulation 1) Inlet and outlet piping between the storage or heating vessel and the heat traps referred to in Article 6.2.3.1 and the first 2 m of outlet piping downstream of the heat traps, shall be covered with insulation having a minimum thickness of 12 mm. 2) All piping forming part of a service water heating system and located outside the building envelope or in an uninsulted crawl spaceshall be insulated to a thermal resistance of at least 1.5 m^2.° C/W-----	No companion article.
6.2.5.1 Showers 1) Shower heads shall have integral means of limiting the maximum water discharge to 9.5 l/min, when tested to CSA Standard B125-M, "Plumbing Fittings" (see Appendix E).	No companion article

Discussion

With the exception of the clauses above, Part 6 mostly references existing Standards. There is a requirement for heated outdoor pools to have covers but this is likely an operational requirement rather than a builder obligation.

Impact

No major cost impacts are likely to result from Part 6.

10. Part 7 – Electrical Power

MNEHC	MBC
7.2.2.1 Controls for Power Receptacles 1) Where exterior receptacles are provided serving an individual dwelling unit, at least one exterior receptacle shall be controlled. 2) In addition to the requirements of Sentence (1), where receptacles are provided for indoor or outdoor parking, and where these receptacles are supplied from a panelboard located within the dwelling unit, these receptacles shall be controlled.	No companion article in Section 9.34. Electrical Facilities

Discussion

With the exception of the clauses above, this section mainly references existing standards.

Impact

The cost implications are minor.

12. Part 8 – Building Energy Performance Compliance

Discussion

"Part 8 provides an alternative to the prescriptive requirements of other parts by specifying a means of demonstrating that a building will not use more energy than if it were to comply with those prescriptive requirements."

Impact

It is likely only large companies with an interest in innovation would have the means to develop alternative methods.

13. Reporting Requirements

The MNEHC places requirements on builders and their suppliers to record he characteristics of the materials (windows for example) and assemblies employed to meet the requirements of the MNEHC. It is likely that the impact of this reporting requirement

on the builder will vary depending on the work practices of the builders and the present rigour of the building permit application and monitoring system where a builder operates. At a minimum, the MNEHC formalizes the process of documenting compliance even in cases where builders already meet or exceed the MNEHC.

The requirements are as follows:

E-2.3.1.1.(1) Required Information. The information documenting the conformity of the building to this Code must describe the essential characteristics of the building and its systems. To this end, the authority having jurisdiction would normally require access to the following information:

- floor plan of the building giving the heated floor area for each storey,
- elevations of all the building faces, giving finished floor and ground levels,
- typical cross-sections of foundations, exterior walls, roofs, ceilings and floors that separate heated space from unheated space or the exterior, describing their construction and giving the thermal resistance of each material and the effective thermal resistance for each element of the building.
- description of the different types of air barrier systems and their location,
- window dimensions,
- characteristics of windows, skylights, sliding glass doors and other doors separating heated space from unheated space or the exterior (ER rating or overall thermal transmittance and solar heat gain coefficient, airtightness),
- required report on trade-offs, where applicable,
- details of required exterior lighting controls and exterior lighting power for exits, entrances and facades of multiple-unit residential buildings,
- details of required interior lighting controls and interior lighting power for common areas in multiple unit residential buildings,
- location of required dampers and of thermostatic controls and cutoffs,
- efficiency of unit and packaged equipment, efficiency of required heat recovery equipment,
- efficiency of service water heating equipment, main electrical distribution and metering layout, for multiple-unit residential buildings,

required report on performance compliance, where applicable.

Discussion

These information requirements will have different impacts depending on the construction volume of the builder. The MNEHC will require all builders to submit detailed drawings for all permit applications. For small builders with only a few housing starts a year, there could be a significant increase in plan development time compared to the present information required for permit application under the Manitoba Building Code.

Large builders with a large number of housing starts may be more accustomed to providing at least some of the MNEHC information such as floor plans, elevations

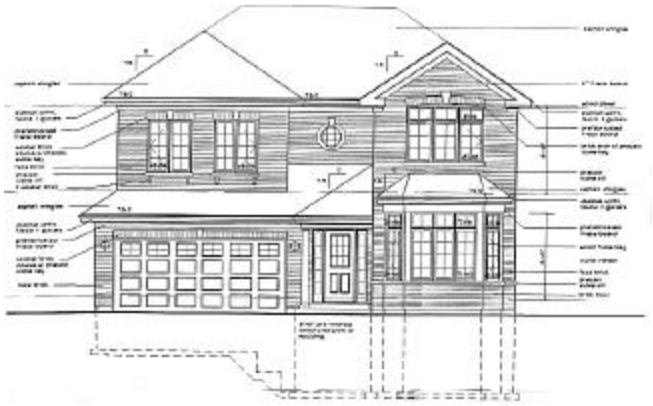
and cross-sections. However, some additional information will be needed for these drawings and the need to show window information and the location of dampers and so on may be more formalized than the way most builders currently obtain approvals.

Impact

For small builders, it is estimated the additional design time and drawing time to meet the MNEHC information requirements will be in the order of 16 hours at a charge out rate of $80 / hour for a total of $1,280 for the first house and 6 hours for subsequent house of like construction for an on-going cost of $640. Averaged over 5 houses, this amounts to $560 per house.

For high-volume builders, the additional design time and drawing time to meet the MNEHC information requirements will be in the order of 10 hours at a charge out rate of $80 / hour for a total of $800 for the first house and 2 hours for subsequent house of like construction for an on-going cost of $160. Averaged over 20 houses of the same model, this amounts to $200 per house.

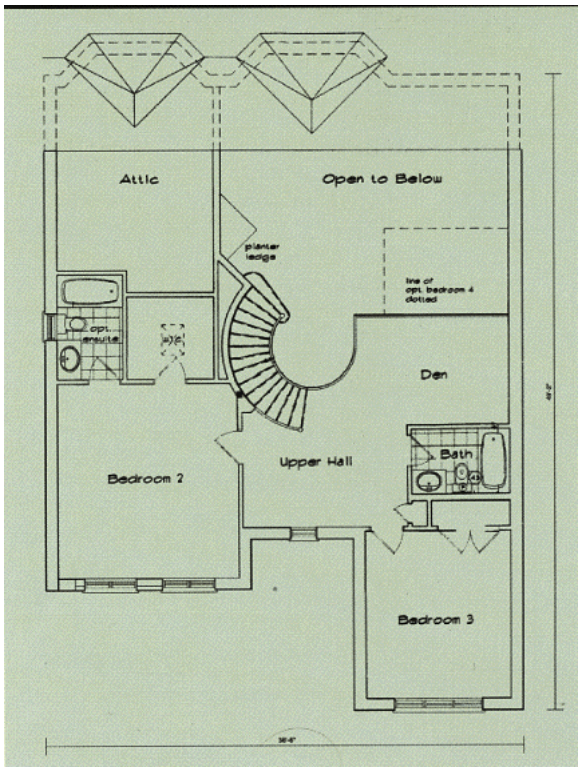
Appendix B Model House



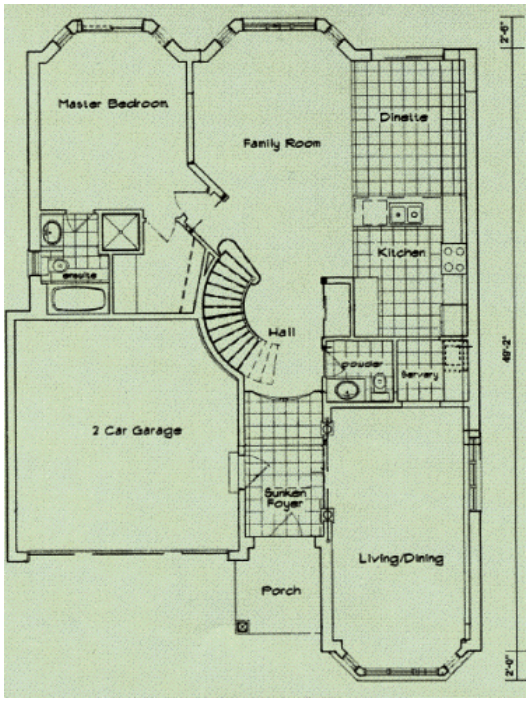
Front Elevation

This 2,000 ft2, 2 storey house was used to assess the impact of the Model National Energy Code for Houses. The 2,000 ft^2 house is wood frame construction with a concrete foundation, natural gas heating, and an attic type roof and wood truss roof structure.

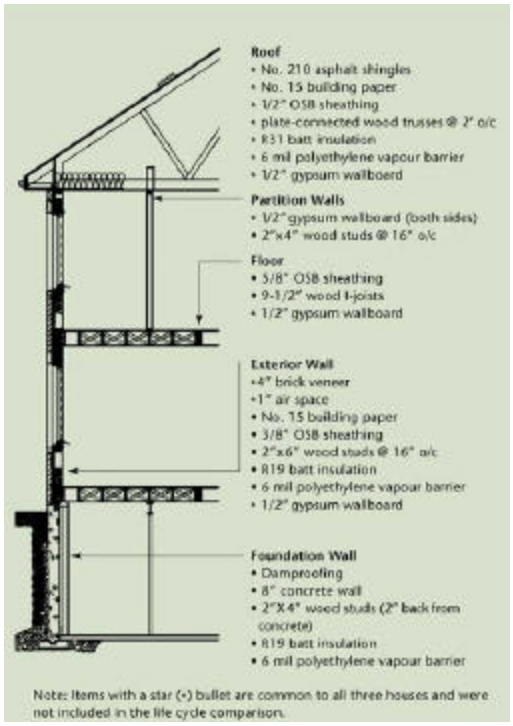
This house is fairly typical of how the majority of Canadian houses are constructed.



Main floor



Second floor



Typical assembly composition

Table B1 Wall Quantities for Model House

Room	**Area (ft^2)**	**Ext. wall length (ft)**	**Ext. wall area(ft^2)**	**Windows and doors (ft^2)**
Main Floor (9 ft ceiling)				
Master bedroom	264	43.5	391.5	54.6
Family/Dinette/Kitchen	653.3	55.0	495	51.6
Living/dining	230.7	40	360	109.7
Foyer	70.6	19.9	179.1	37.6
Second Floor (8 ft ceiling)				
Bedroom 2	316.3	50.0	400.0	44
Bedroom 3	147.3	37.7	301.6	36
Den/Bath	300.8	16.0	128	0
Total	1,983 ft^2	262.1 ft	2,255.2 ft^2	333.5 ft^2

Table B2 Ceiling Quantities for Model House

Room	**Area**
Ceiling (with attic)	1,098 ft^2
Ceiling (cathedral	413 ft^2

Table B3 Basement

Wall area = 1,276 ft^2