Comparison of the

Model National Energy Code of Canada for Houses (MNECH) 1997

to the

Ontario Building Code 1997

Canadian Homebuilders Association

(Revised October 2002)

Introduction

This document compares the major material, labour and administrative cost implications of the Model National Energy Code of Canada for Houses 1997 (MNECH) to the Ontario Building Code 1997 (OBC) for typical residential applications.

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 Ontario, Region A. This is the southern region of Ontario where the heating demand is less than 5000 degree-days and includes Ottawa, Toronto, Hamilton, Windsor and other centres.

The comparison is based on natural gas as the principal heating source, a method of heating typical for southern Ontario.

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 Ontario Building Code. Next, a review was made of the OBC to identify companion clauses. Where necessary, checks of referenced CSA Standards were made to see whether a difference existed between the MNEHC and the OBC. Where helpful, use was made of a model house (Appendix B) to estimate the quantities of materials needed to meet the MNEHC. A professional quantity-surveying firm was consulted to develop the costs.

Scope

This comparison compares the differences between the MNEHC and the OBC 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	Ontario Building Code 1997
Part 1 Scope and Definitions	Part 1 Scope and Definitions Part 1
Part 2 General Requirements	Part 2 General Requirements
Part 3 Building Envelope	Part 3 Fire protection, Occupant Safety and Accessibility
Part 4 Lighting	Part 4 Structural Loads and Procedures
Part 5 Heating, Ventilating and Air-Conditioning Systems	Part 5 Wind, Water and Vapour Protection
Part 6 Service Water Heating Systems	Part 6 Heating, Ventilating and Air-Conditioning Systems
Part 7 Electrical Power	Part 7 Plumbing
Part 8 Building Energy Performance Compliance	Part 8 Sewage Systems
Part 9 Manufactured Housing	**Part 9 Housing and Small Buildings**
	Part 10 Change of Use
	Part 11 Renovation
	Part 12 Transition, revocation and Commencement

Conclusions

The Model National Energy Code for Houses 1997 provides prescriptive requirements for 34 climatic regions and three primary heating sources. This report has looked at but one climatic region and natural gas for the primary heating source. The detailed comparison of the MNEHC to the Ontario Building Code 1997 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 (Ontario Region A, natural gas heating), meeting the MNEHC will result in
   - Increased attic insulation
   - Increased foundation insulation
3. Some upgrading of windows and doors is 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 in jurisdictions that to this point, have not required 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 MNEHC insulating and heat recovery requirements that were not examined.

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

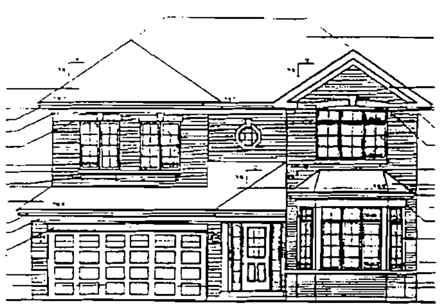
Table 2 Cost Implications of meeting the MNEHC for a typical house

	Material	Labour	Total
1. Effective R Value			
1a Wall insulation			
No change for the case examined	**$0**	**$0**	**$0**
1b Ceiling (Attic over ceiling) insulation			
Increase loose fill cellulose insulation from 9" to 9 ½"			
Net cost increase	**$44**	**$165**	**$209**
1c Ceiling (no attic- cathedral and over garage) insulation			
Delete of 8" joists @ 24" o/c and 6" batt insulation Add 413 ft² of 10" joists @ 24' o/c and 8" batt insulation			
Net cost increase	**$146**	**$7**	**$153**
1d Foundation walls insulation			
Delete 638 ft² of R8 - 4' wide rolled insulation (with vapour barrier) attached with power actuated fasteners to the upper half of the foundation wall	$498	$102	$600
Add 1,276 ft² of R12 - 4' wide rolled insulation (with vapour barrier) attached with power actuated fasteners to the	$1595	$255	$1850

full height of the foundation wall			
Net cost increase	**$1097**	**$153**	**$1250**
1e Slab-on-ground			
Delete 380 ft^2 of 2" EPS board Type 1 under slab			
Add 380 ft^2 of 2.67" (68mm) EPS board Type 1 under slab			
Net cost increase	**$220**	**$27**	**$247**
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**		

The cost estimate is based on:

1. Labour: rate of $36 including overhead
2. Materials: 1-1/4" rigid insulation $16.80 per sheet, 3" rigid insulation $42.24 per sheet, loose fill insulation $1.00 per ft^2, *R12 - 4' wide roll-type insulation $1.12 per ft^2 (*this price has been extrapolated from the R8 product currently on the market)



Conclusion

Based on the cost estimates in Table 2, the additional cost of building a new house with gas heating in southern Ontario to meet the MNEHC ranges is about $2,100 to $3,000 depending on builder practices and preferences.

Appendix 1 – 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

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

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 9.2.1.1., 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 3 below**).

OBC

9.25.2 Thermal Insulation

(4) Except as permitted in Sentences (5), (6), (7), (8), (13) and (14) the minimum thermal resistance of insulation shall conform to Table 9.25.2. 1. (**See Table 2 below**).

9.38.3.8 (1) Insulation applied to the interior of a foundation wall enclosing heated space shall extend down at least 600 mm measured from the adjacent finished ground level.

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 1.1 Excerpt from OBC Table 9.25.2.1
Minimum Thermal Resistance of Insulation to be Installed based on Degree Day Zones
Forming Part of Sentence 9.25.2.1.(4)

	RSI (R) Value Required Up to 5000 Degree Days
Ceiling below *attic or roof space*	5.4 (R31)
Roof assembly without *attic or roof space*	3.52 (R20)
Wall other than *foundation wall*	3.00 (R 17)
Foundation walls enclosing heated space	1.41 (R8)
Floor, other than slab on grade	4.40 (R25)
Slab-on-ground containing pipes or heating ducts	1.76 (R10)
Slab-on-ground not containing pipes or heating ducts	1.41 (R10)

Table 1.2 Excerpt from MNEHC Table A-3.3.1.1.
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, Other	Propane, Oil, Heat Pump	Natural Gas
Assembly Description				
Roofs (See Appendix Note A-3.3.1.1.):				
Type 1	- attic-type roofs	8.80	7.00	5.60
Type 11	- all other roofs (e.g., sawn lumber joists, parallechord trusses and wood I-joists)	5.20	4.30	4.30
Walls		4.40	3.00	2.90
Floors		5.20	4.60	4.60

Table 1.3 Excerpt from MNEHC Table A-3.3.2.1
Prescriptive Requirements – Building Assemblies in contact with the Ground

	Principal Heating Source		
	Electricity, Other	Propane, Oil, Heat Pump	Natural Gas
Walls	3.10 @full wall area	3.10 @full wall area	2.10 @full wall area

Discussion

General: Many building codes establish 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.

Walls: (framed walls above ground): For the comparison case (Ontario, Region A, natural gas heating), the OBC requires walls to have a *nominal* RSI (R) Value of 3.00 (R 17). The MNEHC requires an *effective* RSI Value of 2.90. The wall construction for the model house has a nominal RSI of 2.97 (140 mm batt insulation and brick veneer), which means the model house walls meet the requirements for both the OBC and the MNEHC. The OBC nominal RSI 3.0 requires 126 mm of batt insulation compared to the 140 mm needed for the MNEHC requirement. However, for practical purposes, 140 mm batt insulation is used to meet the OBC requirement and no cost penalty has been assigned.

Ceiling: For the comparison case, the OBC requires a nominal insulating value of RSI 5.40 (R31). The MNEHC calls for an effective RSI of 5.60. In the case of the model house, 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. Even so, the MNEHC is slightly more demanding than the OBC for this comparison. Using the model house insulating assembly and MNEHC Table B-2, (assuming ½" drywall and 2"x4" truss chords as ceiling joists at 24" o/c), insulation having an RSI of 5.64 is needed to provide the MNEHC. For loose fill cellulose insulation, this means providing 9.5" of insulation rather than the 9.0" needed to satisfy the OBC.

Roof assembly without attic or roof space: If the area over the family room/dinette 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 3.52 required by the OBC. Assuming wood-I joist framing at 16' o/c, the OBC requirement could be satisfied by 6" of glass/mineral fibre batts. To meet the MNEHC requirements, the insulation needs to be RSI 4.93 meaning its thickness would be 8".

Foundation walls: For the comparison case, the OBC requires foundation walls to have a nominal insulating value of 1.41 (R8) for the upper 2' of the typical basement. In the Toronto area, builders typically install a 4-foot width of roll-type blanket insulation to meet the OBC requirements for foundation wall insulation.

The MNEHC (Table A-3.3.2.1) requires foundation walls to have a minimum effective thermal resistance of 2.10 (R12) for the full wall area. This means the area to be insulated doubles under the MNEHC and the amount of insulating value also increases. The roll-type batt insulation is apparently no longer available (presumably because of low demand). In estimating the cost implications of this requirement, it has been assumed that roll-type batt insulation would again be available in the R12 format if there were market demand. If this were not the case, the foundation wall insulation would have to be provided by a) RSI 2.13 rigid insulation (for example, 3.25' thick EPS Board Type 1) or b) the addition of a framed wall 38x64 at 2' centres and RSI 2.11 insulation.

Slab-on ground: For the comparison case, the neither the MNEHC nor the OBC 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 unheated space. The OBC requires an RSI 1.41 (R*) for the garage slab-on-ground. 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 1.60 (natural gas heating, not radiant-heated). This can be accomplished by means of a 100mm slab and RSI 1.76 insulation (68 mm – 2.67" EPS board Type 1).

Impact

Walls (framed walls above ground): For the model house, 1,983 ft^2 of 1-1/4" of EPS board Type I are needed.

Ceiling: For loose fill insulation, the MNEHC requires about ½" in thickness of additional insulation.

Roof assembly without attic or roof space: A cathedral ceiling in the model house would require 8" of batt insulation to meet the MNEHC rather than the 6" required to meet the OBC. Therefore there is some additional cost for insulation.

Foundation walls: The R8 roll-type insulation over the upper four feet of the foundation walls must be upgraded to R12 and extend also over the lower half of the foundation walls.

Slab-on ground: For most houses, the MNEHC does not add requirements for basement slab-on-grade construction.

2. Airtightness - General

MNEHC

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).

OBC

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 OBC and the National Building Code require the continuity of the air barrier. The MNEHC does not require air leakage testing of a completed house.

Impact:

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

3. Airtightness - Windows

MNEHC	OBC
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.'	**9.38.6.1. Air Infiltration of Exterior Windows** (1) Windows separating heated space from unheated space or the exterior shall be designed to limit the rate of air infiltration to not more than 0.775 dm^3/s for each metre (0.50 cfm for each square foot) of sash crack when tested at pressure differential of 75 Pa (0. 0 1 1 psi) in conformance with ASTM E283, "Standard Method of Test for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors".

Discussion:

Both codes require windows to be tested to ASTM E283. However, 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 OBC (this is essentially an A1leakage rate).

Impact:

A window industry consultant notes that most window manufacturers and builders already provide customers an A2 window (the OBC requirement essentially discourages the use of single glazed windows).

4. Airtightness - Doors

MNEHC	OBC
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.	**9.6.5.1 Exterior Wood Doors** (1) Exterior wood doors shall conform to CAN/CSA O132.2-M **9.6.5.4. Air infiltration for Exterior Swing Type Doors** (1) Except where a door is weather-stripped on all edges, and protected with a storm door, or by an enclosed unheated space, an exterior swing type door assemblies shall have a rate of air infiltration not exceeding 11.6×10^{-4} m^3/s for each metre (0.0125 ft^3/s for each foot) of crack length when tested at a pressure differential of 75 Pa (0.011 psi) in conformance with ASTM E 283, "Standard Method of Test for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors".

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."

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.

9.6.5.5. Air infiltration for Patio Type Sliding Doors

(1) A patio type sliding glass door shall have a rate of air infiltration not exceeding 38 x 10^{-4} M^3/s for each square metre (0.0125 ft^3/s for each square foot) of door area when tested in conformance with ASTM E283.

9.6.5.6. Weather Stripping

(1) In buildings of *residential occupancy* weather stripping shall be provided around all exterior doors except garage doors.

Discussion

For exterior doors, the OBSC and MNEHC are similar in terms of weather stripping for exterior doors.

For garage doors that separate a heated garages from the exterior, the MNEHC requires that garage doors be weather stripped

Impact

No or minimal impact is likely as a result of this section.

5.Thermal Characteristics – Windows

MNEHC

3.3.1.3. Thermal Characteristics of Windows and Other Glazed Areas

1) Except as provided in *Article* 9.2.1.1., 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 9.2.1.1., 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).

OBC

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 window manufacturers already use low-e argon-filled windows. One window manufacturer estimated the cost of upgrading to these windows is about 8%, or for the model house, in the range of $600.

6. Thermal Characteristics - Doors

MNEHC	OBC
3.3.1.4 Doors and Access Hatches	9.6.5.2 Exterior Wood Doors

MNEHC

3.3.1.4 Doors and Access Hatches

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 $W/m^2 \cdot {}^\circ C$.

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.

OBC

9.6.5.2 Exterior Wood Doors

(1) Exterior wood doors shall conform to CAN/CSA O132.2-M

9.38.5.3. Minimum Thermal Resistance of Doors

(1) Except for doors on enclosed unheated vestibules, all doors separating heated space from the outside shall conform to the appropriate requirements of Article 9.25.2. 1.

Discussion

The information label required by the OBC 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 OBC requirements. But like windows, it is expected this section would result in some cost increase.

7. Total Area of Windows and Glazing

MNEHC

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 *floor 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).

OBC

9.38.4.3 Maximum Area of G lazing

(1) Except as provided in Articles 9.38.4.4 and 9.38.4.5, the total area of glazing, including glazing for doors and skylights, that separates heated spaces from unheated space or the exterior shall not exceed 20 percent of the floor area of the story served by the glazed areas and shall not exceed 40 percent of the total area of the walls of the storey separating heated space from unheated space or the exterior.

9.38.4.4 Different Thermal Resistance of Glazing

(1) Where the thermal resistance ois different from that required in Artciles 9.38.4.1 and 9.38.4.2., the area of such glazing, for the puropose of applying Article 9.38.4.3. may be assumed as being equal to the actual multiplied by the ratio of the required thermal resistance divided by the actual thermal resistance of the glazing.

9.38-4-5. Clear Glass or Shading Coefficient

(1) Except as provided in Article 9.38.4.6., the area of glazing that contains clear glass or that has a shading coefficient of more than 0.70 that is unshaded in the winter and faces a direction within 45' of due South may be assumed to be 50 per cent of its unshaded area in calculating the maximum area of glazing in Articles 9.38.4.3. and 9.38.4.4. provided the *building* is designed with a system that is capable of distributing the solar heat gain from such glazed areas throughout the *building*. For the purpose of determining whether or not the glazing is shaded in the winter, the shading shall be calculated using the noon sun angles of December 21.

Discussion

The MNEHC and the OBC both specify that total window area not exceed 20% of the floor area. For the model house (Appendix A), 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. In addition, the MNEHC and the OBC both make additional allowances for south facing windows meeting stipulated requirements. Although it would entail some paperwork, it is likely that most houses would qualify for at least some additional allowances.

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, additional insulation would be required in other areas to meet the effective insulation value requirement.

Although there is some work involved in calculating window area, this is not considered to be substantial relative to the other checks and calculations necessary for designing a house.

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. Additional requirements would be required in rooms where there is extra window are, for example, in a solarium or around an indoor swimming pool.

8- Part 4 Lighting

MNEHC	OBC
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 irtitial *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)	No companion clause.
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	OBC
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).	**7.6.4.1 Water Supply Fitttings** (1) The flow rates of fittings that supply water to a fixture shall not exceed the maximum flow ratesw at the test pressures listed for the fitting in Table 7.6.4.1. (ie, for shower heads, 9.50 l/min (2.09 gal/min) at a test pressure of 550 kPa.

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	OBC
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 seems that 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 Ontario Building Code.

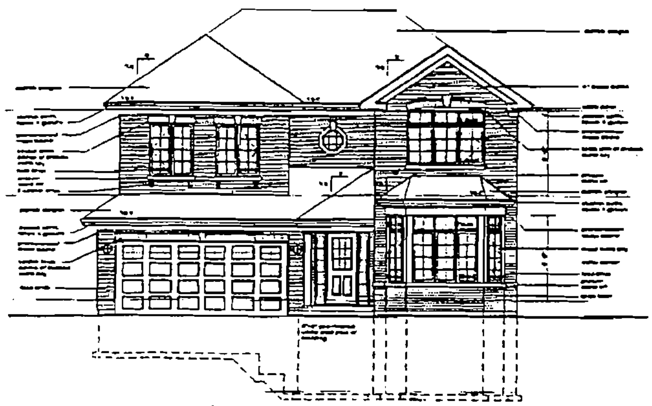
Large builders with a large number of housing starts may be more accustomed to providing at least some of the MNEHC information such as floor plans, elevations and cross-sections. However, some additional information will be needed for these drawings and the need to show window information and the location 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.

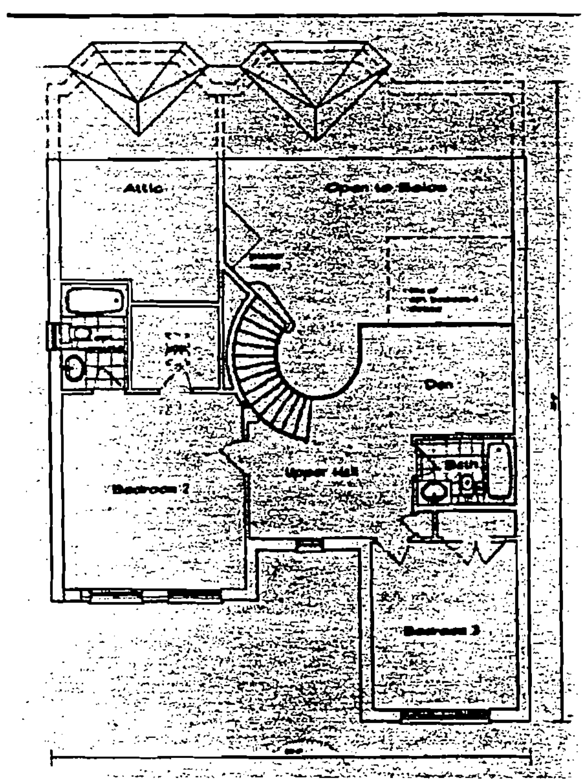
For high-volume builders, the additional design time and drawing time to meet the MNEHC information requirements will be in the order of 10 hours at a charge out rate of $80 / hour for a total of $800 for the first house and 2 hours for subsequent house of like construction for an on-going cost of $160.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

Appendix B Model House

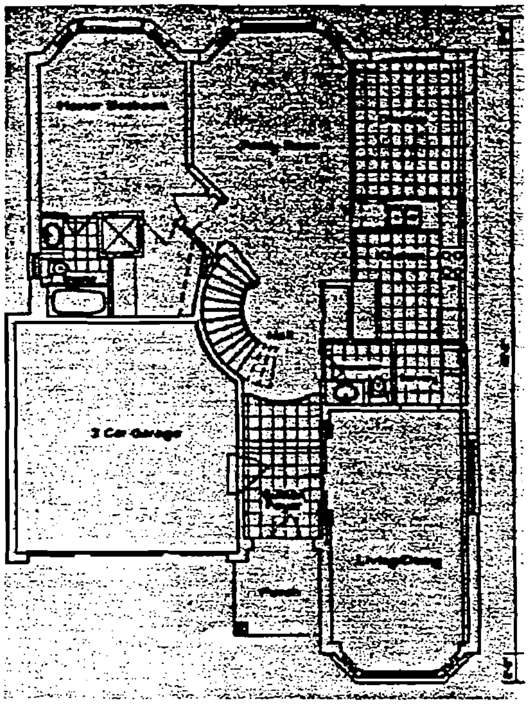


Front Elevation

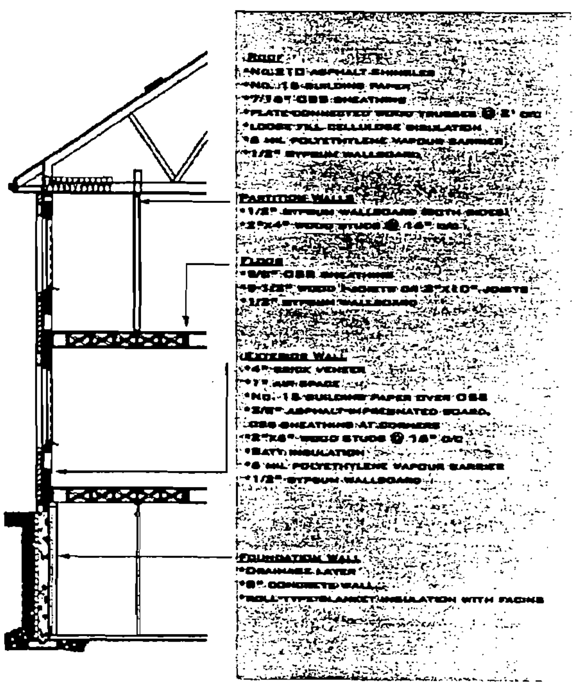
This 2,000 ft2, 2-storey house was used to assess the impact of the Model National Energy Code for Houses. The 2,000 ft^2 house is wood frame construction with a concrete foundation, with natural gas heating, and an attic type roof and wood truss roof structure.



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