ENERGY STAR® for New Homes

Summary of Recommendations from

ESNH Builder Option Package Working Group:

Ontario 2017

19 December 2016

Overview

Builder Option Package Working Groups (BOP WGs) are put in place by NRCan for each province and territory where ENERGY STAR for New Homes (ESNH) is being delivered. The purpose of the BOP WGs is to provide recommendations to Natural Resources Canada (NRCan) on specific elements to include in the BOPs.

BOP WG members are chosen by Natural Resources Canada based on recommendations from provincial/territorial Service Organizations as well as members from the former Next Generation ESNH Advisory Committee. The goal for membership is balanced representation of builders and energy advisors and geographic coverage in each region. Where deemed appropriate, other experts may also be invited to participate on the BOP WG.

Working Group Members

The members for the 2017 BOP WG for Ontario were:

Name	Organization	Role
D. Hickson	Minto Developments Inc.	Builder
R. Johnston	Building Knowledge Inc.	Energy Advisor
S. Magneron	Homesol Building Solutions	Energy Advisor
J. Morin	Arista Homes	Builder
B. O'Flaherty	EnviroCentre	Energy Advisor
G. Schafer	Tamarack Development Corp.	Builder
D. Tarry	Doug Tarry Custom Homes	Builder
J. Zulich	Zulich Homes	Builder

The BOP WG met via several teleconferences in the period from November 2015 to November 2016. Their recommendations for the BOPs, along with rationale and explanations behind the recommendations, are provided below.

Recommendations

Rationale / Explanatory Notes

Code reference house / energy target:

The requirements in *MMA Supplementary Standard SB-12 Energy Efficiency for Housing (*July 7, 2016 update) were applied as the basis for the code house since they will come into effect after December 31, 2016. SB-12 provides several prescriptive packages per climate zone. Since natural gas is the most common source of space and water heating in the province, natural gas packages were used as the basis for the code reference house. BOP WG members recommended that Package A1 (Zone 1) and Package A2 (Zone 2) be used as the code proxies based on the likelihood of their application in the marketplace.

All modelling was done using HOT2000 Version 10.51. As such, ESNH compliance will also be based on this version until such time that the ESNH Standard is converted to the EnerGuide Rating System Version 15 platform.

The ESNH energy target, which is based on space and water heating, was calculated by NRCan. The performance targets are as follows:

- Zone 1: ERS 84
- Zone 2: ERS 84

Based on the information received from Working Group members, it is estimated that the incremental cost (over code) to build to the Ver17 ESNH Standard Ontario varies from $1650 to $6000, with an average of $4000. Note that the actual amount is highly dependent on the choice of BOP options as well as builder or regional costs.

Core BOP

For the most part, the core BOP specifications are the same as the code reference house, save for the following exceptions:

For Zone 1:

- Walls above grade were increased to align with ESNH minimum requirements (Table 2);
- Heated floors on ground were increased to align with ESNH minimum requirements (Table 2);
- Fenestration increased to ENERGY STAR Zone 2 to align with ESNH minimum requirements (Section 4.2.3);
- Airtightness was changed to align with ESNH minimum requirements (Section 4.2.1);
- Ventilation was reduced from 75% to 65% SRE @ 0 °C to provide more flexibility (note: this reduction is allowable since airtightness is increased to align with ESNH minimum requirements); and,
- 400 kWh/yr of electrical savings was added to align with ESNH minimum requirements (Section 4.8).

For Zone 2:

- Ceilings below attics were increased to align with ESNH minimum requirements (Table 2);
- Cathedral ceilings and flat roofs (Ceilings without attic space) were increased to align with ESNH minimum requirements (Table 2);
- Heated floors on ground were increased to align with ESNH minimum requirements (Table 2);
- Fenestration increased to ENERGY STAR Zone 2 to align with ESNH minimum requirements (Section 4.2.3);
- Airtightness was changed to align with ESNH minimum requirements (Section 4.2.1); and,
- 400 kWh/yr of electrical savings was added to align with ESNH minimum requirements (Section 4.8).

Note: an instantaneous water heater was used as the proxy water heater for the code house and core BOP in Zone 1 since SB-12 specifies only a minimum energy factor (and instantaneous performs slightly worse in HOT2000 than a tank of the same efficiency). An EF 0.80 tank was added to the BOP options list to provide flexibility.

Drain Water Heat Recovery

Drain water heat recovery (DWHR) with 42% efficiency was modelled in the code reference house since it is a requirement in the 2017 SB-12 for the code proxy packages as well as the Reference Building Design. To provide flexibility for builders, however, DWHR is not included in the core BOP. Instead, DWHR at three efficiency levels is provided in the BOP Options list.

Since the Ontario Building Code requires low-flow showerheads (i.e. 7.6 L/min), the energy credit for DWHR was adjusted to account for the reduced flow rate given that the DWHR energy credits are based on a flow rate of 9.5 L/min. A ‘low-flow factor’ of 14% was applied based on results from energy modelling.

BOP Options

BOP options are provided for insulation, fenestration, airtightness, HRVs/ERVs, domestic hot water, drain water heat recovery and additional electrical savings. For the most part, the options are the same as with Version 12, with the following exceptions:

- Some BOP options for ceilings and walls above grade have been removed since they fell below code levels;
- Perimeter under-slab insulation for floors below grade has been added to provide additional options;
- Removal of the dual option of highest airtightness and HRV (84%) since this has never been used for compliance and the 84% HRV was not recommended as a BOP option; and,
- Solar domestic hot water has been removed since it is not a common building practice.

Draft BOPs

For inclusion in the ESNH Standard Version 17.0:
Notes:

i. 'X' indicates references to be completed upon inclusion of BOPs into ESNH Standard.
ii. Text in brackets aligns with terminology in SB-12.

Table X[1,2]
Ontario - 2017 Core BOP
Forming Part of X

Item	ON Zone 1 RSI (R)	ON Zone 2 RSI (R)
Ceilings below attic (Ceiling with attic space)	10.43 (59.2)	10.43 (59.2)
Cathedral ceilings and flat roofs (Ceiling without attic space)	4.87 (27.7)	5.02 (28.5)
Walls above grade	3.08 (17.5)	4.46 (25.3)
Floors over unheated spaces (Exposed Floor)	5.25 (29.8)	5.64 (32.0)
Foundation walls below or in contact with the ground (Basement walls)	3.72 (21.1)	3.72 (21.1)
Unheated floors below frost line (Below grade slab entire surface >600 mm below grade)	n/a	n/a
Unheated floors on ground above frost line (…Slab ≤600 mm below grade)	1.96 (11.1)	1.96 (11.1)
Heated or unheated floors on ground on permafrost[3]	n/a	4.44 (25.2)
Heated floors on ground (Heated slab)	2.32 (13.2)	2.85 (16.2)
Slabs on grade with integral footing (Slab ≤600 mm below grade)	1.96 (11.1)	3.72 (21.1)
(Edge of below grade slab ≤600 mm below grade)	1.76 (10.0)	1.76 (10.0)
Fenestration[4] (Windows and sliding glass doors)	ENERGY STAR Zone 2	
Airtightness[5]	Level 1	
Space Heating	96% AFUE ENERGY STAR furnace[6] Air source heat pump, or Ground-source heat pump	
Domestic Water Heating[7]	*Instantaneous* min. EF 0.80	
Combined space and water heating	TPF 0.93	
Combined space and water heating – attached houses and MURBs[8]	TPF 0.86	
Ventilation[9]	65% SRE @ 0 °C; 55% SRE @ -25 °C	70% SRE @ 0 °C; 55% SRE @ -25 °C
Electrical savings[10]	400 kWh/yr	
BOP Options required[11]	1.9	1.6

NOTES:

1) Thermal resistance requirements are listed in effective RSI (R) values. Text not in brackets aligns with Table 2; text in brackets aligns with SB-12.
2) Some thermal resistance requirements will need to be increased in order to comply with Table 2; in these cases, the builder may choose the appropriate option from the BOP Options table in order to obtain a credit.
3) Applies to ≥6000 HDD only, per Table 2.
4) Includes skylights and door systems. Climate zones for ENERGY STAR fenestration products are defined in "Climate Zones – ENERGY STAR," refer to: http://www.nrcan.gc.ca/energy/products/for-participants/specifications/13720.
5) See Appendix A for ACH, NLA and NLR values for this level.
6) Furnaces shall be either ENERGY STAR certified or have a 96% AFUE and a furnace fan efficiency ≤ 2.0%.
7) Cannot be used in combined space and water heating configurations.
8) Excluding *semi-detached* houses.
9) Refer to 4.7.1.2(b) for how to determine the SRE @ 0 °C.
10) Select a minimum of 400 kWh/yr of measures from Table X or Table X.
11) Select options from Table X such that the points assigned total not less than the amount of points indicated in this table for the applicable climate zone.

Table X[1]
Ontario - 2017 BOP Options
Forming Part of X

Category		Item	ESNH ON Zone 1	ESNH ON Zone 2
Ceilings[2]	**Ceilings Below Attic (100%)**	R 70 (nominal)	0.1	0.1
	Cathedral Ceilings/Flat Roofs (100%)	Flat/cathedral–R 40 (nominal)	0.3	0.3
	Ceilings Below Attic and Cathedral Ceilings/Flat Roofs[3]	Attic–R 70 (nominal); flat/cathedral–R 40 (nominal)	0.1	0.1
Walls Above Grade		RSI 3.72 (R 21.1)	0.7	n/a
		RSI 3.91 (R 22.2)	0.8	n/a
		RSI 4.03 (R 22.9)	1.0	n/a
		RSI 4.35 (R 24.7)	1.2	n/a
		RSI 4.79 (R 27.2)	1.5	0.2
		RSI 5.09 (R 28.9)	1.6	0.4
Foundation Walls		RSI 4.19 (R 23.8)	0.1	0.2
		RSI 4.45 (R 25.0)	0.2	0.2
		RSI 5.13 (R 29.1)	0.3	0.4
Unheated Floors Below Frost Line[4]		Edge of slab (600 mm (2ft)) RSI 1.76 (R 10) w/ thermal break	0.1	0.1
		Edge of slab (600 mm (2ft)) RSI 2.64 (R 15) w/ thermal break	0.1	0.1
		RSI 0.88 (R 5.0) full slab	0.1	0.1
		RSI 1.76 (R 10.0) full slab	0.2	0.2
		RSI 2.64 (R 15.0) full slab	0.2	0.3
Fenestration[5]		ENERGY STAR Zone 3	0.5	0.6

Category	Item	ESNH ON Zone 1	ESNH ON Zone 2
Airtightness[6]	Level 2	0.3	0.4
	Level 3	0.7	0.9
	Level 4	1.0	1.3
HRV/ERV[7]	≥70% SRE @ 0 °C	0.1	n/a
	≥75% SRE @ 0 °C	0.2	0.1
	≥80% SRE @ 0 °C	0.4	0.2
HRV/ERV - MURBs[7,8]	≥70% SRE @ 0 °C	max. 0.1	n/a
	≥75% SRE @ 0 °C	max. 0.2	max. 0.1
	≥80% SRE @ 0 °C	max. 0.4	max. 0.2
Domestic Water Heating[9]	*Instantaneous* condensing ≥ EF 0.90	0.3	0.2
	Instantaneous condensing ≥ EF 0.95	0.3	0.3
	Tank condensing ≥ EF 0.80	0.2	0.2
	Tank condensing ≥ TE 90%	0.1	0.1
	Tank condensing ≥ TE 94%	0.2	0.2
Combined Space and Water Heating[10]	TPF 0.94	0.1	0.1
	TPF 0.95	0.2	0.2
	TPF 0.96	0.3	0.4
	TPF 0.98	0.5	0.6
Combined Space and Water Heating – Attached houses and MURBs[11]	TPF 0.87	n/a	0.1
	TPF 0.88	0.1	0.2
	TPF 0.89	0.3	0.4
	TPF 0.90	0.4	0.5
	TPF 0.91	0.5	0.6
	TPF 0.92	0.6	0.7
	TPF 0.93	0.7	0.7
	TPF 0.94	0.7	0.8
	TPF 0.95	0.9	0.8
	TPF 0.96	0.9	1.0
DWHR[12]	≥42% – two showers	0.9	0.8
	≥55% – two showers	1.2	1.0
	≥70% – two showers	1.5	1.3
DWHR - MURBs[13]	≥42% – two showers	0.1 or max. 0.9	0.1 or max. 0.8
	≥55% – two showers	0.1 or max. 1.2	0.1 or max. 1.0
	≥70% – two showers	0.1 or max. 1.5	0.1 or max. 1.3
Electrical Savings	Additional 150 kWh/yr	0.1	0.1

NOTES:

1) Thermal resistance requirements are listed in effective values, unless otherwise indicated with (nominal) for nominal value. An 'n/a' indicates that an upgrade is not possible, likely due to a higher core BOP requirement.
2) Only one of the three sub-categories under Ceilings may be chosen.
3) Where both ceilings below attics and cathedral ceilings or flat roofs are present, both options must be applied.
4) Full slab thermal resistance values do not apply to slab on grade foundations.
5) Climate zones for ENERGY STAR fenestration products are defined in "Climate Zones – ENERGY STAR," refer to: http://www.nrcan.gc.ca/energy/products/for-participants/specifications/13720.
6) See Appendix A for ACH, NLA and NLR values for each level.

7) Refer to 4.7.1.2(b) for how to determine the SRE @ 0 °C.
8) BOP points are calculated as follows: [(max. points) / (# MURB units in building)] * [# HRVs]
9) This option applies only to stand-alone water heaters and not those that form part of a combined space and water heating system.
10) This option cannot be used in conjunction with domestic water heating options.
11) Excludes *semi-detached* houses.
12) This option is based on the number of shower stacks from which heat is being recovered, not the number of DWHR units, with one exception: houses with a total of one shower may claim the points for two showers since the DWHR unit is recovering heat from all the showers in the house. The maximum allowable amount is two showers.
13) BOP points are calculated as follows: 0.1 or [(max. points) / (# MURB units in building)] * [# DWHR units], whichever is greater.