This presentation contains very little in regard to the National Energy code for Building (NECB) However the NECB can be useful for dwellings with large glass areas or that would like to take credit for advanced lighting or innovative heating systems.
The date for compliance to the NECB was pushed back from May 1, 2016 to November 1, 2016.

From the STANDATA:

“Where an application for a building permit for a site-constructed building is received by the authority having jurisdiction before November 1, 2016, the design of the building is not required to comply with the requirements of Section 9.36. ABC 2014 or the NECB 2011 as appropriate.”
The NECB may provide an advantage in large homes with glass.

The area that will see the greatest amount of change is the section on building envelope.
The Scope is set in 9.1.1.1 Application that references Division A Subsection 1.3.3 Application of Parts 9, 10 and 11

1) Part 9 of Division B applies to all buildings described in Article 1.1.1.1. of 3 storeys or less in building height, having a building area not exceeding 600 m², and used for major occupancies classified as
   a) Group C, residential occupancies (see Appendix Note A-9.1.1.1.(1) of Division B),
   b) Group D, business and personal services occupancies,
   c) Group E, mercantile occupancies, or
   d) Group F, Divisions 2 and 3, medium- and low-hazard industrial occupancies.

- Area excludes parking garages that serve residential occupancies

Buildings containing non residential occupancies where the non-residential spaces are more than 300m² floor area
For the purpose of this Section “common space” means all spaces intended to be conditioned to the requirements of the Code not within a *suite and walls serving suites* except *crawl spaces, vertical service shafts, and elevator shafts*.

There is an Alberta clause related to garages in the scope and application section - 9.36.2.1 8 related to garages:

8) The requirements of this Subsection also apply to components of a *building* envelope assembly that separate a heated or unheated attached garage from unconditioned space or the exterior air, where
   a) not more than one *dwelling unit*, or
   b) a house with a *secondary suite*.

From M.A. - That ABC-specific provision was a result of the Alberta-specific provisions we have under Section 9.35. of the ABC, for the HIRF-based interior finishing/thermal insulation requirement for garages.

Log homes must still meet the other bldg. envelope requirements, such as those for windows and door. This is an Alberta-specific rule.

Alberta also exempts walls, floor and ceiling assemblies of Part 10 Relocatable Industrial Accommodation
Modeling a house in the NECB will get you performance gain from efficient lighting, can accommodate different mechanical systems.

The FDWR calculations are in the 2011 NECB. There is an article that lists the max FDWR for our region (7A) at 32%.

9.36 was designed to have average window areas of 17-22%
From the code:

“The reference house is a hypothetical replica of the proposed house using the same energy source for the same function and having the same environmental requirements, occupancy, climate data and operations schedules, but made to comply with all applicable prescriptive requirements of the Code. “

“house energy target” shall mean the annual energy consumption of the reference house.

9.36.5.10 9) For the purpose of calculations in the performance path, the proposed house air tightness value shall be one of the following:

a) 3.2 air changes per hour at 50 Pa pressure difference where the construction complies with Subsection 9.25.,
b) 2.5 air changes per hour at 50 Pa pressure difference, where it can be shown that the air barrier system was constructed according to Subsection 9.25.3. and Articles 9.36.2.9 and 9.
c) c) where tested in accordance with 9.36.5.5.(11), the measured values i) air changes per hour at 50 Pa pressure difference, and ii) Equivalent air leakage area
Conventions for Units

- Effective RSI values for building assemblies
  - “effective thermal resistance”
  - i.e. transmission through framing combined with insulated areas (9.36.1.2(3))
  \[
  \text{RSI to } R = \text{RSI} \times 5.678
  \]
- U-value for windows and doors
  - Overall thermal transmittance (9.36.1.2(2))
  - Overall window value by A440.2

- Effective versus nominal; taking into account the varying insulation abilities of different materials in an assembly; a blended thermal resistance value;
- Tables given for framing percentages with and without framing in common assemblies;
- Tables given for RSI values of common materials
- Simple calculation for calculating the overall (effective) thermal resistance of an assembly’
- Calculations given for calculating and overall RSI for an assembly

- A440 procedure calculates U-values for overall windows, taking into account centre of glass, edge of glass and frame.
Effective Insulation

Effective insulation accounts for insulation, thermal bridging from framing, interior finish, sheathing and cladding.
PAUSE - GOT That?
Option 1: Prescriptive Path

- Prescriptive path
  - No air leakage targets
  - No window/wall ratios

- Use tables and charts in 9.36.2.6 and the appendix notes to find:
  - RSI values
  - How to calculate assemblies
Step 1: List the Assemblies Used in the Building

- Roof
- Above grade wall
- Below grade wall
- Floors over unheated spaces
- Rims, headers etc.
- Areas built differently
  - Garage walls
  - Tall walls
  - Areas with significant different finishes

HPO Illustrated Guide
Step 2: List the Materials that Make Up the Assembly
**Step 3: Determine the RSI of Materials:**

See Tables in ABC 2014 pages A-253 to A-259

<table>
<thead>
<tr>
<th>Sheathing Materials</th>
<th>Thickness of Material</th>
<th>Thermal Resistance (RSI), (m²·K)/W per mm</th>
<th>Thermal Resistance (RSI), (m²·K)/W for thickness listed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gypsum sheathing</td>
<td>12.7 mm</td>
<td>0.0063</td>
<td>0.06</td>
</tr>
<tr>
<td>Insulating fibreboard</td>
<td>—</td>
<td>0.016</td>
<td>—</td>
</tr>
<tr>
<td>Particleboard:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low density (90 kg/m³)</td>
<td>—</td>
<td>0.0098</td>
<td>—</td>
</tr>
<tr>
<td>medium density (800 kg/m³)</td>
<td>—</td>
<td>0.0077</td>
<td>—</td>
</tr>
<tr>
<td>high density (990 kg/m³)</td>
<td>—</td>
<td>0.0059</td>
<td>—</td>
</tr>
<tr>
<td>Plywood – generic softwood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.5 mm</td>
<td>—</td>
<td>0.083</td>
<td>—</td>
</tr>
<tr>
<td>11 mm</td>
<td>—</td>
<td>0.096</td>
<td>—</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>—</td>
<td>0.100</td>
<td>—</td>
</tr>
<tr>
<td>15.5 mm</td>
<td>—</td>
<td>0.135</td>
<td>—</td>
</tr>
<tr>
<td>18.5 mm</td>
<td>—</td>
<td>0.161</td>
<td>—</td>
</tr>
</tbody>
</table>
If you are going to use the prescriptive path for compliance, you need to understand how to calculate areas of various assemblies.

9.36.2.3 - Fenestration means more than windows. It is any building envelope assembly that transmits visible light such as skylights, glass block, translucent panels, transoms, skylights, tubular light pipes etc.

- If the trade-off options is used, calculation of envelope areas and window areas may be necessary.

- There is a credit for adjoining unconditioned spaces of 0.16 RSI (R-1)

- Areas that may need to be calculated separately could be tall wall areas.
From the 2014 Alberta Building Code
Step 5: Determine Blended RSI for Assemblies

Example: 2x6 framing, 24 " o.c. R-22 glass fiber batt

\[
\frac{100}{\frac{\text{% area framing (20)}}{\text{RSI FRAMING (1.19)}} + \frac{\text{% area Insulation(80)}}{\text{RSI INSULATION (3.87)}}}
\]

RSI 2.67

Revised example May 25, 2016
Step 6: Add RSI’s for Each Material

Example: 2x6, 24 o.c. R22 Batt vinyl clad

- Outside air film 0.03
- Vinyl siding 0.11
- Sheathing paper --
- 3/8” (9.5 mm) osb sheathing 0.093
- 2x6 framing, 24 “ oc. RSI 2.45
- R22 fiberglass batt RSI 3.87 2.67 (Blended RSI)
- Polyethylene sheet --
- ½” (gypsum 0.08
- Interior air film 0.12

RSI 3.10

REVISED to reflect change to slide 17 may 25, 2016

Highlight how cladding can change the RSI.
Also how walls built in different ways need to be modeled differently.
Look at percentage of windows.
Climatic data shows most regions are warmer.

Division B, Appendix C  C-12 –C15
## Climatic Zones

*Division B, Appendix C*

<table>
<thead>
<tr>
<th>Climate Zone, Heating Degree Days °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 4</td>
</tr>
<tr>
<td>≤ 3000</td>
</tr>
<tr>
<td>Lethbridge Medicine Hat</td>
</tr>
</tbody>
</table>
- Unheated floors does not apply to floors above crawlspaces (or attached garages?)

- 9.36.2.7 (2) The effective thermal resistance of *rim joists* shall be not less than that required for above-ground walls in Table 9.36.2.6.A. or 9.36.2.6.B., as applicable.
REVIEW: Steps to Assembly RSI For the PRESCRIPTIVE Path

1. List the different assemblies used in the building
2. List the materials that make up the assembly
3. Assign RSI values for each material in an assembly
4. Determine framing and cavity percentages of the assembly
5. Adjust the framing and insulation RSI’s to arrive at a blended RSI value for cavities and framing areas
6. Add the RSI values of each layer of the assembly to determine overall assembly RSI
7. Compare with the required RSI for your zone for each assembly
Trade offs may be required for Tall wall areas with heavy framing
Pause – Over the Worst Part!

Breath, think calm thoughts, its not that bad!
Considerations for Foundations and Floor Slabs - 9.36.2.8

Where and to what level to insulate a floor slab depends on:

- Whether the slab is above or below frost line
- Top of foundation and height of ground cover
- Where the insulation is placed
- Whether the floor is heated

However there are some specific wrinkles....
4a – on the exterior
4bi – interior beneath slab for 1.2 m with thermal break at edge of slab, with 50% of RSI required
4bii – on top of slab 1.2 m from perimeter
4biii – within sleepers on the slab
A 9.36.2.4.(3) The 2% exemption is based on gross wall area, but applies to penetrations through any envelope assembly.

Step 4: Consider Structural Penetrations

- Structural penetrations should not exceed:
  - a total area of greater than 2% of the gross wall area
- If so, the effect of these penetrations must be taken into account
- Examples:
  - Cantilevered balconies; beams, columns
  
  Code reference 9.36.2.4
No Need to Calculate

- Minor penetrations 9.36.2.5 (2)
  - pipes, ducts, though-wall vents, shelf angles, ties, fasteners
- Areas not intended to be heated
  - Uninsulated crawl spaces
9.36.2.4(4) Protected Assemblies

IF a component of the building envelope is protected, the required effective thermal resistance of the building envelope component between the building and the unconditioned enclosure is permitted to be reduced by 0.16 (m2·K)/W

Examples: wall between attached garage and house

Does NOT apply to vented spaces (an attic space)

9.36.2.5.4 4) EXAMPLES :conditioned space, such as a sun porch, enclosed veranda, vestibule or attached garage (See Appendix A.)

_intent is to provide a simple credit
A reduction is permitted provided the insulation is constrained only by the roof slope and venting requirements. The minimum RSI over the wall must be maintained at R-20

Minimum height at outside surface of exterior of wall depends on:

- Minimum 1” vent clearance
- Roof slope and location of top-bottom chord junction

Issue for scissor trusses?
- Insulation levels are generally the same as the assembly it penetrates,

9.36.2.5

6) Where mechanical, plumbing or electrical system components, such as pipes, conduits, cabinets, chases, panels or recessed heaters, are placed within and parallel to a wall assembly required to be insulated, the effective thermal resistance of that wall at the projected area of the system component shall be not less than that required by (the) Tables

(check this) It is unclear at this time if it applies at the junction between a rim joist and the foundation wall.
Continuity at Partial Penetrations in Walls

Interior components must not break the continuity of insulation or decrease the effective thermal resistance to less than that of the assembly.

HPO Illustrated Guide
Continuity at Floors and Ceilings

Pipe ducts etc. placed within the insulated portion of floor or ceiling
  • RSI at the area of the assembly can be reduced to RSI 2.78 (9.36.2.6(7))

Rim joists
  • Not less than walls
9.36.2.5 (2) Full Penetrations of an Assembly

Example: Firewall

- Insulate it:
  - Inward and outward 4X or
  - > 60% of that required in the wall
  - Within itself to the amount needed for the element

Applies to major penetrations such as foundation walls, party walls, firewalls or structural element
Insulation of Full Penetrations

ABC p. A262
An example to which this sentence DOES NOT apply is that of a foundation wall that is insulated on the inside and the insulation continues through the joist cavity and into the wall assembly.

If the insulation ‘kisses’ the rim insulation, no overlap is required. Check Murray’s info.
**Continuity Were Insulation Does not Join**

**Foundation:**
- If it is insulated on the exterior to the footing OR
- The insulation “kisses”

HPO Illustrated Guide
9.36.1.2 (4) defines fenestration as all building envelope, assemblies, including their frames, that transfer visible light, such as windows, clerestories, skylights, translucent wall panels, glass block, transom sidelights, sliding overhead or swinging glass door, and glass inserts in doors.

These numbers are for zones 6 and 7A.
- ER is harder to reach as it has an air tightness requirement; difficult for sliding windows and sliding patio doors.
- Could be an issue with some basement windows; Some door manufacturers.
- Site-built windows do not need to comply to U-values but must still meet airtightness.
- There is more information on compliance options for site-built windows and doors and glass block in section 9.36.2.7.

- 9.36 assumes a maximum window area of 22% compared to 33% for the NECB but the maximum is not stated in the body of 9.36.
- Separating conditioned from unconditioned or the exterior

- Appendix note A-9.36.2.5(8) recognizes that it might not always be acceptable or necessary to insulate this gap, especially if doing so compromises drainage
Trade-Off Option
9.36.2.11

*Trade like for like
- Windows – Windows
- Walls to walls, floors or ceiling; above ground only
- Limitations in amounts of reduction
- Areas must be the same

Useful for small areas
- Tall walls or bonus room floors
  - Thicker studs, closer spacing

Trade off bonus room floor with common garage Wall?

New terminology:
- “opaque area”

– Above-ground opaque

Decreased insulation in a wall area compensated by increased insulation in an equal area of ceiling or another wall
- Limits placed on maximum permitted reduction in performance
- Ceiling/floor with window reduction

- residential tall walls are considered to be walls in residential buildings that are constructed under Part 9 of the ABC 2006 and are greater in height than currently permitted under Part 9 of the Code (Table 9.23.10.1) which is 3.6m (11.9 feet). The walls may be load-bearing and/or wind bearing.
Air leakage characteristics of materials (not new)
- Compatible with adjoining materials
- Continuous (junctions, penetrations, expansion joints, windows, doors, overhangs, interior walls, chimneys)
- Lapping and sealing
- Structural support

There are 3 methods of meeting airtightness:
- 936.2.10
- 9.25 plus a tested assembly
- Blower door test
Air Tightness Details 9.36.2.10

- Properties specified for materials intended to provide air tightness
- Comments on sealing of rigid and flexible air barriers
  - Air barrier (flexible) - lapped 50 mm (2"), sealed, structurally supported.
  - Continuous
- Construction details described for joints and junctions and penetration in the airtight plane
  - Details for sealing ducts, wiring, rim joist, foundation, cantilevers, interior walls, stacks, chimneys, party walls
Exterior Air Barriers

- A material itself is not an air barrier.
- It is a system of materials, sealant and solid materials across the whole assembly.
Airtightness – Key Areas

- Rim joist area
- Cantilevered floors
- Rough openings to windows/doors
- Interior walls that meet exterior walls or ceilings
- Attic hatches, stacks, chimneys
Easy Stuff Ahead!
- Equipment sizing – do our contractors know how to do this? This has been an issue in B.C.

- Duct sizing – Best practice according to HRAI, ASHRAE, SMCANA

- Under floors – Does this apply to bonus room floors? Does not consider round ducts.

- Dampers not needed where other regulations do not permit them or on equipment that is designed to operate continuously (furnaces?)

- Piping installed to the hydronic standard, B-214

- Alberta has an additional require clause 9.36.3.3 3) that provides and exemption for Part 10 buildings with fuel-fired warm-air furnaces
- exceptions to dampers is where other regulations take effect or on appliances required to operate continuously
- Means shall be provided to adjust the heating of each zone by automatic devices or manually operated dampers, valves or switches as appropriate for the heating system used
- Exception if solid fuel for temperature control
- Lowering heating set point will not cause energy for cooling to be expended
Fireplaces efficiencies according to CSA P4 or Enerchoice
Issue with these being considered as heating appliances
Split and single packages

**HVAC Efficiencies**

9.36.3.10

- Table of minimum efficiencies
  - Gas-fired boilers 90% AFUE
  - Gas-fired furnaces 92% AFUE
  - Gas-fired fireplaces
    - Direct vent, pilot on demand
  - Air conditioners, air cooled 14 or 14.5 SEER
- No mention of installation type or requirements for installation – no standards, no reference for training etc.

- Sensible heat recovery percentage are for 2.5% January design temperature of less than -10°C
Service Water
9.36.4.2

- Such as boilers, pool heaters and storage tanks

- Water heater tank efficiency is after standby losses
“house energy target” shall mean the annual energy consumption of the reference house. This is roughly equivalent to an EnerGuide 78.

Insert in from STANDATA and Code on “professionals”

9.36.1.3 Subsection 9.36.5. applies only to
a) houses with or without a secondary suite, and
b) buildings containing only dwelling units and common spaces whose total floor area does not exceed 20% of the total floor area of the building.
**Anticipated Impacts**

- Choose to go with or without HRV
- Choose prescriptive or performance path
- Framing practices may change
  - 16” to 24” o.c. or EE framing
- Above grade and below grade insulation may change
- Garages may need more insulation
- Windows may be affected especially in doors etc.
- Door U-values need to be checked to ensure values include the frame and sashes.

**Strategy**

- Emphasize the sizable improvements that builders have made over the years while maintaining housing affordability. When these initiatives are driven by a response to consumer demand, rather than by regulatory decree, they are introduced at the proper pace and cost.

- Continue to participate in the energy codes process, emphasizing that changes must be attainable, supportable and economically sustainable.

- Improve the statistical capabilities of the Association to better show the improvements that builders have been making and what products are in demand
Put it On the Drawings!

- Which path you are using to comply
- Assembly RSI values
  - Where assemblies differ
  - Areas where insulation levels could be reduced
- Detail areas where continuity of insulation is an issue
- Include critical air barrier details
  - Ex: rim joist, attic hatch, pot lights, supported poly hats
- Equipment efficiencies
Compliance – Prescriptive Path

Prescriptive

- Consider creating separate spec sheet of items that meet code
  - See HPO Illustrated Guides for checklist
  - City of Calgary NECB checklist
- Train site supers on key areas
  - Air sealing

▲ WORK WITH YOUR AHJ’s!
Compliance - Performance

- Identify a energy advisor you can work with
- Ensure they are certified by NRCan
- Do detailed drawings for plans
- Train site supers on key areas
- Concentrate on areas that make a difference
  - Air sealing
- WORK WITH YOUR AHJ’s!
AHJ’s are still working on this
Training just rolling out on 9.36
# Medicine Hat Example

## Performance Checklist

<table>
<thead>
<tr>
<th>ENVELOPE</th>
<th>Reference House</th>
<th>Proposed Home</th>
<th>As Built</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Insulation (IU)</td>
<td>1.43</td>
<td>R60 Blown on 24” OC</td>
<td></td>
</tr>
<tr>
<td>Ceiling Insulation (IU)</td>
<td>1.88</td>
<td>R20 Blown on 24” OC</td>
<td></td>
</tr>
<tr>
<td>Exterior Wall</td>
<td>3.90</td>
<td>R10</td>
<td></td>
</tr>
<tr>
<td>Additional Exterior Insulation</td>
<td>3.00</td>
<td>R10</td>
<td></td>
</tr>
<tr>
<td>Floor Heaters</td>
<td>5.82</td>
<td>R28</td>
<td></td>
</tr>
<tr>
<td>Front Door (Insulated)</td>
<td>5.82</td>
<td>R28</td>
<td></td>
</tr>
<tr>
<td>Heat Loss Insulation</td>
<td>3.46</td>
<td>R10 Blown on 24” OC</td>
<td></td>
</tr>
<tr>
<td>Small Door/Fascia (Insulated)</td>
<td>Double Pane Argon Filled</td>
<td>Triple Pane Argon Filled</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MECHANICALS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Heating</td>
<td>83.6% APH</td>
<td>83% APH Natural Gas</td>
</tr>
<tr>
<td>Domestic Hot Water (Direct Vent)</td>
<td>6.47% EF</td>
<td>6.47% EF Power Vent</td>
</tr>
<tr>
<td>Condensation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Mechanical Improvements</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## RENEWABLES | | |
| Photovoltaic Systems | | |
| Geo thermal Heat System | | |

## MISCELLANEOUS | | |
| LED/LV Lighting | | |
| Energy Star Applies | | |

## Overview | | |
| Proposed Annual Energy Consumption | 284,767 GJ | 234,393 GJ | |
| Proposed Energy Rating | 77 | 97 | |
| Compliance: Yes or No | Yes | |

EA Representative: ____________________  Builder Representative: ____________________
Resources On the Code

- Alberta Building Code
- Users Guide to the NECB
- HPO Illustrated Guides
  - By zone
WALL RSI/R Value Calculations

- Alberta Building Code
  - Page A-243
- Canadian Wood Council
  - www.cwc.ca/wtd
- Okotrope Design
- Owens Corning
  - http://insulation.owenscorning.ca/builders/calculators/thermal-project-calculator/
Resources for Wall Construction Air Sealing

- CHBA Builders Guide
  http://www.buildermanual.ca/

- Builder’s Guide to Cold Climates
  https://buildingscience.com/bookstore/books/builders-guide-cold-climates

- HPO R-22 Wall Guide
Resources for Wall Construction

Residential Insulated Sheathing – Installation Guide

- Roxul
A whole section on air sealing and insulation
- Air Sealing Attached Garage
- Building Science Introduction - Air Flow
- building Science Introduction - Heat Flow
- Cantilevered Floor
- Garage Rim/Band Joist Adjoining Conditioned Space
- Multifamily Party Walls
Other Issues of Interest? Questions?