

# Deep Energy Retrofits

## Building Code Updates



CAPITAL **HOME** ENERGY



CANADIAN  
HOME BUILDERS' ASSOCIATION  
**SEA TO SKY**

# Luke Dolan

## Capital Home Energy

Licensed Service Organization servicing  
British Columbia

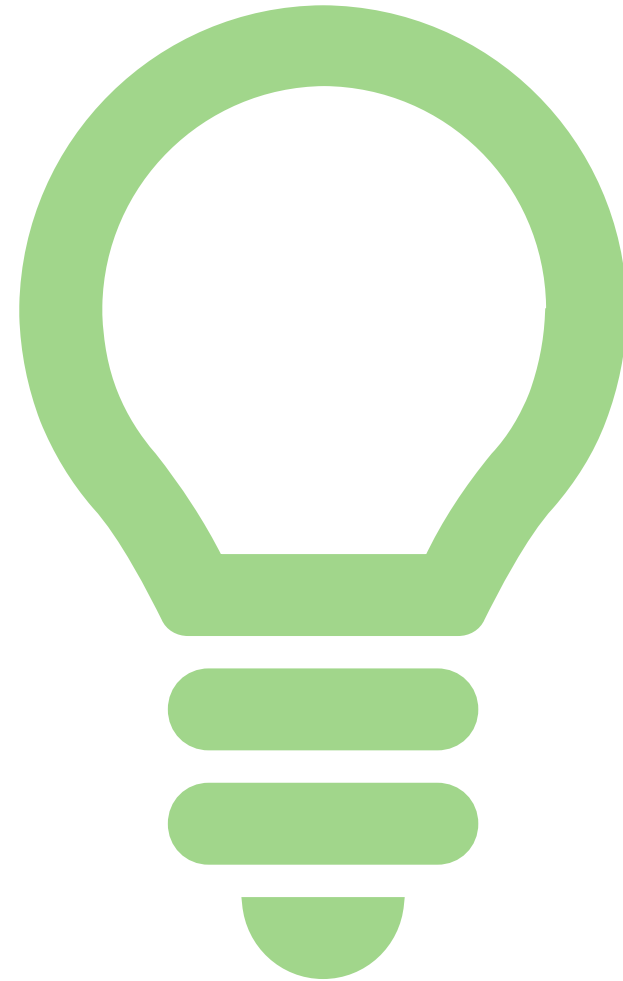
- 15 years of EnerGuide evaluations
- Master Energy Advisor
- Home Inspector
- Building Science instructor
- Personally Evaluated over 6000 homes
- Team of Professionally trained Energy Advisors
- Founded trade association - CACEA  
Canadian Association of Consulting  
Energy Advisors



# Agenda

- Understanding Deep Energy Retrofits
- Key components
- The process
- Avoiding unintended consequences
- Cost consideration & rebates
- Case Study
- Summary
- Building Code updates

# Understanding Deep Energy Retrofits



# What is a Deep Energy Retrofit ?

- A **deep energy retrofit (DER)** for residential homes is a comprehensive renovation process that significantly reduces a home's energy consumption—typically by **50% or more**—compared to its baseline performance.
- It goes beyond simple upgrades (like new windows or a better furnace) to holistically improve the entire building's **energy efficiency, comfort, and indoor air quality**.

# Why Deep Energy Retrofits?

- Health & comfort & durability  
(better indoor air quality, temperature control, protection of the envelope assemblies)
- Economic benefits  
(lower energy bills, increased home value)
- Environmental benefits  
(GHG reduction, sustainability)
- Resilience ?  
Resilient Homes have reduced risks from climate-related weather impacts



# What is Sustainable Resilience ?



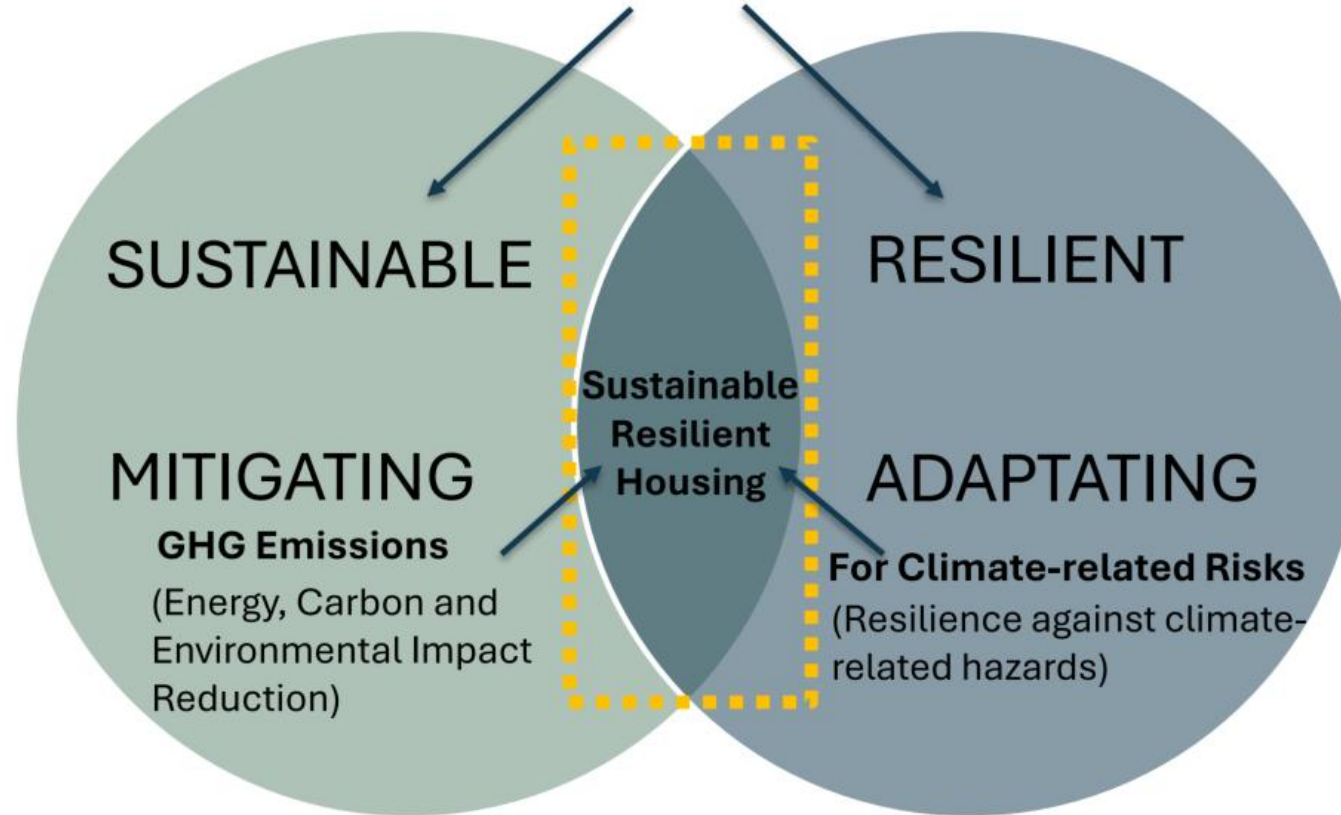
Sustainable Homes have reduced energy demands and carbon emissions.



Resilient Homes have reduced risks from climate-related weather impacts

# MARKET DIRECTION

## ENVIRONMENTAL DISCLOSURES:



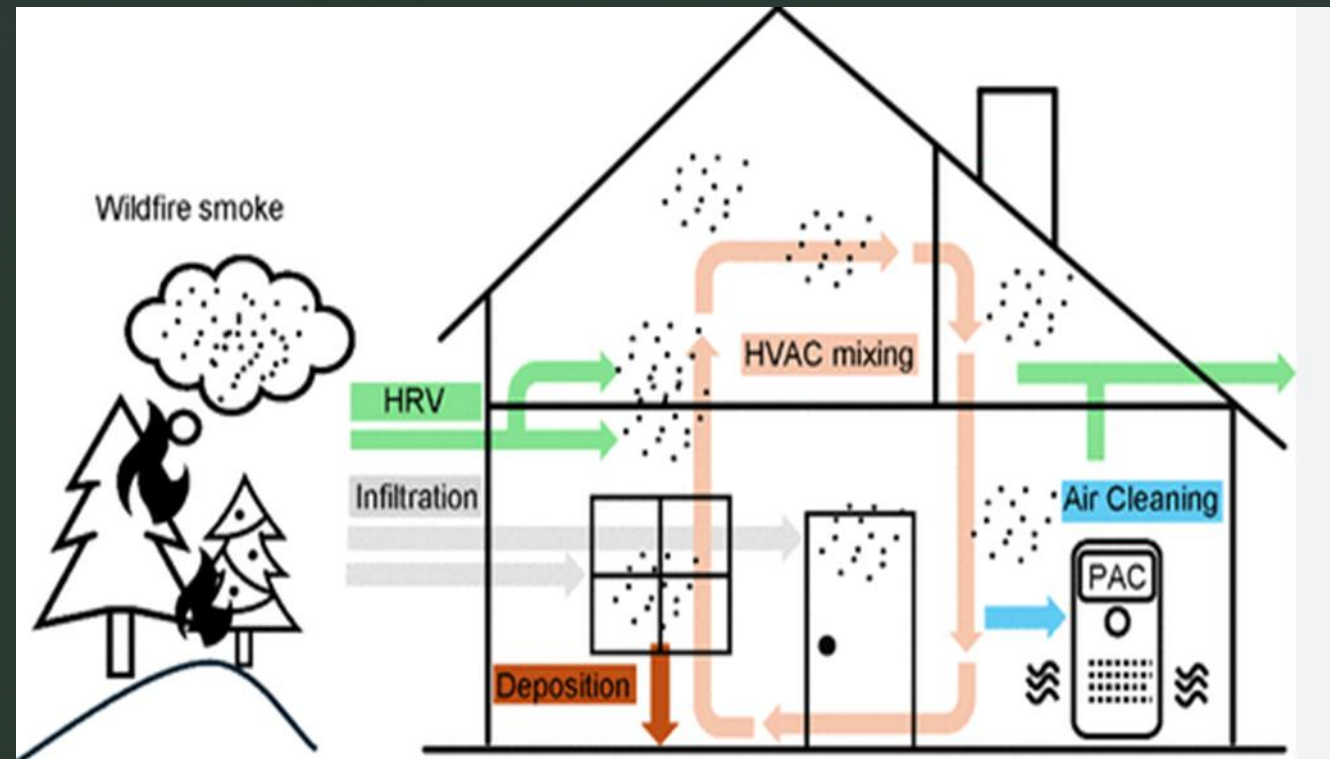
# Non-Combustible Roofing, Cladding, and Insulation



# Site Trees, Landscaping, Decking



# Indoor Air Quality



# Flooding

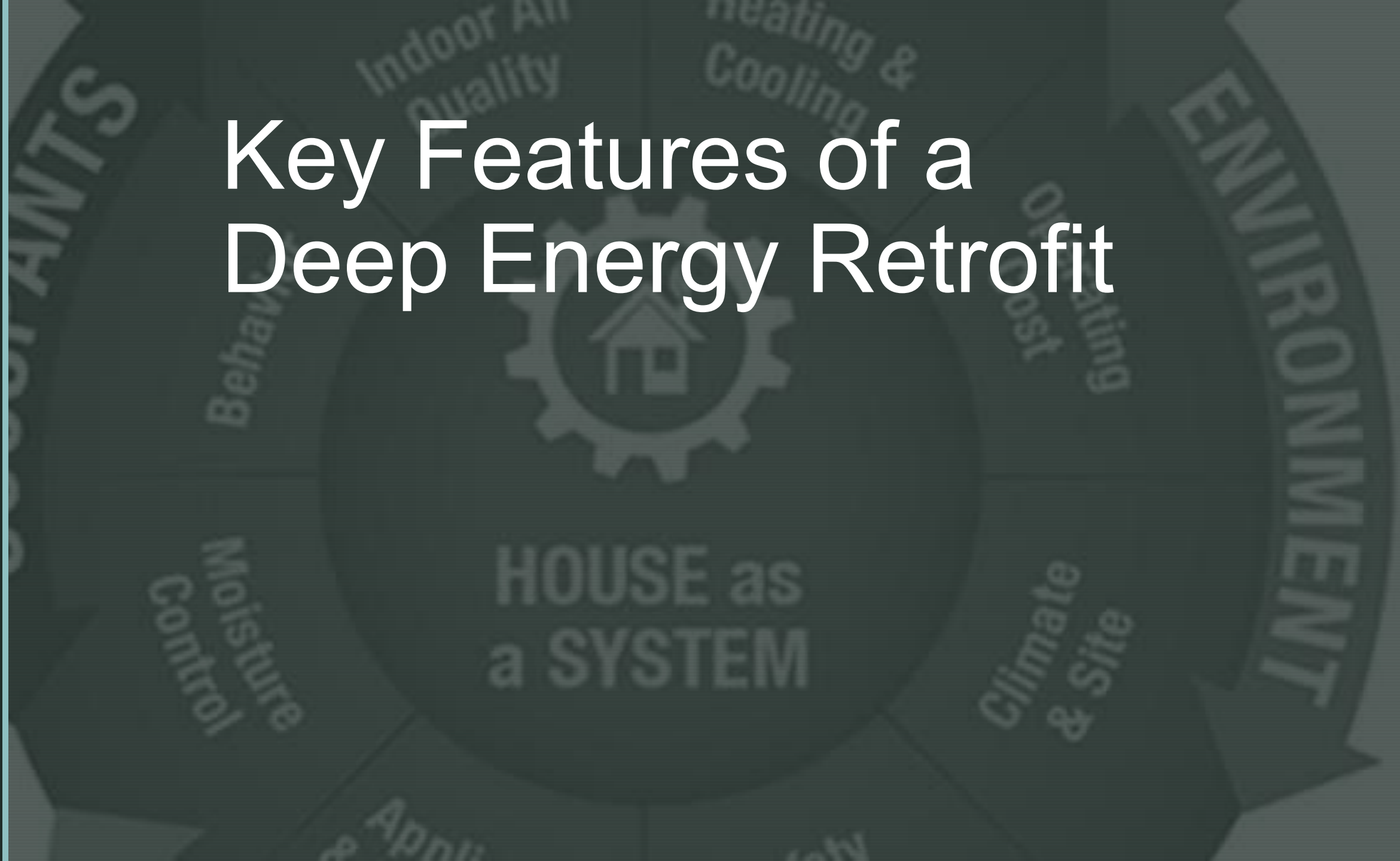


Photo from Squamish Chief

## When to Consider a Deep Energy Retrofit:

- During major renovations or additions
- If you have very high energy bills
- For climate goals (e.g., net-zero energy or carbon-neutral living)
- To improve resilience, comfort, and home value

# Key Features of a Deep Energy Retrofit



# Key Features of a Deep Energy Retrofit

## 1 The House of a System Concept

- Considers the interactions between building envelope, mechanical systems, lighting, appliances, and occupant behavior.



# Key Features of a Deep Energy Retrofit

## 2. Building envelope improvements

- Upgrade/increase insulation - where feasible (walls, roof, floors, foundation)
- High-performance windows (e.g., triple-pane low USI value)
- Air sealing
- Thermal bridging mitigation (e.g., exterior insulation)



# Key Features of a Deep Energy Retrofit

## 3. Efficient mechanical systems:

- High-efficiency heat pumps for space heating and cooling
- Heat pump water heaters ?
- Energy Recovery Ventilators (ERVs) or Heat Recovery Ventilators (HRVs) for healthy balanced ventilation



# Key Features of a Deep Energy Retrofit

4. **Renewable energy integration**  
(optional but common):
  - Solar photovoltaic (PV) systems
  - Solar thermal systems for water heating
  - CHBA Net Zero Reno



# CHBA Net Zero Home Program

- Net Zero = Produces as much energy as consumed annually
- Two tiers: Net Zero Ready (NZR) & Net Zero (NZ)
- Uses 40%-50% on average less energy than a min code home
- Requires Builder education



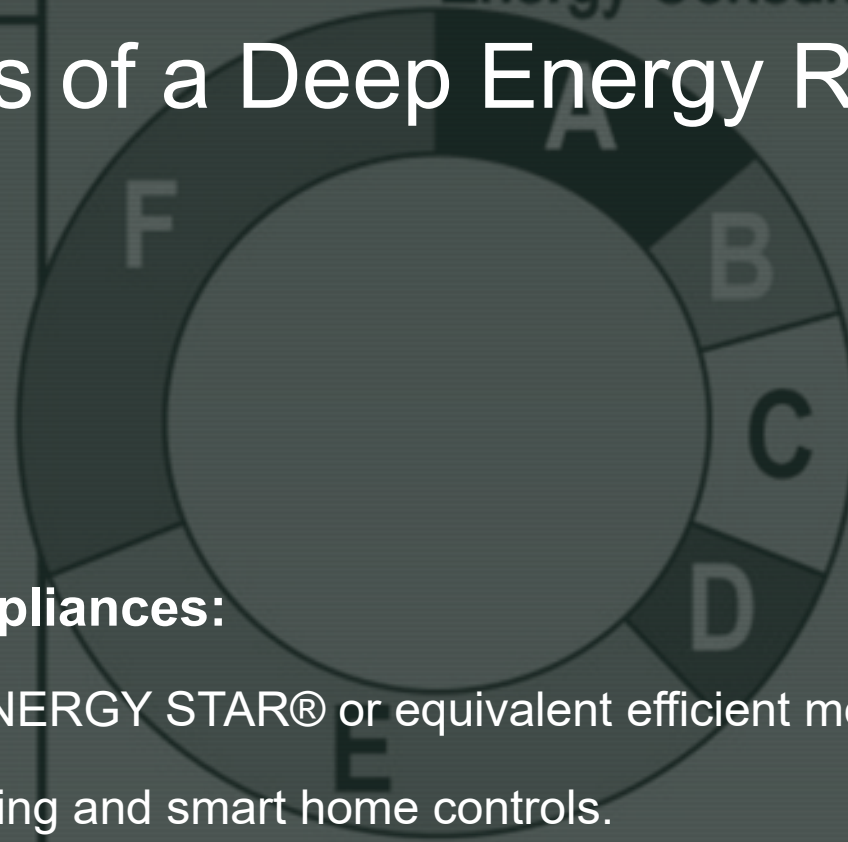
# Key Features of a Deep Energy Retrofit

Annual Energy Consumption	29 GJ
Electricity	29
Renewable energy contributions	- 29 GJ
Electricity	32
Hot water heating	0
<b>Guide Rating:</b>	<b>= 0 GJ</b>

## 5. Lighting and Appliances:

- Replace with ENERGY STAR® or equivalent efficient models.
- Install LED lighting and smart home controls.

## Breakdown of Rated Annual Energy Consumption:



A	Space heating	12
B	Space cooling	4
C	Water heating	9
D	Ventilation	2
E	Lights & appliances	27
F	Other electrical	46

Rated Energy Intensity: **0.23 GJ/m<sup>2</sup>/year**

Rated Greenhouse

Gas Emissions:

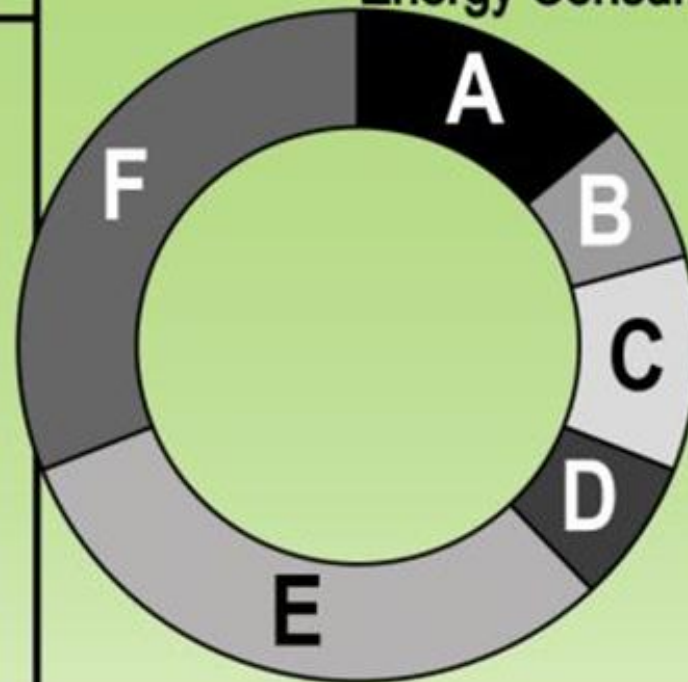
**0.0 tonnes/year**

Values may not add up due to rounding.

<b>Rated Annual Energy Consumption</b>		<b>29 GJ</b>
• Electricity	29	
<b>On-site renewable energy contributions</b>		<b>- 29 GJ</b>
• Electricity	32	
• Solar water heating	0	
<b>EnerGuide Rating:</b>		<b>= 0 GJ</b>

Figures may not add up due to rounding.

### Breakdown of Rated Annual Energy Consumption:



A	Space heating	12%
B	Space cooling	4%
C	Water heating	9%
D	Ventilation	2%
E	Lights & appliances	27%
F	Other electrical	46%

Rated Energy Intensity: **0.23 GJ/m<sup>2</sup>/year**

Rated Greenhouse Gas Emissions:

**0.0 tonnes/year**

# Key Features of a Deep Energy Retrofit

## 6. Improved indoor air quality:

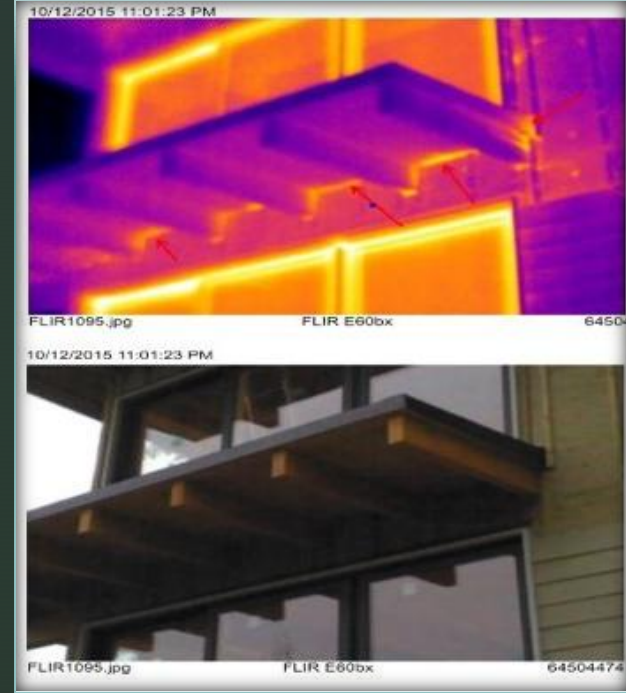
- Filtration
- humidity control
- low-VOC materials





## Typical Process:

- **Energy evaluation:** Assessment of current performance using tools like blower door tests and thermal imaging
- **IDP:** Development of an integrated retrofit plan
- **Construction:** Implementation in stages or as a full remodel
- **Post-retrofit testing:** final blower door testing, certification, rebate application



# Mid construction blower door test

Follow the Science

# Avoiding Unintended Consequences

# Why “Building Science”?

- Helps us answer the following questions:
  - how to build in “durability”?
  - how to build a more “efficient” house?
  - how to not cause more problems than we solve?
  - how to meet Code requirements in the most cost-effective way, while avoiding “unintended consequences”?



# Dos and Don'ts

- **Do focus** first on health and safety.
- Ensure the home has structural integrity
- Free of mould, asbestos, radon
- Free of knob-and-tube wiring
- Free of poly b piping



# Dos and Don'ts

- **Do eliminate** any natural draft combustion appliances that might “back draft” CO<sub>2</sub>
- Fireplaces (wood or gas)
- Hot water tanks
- Fuel burning heating systems



# Dos and Don'ts





# Dos and Don'ts

- **Do consider** switching to a heat pump as you take steps to improve the envelope
- More insulation, air tightness, better windows, reduces heating loads and will require a smaller back up heat source
- Reduces oversizing, especially for the cooling season
- F280-12 room by room heating/cooling load calculations

# Dos and Don'ts

- **Don't seal the home without proper ventilation**
- “airtight, ventilate right”
- Use the data from your EnerGuide report
- Anticipate new ACH target, and ventilate accordingly
- Balanced ventilation is key



# Dos and Don'ts

- **Don't** insulate walls without ensuring the home has proper water management and drainage.
- Existing problems can be made worse when you insulate and update/upgrade vapour and air control layers.
- The buildings drying potential could be significantly reduced



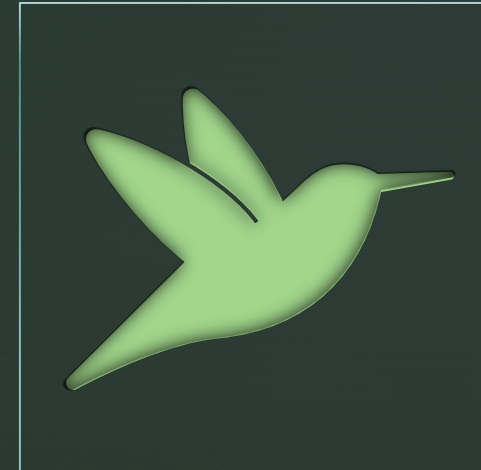
*Figure 2-38. Example of a self-adhered membrane exterior air barrier approach.*



*Figure 2-37. Self-adhered sheathing membrane with adhesive primer.*

# Dos and Don'ts

- **Do keep it simple**
- Less reliance on complex expensive mechanical and control systems.
- More emphasis on envelope:  
Better windows, more insulation, air tightness



## Avoiding Unintended Consequences

- Thorough Planning and Analysis
- Ensuring Proper Ventilation to Prevent Moisture Problems
- Monitoring and Adjusting Systems Post-Retrofit



# Cost Considerations

- Deep Energy Retrofits can be cost prohibited.
- Are there Investment and Financing Options?
- Rebates and Incentives



### The benefits of the RBC Green Home Mortgage



#### Lower monthly mortgage payments

An RBC Green Home Mortgage comes with the option to extend the amortization period to up to 35 years (compared to a traditional mortgage with a 30-year amortization).<sup>2</sup>



#### Financing for upgrades

You may want to include the costs of energy-efficient upgrades you select as part of your purchase price. Speak to your RBC Mortgage Specialist to learn more.



#### Complete your mortgage from the comfort of your home

As always you can connect with an RBC Mortgage Specialist online or by phone and complete your documents electronically. It's simple, convenient and secure.



#### A firm mortgage approval

Once approved, you stay approved, throughout the entire construction period until your closing date.<sup>3</sup>



# Mortgage Incentives

# Mortgage Incentives

- **New Mortgage Insurance Rebate of 15% to 25%**
- **CMHC:** Home buyers can access rebates with The Canadian Mortgage and Housing Corporation
- Sagen Canada by getting an energy evaluation or EnerGuide rating that shows home efficiency improvements. It's that simple.

# Rebates and Incentives

- Better Homes BC
  - <https://www.betterhomesbc.ca/>
- FortisBC rebates
  - <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers?l=>



## Loan details

**Maximum:** \$40,000

**Minimum:** \$5,000

**Repayment term:** 10 years, interest-free

**Loan type:** Unsecured personal loan on approved credit

The maximum eligible loan amount is calculated based on the retrofits selected in the application and the quotes for this work. The eligible amount is capped based on industry standards and market norms. The maximum eligible loan amount may be less than your quoted cost, in which case you will be responsible for funding any difference.

A maximum of one loan is available per eligible property and homeowner.

The loan can only help you finance [eligible products and installations](#) that are part of a retrofit that is both recommended by an energy advisor and eligible for the grant.



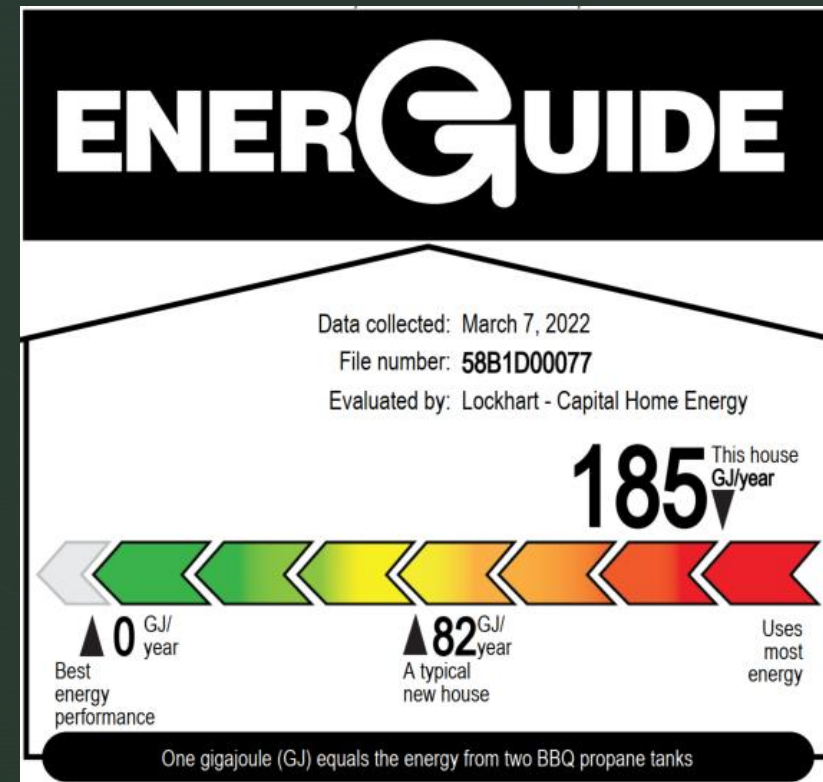
# Rebates



North Vancouver Net Zero  
**Case Study**

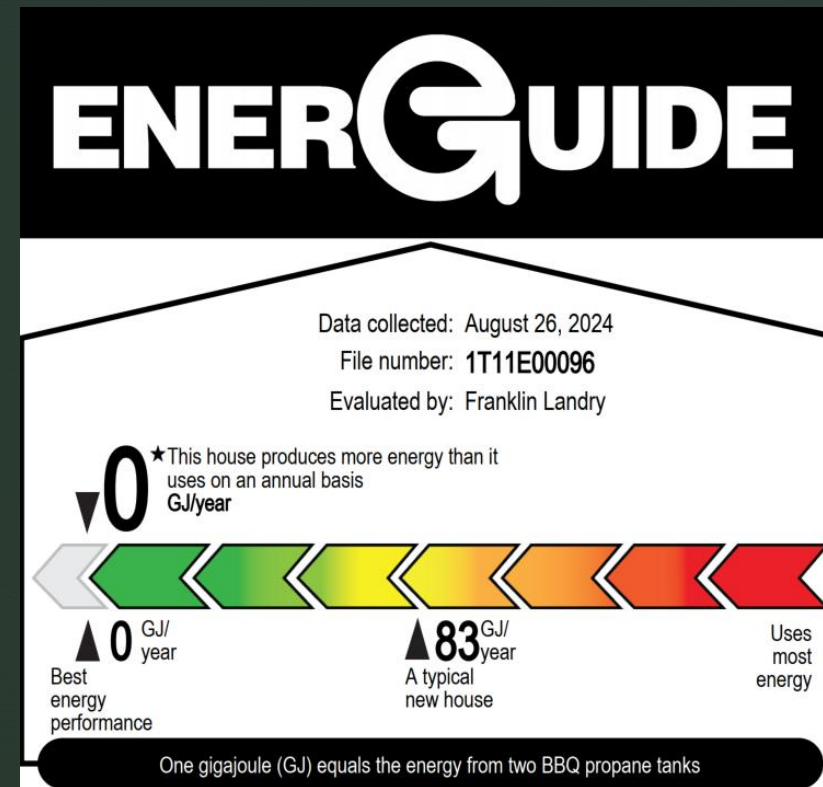
# North Vancouver Net Zero

- 1958 Rancher
- 1650 ft<sup>2</sup>
- 2x4 R-8 Walls
- ERS 185 GJ/yr

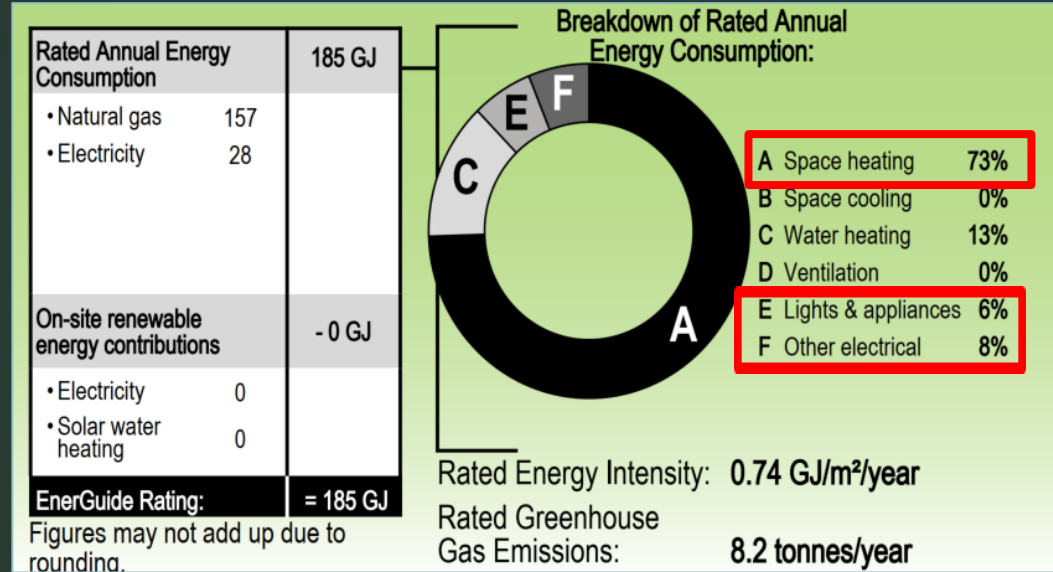


# North Vancouver Net Zero

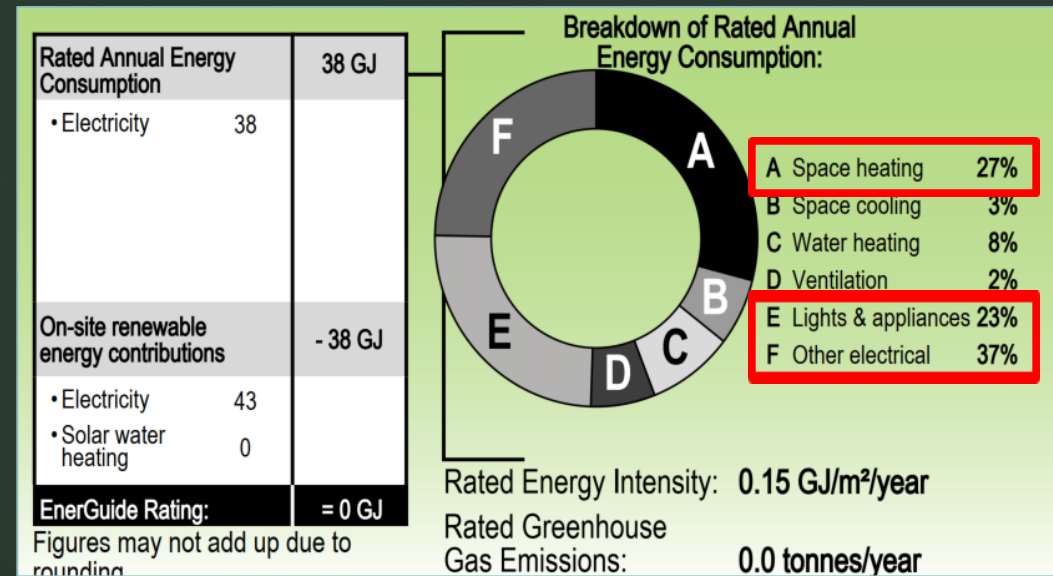
- Increased basement insulation from nothing to an average R-22
- Increased wall insulation from R-8 to R-24
- Increased attic insulation from R-24 to R-60
- Upgraded windows from single glazed to triple glazed with USI 0.97-0.91 SHGC 0.16
- Heating system upgraded to cold climate air source heat pump
- Domestic hot water upgraded to a Rheem hybrid electric integrated heat pump hot water tank
- Ventilation upgraded to HRV 81% SRE @ 0 degree C (balanced ventilation)
- Air tightness improved from 9.37 ACH to 1.08 ACH
- Solar PV System: 27 panels, 570 ft<sup>2</sup> array size, 43 GJ/year (12,023 kWh) estimated on site renewable energy contribution



## Pre-reno evaluation



## Post-reno evaluation



# Summary Deep Energy Retrofits



# Key Retrofit Measures

- Roof insulation: eff R50+ to handle alpine winters
- Wall insulation: eff R-22+
- Triple-glazed windows
- High-efficiency heat pumps (cold climate rated)
- HRV/ERV for fresh air and heat recovery

# EnerGuide & Net Zero Alignment

- Sea to Sky homes benefit from both
- Step Code + ERS = deep savings
- Target: 50% less energy consumption for Net Zero Ready



Retrofit costs: ?

Rebates: CleanBC,  
Greener Homes

Local support via  
Retrofit Assist

Mortgage incentives

# Costs & Incentives

# Benefits to Homeowners

- Year-round comfort in Whistler's alpine climate
- Lower bills, fewer emissions
- Increased home value and resale appeal
- Durable, heathy, comfortable



# Next Steps

- 1. Schedule EnerGuide evaluation
- 2. Connect with CHBA Sea to Sky trades, suppliers
- 3. Use CleanBC & federal rebates
- 4. Begin your Sea to Sky retrofit journey



# Building Code updates & reminders

# Prevent Overheating Cooling Requirements

## ▶ Bulletin 24-08 – Protection from Overheating in Dwelling Units

- Protection against extreme heat
- Guidance on strategies for passive and active cooling for Part 3 and 9 buildings

[https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/bulletins/2024-code/b24-08\\_overheating.pdf](https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/bulletins/2024-code/b24-08_overheating.pdf)

# Overheating Protection

- Compliance Methodologies:
  1. Central mechanical cooling (whole house)
  2. Localized mechanical cooling (“refuge room”)
  3. Passively cooling dwelling units (no mechanical cooling serving the dwelling)

## Requirement

### 9.33.3.1(2) Indoor Design Temperatures

*2) At the outside summer design temperature, required cooling facilities shall be capable of maintaining an indoor air temperature of not more than 26°C in at least one living space in each dwelling unit.*

[https://www.tol.ca/en/building-development/resources/building/bulletins-forms-resources/Document-Feed-Building-Bulletins/PLI---Overheating-Protection---BC-Building-Code-requirement-9.33.3.1-\(2\).pdf](https://www.tol.ca/en/building-development/resources/building/bulletins-forms-resources/Document-Feed-Building-Bulletins/PLI---Overheating-Protection---BC-Building-Code-requirement-9.33.3.1-(2).pdf)

# Path 1 & 2 Central & Localized Mechanical Cooling

- Sized through F280-12 heat gain and loss analysis
  - Block-Load vs. room-by-room calculations
  - Must be part of a system integral to the building (no plug-in A/C)
- Path 1
  - Centralized mechanical cooling for the whole house
- Path 2
  - Refuge room – single room mechanically cooled
  - Designed to be used during extreme heat events for the whole household

## Path 3

## Passively cooled dwelling units

- No mechanical cooling
  - Whole building analysis performed in accordance with BCBC 2.2.2.1(1)
- Results must demonstrate that at no time during the cooling season does the dry bulb temperature of the refuge room exceed 26°C

**2.2.2.1. General Information Required**

- 1)** Sufficient information shall be provided to show that the proposed work will conform to this Code and whether or not it may affect adjacent property.

# Which pathway is the best?

- Our experience: the simplest pathway is to install mechanical cooling
  - Each unit must be cooled individually
  - Ductless mini-split systems are great for small spaces
- Remember
  - Each dwelling unit must be cooled
  - If there is a secondary suite, it must be able to control the cooling independently from any primary systems



## 9.36 Prescriptive Path

- RMOW is enforcing new tables in the BCBC as of May 1, 2023

9.36  
Prescriptive  
fenestration USI values



# BCBC Prescriptive path Windows

**Table 9.36.2.7-D**  
**Required Thermal Characteristics of Fenestration for Buildings Containing Only Dwelling Units**  
 Forming Part of Sentence 9.36.1.3.(6) Sentence 9.36.2.7.(1)

Components	Thermal Characteristics (1)	Heating Degree-Days of <i>Building</i> Location, <sup>(2)</sup> in Celsius Degree-Days					
		Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
Fenestration (3)	Max. U-value, W/(m <sup>2</sup> ×K)	1.22	1.22	1.22	1.22	1.22	1.22

**Notes to Table 9.36.2.7-D:**

(1) See Note A-Table 9.36.2.7.-A.

(2) See Article 1.1.3.1.

(3) Except doors(see see Sentence (1) and Table 9.36.2.7.-A), skylights (see Sentence (2)) and glass block assemblies (see Sentence (4)).

# BCBC Prescriptive path Doors

**Table 9.36.2.7-A**  
**Required Thermal Characteristics of Fenestration and Doors**  
 Forming Part of Sentence 9.36.2.7.(1)

Components	Thermal Characteristics (1)	Heating Degree-Days of <i>Building</i> Location, <sup>(2)</sup> in Celsius Degree-Days					
		Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
Fenestration <sup>(3)</sup> and doors	Max. U-value, W/(m <sup>2</sup> ×K)	1.84	1.84	1.61	1.61	1.44	1.44

# BCBC Prescriptive path Skylights

**Table 9.36.2.7-B**  
**Overall Thermal Transmittance of Skylights**  
Forming Part of Sentence 9.36.2.7(2)

Component	Heating Degree-Days of <i>Building</i> Location, <sup>(1)</sup> in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Maximum Overall Thermal Transmittance, W/(m <sup>2</sup> ×K)					
Skylights	2.92	2.92	2.75	2.75	2.41	2.41

9.36  
Prescriptive  
Assembly R  
(RSI) values




**Table 9.36.2.6.-C**  
**Effective Thermal Resistance of Above-ground Opaque Assemblies for Buildings Containing Only Dwelling Units**

Forming Part of Sentence 9.36.1.3.(6) Sentence 9.36.2.6.(1)

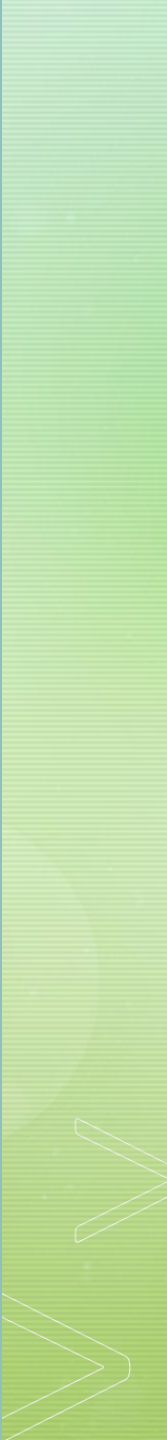
Above-ground Opaque <i>Building Assembly</i>	Heating Degree-Days of <i>Building Location</i> , <sup>(1)</sup> in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Minimum Effective Thermal Resistance (RSI), (m <sup>2</sup> xK)/W					
Ceilings below attics <sup>(2)</sup>	8.67	8.67	10.43	10.43	10.43	10.43

**Table 9.36.2.6.-C (continued)**

Above-ground Opaque <i>Building Assembly</i>	Heating Degree-Days of <i>Building Location</i> , <sup>(1)</sup> in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Minimum Effective Thermal Resistance (RSI), (m <sup>2</sup> xK)/W					
Cathedral ceilings and flat roofs <sup>(3)</sup>	4.67	4.67	4.67	5.02	5.02	5.02
Flat roofs <sup>(4)</sup>	5.28	5.28	5.28	5.72	5.72	5.72
Walls <sup>(5)</sup>	3.08	3.69	3.69	3.69	3.96	3.96
Floors over unheated spaces	4.67	4.67	4.67	5.02	5.02	5.02



# Above grade assemblies Whistler

- Attic Ceilings: Effective R-59 (RSI 10.43)
  - Vaulted and Flat roofs: Effective R-26.5 (RSI 4.67)
  - Above grade walls: Effective R-21 (RSI 3.69)
  - Exposed floors: Effective R-26.5 (RSI 4.67)
- 

**Table 9.36.2.8.-C**

**Effective Thermal Resistance of Assemblies Below-Grade or in Contact with the Ground for Buildings Containing Only Dwelling Units**

Forming Part of Sentence 9.36.1.3.(6) Sentences 9.36.2.8.(1) to (9)

<i>Building Assembly Below-Grade</i> or in Contact with the Ground <sup>(1)</sup>	Heating Degree-Days of <i>Building</i> Location, <sup>(2)</sup> in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Minimum Effective Thermal Resistance (RSI), (m <sup>2</sup> ×K)/W					
<i>Foundation walls</i>	3.46	3.97	3.97	3.97	3.97	3.97
Unheated floors <sup>(3)</sup> <sup>(4)</sup>						
below frost line <sup>(5)</sup> <sup>(6)</sup>	2.98	2.98	2.98	2.98	2.98	2.98
above frost line <sup>(6)</sup>	3.46	3.46	3.46	3.46	3.46	3.46
Heated and unheated floors on permafrost	n/a	n/a	n/a	n/a	4.44	4.44

## Below grade assemblies Whistler

- Foundation walls: Effective R-22.5 (RSI 3.97)
- Unheated Slab: below frost line Effective R-16.92 (RSI 2.98)  
Bove frost line Effective R-19.64 (RSI 3.46)
- Heated Slab: Effective R-19.64 (RSI 3.46)
- Slab on grade with an integral footing  
R-19.64 (RSI 3.46)

# The Good news is You have options

We're here to provide  
solutions for your next project



# Questions?

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