FIRST NATIONS HOME ENERGYSAVE

BUILDING ENVELOPE - NEW CONSTRUCTION

WHY ENVELOPES FAIL

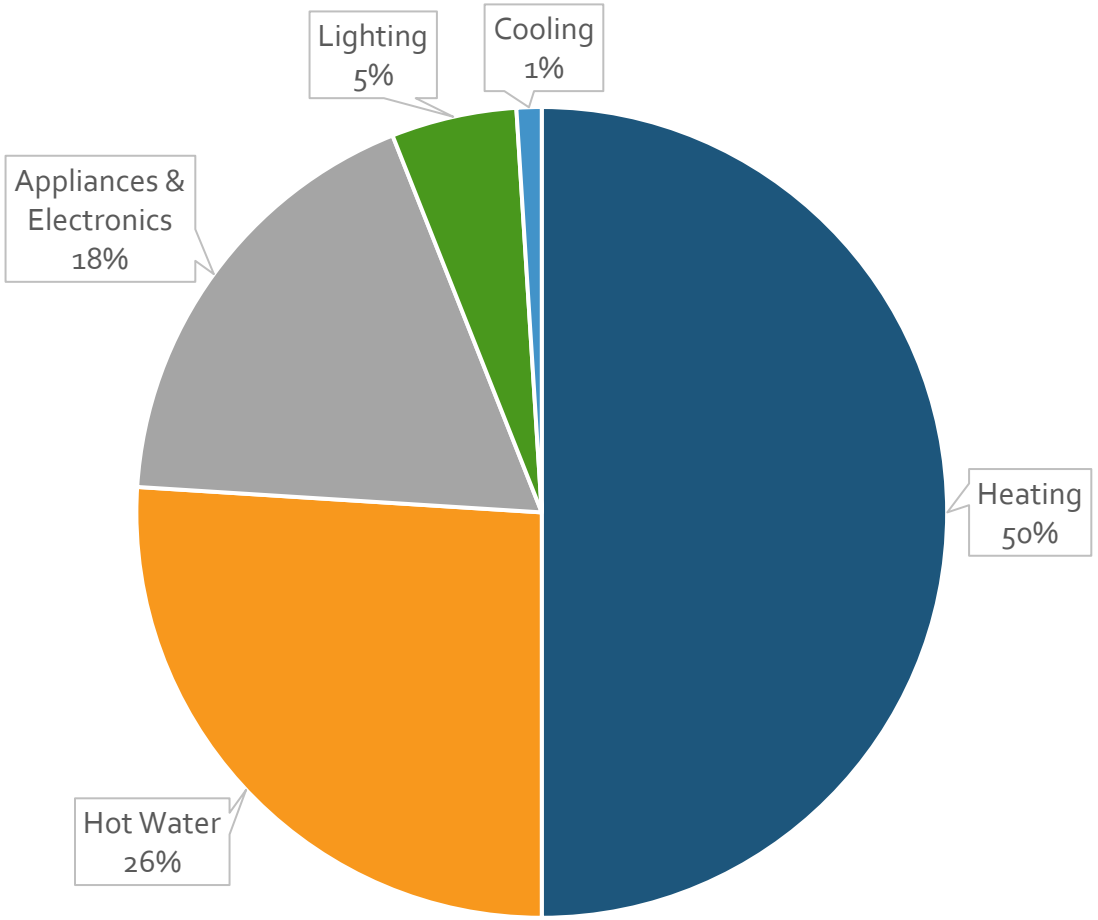
Design Deficiencies

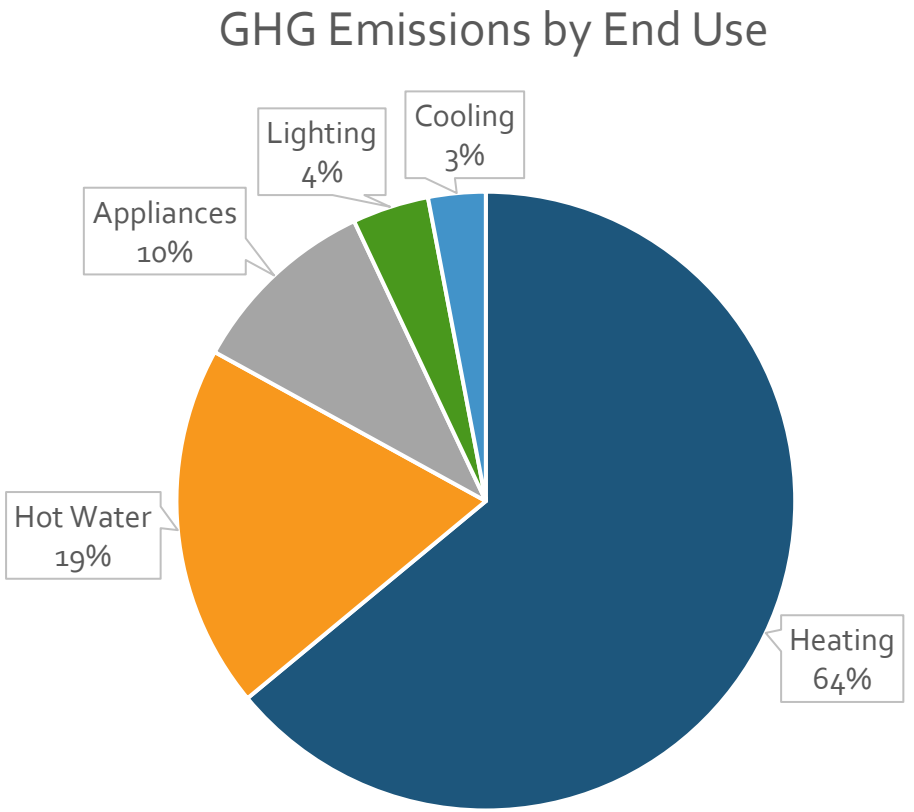
Material Failure

Poor Workmanship

Acts of Nature

HOME ENERGY USE

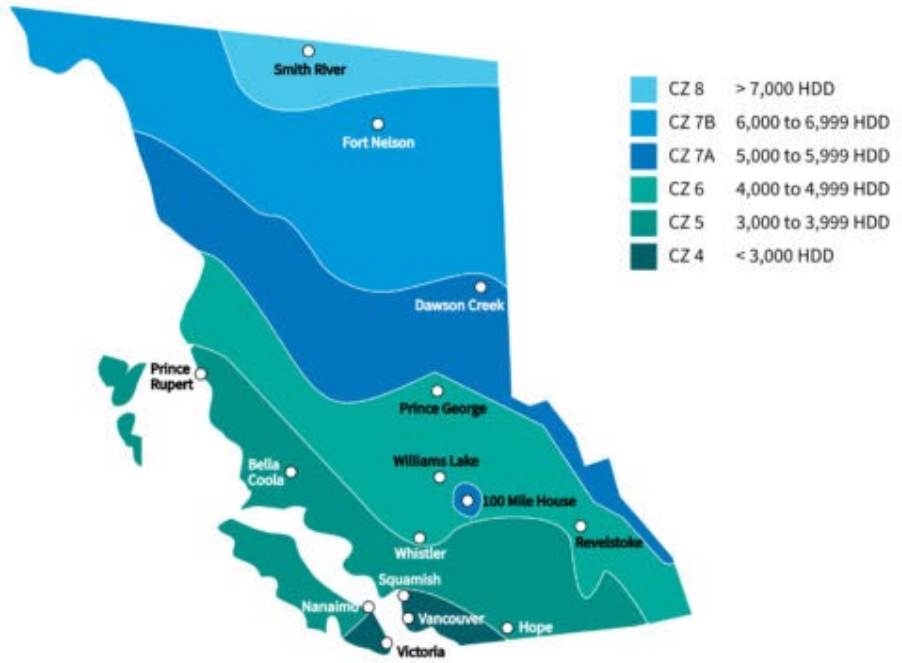




CLIMATE ZONES

Climate Zones

The BC Building Code defines the energy performance targets of the Step Code based on the building's climate zone (CZ). The BC climate zones are defined by the average heating degree-days below 18° C (HDD). The BC Building Code states that the authority having jurisdiction (AHJ) can establish climatic values to define climate zones, typically based on information from Environment Canada, and building designers must consult the AHJ before making any assumptions about a building's climate zone. Note that in some locations, there may be several climate zones due to variations in elevation.



BC Climate Zone Per BCBC (* denotes locations with multiple climate zones)

CZ 4 < 3,000 HDD

Abbotsford	Duncan	Langley	Richmond	Surrey
Agassiz	Delta	Mission	Sechelt	Vancouver
Burnaby*	Maple Ridge	New Westminster	Sidney	Victoria
Chilliwack	Jordan River	North Vancouver*	Sooke	West Vancouver
Crofton	Langford	Port Renfrew	Squamish	White Rock

CZ 5 3,000 to 3,999 HDD

Alberni	Courtenay	Ladysmith	Osoyoos	Queen Charlotte City
Ashcroft	Crescent Valley	Lillooet	Parksville	Salmon Arm
Bamfield	Gold River	Lytton	Penticton	Sandspit
Bella Bella	Grand Forks	Masset	Port Alberni	Tahsis
Bella Coola	Hope	Merritt	Port Alice	Tofino
Burnaby (SFU)	Kamloops	Montrose	Port Hardy	Trail
Cache Creek	Kaslo	Nakusp	Port McNeill	Ucluelet
Campbell River	Kelowna	Nanaimo	Powell River	Vernon
Castlegar	Kitimat Plant	Nelson	Prince Rupert	Youbou
Comox	Kitimat Townsite	Ocean Falls	Qualicum Beach	

CZ 6 4,000 to 4,999 HDD

Carmi	Fernie	McBride	Revelstoke	Williams Lake
Cranbrook	Golden	Prince George	Stewart	
Dog Creek	Greenwood	Princeton	Terrace	
Elko	Kimberley	Quesnel	Whistler	

CZ 7A 5,000 to 5,999 HDD

100 Mile House	Glacier
Burns Lake	Mackenzie
Chetwynd	McLeod Lake
Dawson Creek	Smithers
Fort St. John	Taylor

CZ 7B 6,000 to 6,999 HDD

Beatton River
Dease Lake
Fort Nelson

CZ 8 > 7,000 HDD

Smith River

Source: CleanBC Better Homes, accessed Sept 6, 2020, webpage *What is my climate zone?*, https://betterhomesbc.ca/faqs/what-is-my-climate-zone/

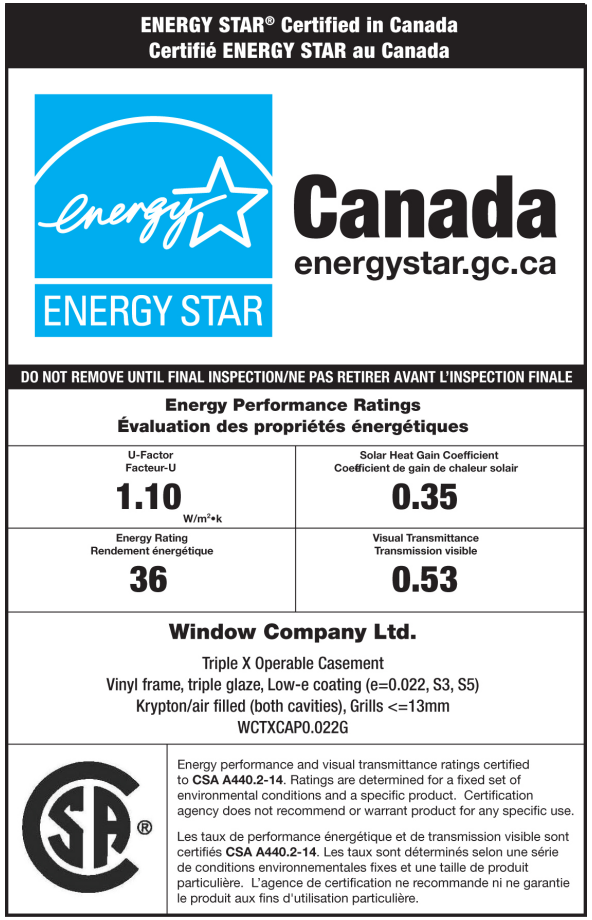
R-VALUE AND U-VALUE

R-Value

Higher = Better

U-Value

Lower = Better



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DO NOT REMOVE UNTIL FINAL INSPECTION/NE PAS RETIRER AVANT L'INSPECTION FINALE

Energy Performance Ratings
Évaluation des propriétés énergétiques

U-Factor / Facteur-U	Solar Heat Gain Coefficient / Coefficient de gain de chaleur solaire
1.10 W/m²•k	0.35
Energy Rating / Rendement énergétique	**Visual Transmittance / Transmission visible**
36	0.53

Window Company Ltd.

Triple X Operable Casement
Vinyl frame, triple glaze, Low-e coating (e=0.022, S3, S5)
Krypton/air filled (both cavities), Grills <=13mm
WCTXCAP0.022G

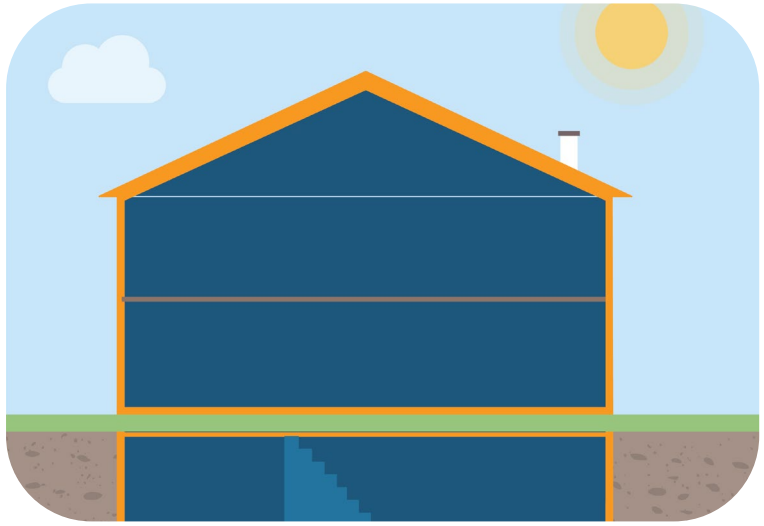
Energy performance and visual transmittance ratings certified to **CSA A440.2-14**. Ratings are determined for a fixed set of environmental conditions and a specific product. Certification agency does not recommend or warrant product for any specific use.

Les taux de performance énergétique et de transmission visible sont certifiés **CSA A440.2-14**. Les taux sont déterminés selon une série de conditions environnementales fixes et une taille de produit particulière. L'agence de certification ne recommande ni ne garantie le produit aux fins d'utilisation particulière.

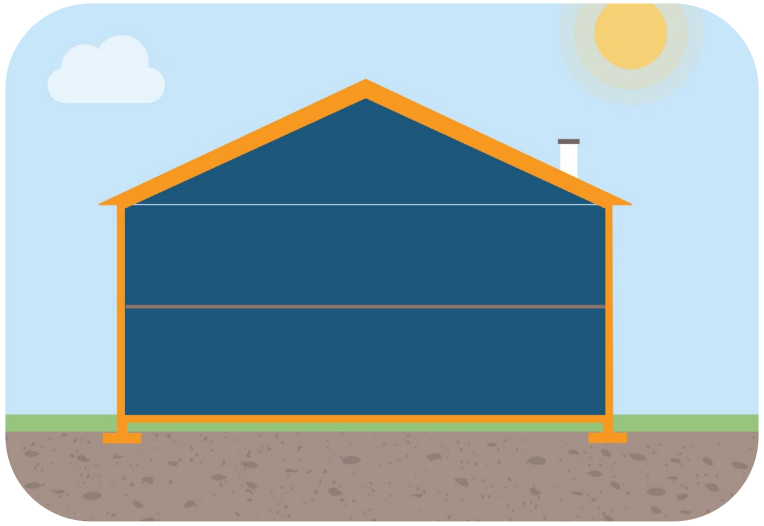
COMPONENTS OF A BUILDING ENVELOPE

- Foundation
- Walls
- Roof
- Windows
  - Skylights
- Doors
- Penetrations
  - Venting, meters, etc.

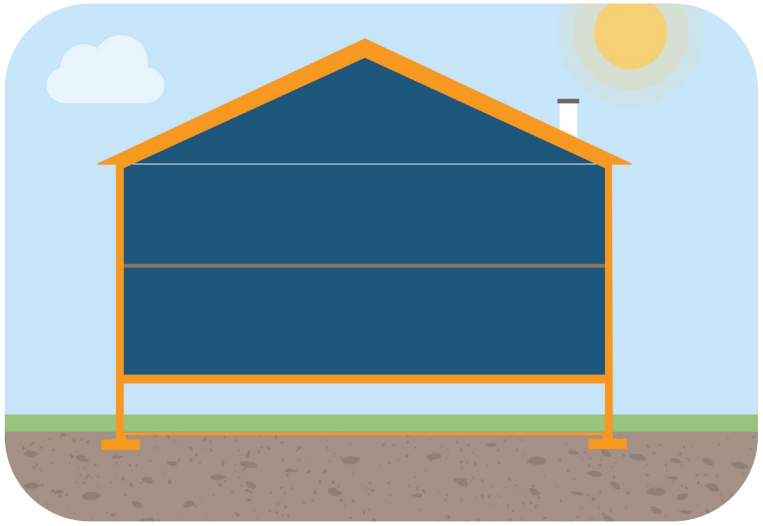
FOUNDATION



Basement

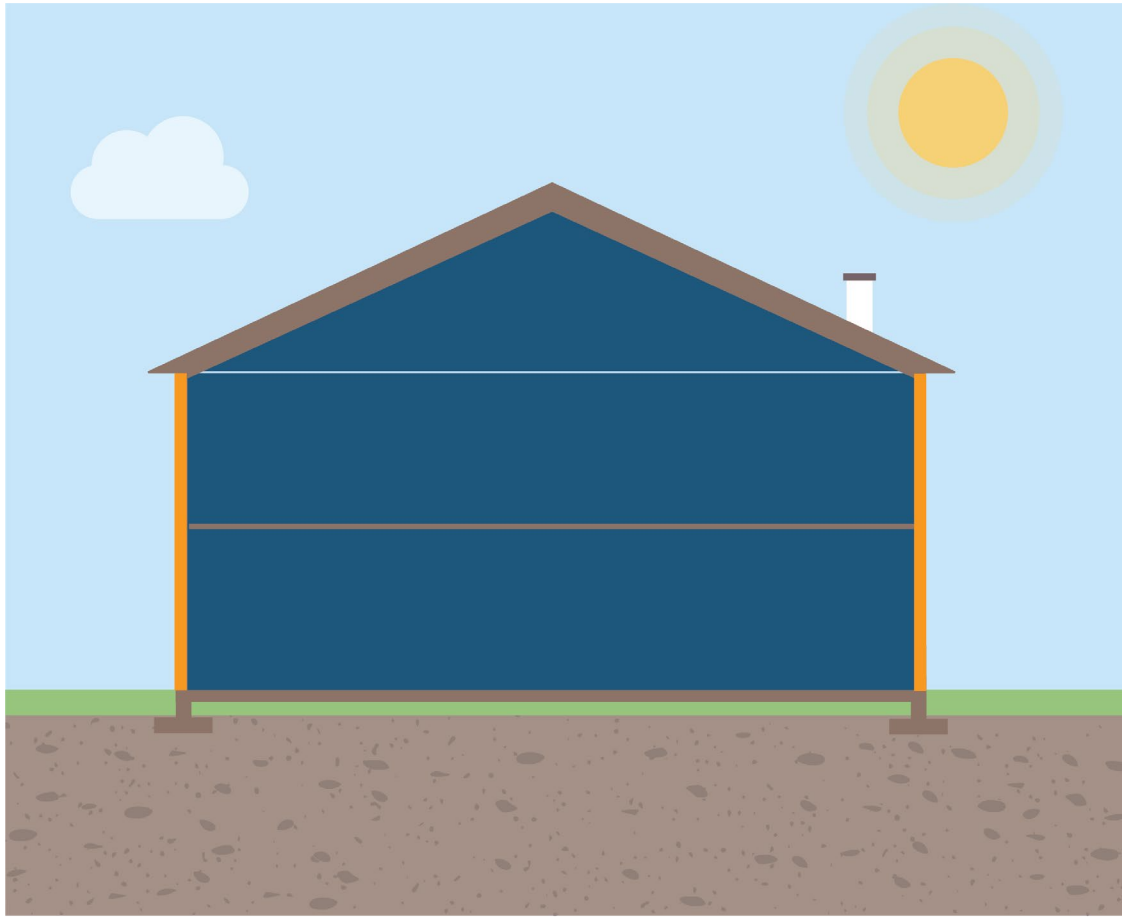


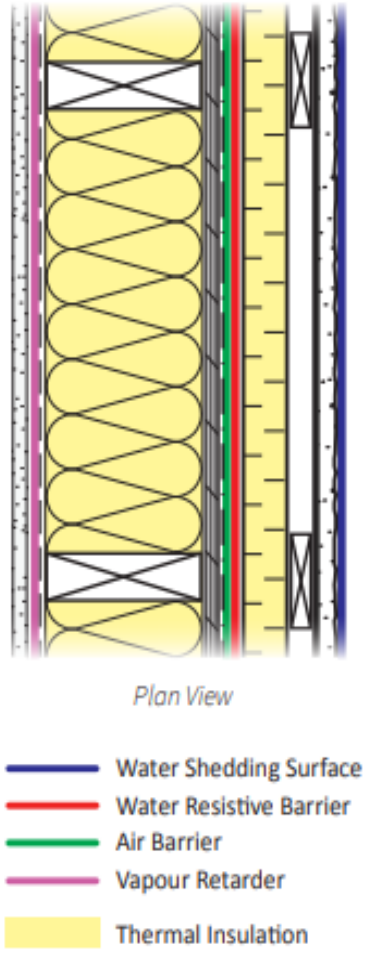
Slab on Grade



Crawlspace

WALLS

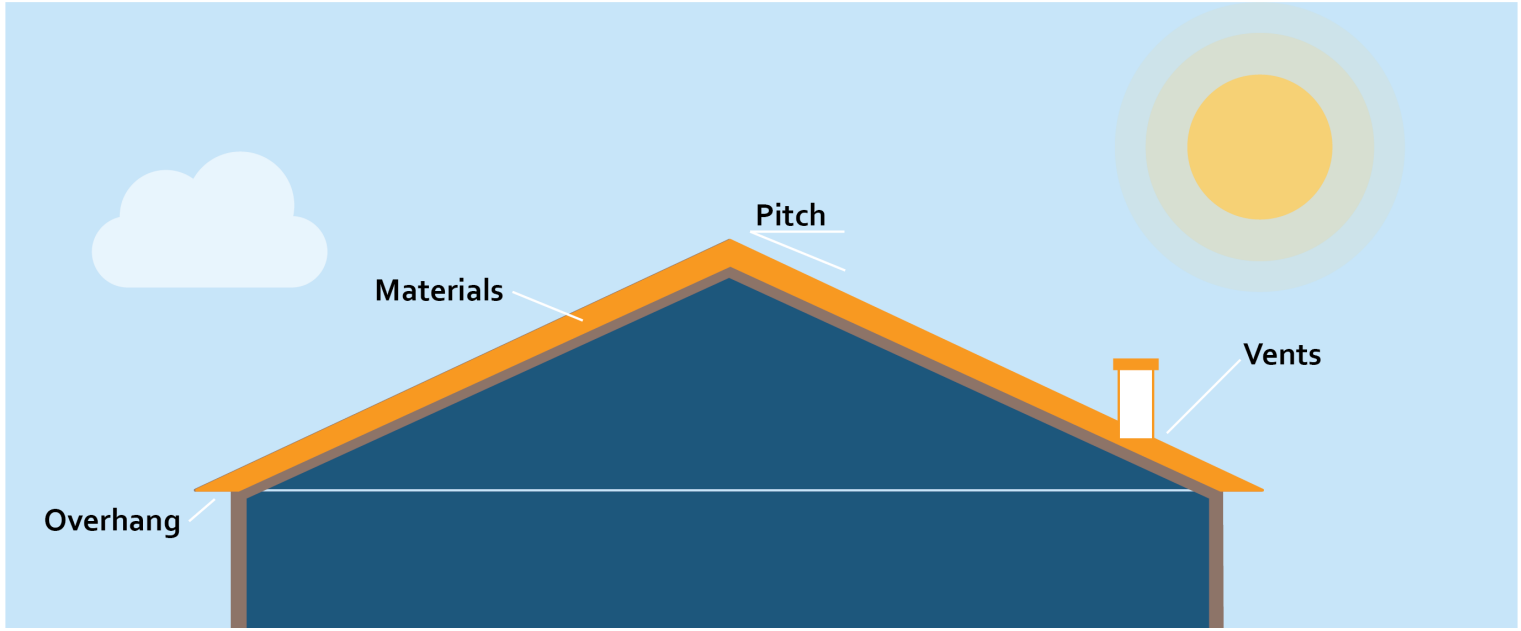




Main Purchasing Considerations:

- Cost
  - Initial cost
  - Cost effectiveness
- Constructability
- Air tightness
- Moisture Durability
- Sustainability

ROOF



Considerations:

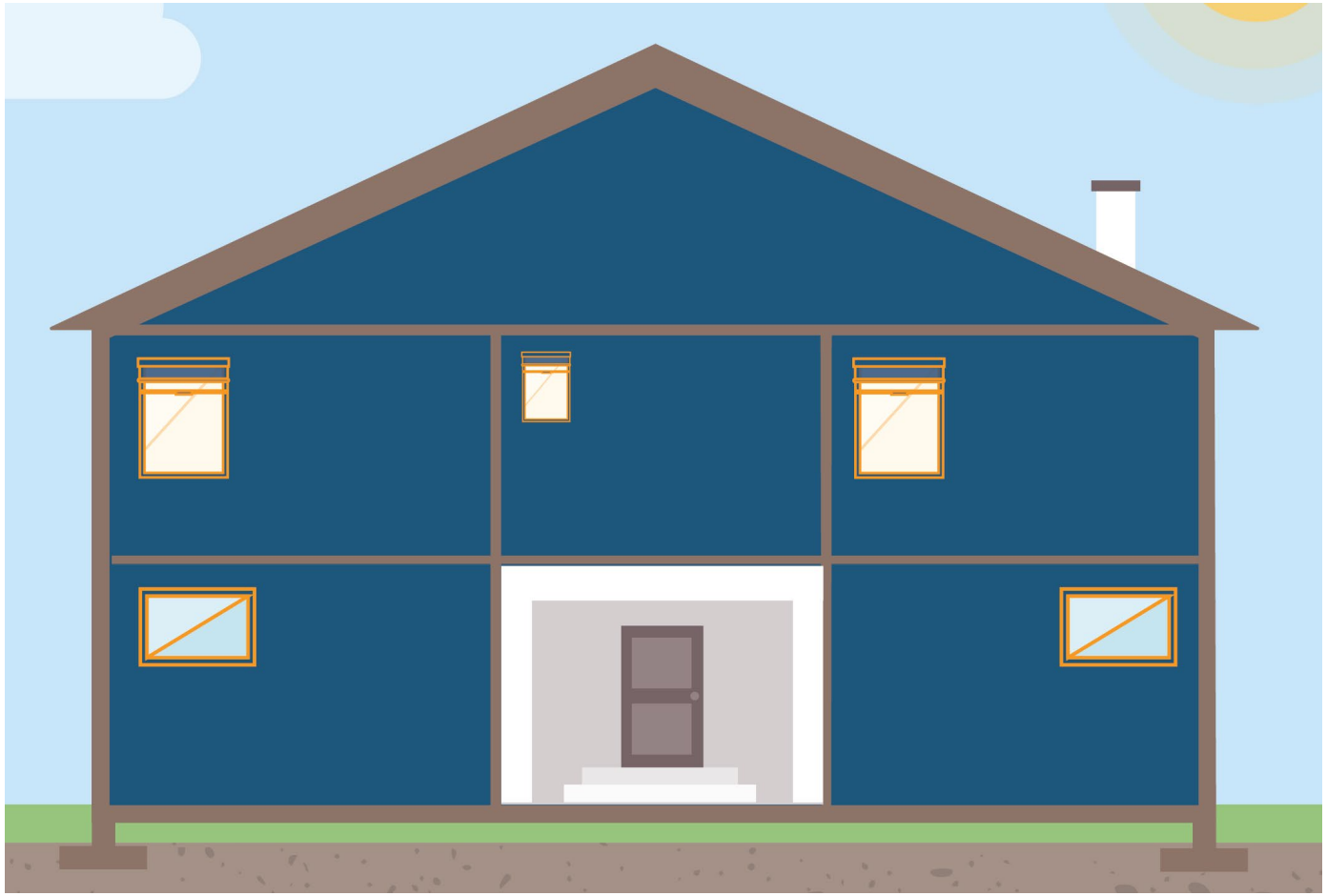
- Roof Material
- Roof Pitch
- Roof Overhangs
- Fenestrations, vents, etc.

Asphalt

Metal

Wood

WINDOWS



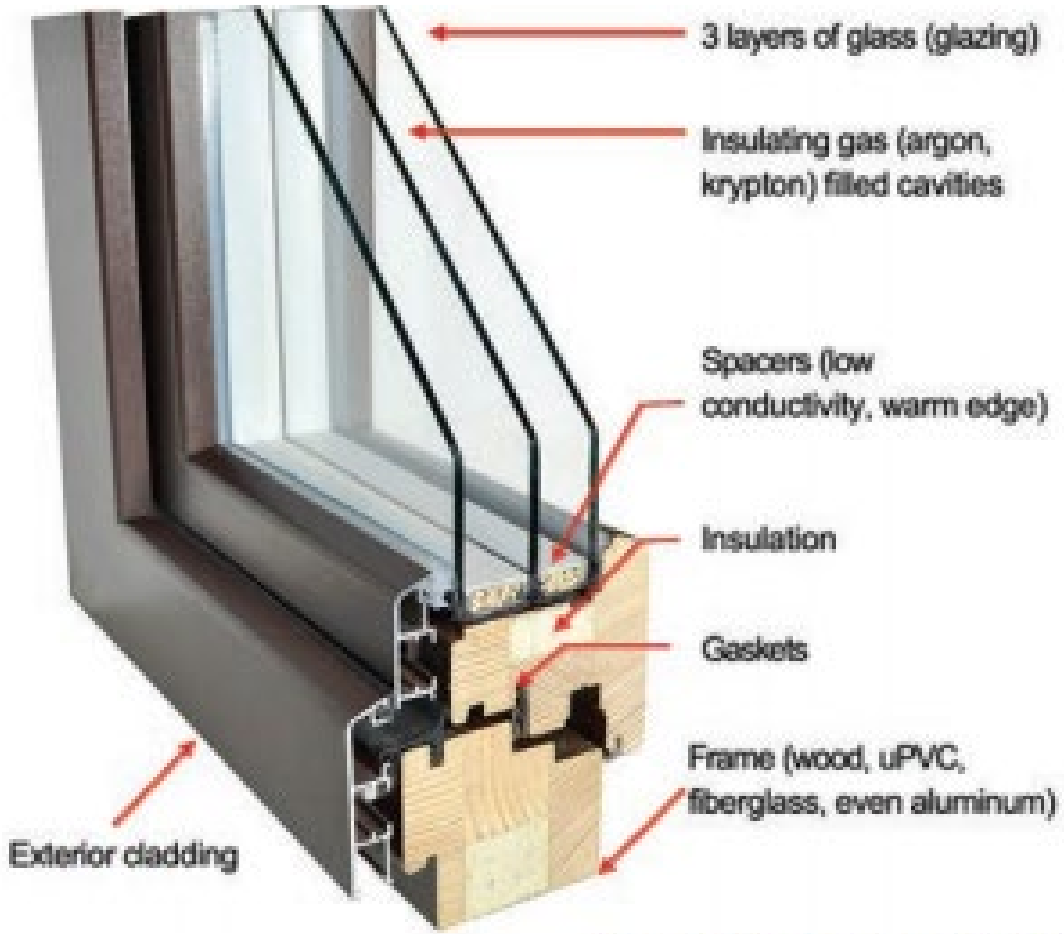
Considerations:

- Window Quality
- Quality of Installation

BIG IDEA | WINDOW QUALITY

Consider:

- Single, Double, Triple pane
  - Multiple low-e coatings
- Gas filling
  - Argon
  - Krypton
- Quality of frame/seal
  - Insulated framing
  - Non-conductive framing



Courtesy of Zola Thermo Plus Clad Window Profile

BIG IDEA | QUALITY OF INSTALLATION

Consider:

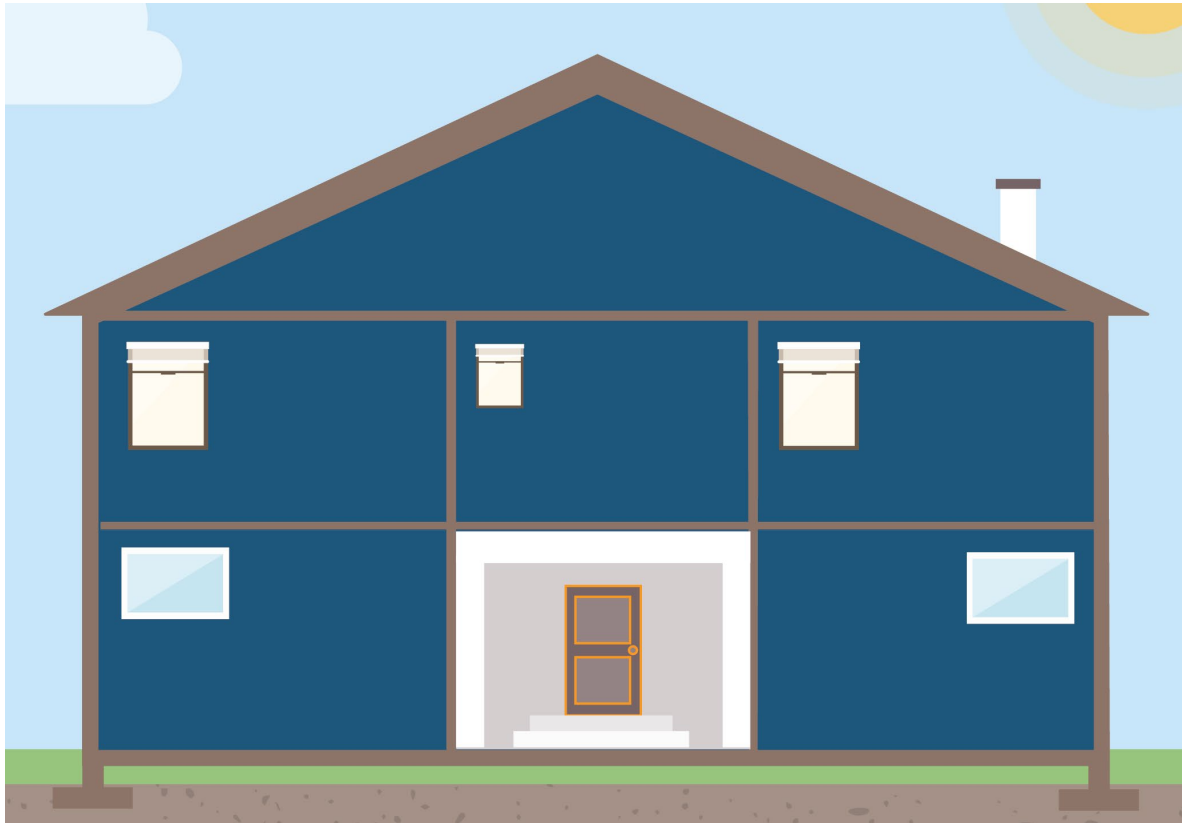
- Window positioning
- Size
- How flush it is installed
- How well it is sealed

- Check with blower door/ pressure test

DOORS

Main Considerations:

1. Cost
2. Function
3. Aesthetics
4. Thermal Performance
5. Security

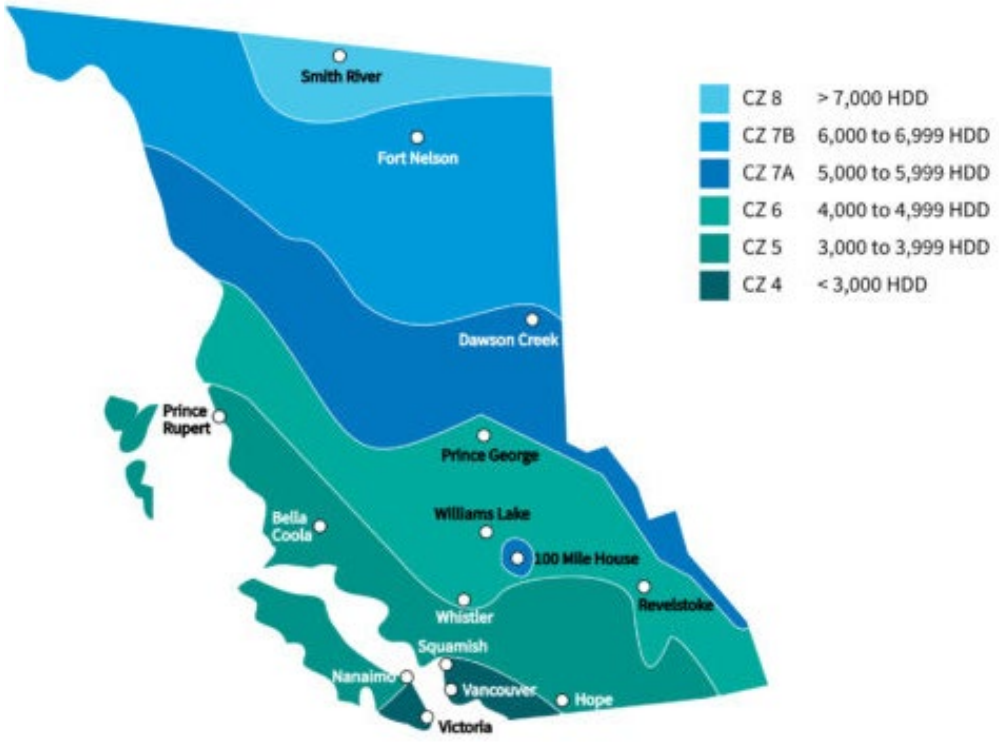


WALL PENETRATIONS

Potential Solutions:

1. Flashing
2. Rain Screens
3. Caulking
4. Sealing

BIG IDEA | AIR TIGHTNESS

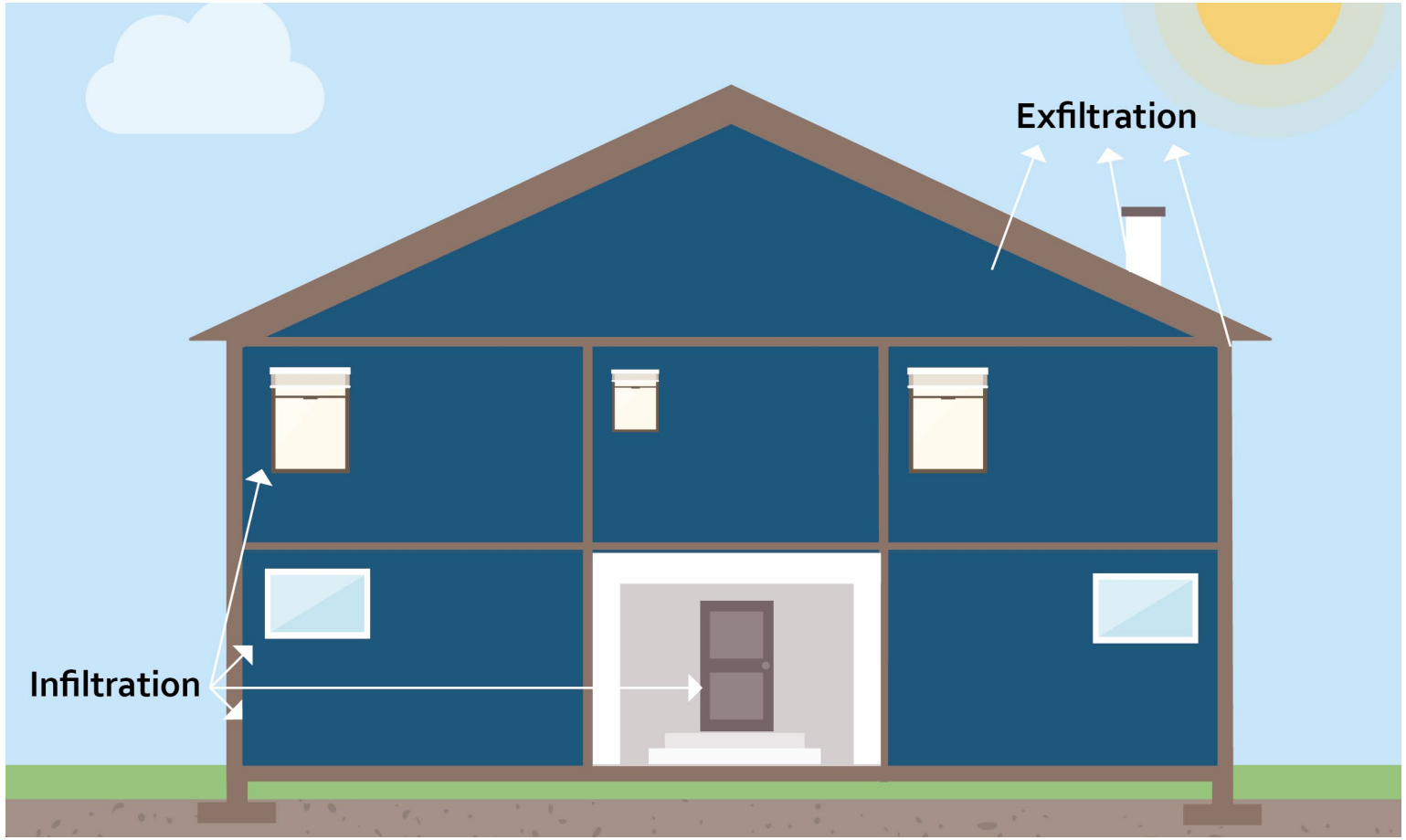


Recommended Airtightness Targets and Insulation Levels for Homes in BC

Wood-frame Building Enclosure Assembly	Zones 4 & 5 ≤3999 HDD	Zone 6 4000-4999 HDD	Zone 7A 5000-5999 HDD	Zone 7B & 8 ≥6000 HDD
Attic Spaces	R-40	R-50	R-60	R-60
Cathedral or Flat Roofs	R-30	R-30	R-35	R-40
Above-grade Walls	R-20	R-25	R-25	R-30
Below-grade Walls	R-20	R-20	R25	R-25
Suspended Floors	R-25	R-30	R-40	R-50
Slab-on-grade Floors	R-10	R-15	R-20	R-25
Airtightness (ACH50)	<5 ACH	<4 ACH	<3 ACH	<2 ACH

- **R-Value & airtightness of home is determined by climate & geography**
- **Warmer, damper regions require less insulation, but more air changes**

INFILTRATION & EXFILTRATION



- **Infiltration-** Is the movement of air into a building
- **Exfiltration-** Is the movement of air out of a building
- Ways to prevent:
  - Continuity of materials
  - Structural support
  - Air impermeability of materials
  - Durability of materials for air barrier system

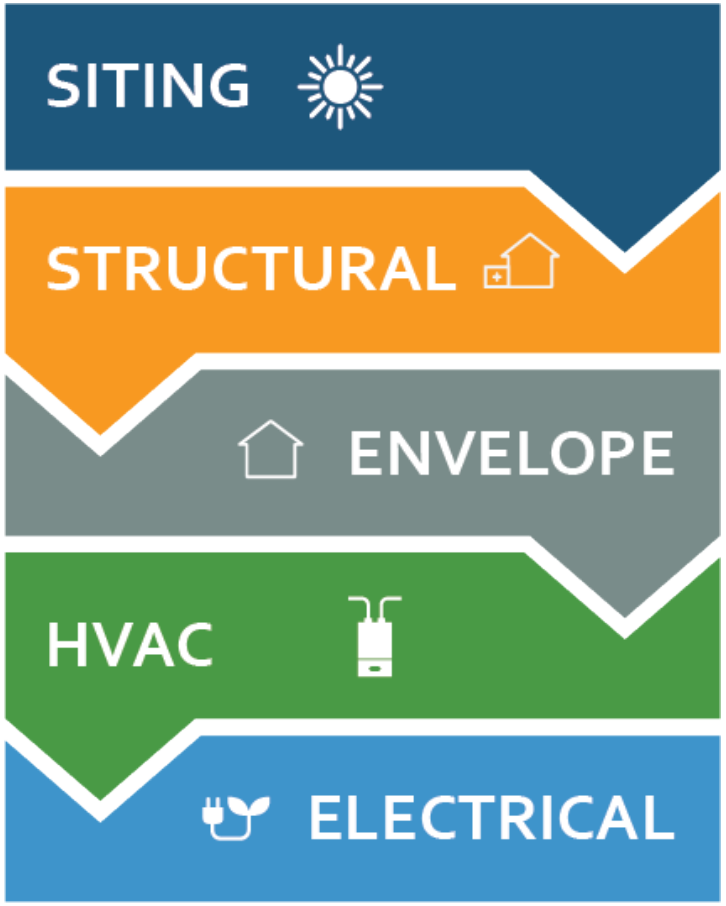
INTERFACES

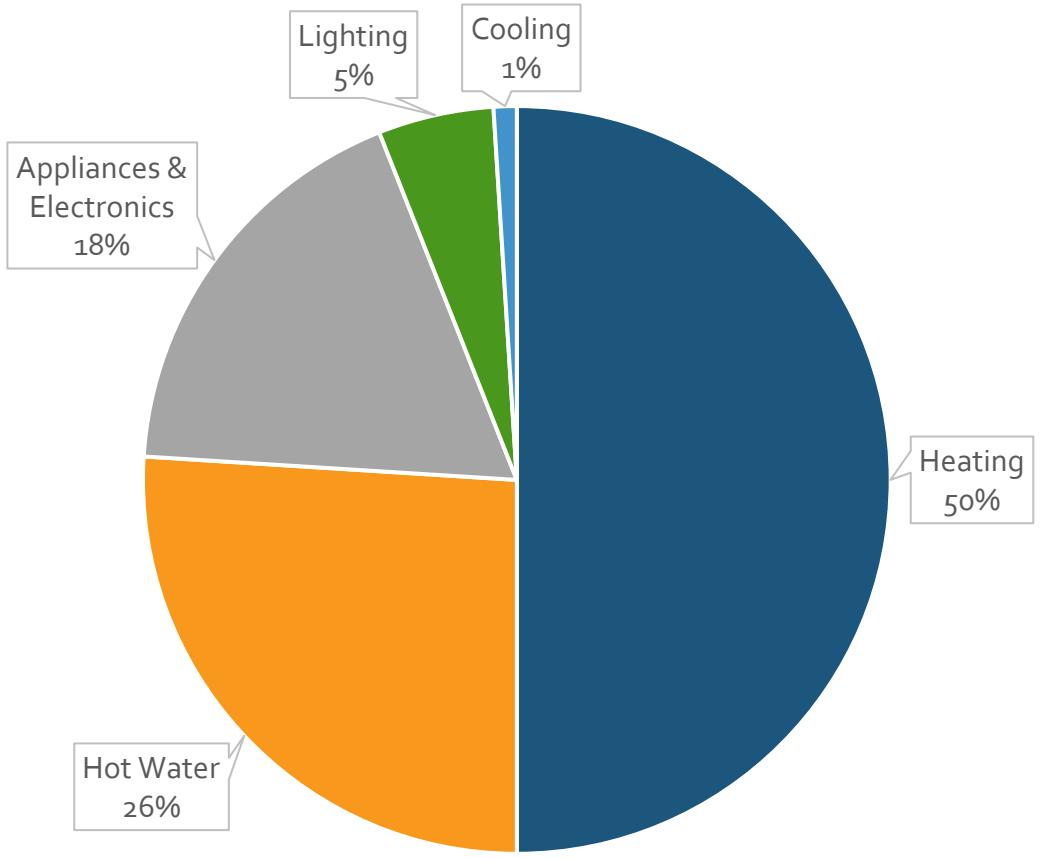
QUALITY CONTROL & INSPECTIONS

Ways to ensure built-out conforms with design:

- Design review by third party
- Thermal imaging and blower-door inspections
- Warranties and performance guarantees
- Reference checking contractors
- Mid-construction structural inspections

PRIORITIZING INVESTMENTS

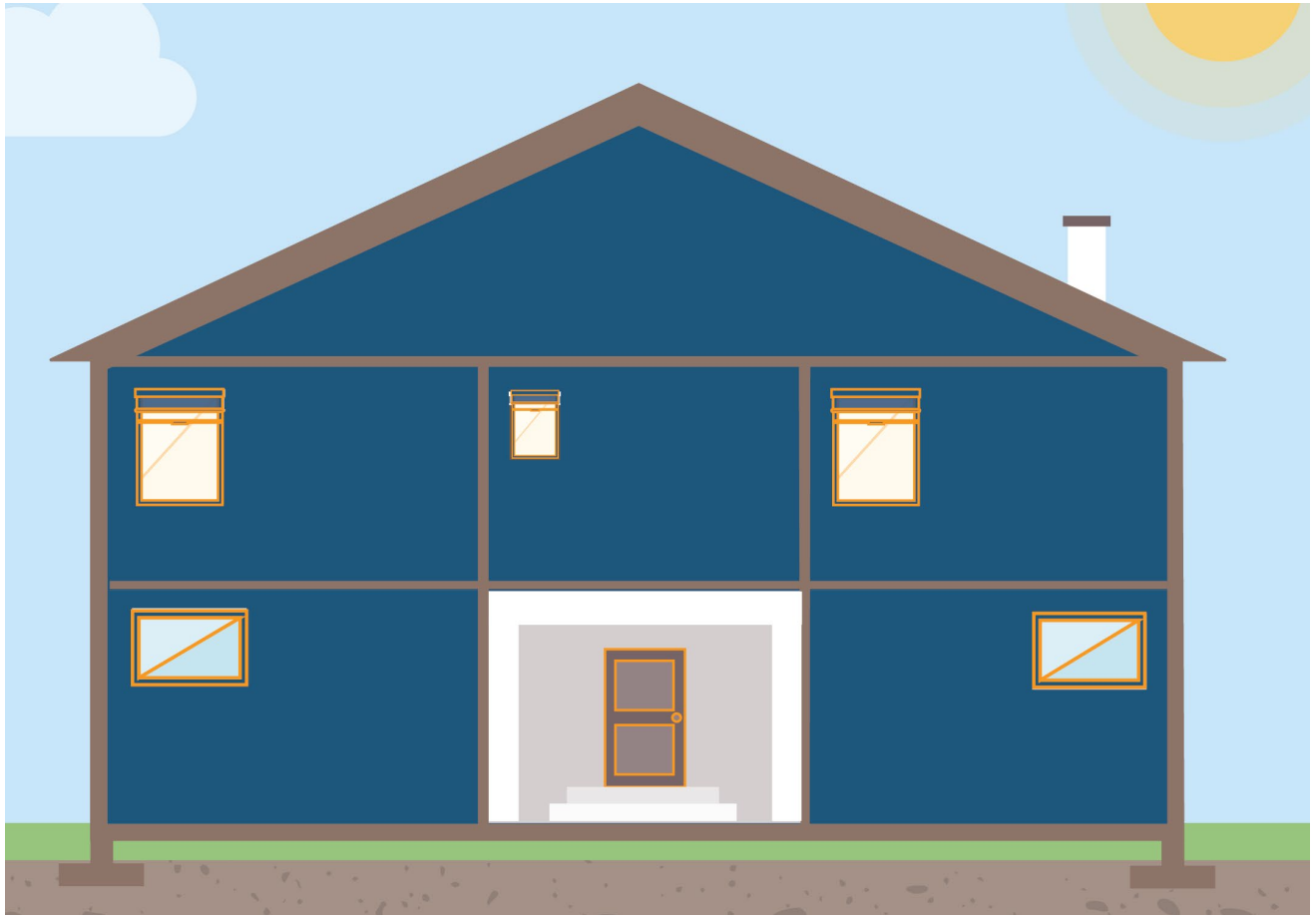




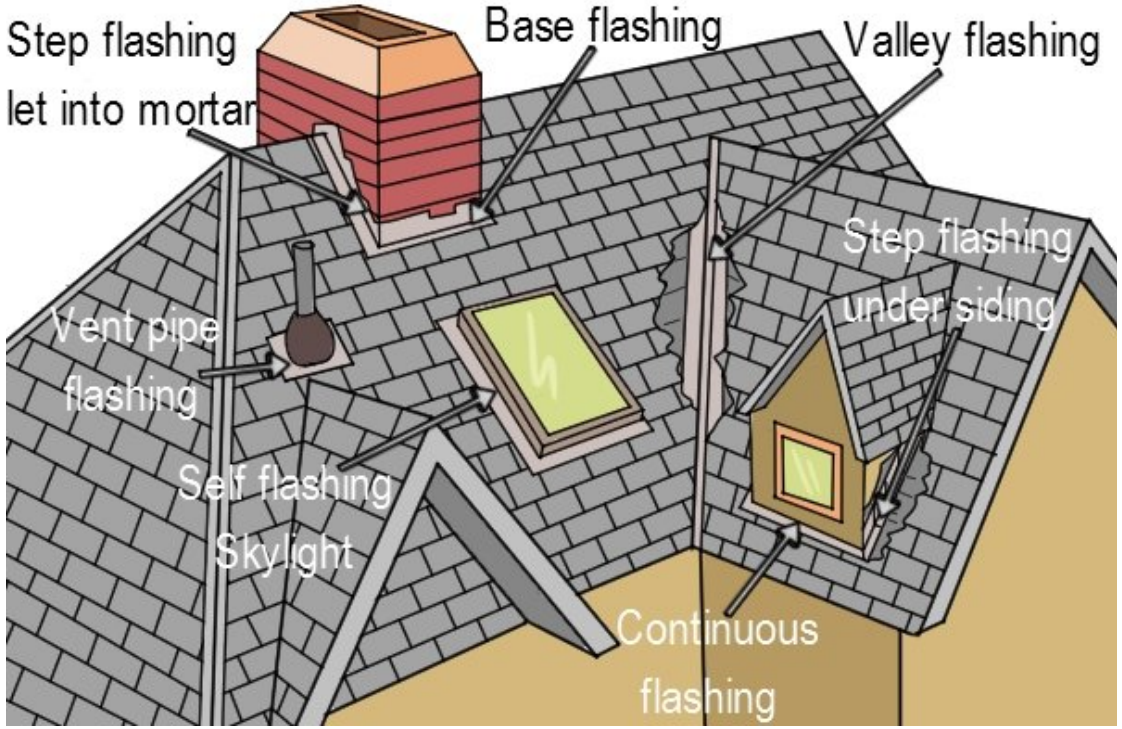
WINDOWS AND DOORS

Investment/Design Considerations:

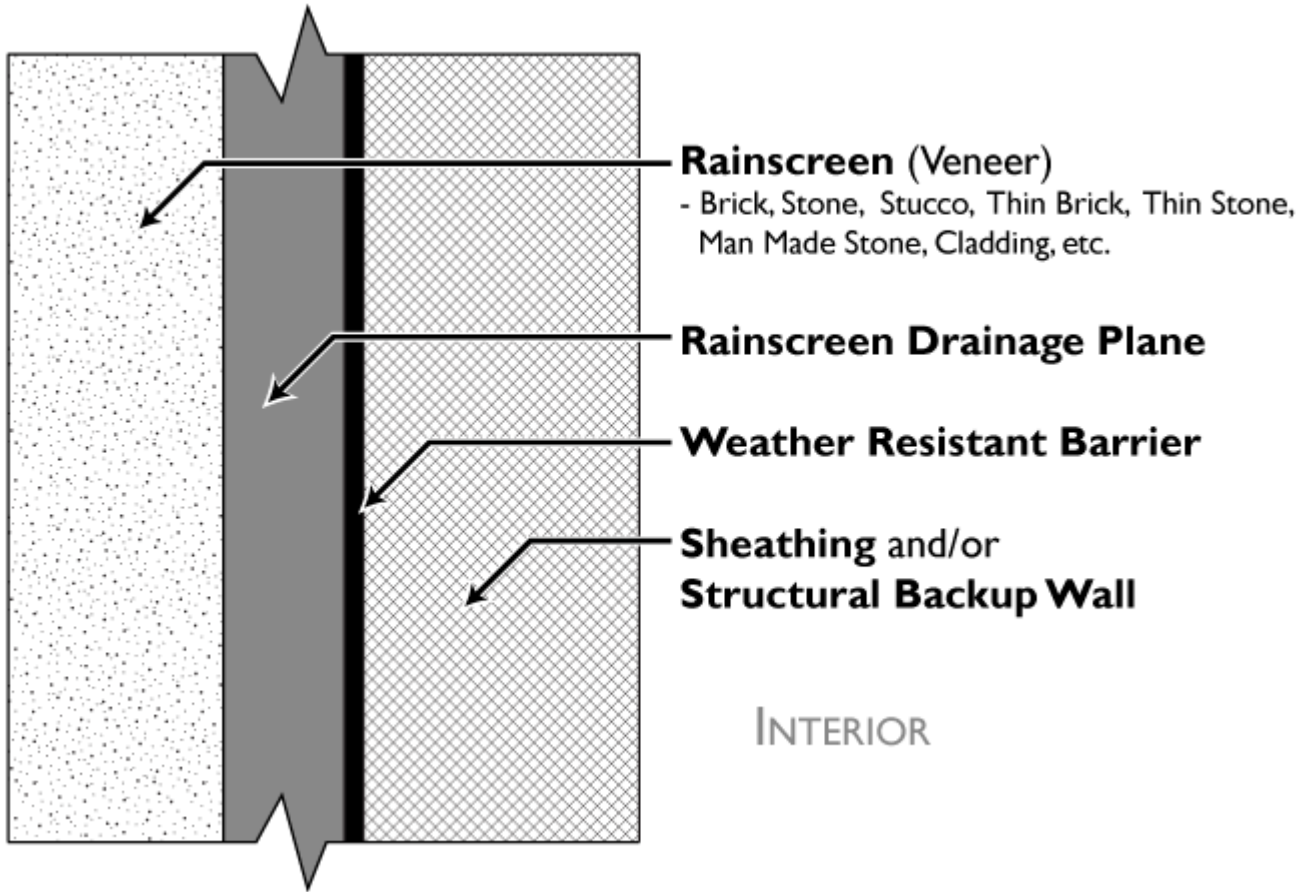
- South facing (when possible)
- Fewer, higher quality windows
- Triple or double pane
- Window caulking
- Door seals
- Blower door test



WALL PENETRATIONS



Source: Wonkee Donkee Tools



Source: Wikipedia: Rainscreen

WALL INSULATION

Do it right from the start and save $$$ and headaches later!

Fiberglass

Cellulose

Open Cell Foam

Closed Cell Foam

Less Efficient

More Efficient

ROOF INSULATION

Investment/Design Considerations:

- Attic insulation should be R-40 minimum and higher in most regions
- Increasing R-value is minimal in long term & does not interfere with building function
- Adding insulation to ceiling is less challenging and destructive than walls, but still more cost effective to do when home is being built

PRE-BUILT OR ON-SITE CONSTRUCTION

- Pros of pre-built:
  - Faster
  - Higher quality control
  - Cost certainty
  - Easier project management and administration
- Cons:
  - Need for crane
  - Damage during transport
  - Harder to involve local labour/onsite training
  - Lack of familiarity among builders of Community needs
  - Homes are not built for family needs and are standardized
  - Hard to modify/change plans
  - Harder to use local materials

THE FINANCIAL CASE

- Rules of thumb:
  - Building energy efficient envelopes are financially sound-if done from the start
  - It's always cheaper to do it right the first time, then to do it poorly and fix it
  - Building envelope repairs are expensive!
  - If training/employment are priorities for your Community, negotiate with contractors to use local labour
  - Ask manufacturers, consultants, and builders to give energy efficient options, and normal options, to gauge the price difference
  - Consider local context in decisions

THE FINANCIAL CASE

Adam's House	Option 1	Option 2	Option 3
$0.50-$2.00 per sq.ft for insulation, depending on R-value & material selection for a 1,000 sq. ft home	**$0.50/sq.ft for R-18** fiberglass with no added insulation to studs	**$1.50/sq.ft for R-35** open cell foam with thermal bridging addressed	**$2.00/sq.ft** for closed cell foam with effective **R-50**

THE FINANCIAL CASE

Option #	R-Value	Insulation Type	Upfront Cost	Winter Heating Bill	Summer Heating Bill	Annual Heating Bill	Lifetime Heating Cost (25-Yr)
Option 1	R-18	Fiberglass	$500	$165	$60	$1,350	$33,750
Option 2	R-35	Open cell cellulose	$1,500	$125	$50	$1,095	$27,375
Option 3	R-50	Closed foam cellulose	$2,000	$85	$40	$765	$19,125

This training series was developed by

SES CONSULTING

For the Fraser Basin Council's First Nations Home EnergySave program,

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