



# THE FUTURE OF NET ZERO HOMES IN CANADA

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Manager - Energy Modeling Services



BETTER SCIENCE. BETTER PERFORMANCE. BETTER BOTTOM LINE.

# Building Knowledge Canada

- Residential Building Performance Specialists
  - Indoor Air Quality
  - Energy Evaluators
  - Building Science Specialists and Trainers
  - HVAC Forensics
  - Deliver new home builder programs such as:  
ENERGY STAR® for New Homes · R2000 · LEED for Homes
- Mission Statement:  
Improve the quality, comfort, durability and energy efficiency of new homes built in Ontario and across North America

# The Outline:

1. Building Codes, Programs – The Why!
2. Canadian Home Builders NZ/NZr program  
-Requirement and Definition
3. Lessons learned
4. Past Projects

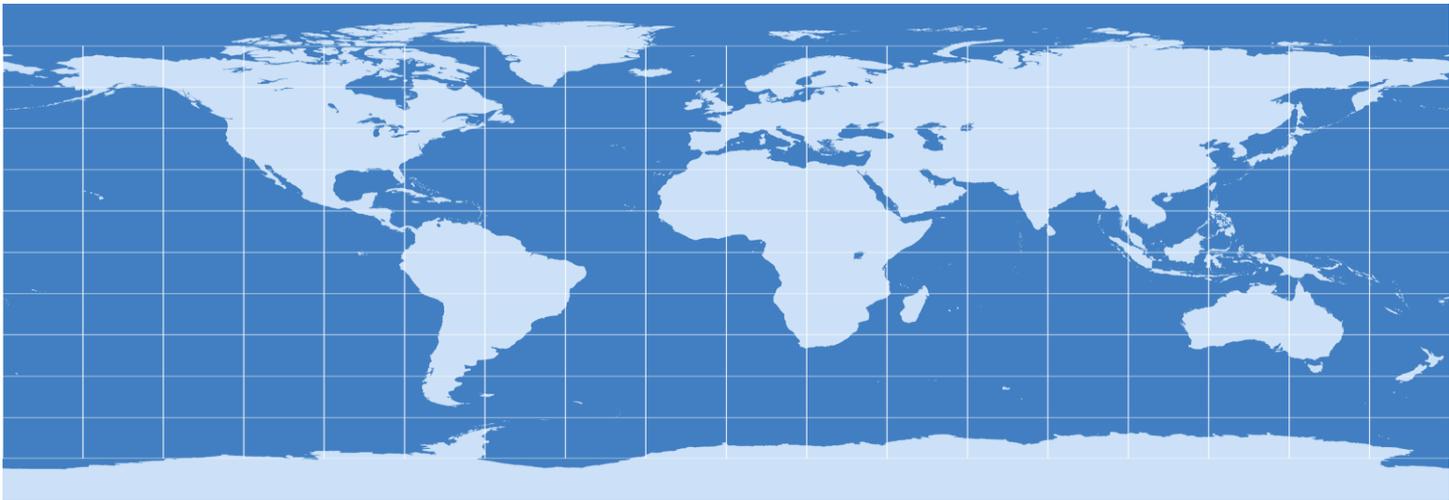
## Net Zero- Benchmarks Around the world!

**Japan:** 20,000 zero energy homes in 2014!

**USA-California:** All homes to be NetZero Ready by 2020!

**Europe:** All new buildings zero energy 2021!

**UK:** Grading of all Homes! A to G scale.



# Canadian Perspective

<b>2006 - 2008</b>	EQuilibrium™ Housing Initiative - CMHC
<b>2010 - ongoing</b>	Affordable Net Zero Research NRCan CanmetEnergy
<b>2013 - 2015</b>	R-2000 NZE Pilot NRCan OEE
<b>2012 - 2016</b>	Affordable Production NZE Housing Demo NRCan ecoEII
<b>Today</b>	CHBA Net-zero Home labelling program

## R2000 Net Zero Energy Pilot – NRCan – 2014-2016

- 15 builders across Canada – Building Knowledge is working with 2 builders
- Testing new draft R2000 Net Zero Energy Home technical standard

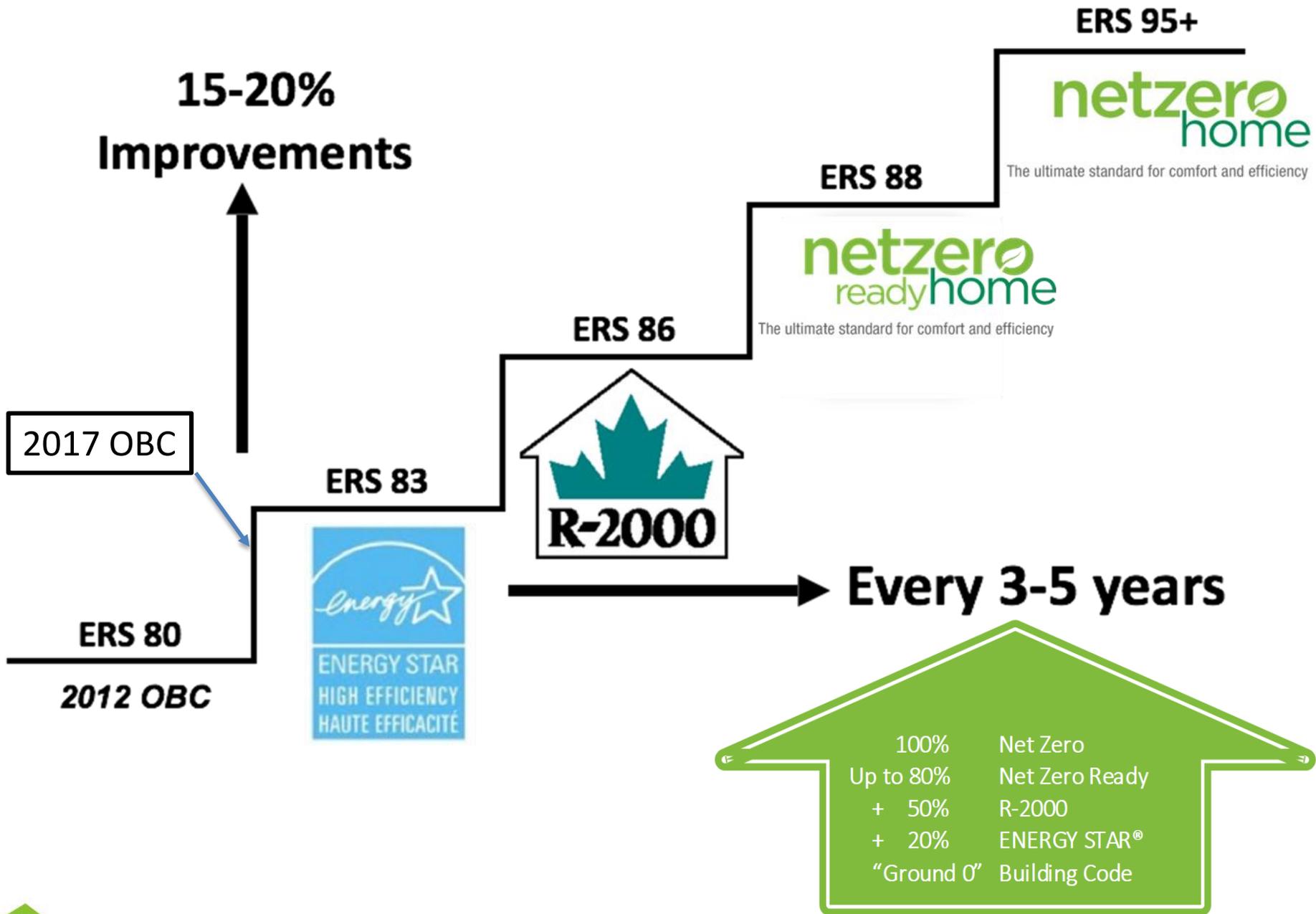
## ecoEnergy Innovation Initiative – NRCan & Owens Corning – 2014-2016

- 25 homes across Canada by 5 different builders

# R2000 Net Zero Energy PILOT

## 28 homes from 11 builders were Qualified under the Pilot

- Reid's Heritage Homes Guelph, ON 5 Net Zero Homes
- Lucchetta Homes Welland, ON 1 Net Zero **Ready** Home
- Doug Tarry Homes St. Thomas, ON 1 Net Zero Home
- Construction Voyer Laval, QC 6 Net Zero Homes (Stacked MF Units)
- Mattamy Homes Calgary, AB 5 Net Zero Homes
- Minto Communities Kanata, ON 5 Net Zero Homes (4 townhomes)
- Effect Homes Edmonton, AB 1 Net Zero Home
- K&P Contracting Flatrock, NL 1 Net Zero **Ready** Home
- Habitat Studio Edmonton, AB 1 Net Zero Home
- Sifton Properties London, ON 1 Net Zero Home
- Sloom Construction Guelph, ON 1 Net Zero Home



# What is a **CHBA** qualified Net Zero / Net Zero Ready home?

A NZE home is one that is ***designed, modelled and constructed*** to produce as much energy as it consumes on an annual basis.

**NZE Ready (NZEr) = A NZE home that has not yet installed the renewables**

**netzero**  
home

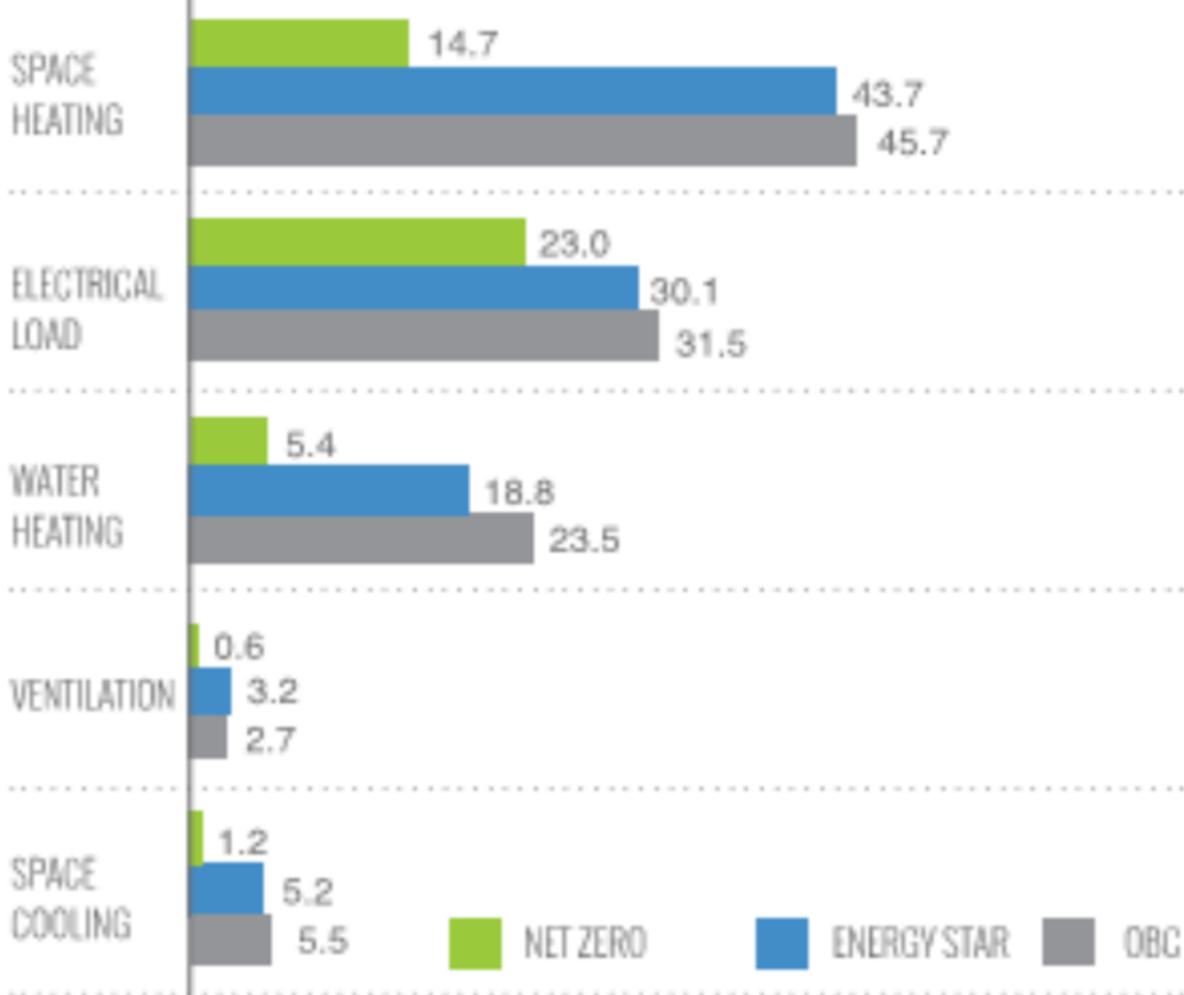
The ultimate standard for comfort and efficiency

**netzero**  
readyhome

The ultimate standard for comfort and efficiency

# The Program Minimums:

- Certified through the Canadian Home Builders Association and Natural Resource Canada
- A Home that **uses as much energy as it consumes**
- Has the **ability to integrate Renewables** easily
- Must use at least **33% less Space Heating energy** than a code built home
- Must be at least **1.5 ACH at final** inspection
- Be equipped with an **Energy Monitor**
- Must use a **secondary program** as a base



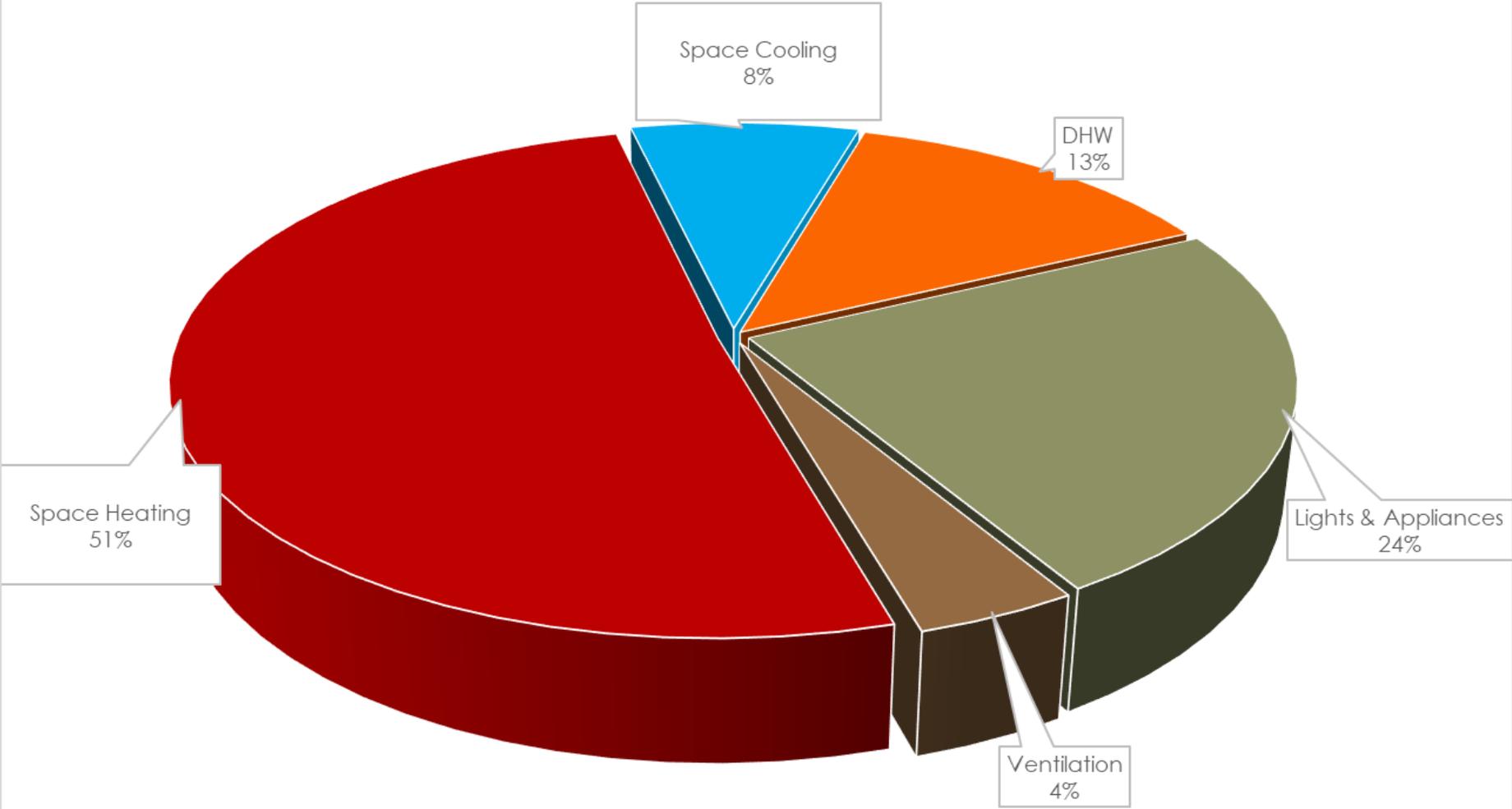
NET ZERO CONSUMPTION 45 GJ/yr



NET ANNUAL ENERGY 0 GJ

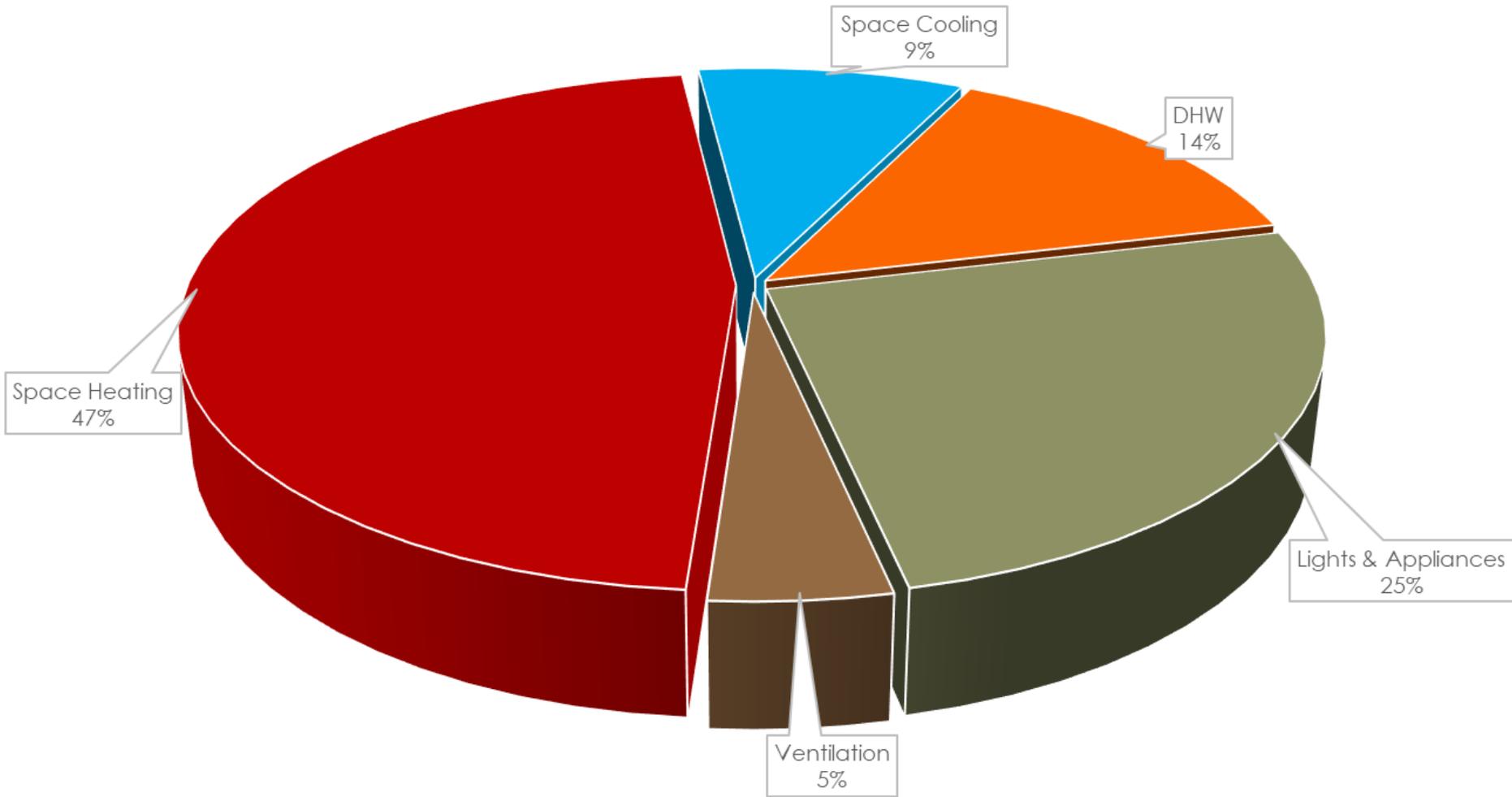
# Code Built - A1

## Annual Energy Consumption - Detached



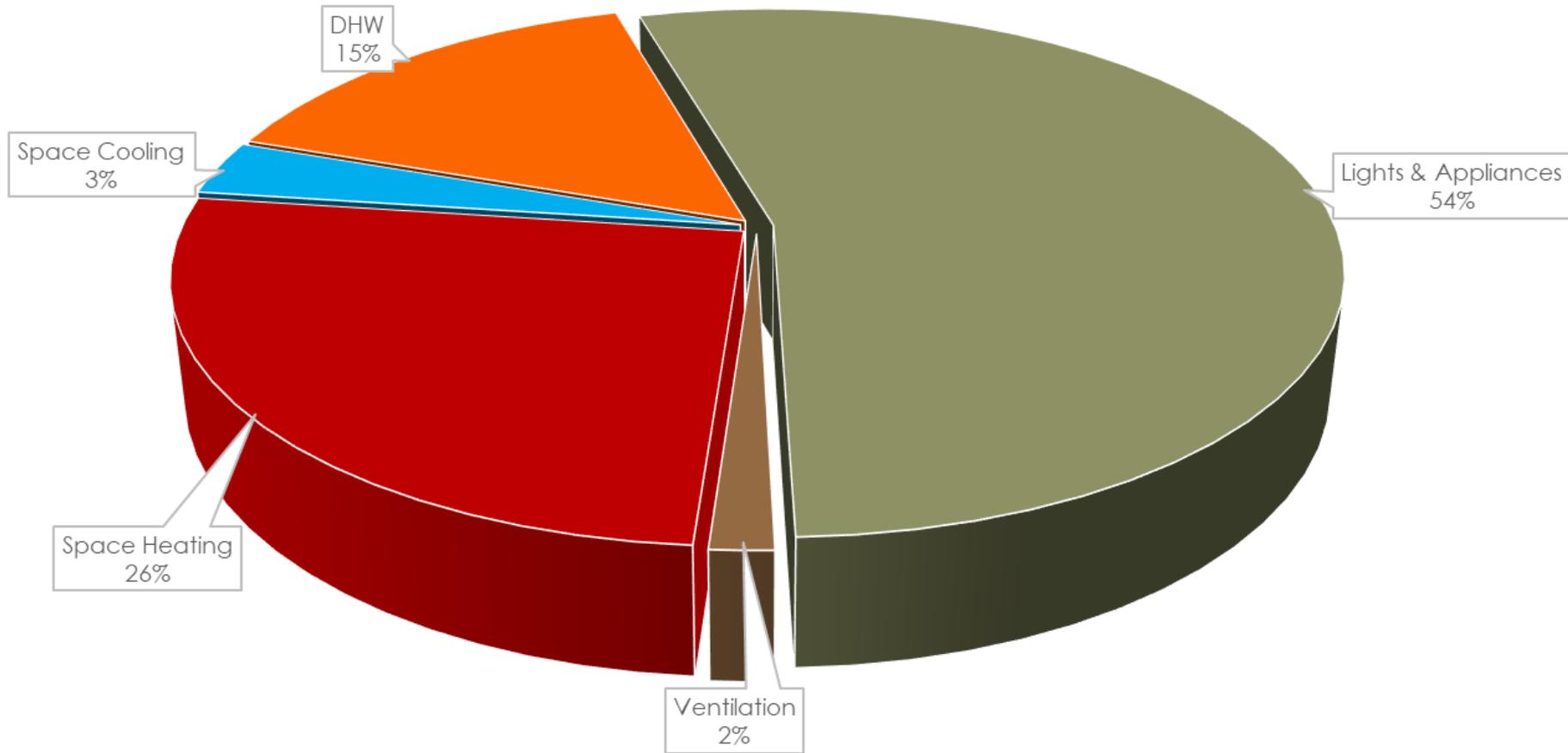
# Energy Star v17

## Annual Energy Consumption - Detached



# Net Zero Ready

## Annual Energy Consumption - Detached



# Typical NZ/R Package:

## BUILDING ENCLOSURE

### Framing

2x6 @ 16" o.c.

### Insulation

Ceiling | R60 Blown-in

Main Walls | R10 Exterior Foam + R22 Batt

Foundation Walls | R10 Foam + R22 Batt

Basement Slab | R10 Foam

### Windows and Doors

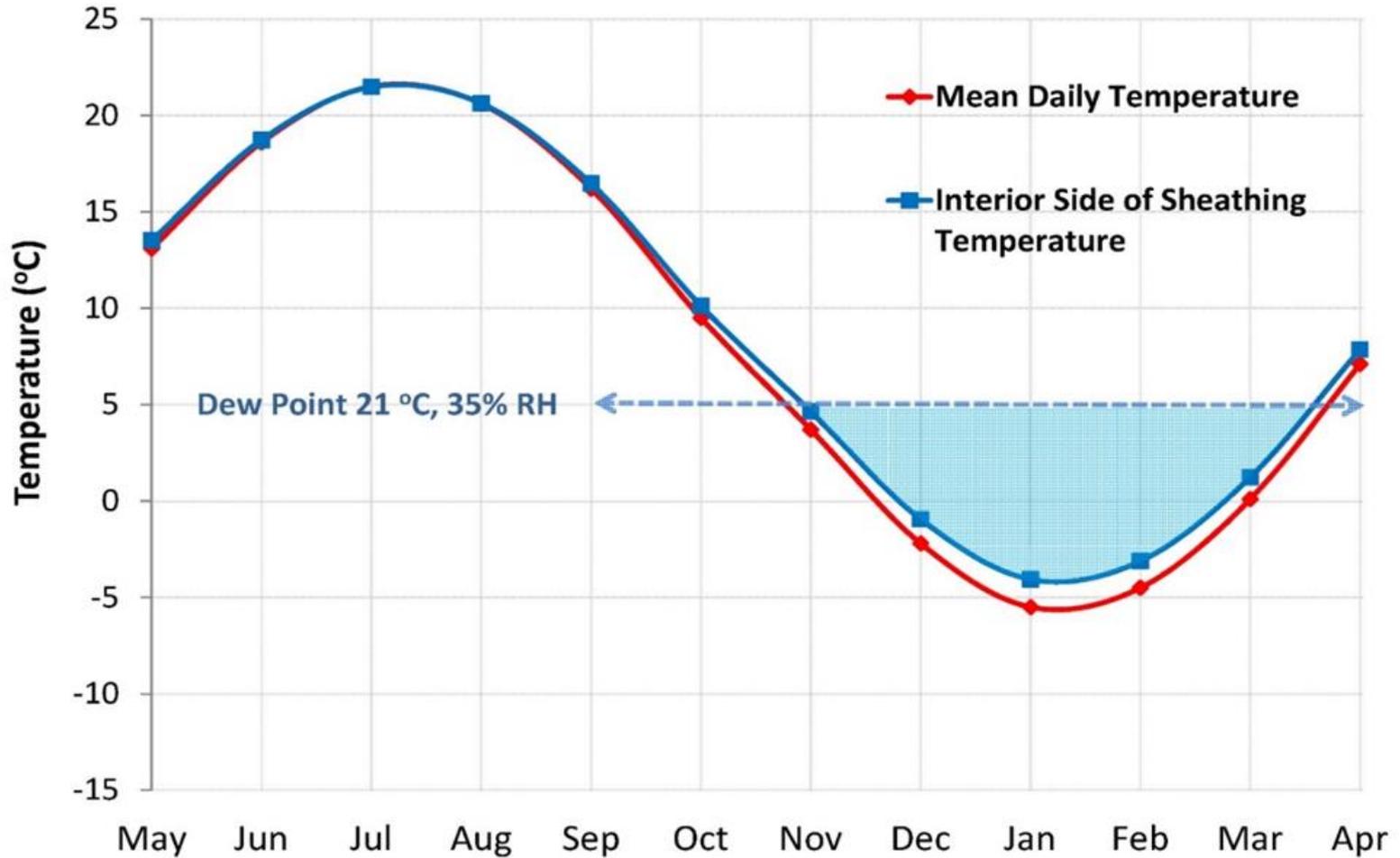
Triple Pane | R5+, Optimized SHGC

# Exterior Walls:



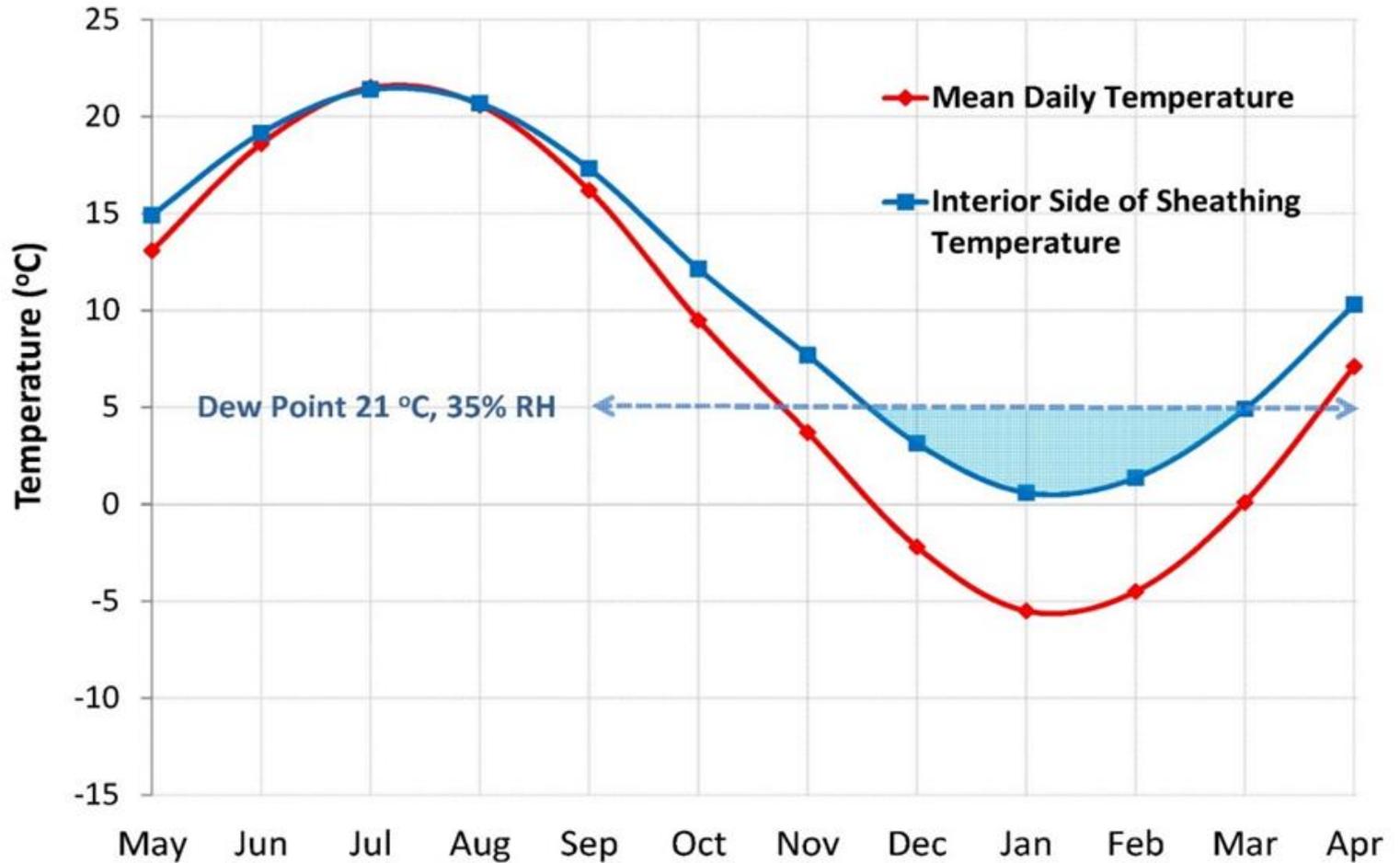
# TORONTO

2X6 R24 BATT W/ OSB SHEATHING



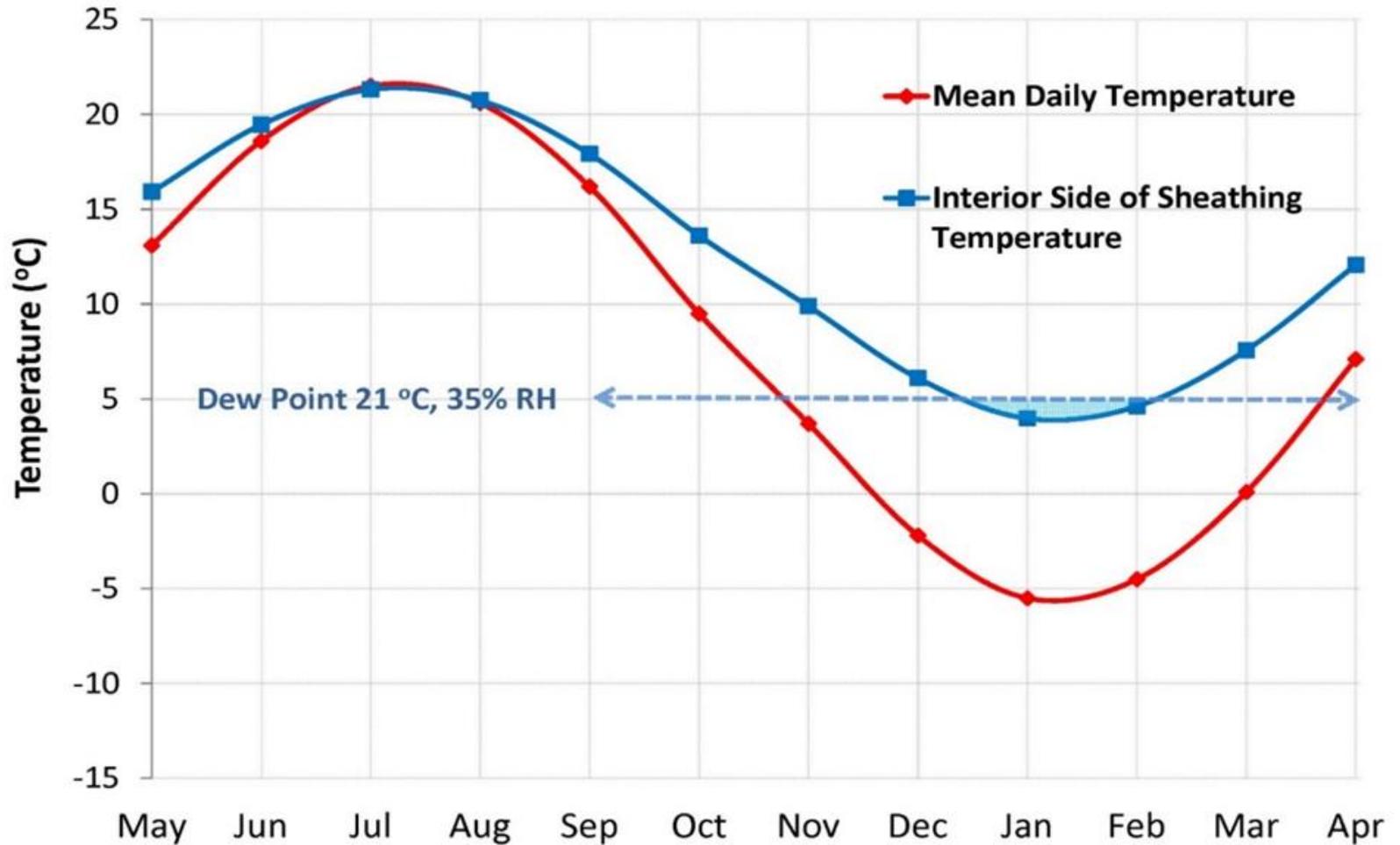
# TORONTO

2X6 R19 BATT W/ R5 EXTERIOR INSULATION



# TORONTO

2X6 R19 BATT W/ R10 EXTERIOR INSULATION



# NZR Basements:

- Below Grade Walls: R 22 batt + R10 continuous
- Underslab: R 10+

- Warm Feet, Warm body
- No basement Odor
- Dry and Comfortable!



# Windows:

## ASHRAE 55 and Windows: Zone 5-6:

- 1m from glass, patio door
- Winter: Acceptable room side glass threshold temp= 57F or 14C
- Summer: Discomfort comes from any hour/elevation with solar gain greater than 70 btu/hr-ft<sup>2</sup>-°F

- Single, metal frame:
  - Winter: 3000+ hrs of discomfort
  - Summer: 300+ hrs of discomfort
- Double , insulated, SHGC 0.55
  - Winter: 500+ hrs of discomfort
  - Summer: 75+ hrs of discomfort
- Triple: insulated, SHGC 0.22
  - Winter: negligible
  - Summer: negligible



# Net Zero HVAC:

**NZ Homes need to be SIMPLE TO OPERATE**



# Typical NZ/R Package:

## MECHANICALS

### Heating and Cooling

Dual Fuel- Hybrid System:

Primary= Air Source Heat Pump

Secondary = Back up Gas Furnace

### Water Heating

-High efficiency condensing tank

-Instantaneous (condensing) Water Heater

-Heat pump water heater

### Ventilation

-Fresh air machine = ERV, Low wattage (ECM motor)

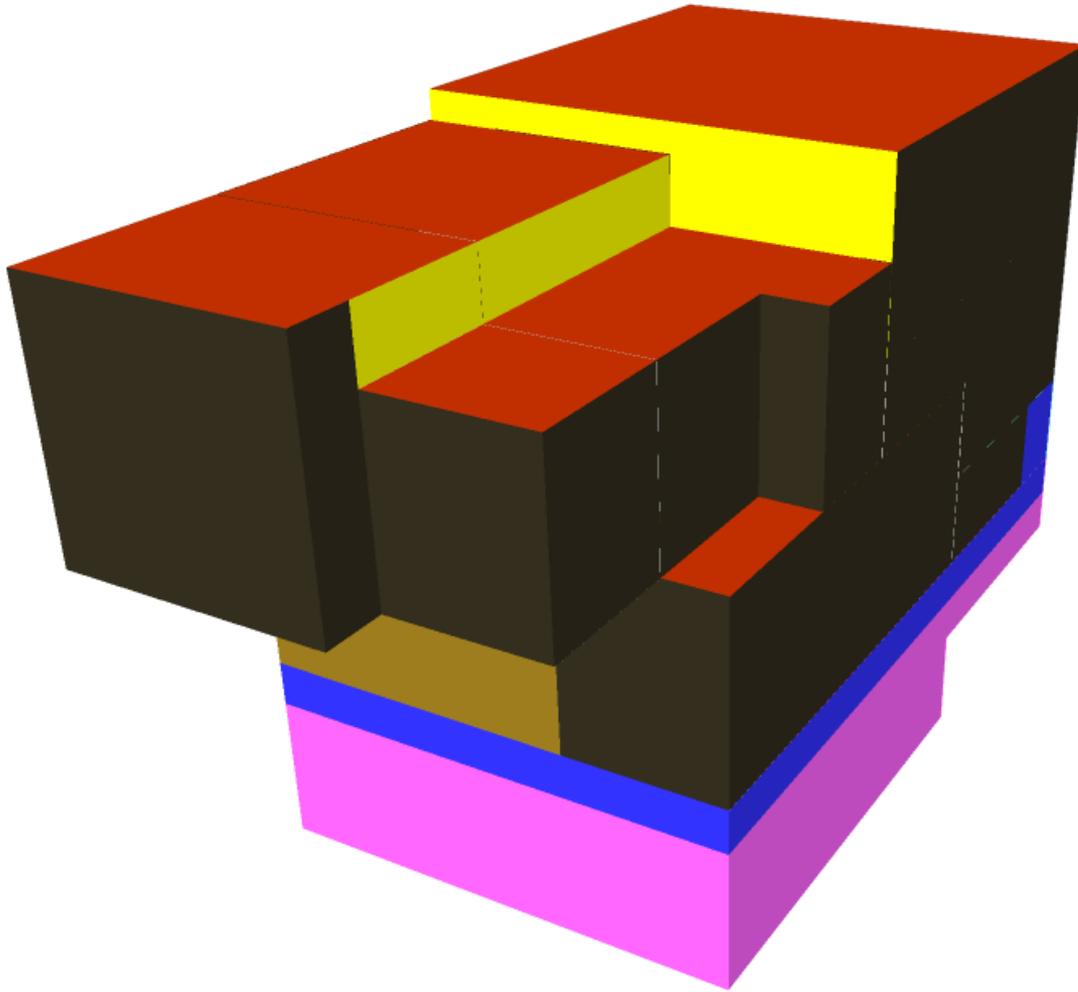


# **Lot 7 NZ**

## **Lessons Learned**



# TOWNSEND – Air Barrier Nightmare



- Main Wall (BROWN)
- Attic Ceiling (RED)
- Attic Wall (YELLOW)
- Garage Wall (L. BROWN)
- A.G. Found. (BLUE)
- B.G. Found. (PINK)

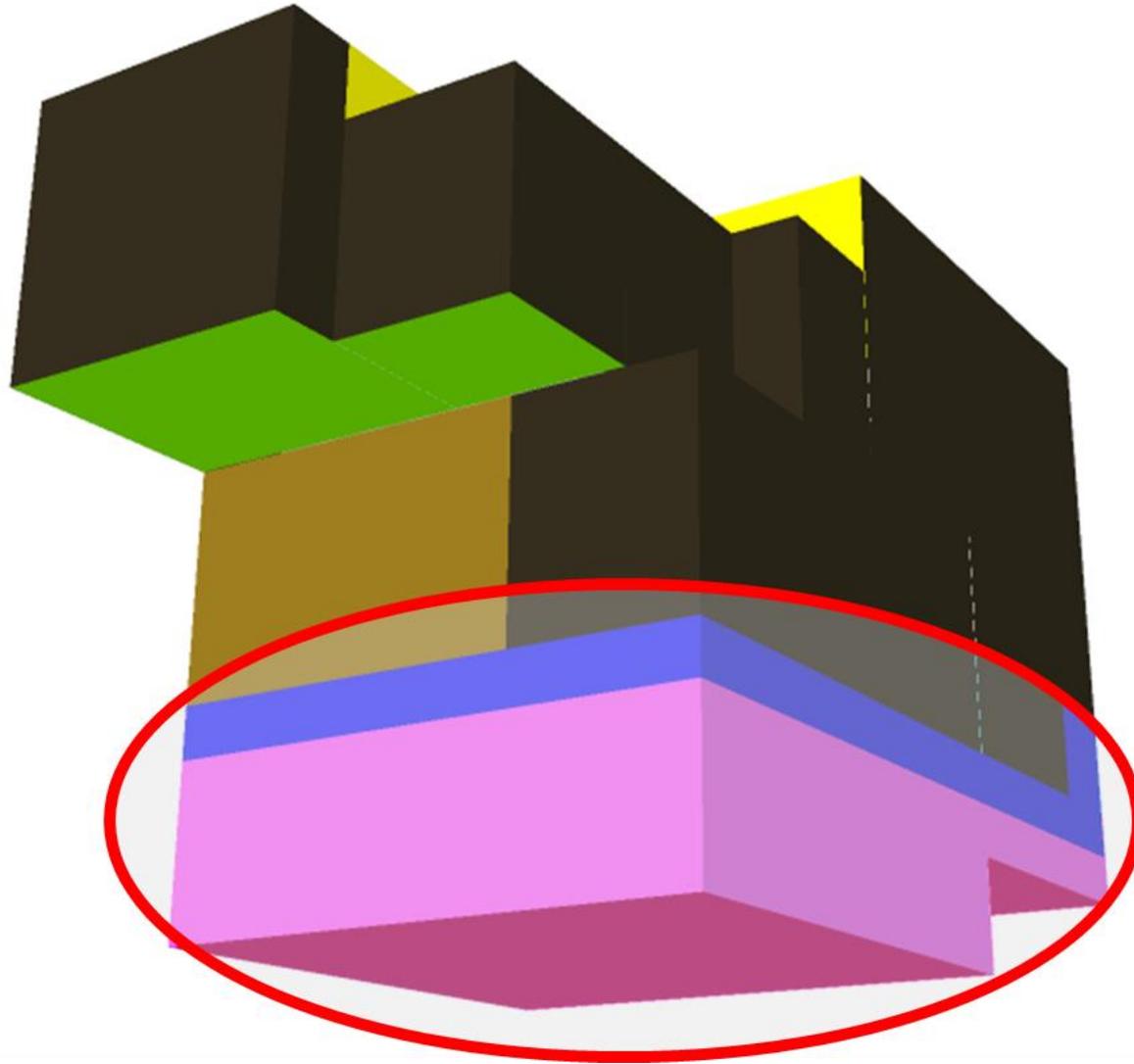
# Air Tests

- First Test
  - 1.54 Air Changes per Hour @ 50 Pa
  - 508 CFM50

Sprayed Ring Joists and addressed foundation foam joints.

- Second Test
  - 1.36 Air Changes per Hour @ 50Pa
  - 447 CFM50

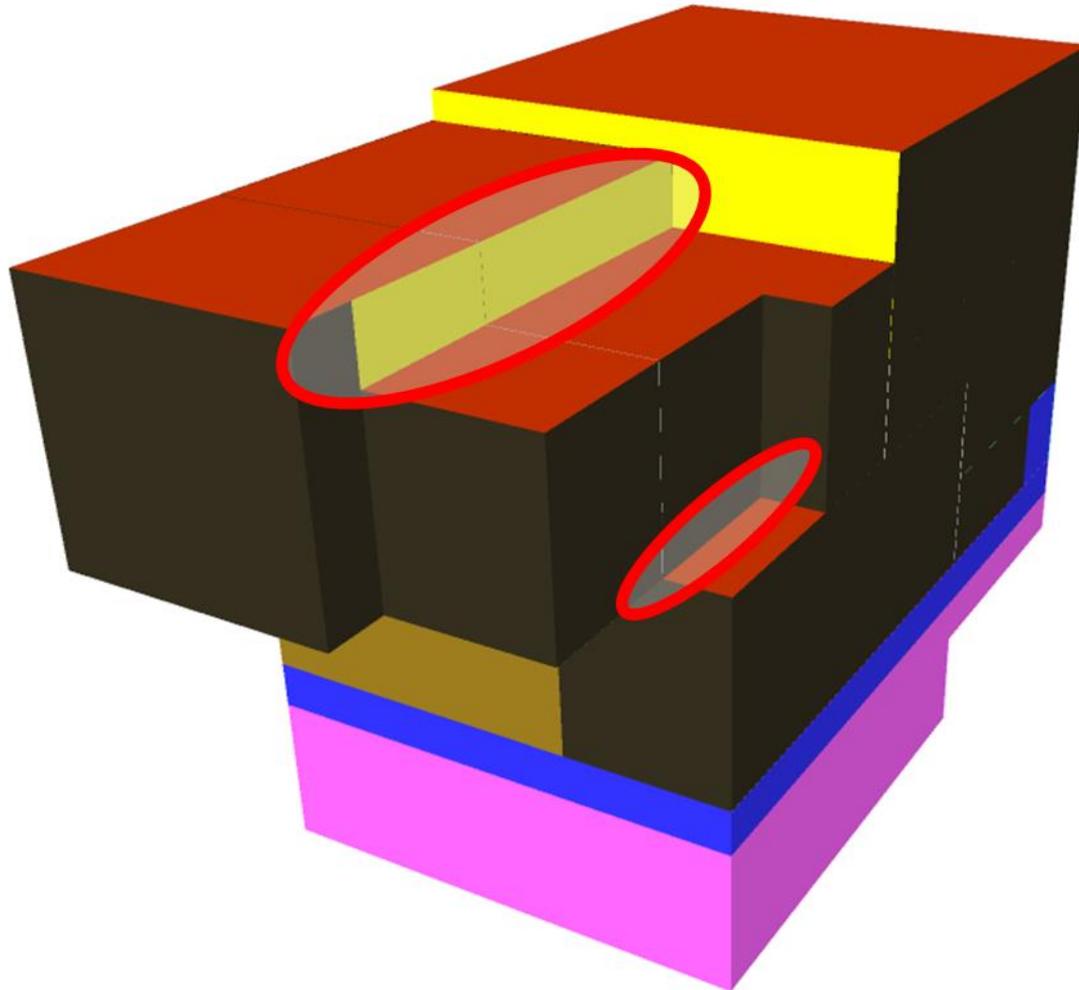
# Problem Area #1 – Below Grade



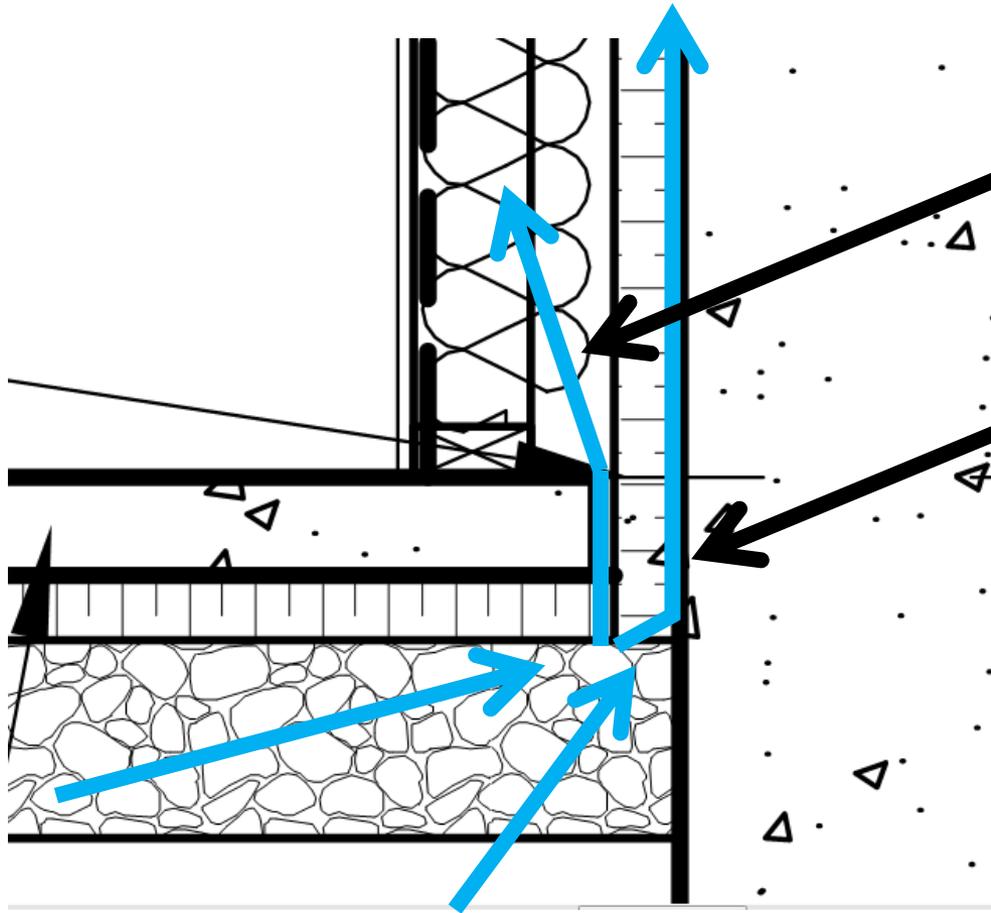
# Problem Area #2 – Ring Joists



# Problem Area #3 – Attic Wall to Ceiling

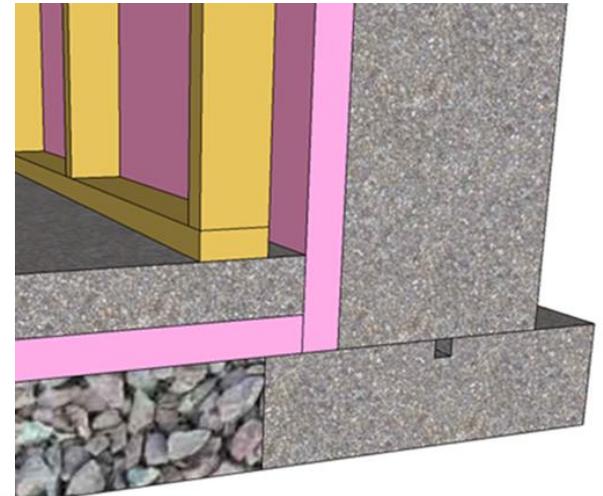


# Underslab Infiltration

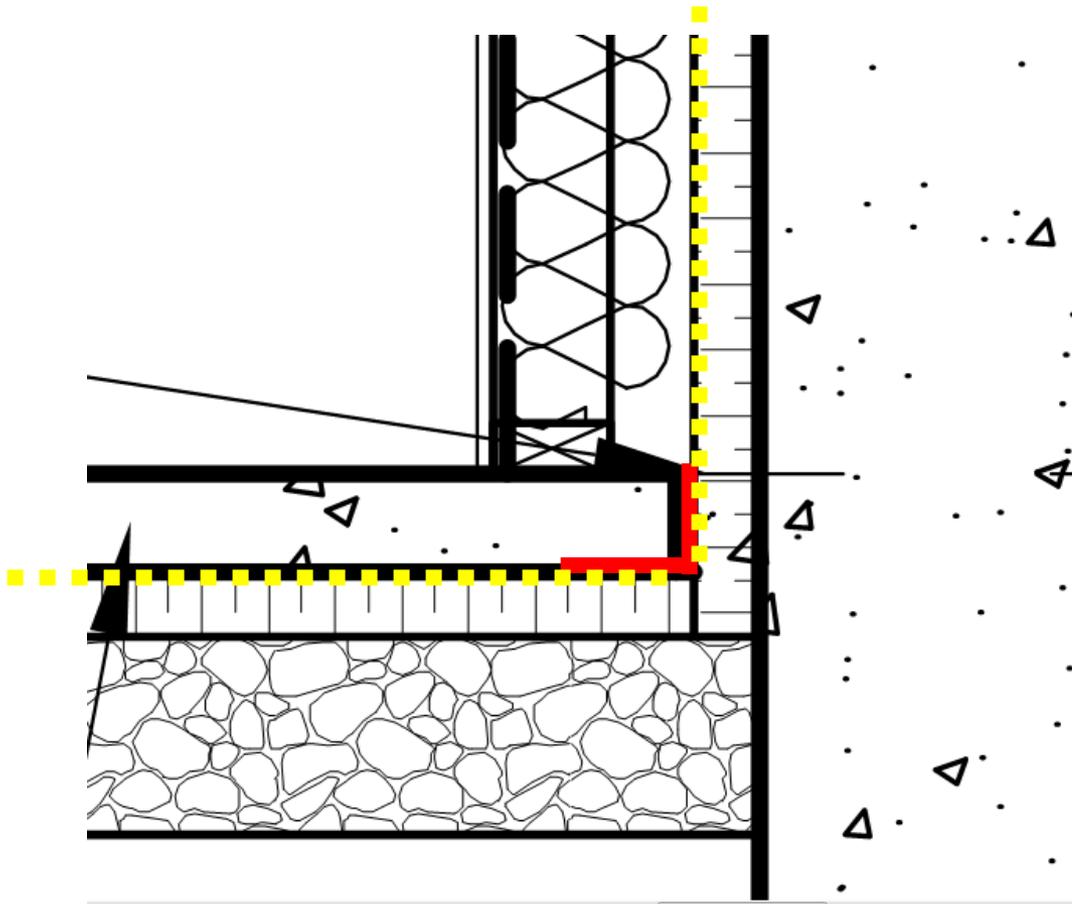


Infiltration at edge of slab

Infiltration from under slab follows airspace b/w CODEBORD and Concrete



# Underslab Infiltration - Tape



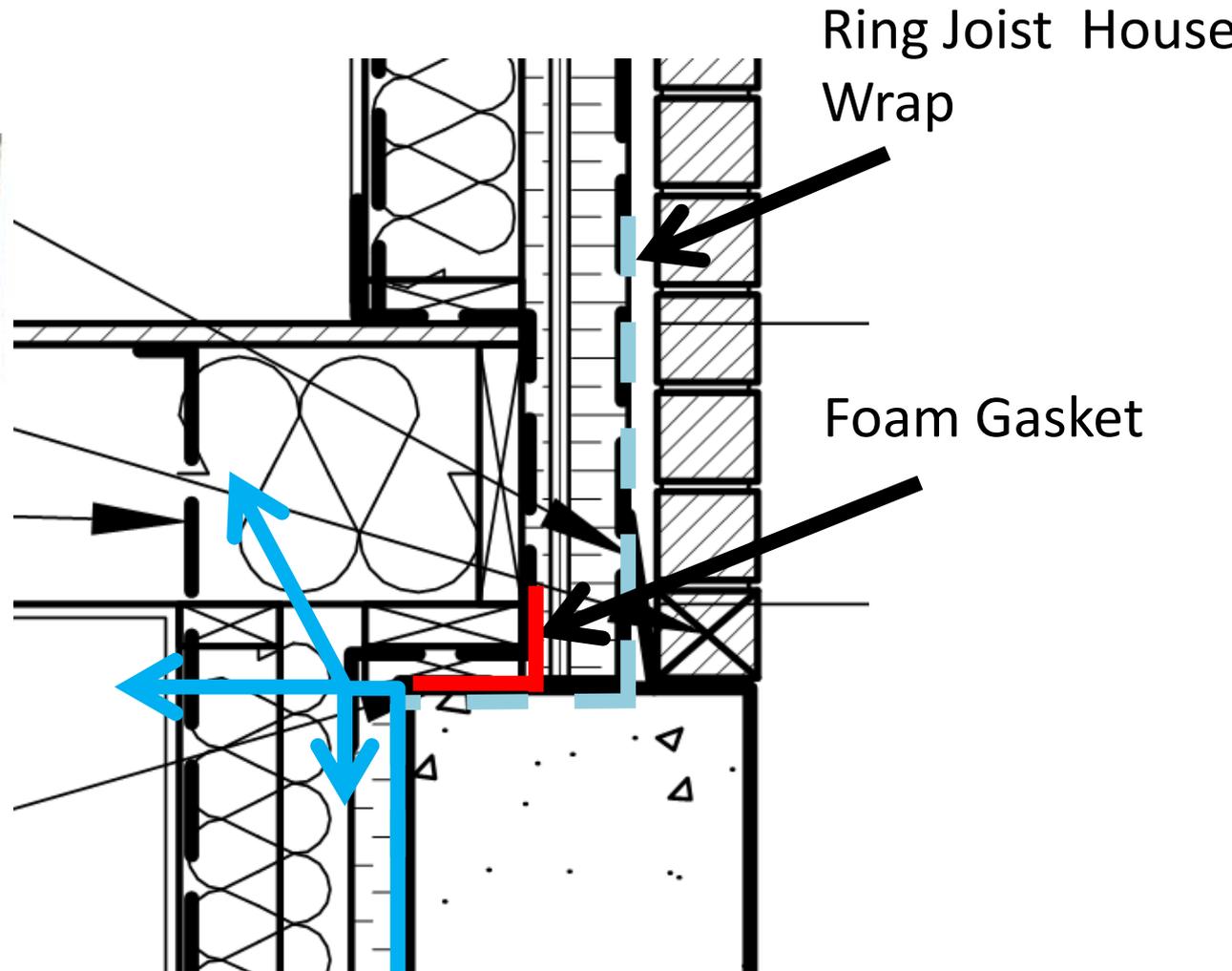
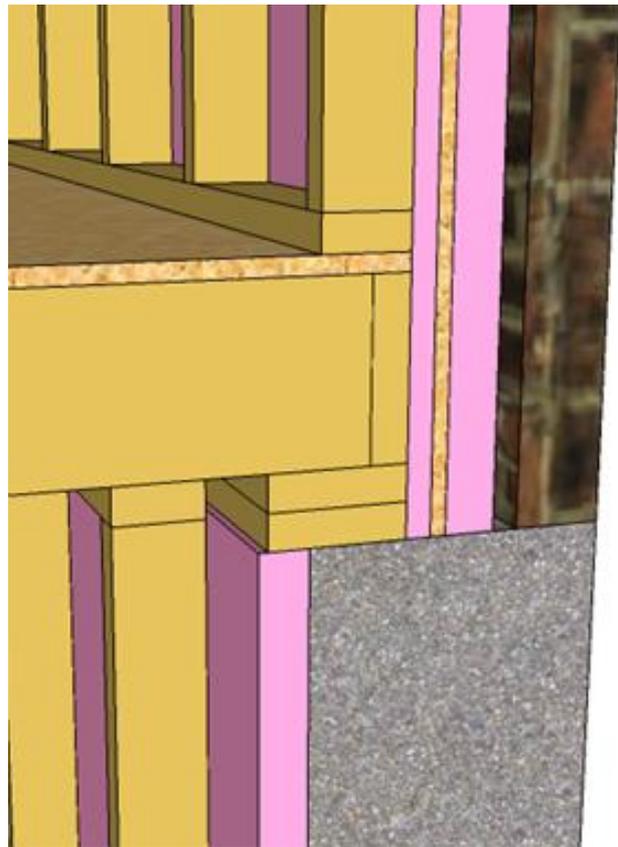
Use JOINTSEALR tape b/w underslab foam and foundation foam.

Must also tape all joints and seal foam to house wrap.

**Air Barrier is:**

- Foam

# Ring Joist - Foundation



# Reid's Heritage Homes NZ 1.0

## MECHANICALS

### HEATING AND COOLING

Mitsubishi CITY MULTI VRF Heat Pump PUMY-P36

### WATER HEATING

Rheem Hybrid Heat Pump HB50RH

### VENTILATION

Venmar AVS EKO 1.5 ERV

## RENEWABLE ENERGY

### PHOTOVOLTAIC SYSTEM

33 panels | 255W Polycrystalline Modules

### ELECTRICAL STORAGE CAPACITY

3 day battery storage capacity | 20 kWh/day

### Annual Energy Consumption

# 37 GJ



# NET ZERO PROJECT PROFILE

**BUILDER** Doug Tarry Homes

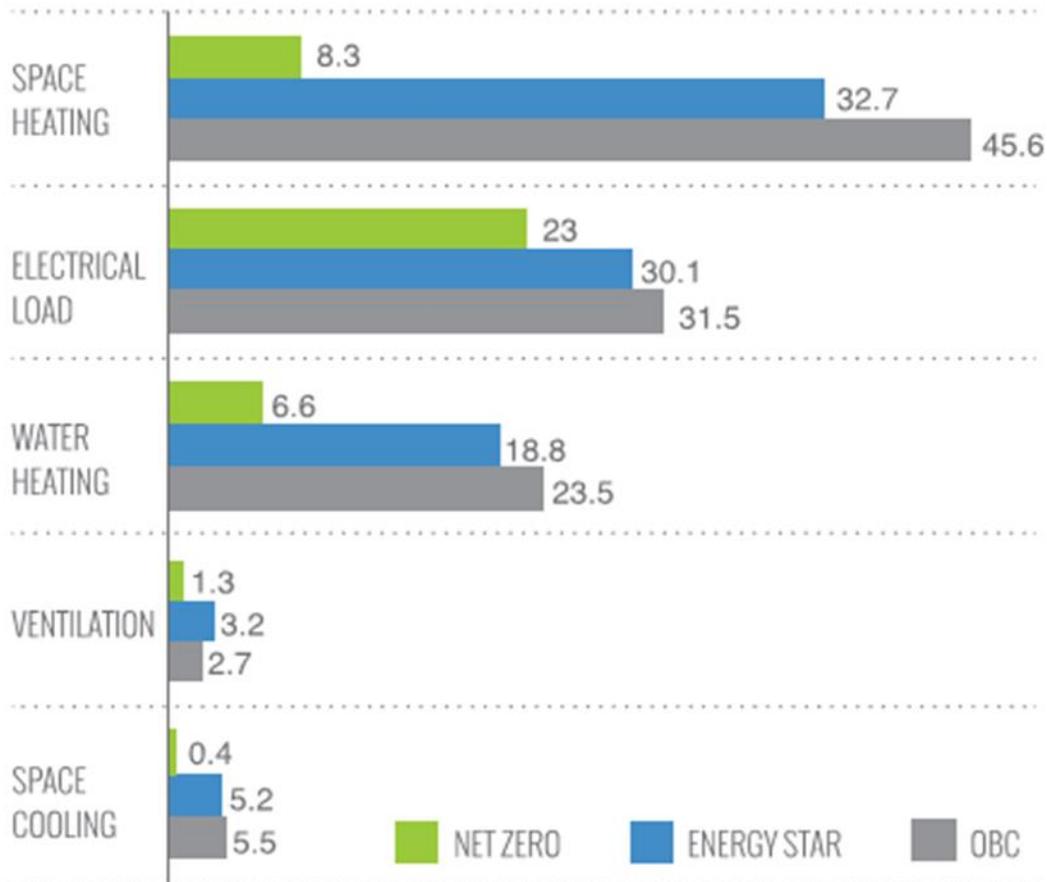
**MODEL** Northgate 'A'

**TECHNICAL  
STANDARD** R2000 Net Zero Energy Pilot  
Technical Procedures

**PROGRAM** Net Zero Discovery Home



## ENERGY CONSUMPTION



NET ZERO CONSUMPTION

40 GJ/yr



NET ANNUAL ENERGY

0 GJ

## BUILDING ENCLOSURE

### Air Barrier

Continuous Interior Air Barrier System

### Framing

2x6 @ 24" o.c.

### Insulation

Ceiling | R60 Blown-in

Main Walls | R10 Exterior Foam + R24 Batt

Foundation Walls | R8 Mineral Wool + R22

Basement Slab | R10 Foam

### Windows and Doors

Northstar Triples | R4.5+, Optimized SHGC

## MECHANICALS

### Heating and Cooling

Dettson Chinook + Alize w/ Smart Duct System

### Water Heating

Navien Tankless w/ On-Demand Recirculation

### Ventilation

VanEE 90HV ECM ERV

## RENEWABLE ENERGY

### Photovoltaic System

32 x 250W Canadian Solar PV Modules

### Electrical Storage Capacity

N/A | Net-Metered Installation



**BUILDING  
KNOWLEDGE**  
CANADA INC.

# NET ZERO PROJECT PROFILE

BUILDER

BK Cornerstone

MODEL

Custom | Klundert Residence

TECHNICAL  
STANDARD

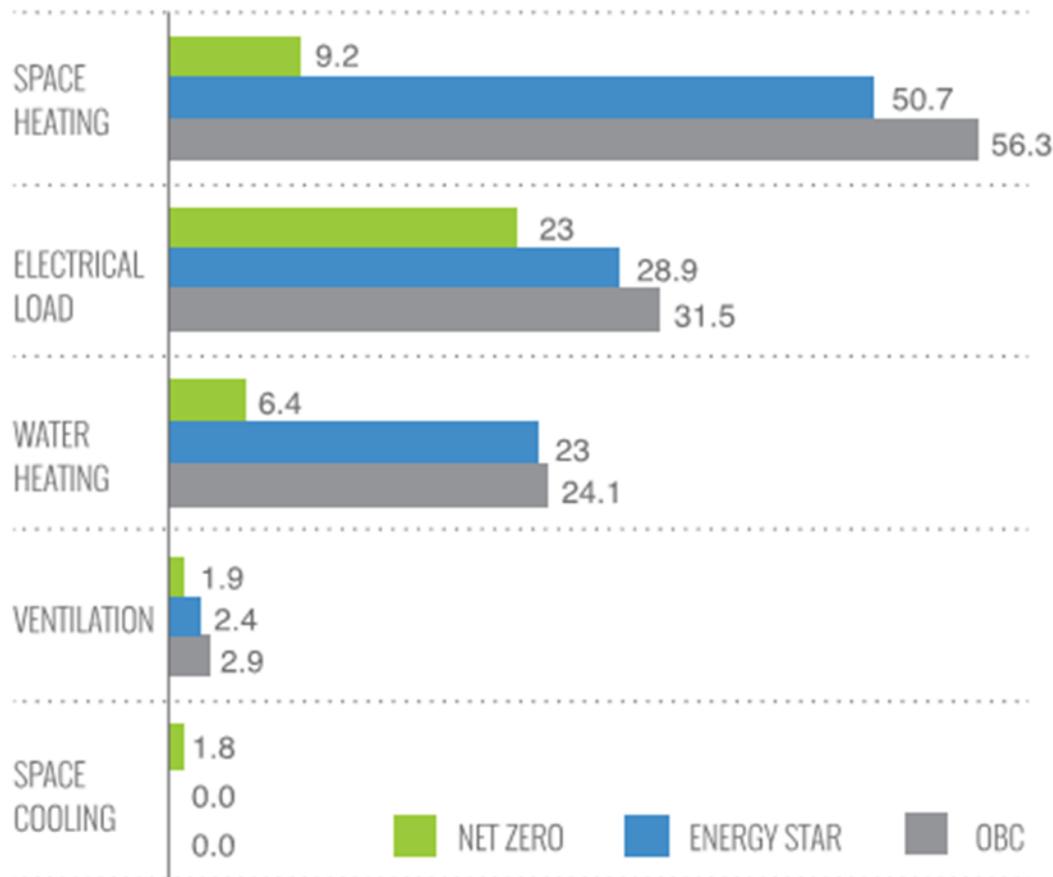
CHBA Net Zero Energy Pilot  
Technical Procedures

PROGRAM

Union Gas Optimum Home



## ENERGY CONSUMPTION



NET ZERO CONSUMPTION

42.3 GJ/yr



NET ANNUAL ENERGY

- 8.3 GJ

## BUILDING ENCLOSURE

### Air Barrier

Owens Corning FOAMULAR® CodeBord™  
Air Barrier System

### Framing

2x6 @24" o.c.

### Insulation

Ceiling | R60 Blown-in  
Main Walls | R10 Exterior Foam + R22 Batt  
Foundation Walls | R10 Interior Foam + R20  
Basement Slab | R10 Foam

### Windows and Doors

North Star Triple Pane | R4.5+, < 0.4 SHGC

## MECHANICALS

### Heating and Cooling

Armstrong Air | Gas Furnace w/ Air Source Heat Pump

### Water Heating

A.O. Smith Voltex Heat Pump Water Heater

### Ventilation

Venmar ERV

## RENEWABLE ENERGY

### Photovoltaic System

40 x 250 W PV Panels | 50.5 GJ/yr

### Electrical Storage Capacity

N/A | Net-metered Installation



# Timberworx Presents

## *Net Zero Home*



THANK YOU

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