

Presented By:



Sustainable Housing Webinar Series

The implication **with providers from
High Performance Homes.**

November 17 at 10 AM

Stephen Farrell (P.L.Eng.), VT Group of Companies
Kevin D Brown, Nicol Design

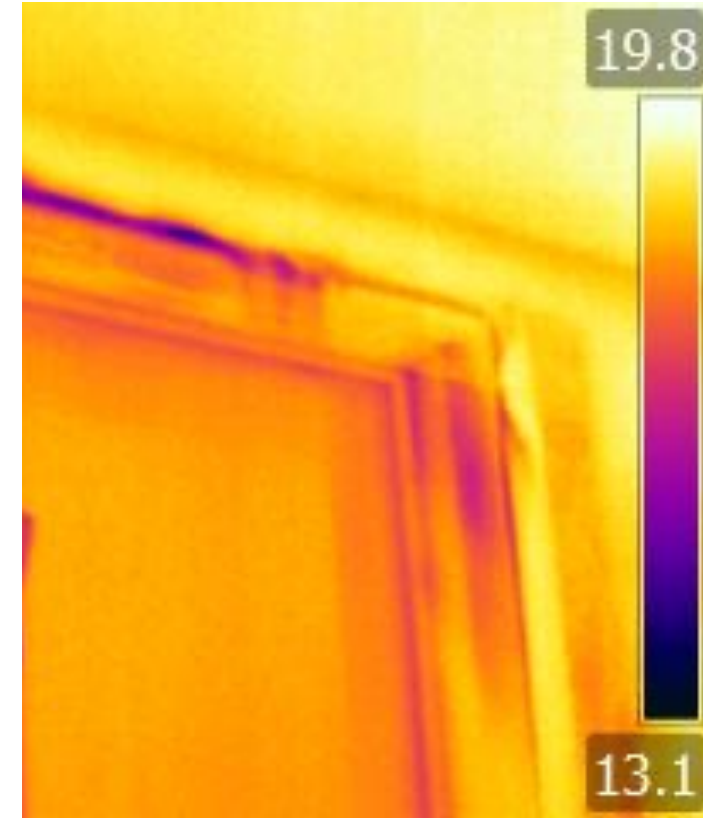




VT Group
of Companies

The Implication with providers from High Performance homes

17 November 2021



INTRODUCTION

- Stephen Farrell (P.L.Eng.) Mech Eng.; REA; C.E.M. NH Dip Mech. Eng.
 - Owner of Acacia Engineering
 - Mechanical Engineering, NECB & professional engineering services
 - Alberta, British Columbia, Yukon, Saskatchewan.
 - Owner of Verdatech Energy management and Consulting
 - Residential energy management (across Canada)
 - Owner of Qualistat Building Performance Consultants
 - Part 9 building envelop consulting (design and problem solving)
 - Trainer for CIET (Canadian Institute for Energy Training)
 - Completed in excess of 50,000 evaluations



Definition of a high performance home?

It's a home with a good or better than good building envelope (air barrier, vapor barrier, moisture barrier thermal barrier and weather barrier). The mechanical systems properly designed, installed and commissioned. The home is thought of as a system. Indoor air quality, energy consumption, passive energy, active solar are considered and incorporated into the build and design.

In brief "A comfortable, healthy, durable, and energy efficient place we want to call our home."



Definitions and terms

- Air barrier
- Vapor barrier
- Weather barrier
- Thermal barrier
- Mechanical ventilation
- Passive energy
- Active solar energy
- Blower door testing
 - ACH
 - ELA



Labelling & high performance homes

- Labelling & Rating
 - Code compliant home
 - Step Code
 - TEDI (Thermal Energy Demand Intensity)
 - MEUI (Mechanical Energy Intensity)
 - 1 Through 5
 - Determined by each (AHJ)
 - 9.36 (Prescriptive, performance or trade off)
 - Tier Code (Future across Canada and similar to Step code)
 - EnergyStar™
 - ENERGYSTAR certified home is built to be about 20% more energy efficient than a typical home.
 - LEED
 - A LEED certified home is **one verified by an independent third party to have met standards beyond conventional building practices** to create a healthier, more sustainable and energy efficient home.
 - Passive House
 - The Passive House Standard stands for **quality, comfort and energy efficiency**. Passive Houses require very little energy to achieve a comfortable temperature year-round, making conventional heating and air conditioning systems obsolete.
 - ERS V15
 - Calculated GJ per year consumption with standard operating conditions
 - Energy intensity (GJ / unit area)
 - Reference home comparator



Labelling & high performance homes

- Labelling & Rating continued

- **R2000**

- High standard
 - Set standard that must be met
 - Home as a system

- **Net Zero**

- A net-zero home will make as much electricity on-site as it will consume over the course of one year.
 - Is the home fully net zero or just the electrical consumption?

- **Built Green**

- Point based rating system
 - Tiered certification

- **EQuilibrium™**

- EQuilibrium™ homes are designed to address occupant health and comfort, energy efficiency and renewable energy production, resource conservation, reduced environmental impact and affordability.
 - CMHC initiative



Why label a home?

- Understanding how the home is rated
- Comparing homes
- Third party labelling
- Independent labelling
- Governing body (Professional association)
 - Government oversight
- Set standards
- Reliable results
- Demonstrate the standard that has been met
 - Know your options and their advantages and disadvantages. They are not all the same.



Features

- Passive Energy
 - Free energy when available that can be stored
 - Thermal mass
 - Orientation and shading
- High performance Mechanical Systems
 - Heating
 - Heat pumps (ASHP)
 - Geothermal heating system
 - Condensing technologies (Furnaces and boilers)
 - Design (F280) - sizing
 - Cooling
 - Mini split systems with High SEER values
 - Zoning



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ACACIA
ENGINEERING LTD



QualiSTAT
BUILDING PERFORMANCE CONSULTANTS

Features

- Ventilation
 - ERV vs. HRV
 - Standards 9.32, F326 or ASHRAE)
- Building envelope
 - High performing building envelope
 - Many functions
- Tested Air barrier (Blower door testing)
 - ACH at 50 Pa
 - ELA
 - NLA



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Benefits:

- Smaller mechanical systems (heating and cooling)
- Lower annual operating costs
- More comfortable year round
- Zone control - more comfortable
- Better indoor air quality when ventilated correctly
- Lower GHG emissions and environmental foot print
- Future proofing
 - Carbon tax increases
 - Different energy sources
 - Sustainability



Other considerations to consider

- Available CMHC mortgage rebates
- Upgrading existing homes to a high-performance home
 - How to upgrade an existing home
- Increased value of the home
 - Understanding benefits and features
- Understanding how to use the home
 - Using the technology, you have in the new home
- Life cycle cost of building and materials
- Maintenance costs
 - Complexity of system
- Active solar
 - Understand how this is calculated (fully understand this)



Technologies & Considerations

Windows

- ER (Energy rating)
- U value (Conductance)
- SHGC (Solar Heat Gain Coefficient)

Walls

- SIPS (Structurally Insulated Panels)
- ICF (Insulated Concrete Forms)
- EFIS (Exterior Insulation Finishing System)

ASHP

- HSPF (Heating Season Performance Factor)



Technologies & Considerations

IMS

- Integrated mechanical systems

Geothermal

- COP (Coefficient of Performance)

Heat pump hot water heaters

Drain water heat recovery systems

Controls

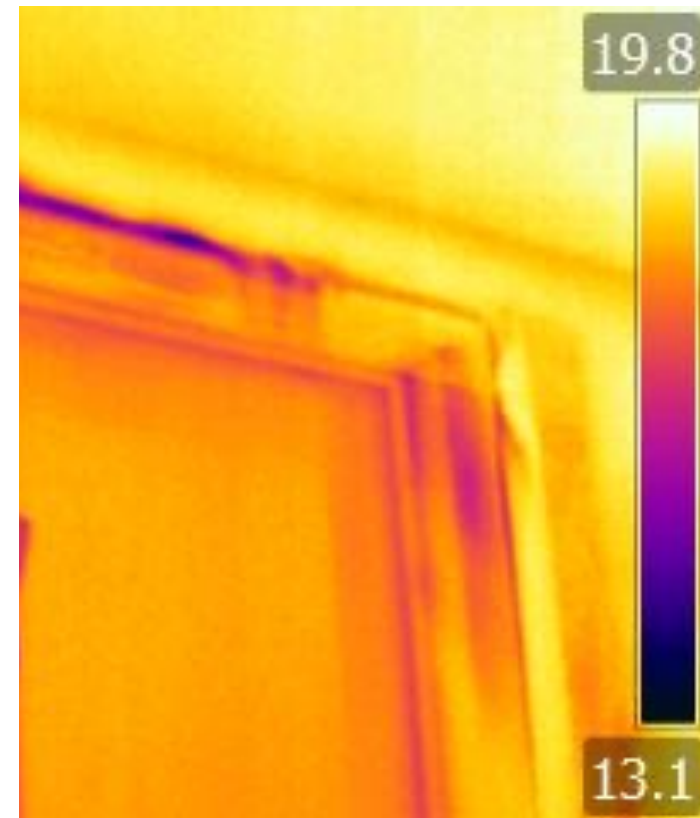
- Lighting
- Temperature
- Humidity
- Ventilation





Thank You

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sfarrell@EnergyExperts.ca
Sfarrell@AcaciaEngineering.ca



What the buyer needs to know.



+ND
Nicol Design
Passive House

Kevin D Brown, DHBR, MEDES(ID), CPHD

Owner of Nicol Design

- Passive House,
- EnerPHit retrofits,
- Heritage Restoration and Adaptive Reuse
- Energy Concierge Services

Co-founder of Deep Retrofit Capital

- Retrofit financing



first: what house is being sold?

NEW HOUSE?

- What energy standard does it meet?
Net Zero? Passive House? Code minimum?
What future energy standard will it meet?
- Quick clues:
External insulation on the foundation?
What's the mechanical room look like? What gear is installed?

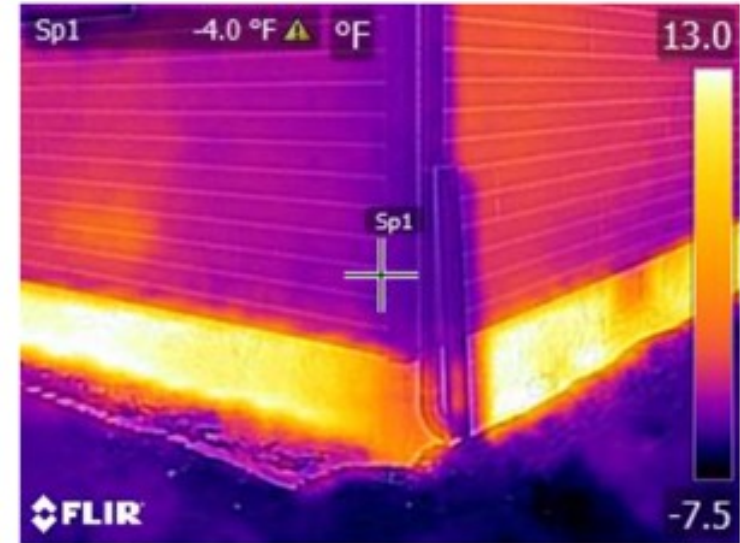
OLD HOUSE?

- Is there a reliable inspection report?
- Are utility bill records available?
- What are the comparables?
 - Sale prices, AND utility expenses.
- What is the age of the building?
- Is it worth retrofitting? Older houses are often better...

Common Errors

Built to Code:

- * Dependence on rule of thumb, industry inertia
- * If it's even on the radar: energy efficiency as secondary but not core principle
- * Lack of thorough economic analysis



An uninsulated concrete basement at -10°F (-23.3°C)

Are Buyers Changing?

Millennials: the new market.

THE JOURNAL OF THE AMERICAN INSTITUTE OF ARCHITECTS

ARCHITECT



Posted on: April 12, 2016

BUILDER

Millennial Home Buyers Expect Energy Efficient Features

A three-pronged approach can help meet young buyers' demands for high-performance homes with proven results.

So how do builders realistically work within a lower construction premium to meet Millennials' expectations for a sustainable, high-performance home? It involves a three-part 50/30/20 formula, integrating sustainable construction, alternative energy, and empowering a change in occupant behavior.

- Another selling point: High-performance upgrades on average yield a 10 percent return when it comes time to put the home on the market.

Millennial Building Design: How millennials are changing the shape of buildings and architecture.

Published on February 5, 2018



Rebecca Calbert, AIA

Strategic thinker with 27 years of experience in the commercial real estate development industry.

1 article

+ Follow

Millennials are global citizens.

According to the [Cone Study](#), "An overwhelming 89% are likely to switch from one brand to another (if price and quality are equal) if the second supports a cause." Not only do Millennials support global initiatives, but they are also expecting businesses to do their part as well.

Having an energy efficient building makes financial sense for all businesses, but it's not enough to just switch out a few light fixtures. Designing visible attributes into your building sends a message to your Millennial patrons that your business is prepared to do as much as possible to contribute to a better world. Don't shy away from solar panels, celebrate them!

Keep in mind that highly educated Millennials know what they want and are not afraid to stand up for what they think is right. Cater to that mindset, and they will consistency support your business for years to come.

Millennials: Health, wellness, global concerns...

CONSTRUCTION DIVE Deep Dive Opinion Data Library Events

Commercial Corporate News Economy COVID-19 Infrastructure Labor/Safety T

DEEP DIVE

'The next wave' of design: Why wellness-minded spaces are on the rise

Published Jan. 26, 2017

By Kim Slowey
Contributing Editor

in f t e p

Millennials driving the trend

The ever-increasing popularity of healthy living has something to do with it, but that's nothing compared to the sea change that millennials have brought to the wellness table. "I think that it is a kind of milieu we're in, that we're probably going to stay in, driven by younger people who are much more sensitized to everything from environmental issues to sustainability to wellness and quality of life," said John Kirk, architect and partner at [Cooper Robertson](#).

EBR The European Business Review
empowering communication globally

Home > SUSTAINABILITY & WELLBEING > Climate Change > Are Millennials Driving More Sustainable Homes?

SUSTAINABILITY & WELLBEING Climate Change Social Impact

Are Millennials Driving More Sustainable Homes?

June 17, 2019

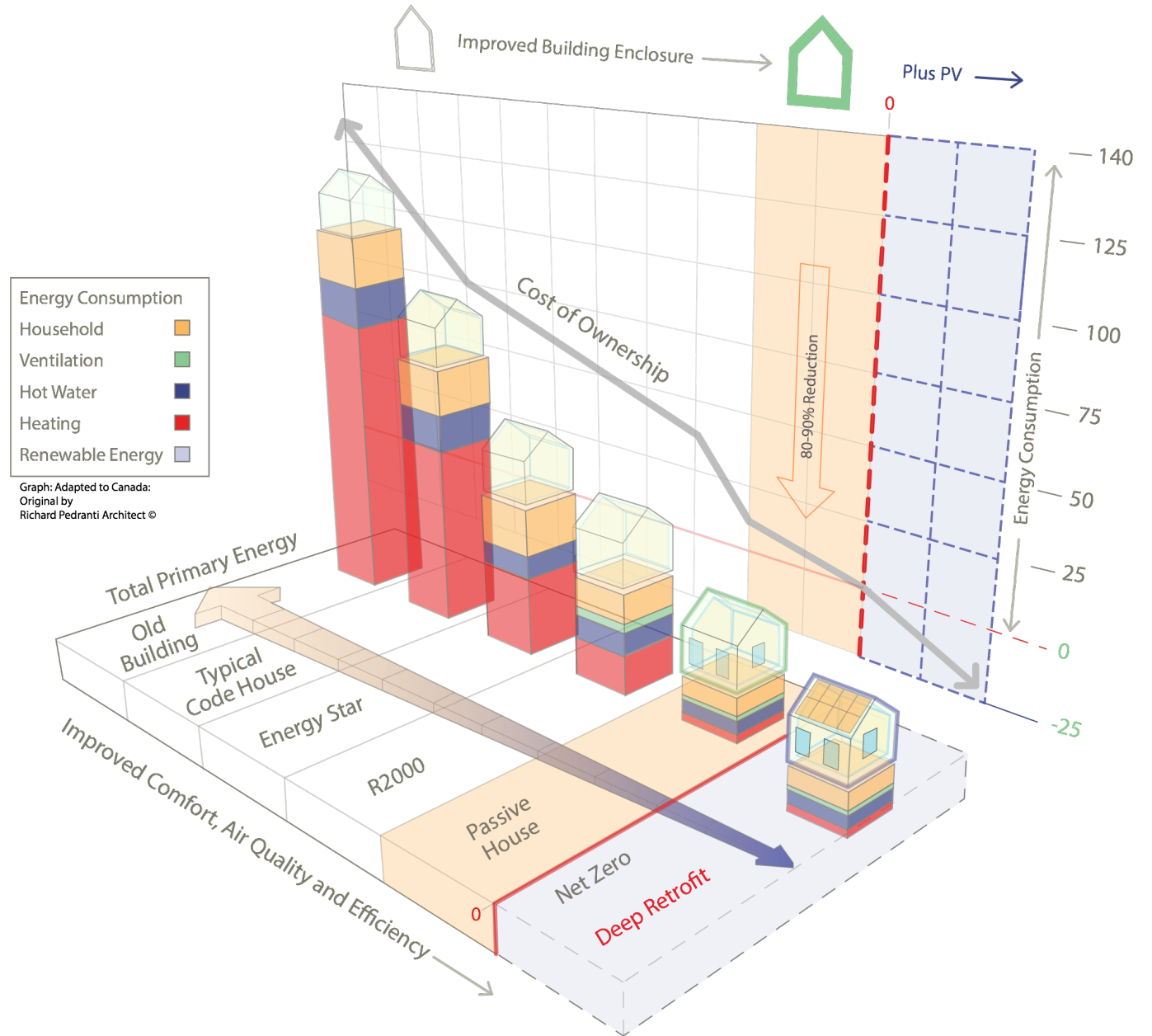
Millennials are responsible for driving a lot of new trends and services. As they make up a large proportion of consumers, businesses are constantly looking at ways to cater to their demands. What Millennials look for compared to what the older generation once looked for, is completely different. This is especially true when it comes to buying houses.

Millennials care about the environment

Due to how much knowledge is now available regarding environmental issues, Millennials tend to be much more focused on saving the environment. This has led to a lot of businesses being forced to adopt eco-friendly measures, such as the recent move to ditch single-use plastics.

However, it's not just businesses which are being forced to adopt new eco-friendly measures because of Millennials. Homeowners and developments are also being forced to be more economical. Millennials look for sustainable homes which have good energy efficiency ratings. So, builders and contractors are starting to construct new buildings in a sustainable manner.

Energy, Emissions & Costs

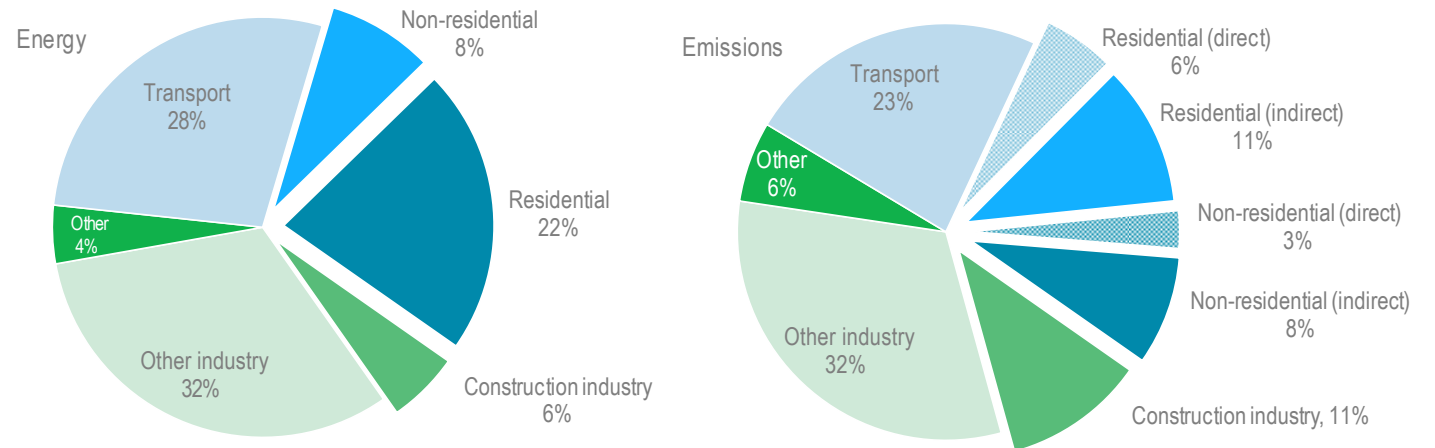


Graph: Adapted to Canada:
Original by
Richard Pedranti Architect ©

COUNT EVERYTHING...

Energy, Emissions & Costs

Global share of buildings and construction final energy and emissions, 2017



Note: *Construction industry* is an estimate of the portion of the overall industry sector that applies to the manufacture of materials for buildings construction, such as steel, cement and glass.

Sources: Derived from IEA (2018a), *World Energy Statistics and Balances 2018*, www.iea.org/statistics and IEA *Energy Technology Perspectives* buildings model, www.iea.org/buildings.

Key message • The buildings and construction sector is a key actor in the fight against climate change: it accounted for 36% of final energy use and 39% of energy- and process-related emissions in 2017.

COUNT EVERYTHING...

Energy, Emissions & Costs

COUNT EVERYONE...



Energy, Emissions & Costs...



EVERYONE COUNTS...

the basics: solar access

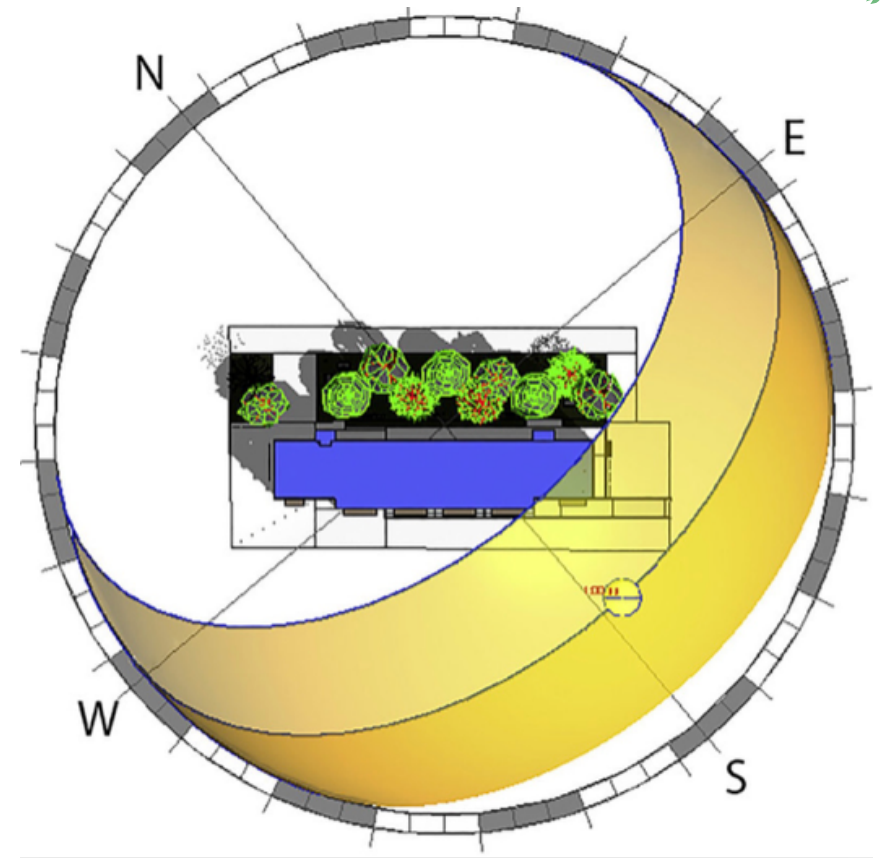


Solar energy provides as much of the heating energy as possible.

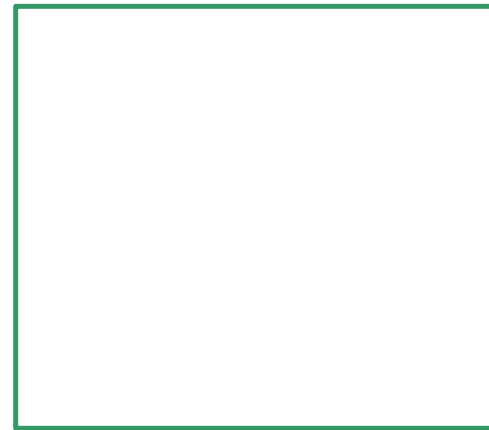
60-80% depending on the site.

Excellent solar exposure = more free heat

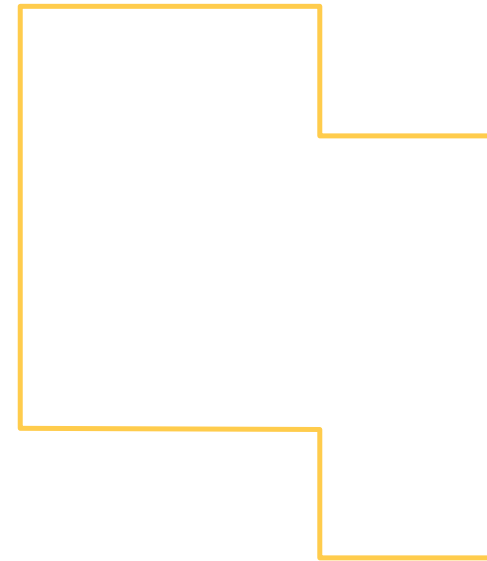
Plan for shade = more free cooling



the basics: simple building shape

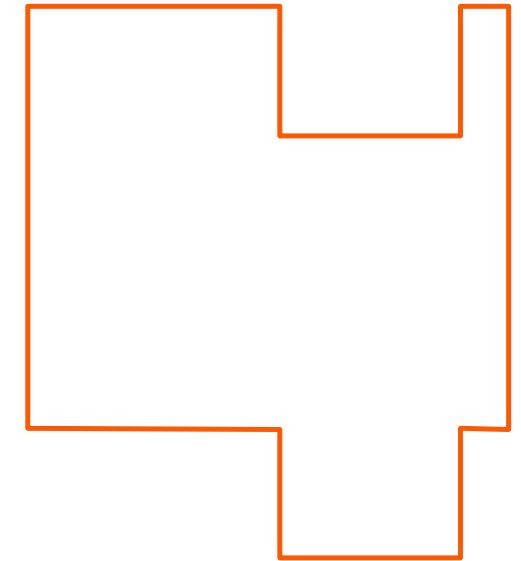


Compact.



Wall area = +12.5%

Insulation = +30 mm



Wall area = +22%

Insulation = +40 mm??

or more!

A compact shape is cheaper and easier to build.

There is a real, measurable energy cost to building complexity.

the basics: simple building shape

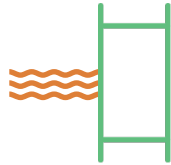


5 principles for high energy efficiency

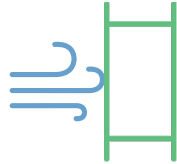
1. Insulation



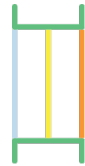
2. Thermal Bridge Free



3. Airtightness



4. Windows and Doors



5. Ventilation

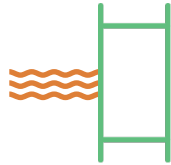


5 principles for high energy efficiency

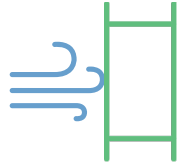
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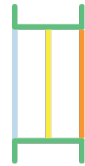
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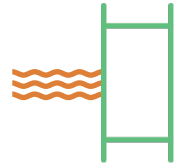


5 principles for high energy efficiency

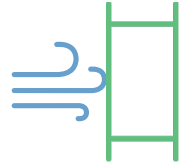
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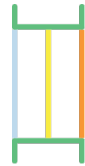
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3. Airtightness



4. Windows and Doors



5. Ventilation

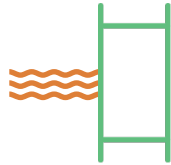


5 principles for high energy efficiency

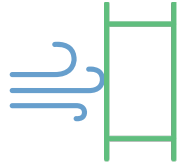
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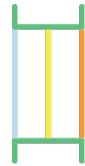
2. Thermal Bridge Free



3. Airtightness



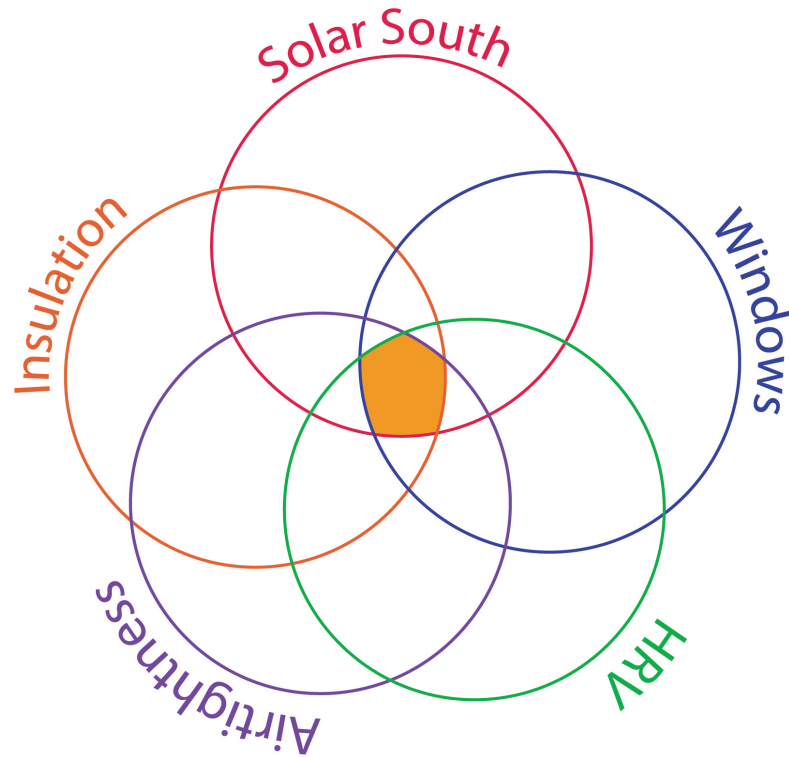
4. Windows and Doors



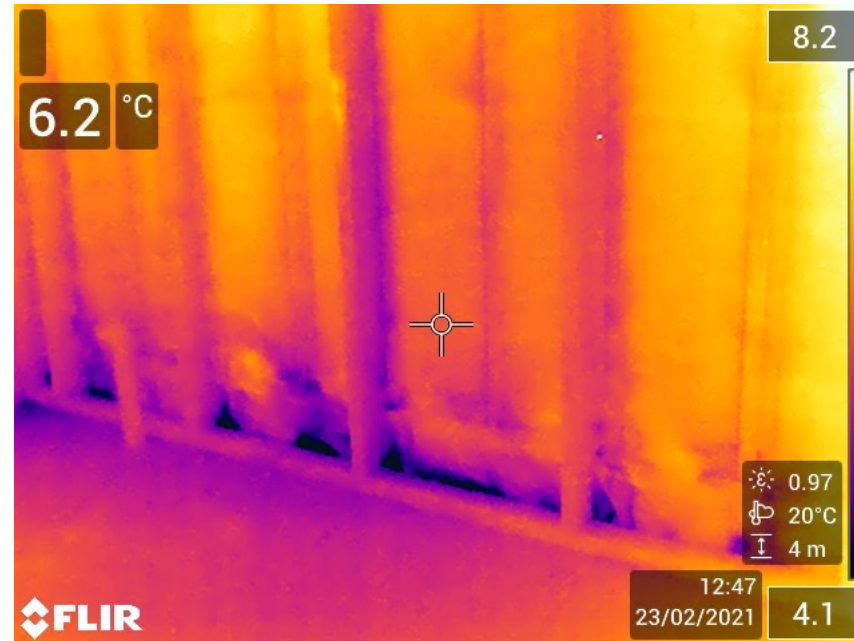
5. Ventilation



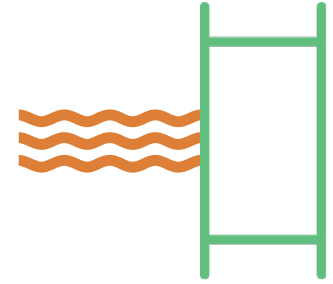
whole building design.



what's on the market?



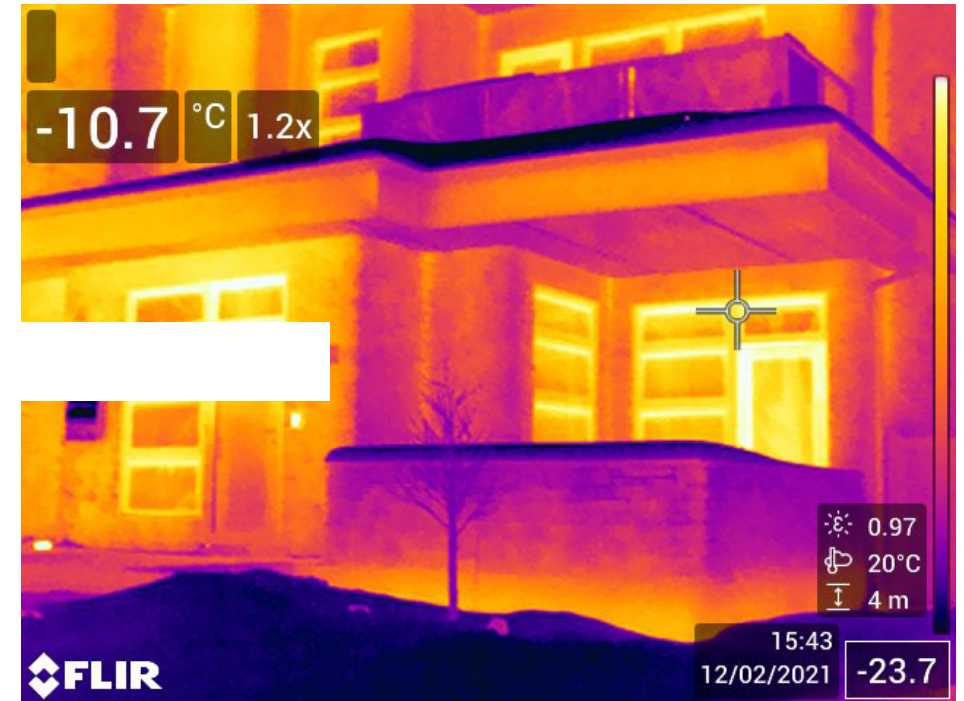
what will compete long term?



Thermal bridges - the loss of heat (or cool) through building parts - is a huge energy cost.

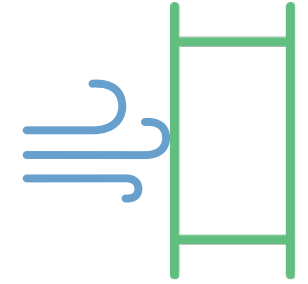


Rosedale Passive House, Calgary



Right next door: house built to code.

insulation: check.
airtightness: X



or...

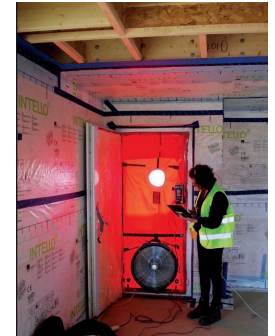
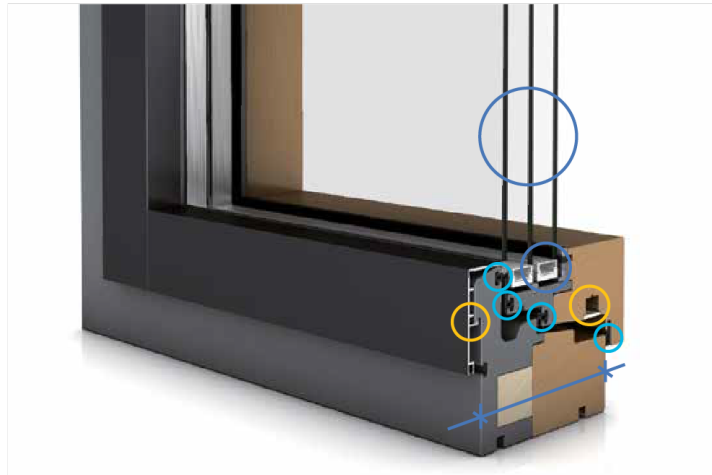
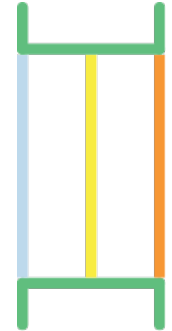


Photo: © passivehouse.ie

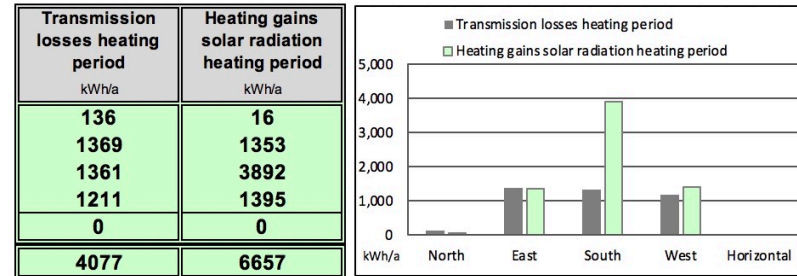
Passive House windows:
yes, they are different.



how many times will we replace?



Passive House windows are a heat source, rather than a heat sink.



Gains 6657 - Losses 4077 = 2580
kWh/yr net gain



Rosedale Passive House



Space heating

Treated floor area m²

Heating demand kWh/(m²a)

Heating load W/m²

| |
|-------|
| 219.9 |
| 15 |
| 13 |

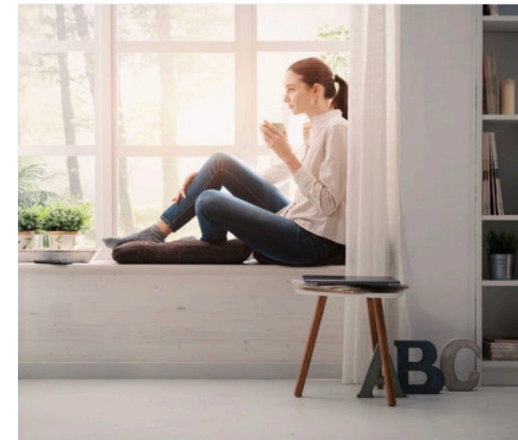
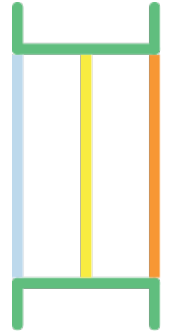
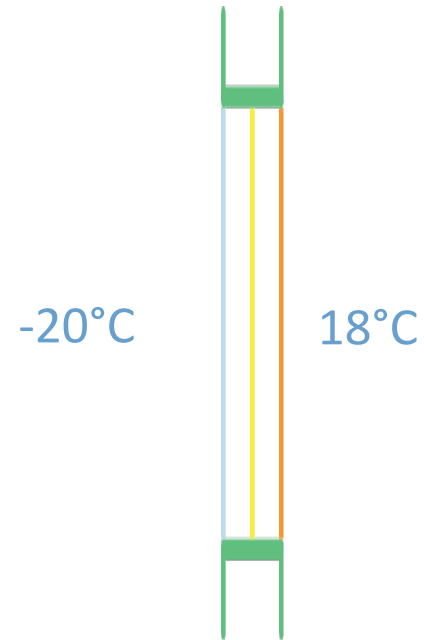
219.9 x 15
= 3,298 kWh/yr
heating energy

2580 kWh/yr from windows (R7.6) = 78% of heating energy from the sun

Or...

Windows and doors: airtight, superior R value with triple panes.

Comfort:



fresh air: an essential part of physical & mental health.



Certified Passive House School, US

There are more positive results on cognitive tests in well-ventilated buildings built to green standards.

Joseph G. Allen, et al., Environmental Health Perspectives, Vol.

124, No. 6, 1 June 2016

passive house mechanical systems



They can be simple.



Backup systems? Required?

passive house mechanical systems



They can be simple.

Implications for:

Service and maintenance?

Insurance?

Home inspections?



Backup systems? Required?



EnerPHit Retrofit Step Plan

Bowness Road Heritage House, NW Calgary



15 January, 2021
Kevin D Brown, MDes(ID), CPHD

Implications for:

Service and maintenance?

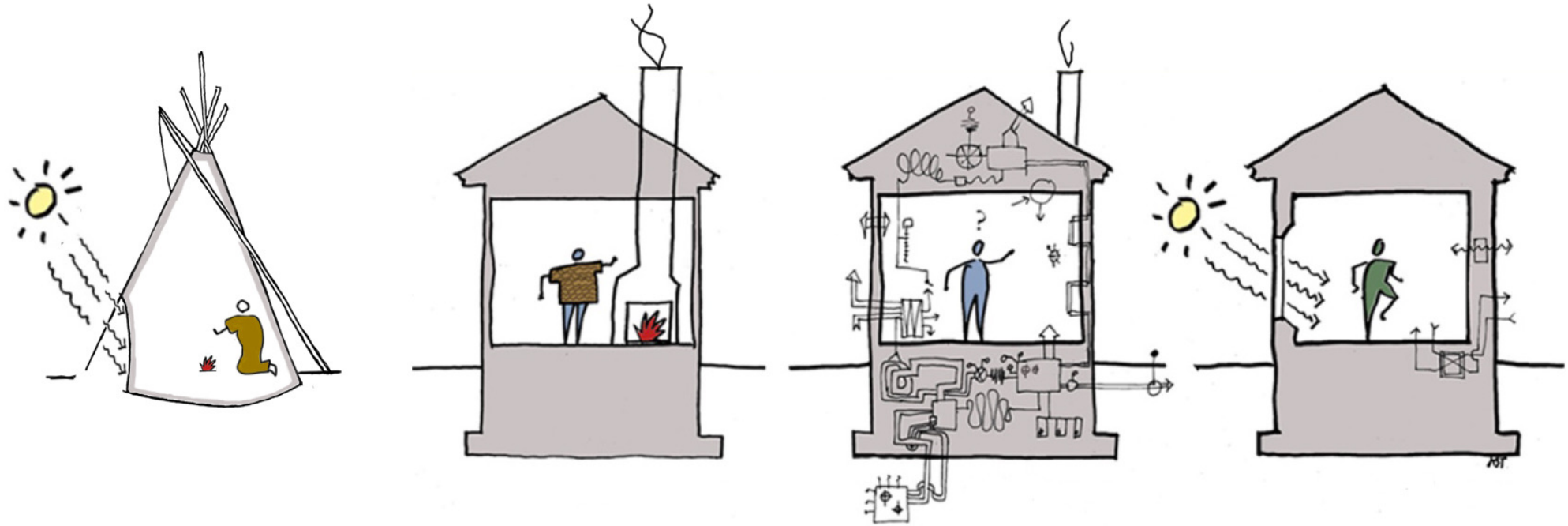
Insurance?

Home inspections?

one house green
passivehouse manual
armson residence

kevin d brown
v5 15 October, 2020





18th C

19th C

20th C

21st C

passive house wall systems



Implications for:

Service and maintenance?

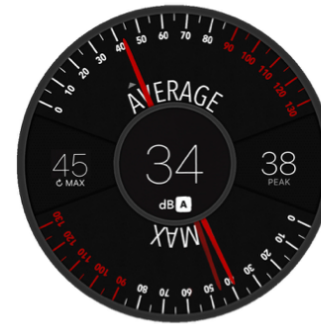
Insurance?

Home inspections?

how quiet?

Closed window:

30-40 decibels (a whisper), 45 dB during thunder...



Open window:

55-60 dB, with 75 dB during thunder..



durability?

Uncompromised building science ensures a building that is long lasting.

The majority of building failures are prevented, caused by condensation, moisture buildup, mold and rot.

Foam insulation at 6" thick?



Air leakages?



Thick batt insulation?



Insufficient air sealing?



code compliance?

Emerging codes have much less chance of compromising long term building value - resale value.

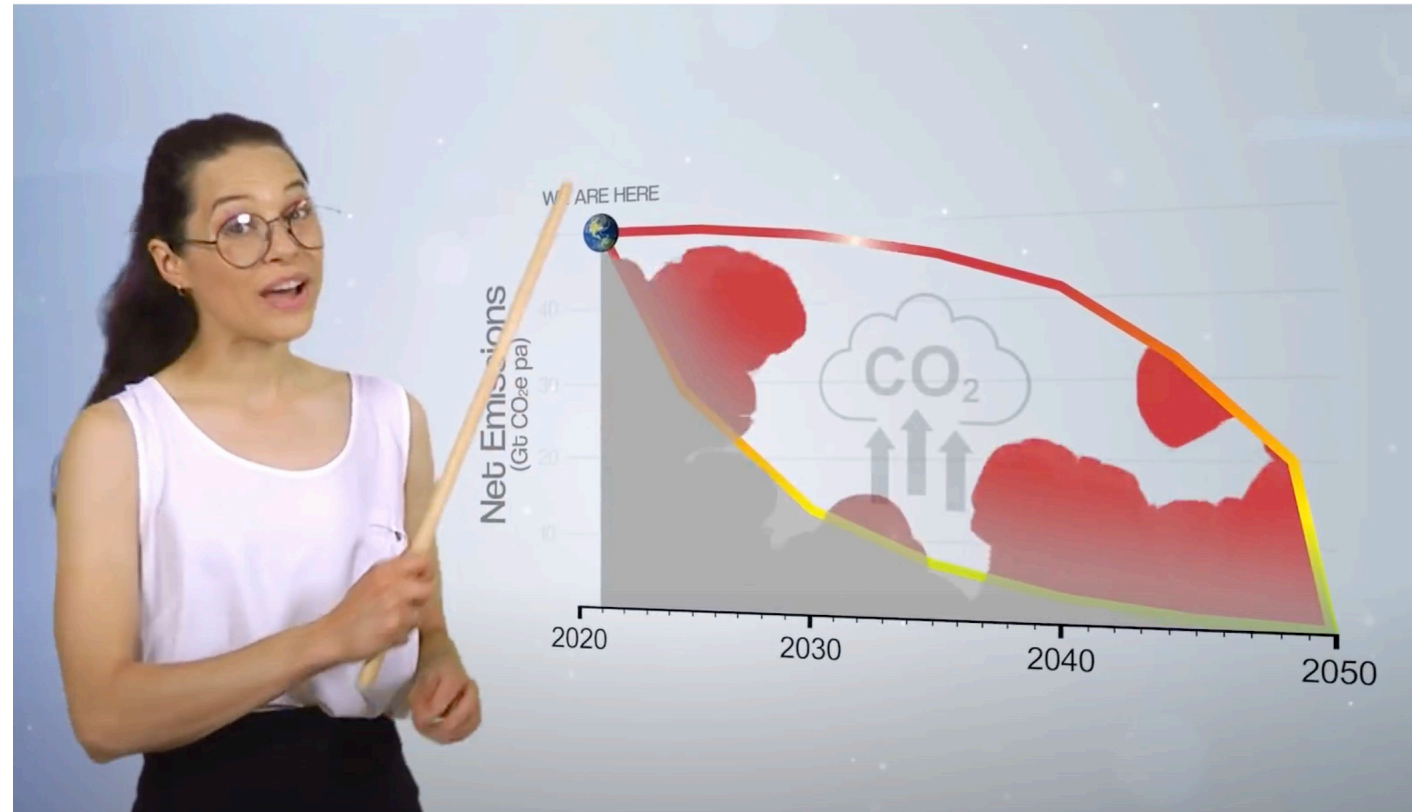


PH meets this standard - right now.

climate compliance?

Net Zero by 2050?

Completely depends on the path
we choose.



Passive House meets 2050 standards – right now.

Honest Government Ads, "Net Zero by 2050," Juice Media

Richmond Passive House



Alberta's first certified Passive House

Suburban Calgary, Alberta

New build, 2016

Total Developed Area: 2,171 ft²

Heating demand: 15 kWh/m²/yr

68% of heating energy from the sun.

Airtightness: n₅₀ = 0.49 ACH

Total primary energy: 107 kWh/m²/yr

Envelope:

R48 above grade walls & R89 roof

R36 below grade walls & slab, R7+ windows

Cost: \$685,000 (*), \$355 / AG ft², \$315/ Dev ft²

Rosedale Passive House



Certified Passive House +

Inner City, Calgary, Alberta

New build, 2017

Total Developed Area: 2,778 ft²

Heating Demand: 14.7 kWh/m²/yr

Air tightness: 0.39 ACH at 50Pa

Total primary energy demand: 80 kWh/m²/yr

Solar system: 8.9 kW, grid tie

Envelope:

R59 above grade walls & R77 roof

R41 below grade walls & slab, R7 windows

Cost: \$845,000 (*), \$440 / AG ft², \$304/ Dev ft²

Cambridge Passive House



Under Passive House Certification review.

Inner City, Calgary, Alberta

Passive House Classic? Low Energy?

New build, 2018

Total Developed Area: 2,408 ft²

Heating Demand: 27? kWh/m²/yr

Air tightness: 0.39 ACH at 50Pa

Total primary energy demand: 77 kWh/m²/yr

Solar system: Under planning, grid tie

Envelope:

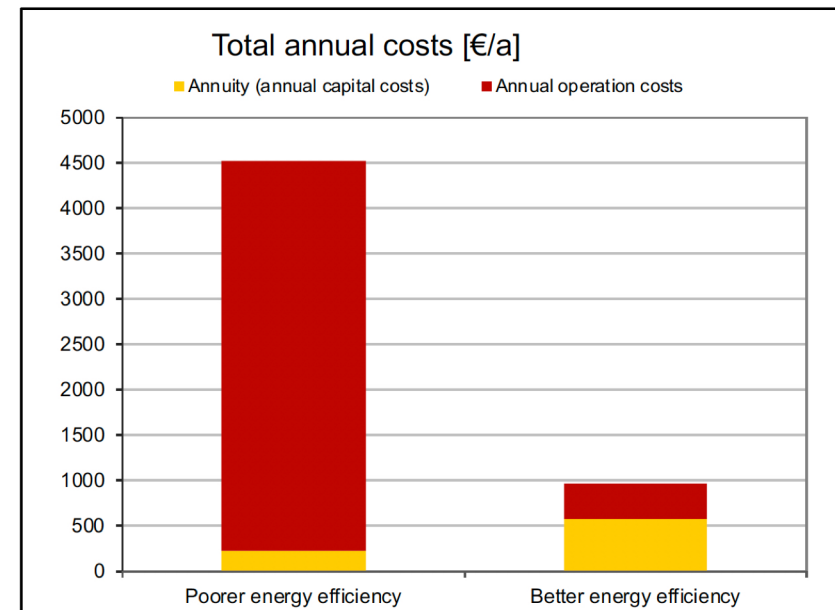
R49 above grade walls & R118/R65 roof

R48 below grade walls & R47 basement slab,

R9 windows

analysis: value

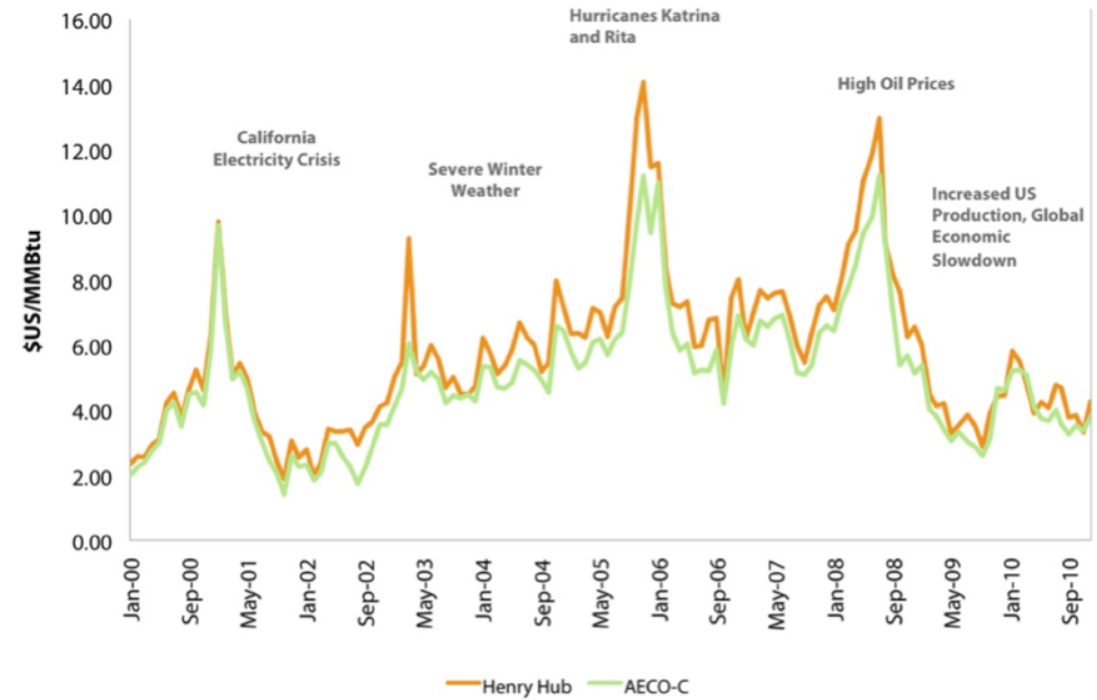
- * Net Present Value and Return On Investment: true measures.
- * Payback: Completely inadequate.
- * Long term cost vs. upfront costs.



energy security?

Natural Gas Prices - Historical Chart

Interactive chart illustrating the history of Henry Hub natural gas prices. The prices shown are in U.S. dollars. The current price of natural gas as of November 09, 2021 is **\$5.08**.



GLJ Energy Consultants & NEB, 2011

analysis: monthly expenses

- Montgomery Passive House: Monthly energy savings of **\$210.00** per month.
- Net Zero Passive House Duplex, Balmoral, Calgary: client in one reports his monthly expenses are the same as it was in his previous, much smaller, far less comfortable rental.
- Richmond Passive House: 1st Certified Passive House in AB: Clients report that the increase in their mortgage is not even noticeable: The comfort benefits alone are worth it.

| Mortgage Value | Monthly Payment (3% interest, 25 year term) | Monthly Increase for 5% Larger Mortgage | Monthly Increase for 10% Larger Mortgage | Monthly Increase for 15% Larger Mortgage |
|----------------|---|---|--|--|
| \$300,000 | \$1,420 | \$70 | \$140 | \$210 |
| \$400,000 | \$1,890 | \$100 | \$190 | \$290 |
| \$500,000 | \$2,360 | \$120 | \$240 | \$360 |
| \$600,000 | \$2,840 | \$140 | \$280 | \$430 |

Frank Crawford, CPHD, and David Smith, CPHD.
Passive House: Barriers Removed: Lessons from Calgary's First Passive Houses, 2017.

analysis: resale value

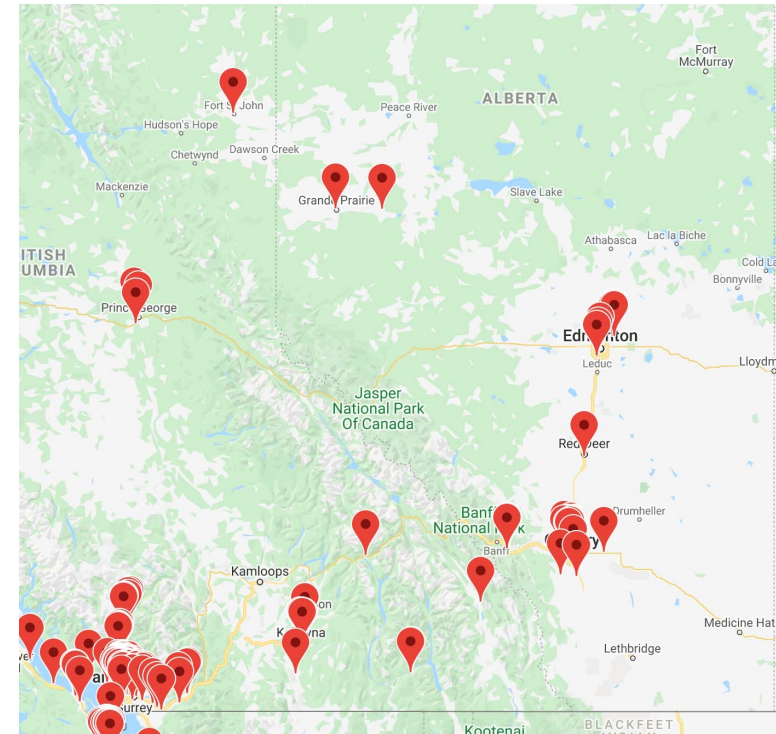
- * Almost zero comparables in AB.
- * Assessment authority of Alberta: \$0.00 value assigned for energy efficiency improvements (although they appear to be moving on this.)
- * In the U.S., high performance homes are seeing a resale value 10% higher than standard houses.



looking ahead:

- Specific supplies and materials becoming less expensive as NAm manufacturers get into the game:
 - 2012: 0 PH rated window manufacturers in Canada.
 - 2021: at least 5 in BC alone, more in ON, MB.
 - 1st PH Cold Climate certified curtain wall system: GlasWall of Calgary.

- Local contractor and consultant pool expanding:



passivehouse.com/en/training/data/designers/map/

looking ahead:

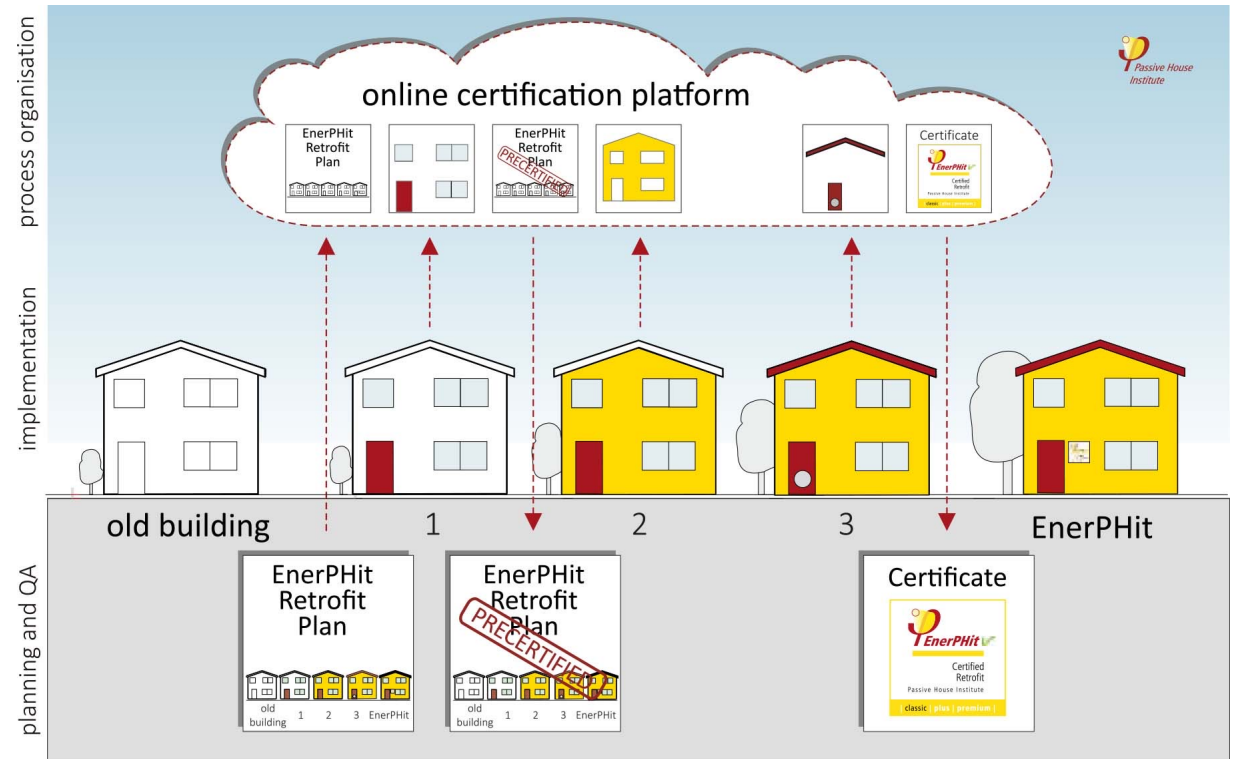
- More Passive Houses are being built all the time:

Passive House Database Canada [Advanced Search](#)

| Project ID | Location | Building Type | Construction Type | Year | Area | Units |
|------------|------------------------------|-------------------------------|------------------------------|-----------|---------------------|--------------------------------|
| CA-V8T1A9 | Comox (British Columbia) | detached single family house | Low-energy house | new build | 2019 | 1 unit 206 m ² |
| CA-V5X 1T2 | Vancouver (British Columbia) | apartment house | Passive House new build | 2016 | mixed construction | 95 units 5269 m ² |
| CA-T2M 3C1 | Calgary (Alberta) | detached single family house | Passive House Plus new build | 2016 | timber construction | 1 unit 220 m ² |
| CA-T4N 4E2 | Red Deer (Alberta) | factory industrial building | Passive House new build | 2018 | timber construction | 1 unit 1542 m ² |

OLD HOUSE?

- Is there a reliable inspection report?
- Are utility bill records available?
- What are the comparables?
 - Sale prices, AND utility expenses.
- What is the age of the building?
- Is it worth retrofitting? Older houses are often better...



Schematic representation of the EnerPHit certification process for step-by-step retrofits
© Passive House Institute

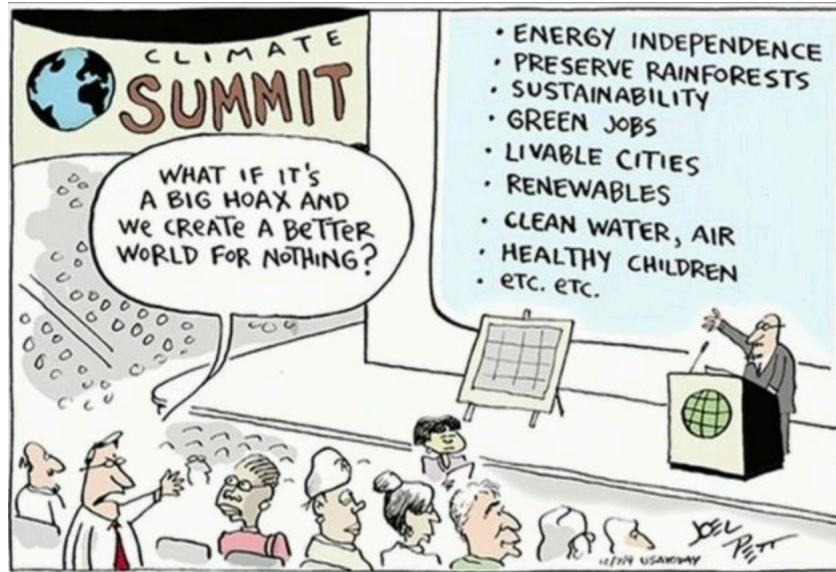
- EnerPHit: the Passive House retrofit standard
- 70% of current buildings: still here in 2050
- About to grow exponentially.

to scale?

- * Ken Soble Tower, Hamilton, ON
- * EnerPHit retrofit
- * 94% reduction in GHG emissions
- * 89% reduction in thermal energy demand intensity (TEDI)



Lastly, thank you!



+ND
Nicol Design
Passive House

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Questions?



AREA and Rise Sustainable Housing Webinar Series

Final webinar in the series:

- [High Performance homes and Comfort](#) – December 15 at 10 AM

