

# Passive House + Net Zero Energy



A match made in heaven!

# What is a Net Zero Energy home?

A home which generates as much energy as it requires in a year

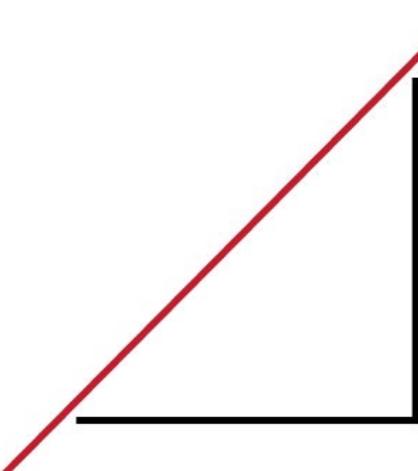
# What is a Passive House?

A home which requires less energy to operate



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CAD draftsman  
Estimator  
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COLLECTIVE  
CARPENTRY

high performance building + off-site construction

# Collective Carpentry: a High Performance Builder

- Custom homes & renovations
- Pre designed homes
- Building envelope supply and install
- Durable building, quality living.
- Our buildings are 'locked in'



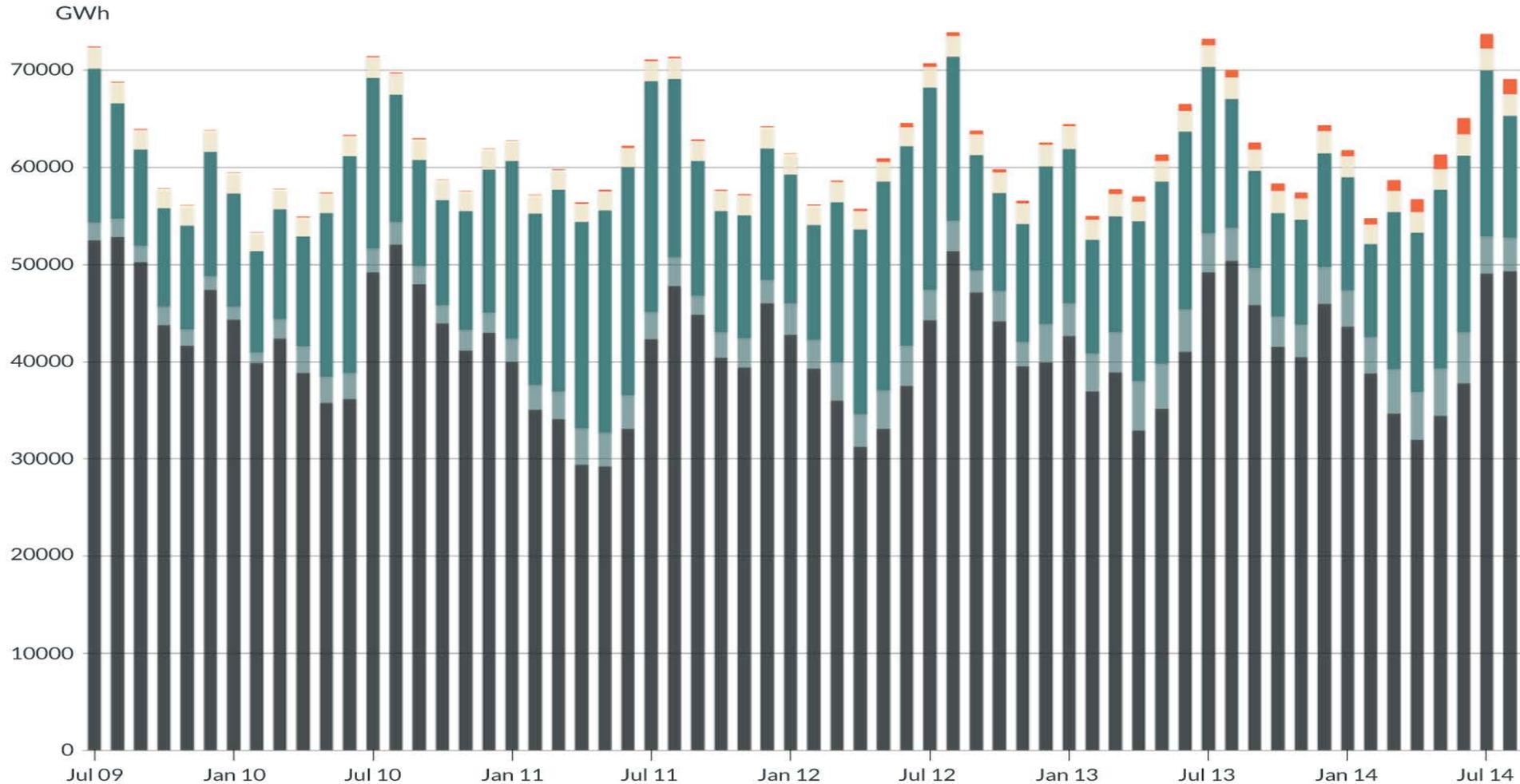
**Ultimate goal:** Be a part of the climate solution by building high performance homes and buildings which last for generations : Make them beautiful and relevant so they will be cared for.

# Why Net Zero now?

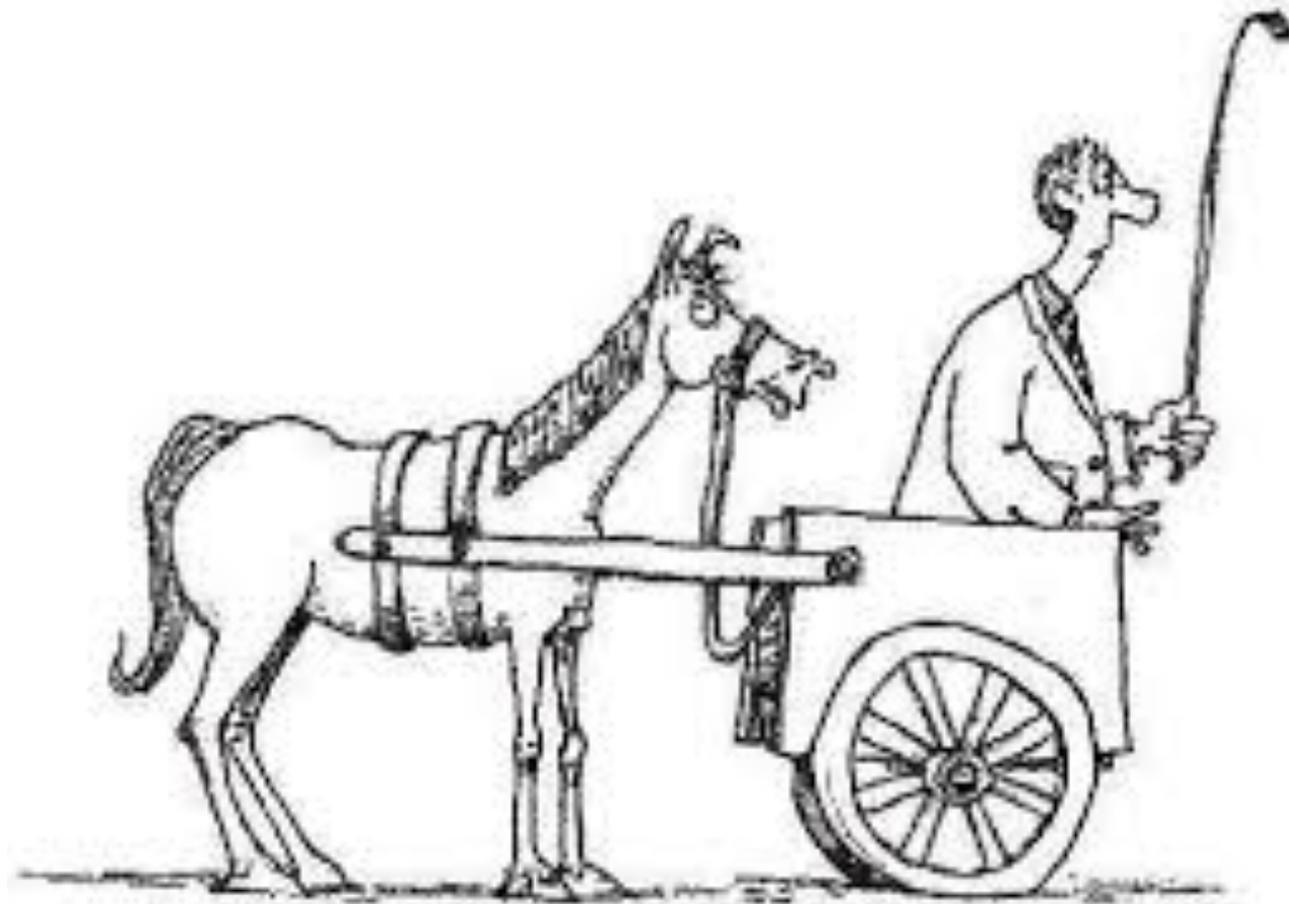
- We must reduce our reliance on fossil fuels
- Prices are dropping, it's more attainable
- Sell power back to the grid, buy your capital asset instead of renting power.
  - Go from tenant to landlord!
- Contribute to the energy supply
  - reduce the overall load on energy production – primarily coal and nuclear, followed by hydro, then wind, biomass, solar (a teeny bit)

# ELECTRICITY GENERATION BY SOURCE

## GRID: WESTERN INTERCONNECTION (US PORTION)



- SOLAR
- OTHER RENEWABLE
- HYDRO
- WIND
- FOSSIL FUELS & NUCLEAR



When you're trying to get to Net Zero energy use in a new home , don't put the cart before the horse!

**Net Zero Energy** building (the cart) offers an energy use/energy generation balance.

But there's no guarantee for:

- Comfort
- Air quality
- Occupant health
- Durability
- Reducing energy demand

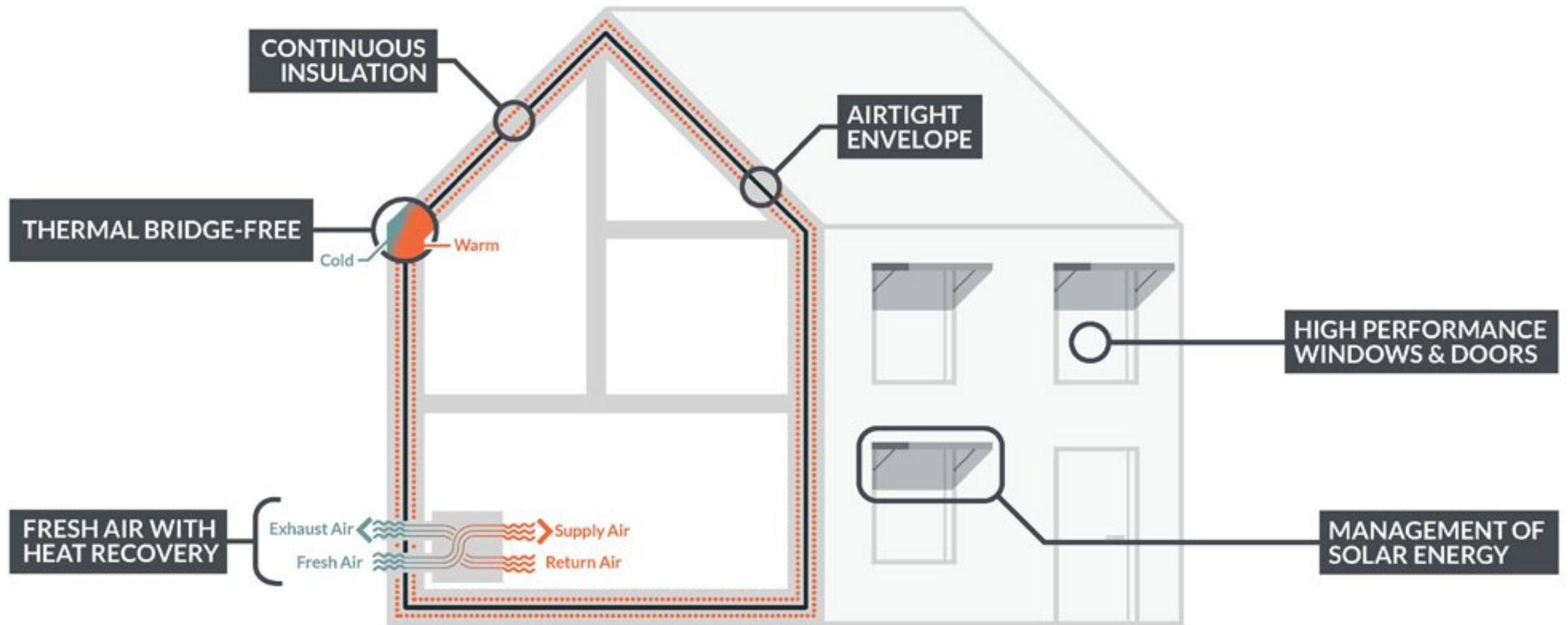
A clear objective but no instructions, and only one piece of the sustainability puzzle

..... **Enter Passive House!**

# So what's another piece of the sustainability puzzle?

## The horse, of course!

- Building to last
- Making our buildings adaptable/flexible
  - Open building techniques
- Beautiful buildings are better cared for and last longer
- Choosing lower impact materials
  - Insulation, wood, er...foam?
- Building them in a way that optimizes material, wastes less, and designs the building as a whole system.



# PASSIVE HOUSE PRINCIPLES

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# Passive House process



- Specific: Certified (or Certifiable) Passive House
- Measureable: .6 ACH 50 pascals / 15kw/h/m<sup>2</sup> (10w/m<sup>2</sup> peak demand) from heating/cooling
- Attainable: 30000 passive houses in the world, affordable cost of ownership
- Relevant: result is a home with lower energy demand
- Time bound: due to economics, desire to move in someday

**REDUCES DEMAND AND MAKES NET ZERO MORE ATTAINABLE**

# Passive House Outcome

- Comfort: consistent ambient temperatures, draft free
- Durability: stronger, better insulated, air & weather tight, vapour open.
- Occupant health: mechanically delivered, filtered, pre warmed, fresh air
- Energy Efficiency: reduced heating and cooling demand.
- Ripple Effect: a local movement to reduce energy use on the heels on a international building revolution
  - Building codes changing,
  - Incentives to build PH
  - Higher Resale value

# Put Passive House first, then achieve Net Zero with smaller PV array

- Average power use/household in BC: 20000 kWh or 55 kWh / day
- Divided by sun hours / day: 6 (cranbrook data)
- Approximate power requirements: 9 kW
- System efficiency factor: .7 (70%)
- Total system requirements:  $9 \text{ kW} / .7 = 13 \text{ kW}$  array
- Cost of \$4.50/watt installed:  $13 \text{ kW} \times \$4.50 = \$58\,500.$
- Average cost of Net Zero for an average home: **\$58 500.**
- BC Hydro average monthly bill: **\$3000.**
- Payback on PV: **20 years.**

Not so bad if you're planning to stay put, or those panels add to resale value, but it can be better.

# Passive House will *help* you cut your energy bills by 60%

- When energy requirements are cut by 60%, the cost of that PV array becomes manageable
- 20000 kWh becomes 8000 kWh or 22 kWh per day
- / 6 hours of sun = 3.66 kW
- 3.66 / .7 efficiency = 5.25 kW array
- @ \$4.50/watt installed = \$23 570.

# Passive House and Net Zero have a symbiotic relationship

Passive House results in:

- Accurate performance modelling ; providing accurate energy demand
- Smarter, simpler, integrated design
- Moderate sizes and levels of complexity
- Making Net Zero more attainable!
  - Smaller PV arrays : buy the PV set up you need

# Passive House may not provide all the answers but it asks all the right questions...

- Heat losses
- U values of materials
- Window and door calculations
- Shading
- Ventilation
- Heating and cooling demand
- Heating load
- Cooling load
- Domestic Hot Water
- +++

# When it doesn't have the answer: Limitations

- Poor siting
- Existing house
- poor solar exposure
- Workforce is resistant to change
- Can sometimes lead to poor judgement : chasing certification at the cost of usefulness, curb appeal
- Law of diminishing returns

# How to build a Passive House

- Awareness: Building and Owner – Budget, goals, costs
- Consulting: PHPP (Passive House Planning Package)
- Design: Siting, orientation,... back to consulting
- **Building:** Choosing and working *with* a builder
- Mechanical systems: HRV, DHW, heating (and cooling)
- Finishing: Keep it simple, save some money
- Living in a PH/Net Zero House: It's up to you to keep energy use down.

So how do we build these things?



( Building continued )

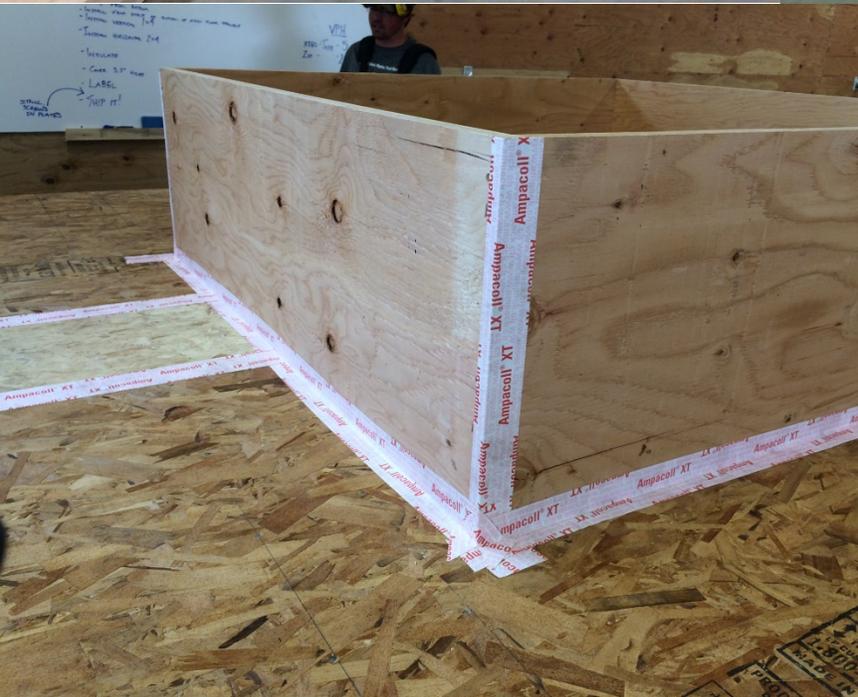
## New Materials/Methods:

- Tapes, membranes, gaskets
- Thicker walls
- More insulation
- Air tightness
- Better windows and doors
- How to install them
- Educate/monitor the trades
- Planning and clear communication reduces site issues





How we work



# Panelized construction



# Installation in 2.5 days





Air Tight



Ready for trades

# Barriers to High Performance building:

- Mortgage Values/Appraisals - Lower appraised values
- Learning curve for clients, builders, inspectors
- Builder backlash / apathy / fear
- Lack of awareness of actual costs
- Small Market, increasing competition (opportunity?)
  - Green washing.
- Struggling market
- Energy costs are increasing however...now's the time to overcome these barriers.

# Why Pre-designed Plans?

- Attainable
- Affordable-economies of scale through all stages of production: integrated design, to installation
- Can offer design flexibility with 3D library
  - Standardized thermal envelope with custom architectural options.



# Builders...

- We have a responsibility to use our skills and brains to build better homes.
- We have a unique opportunity to identify our work with a standard and an outcome that is accurate, tested, and gaining momentum.
- Be at the forefront of building science and lead by example
- Don't wait for the code to change.
  - Gain that competitive advantage by starting now.
- There's lots of help out there.

# Prospective Home Buyers, renovators, retrofitters...

- Sustainability is about more than just power balance.
- Building, or renovating, for durability, air quality, comfort & performance will pay back every day and every month in intangible ways like sense of security and quality of life, but also in your overall monthly cost of ownership.
- Passive House is proven to cost less and the trip to Net Zero Energy will also cost less (to acquire, maintain, operate, repair and (ultimately) reinstall).

Thank you!