

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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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'



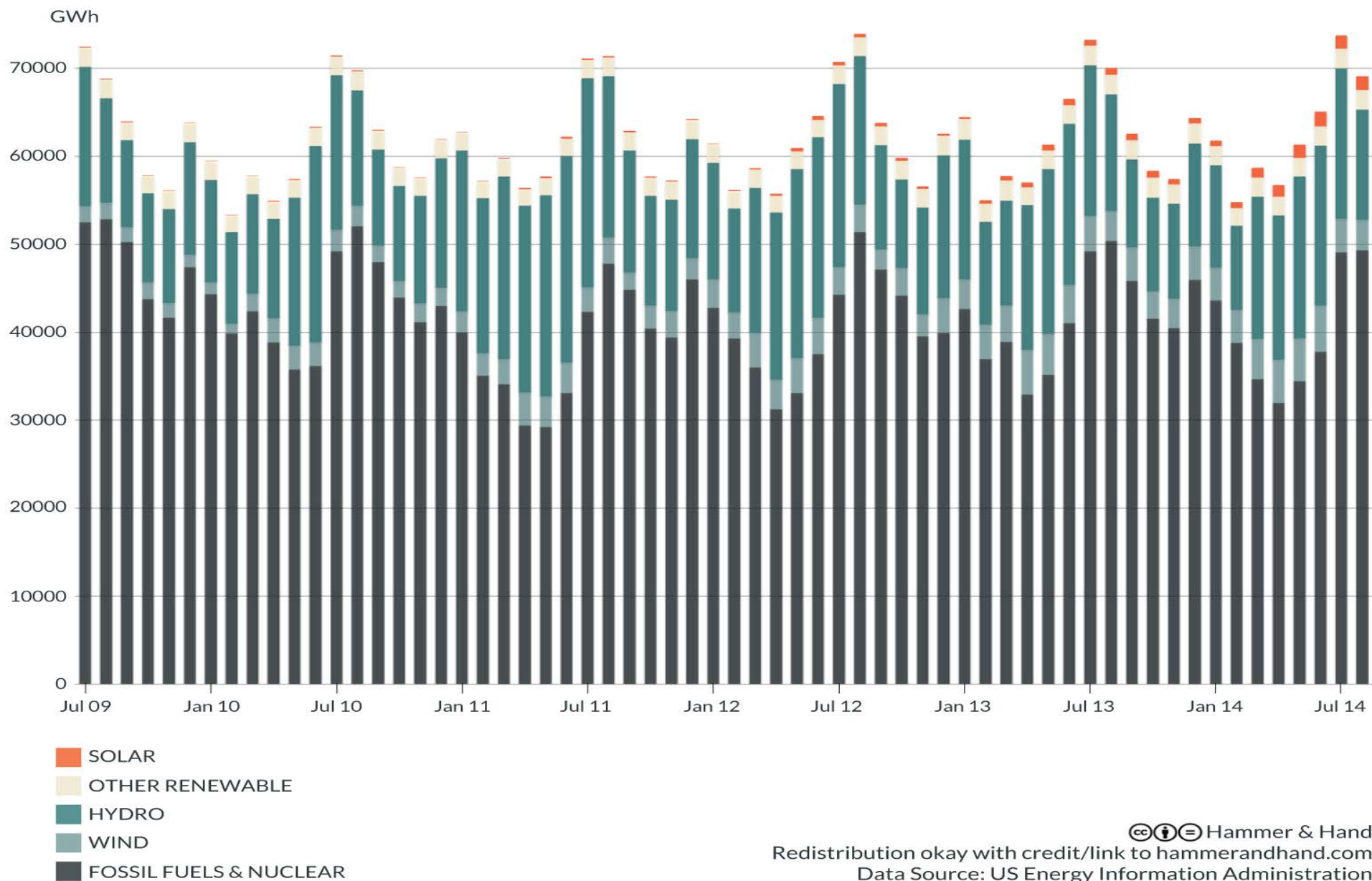
Ultimate goal: Be a part of the climate solution by building high performance homes and buildings which last for generations : Make them beautiful and relevant so they will be cared for.

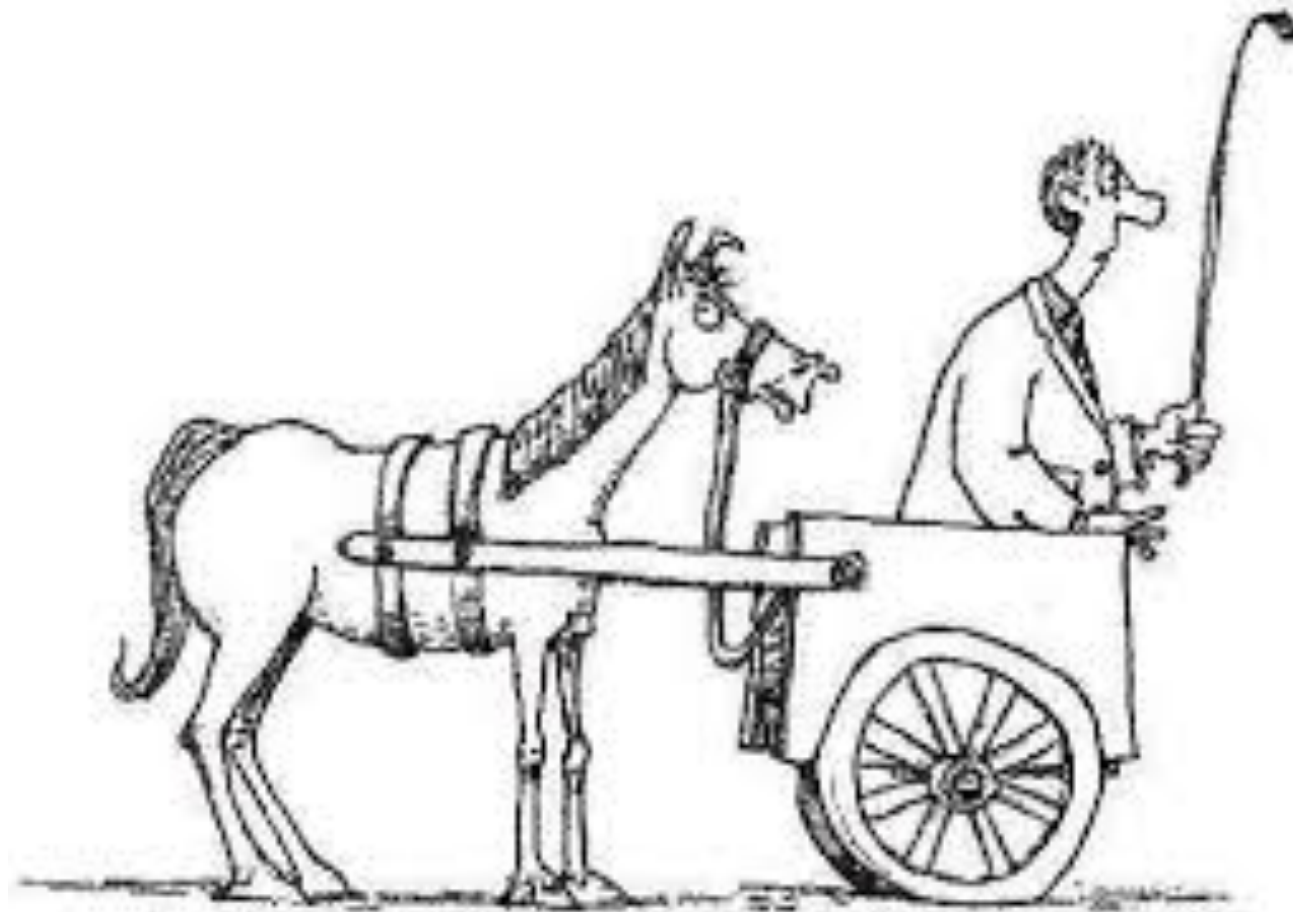
Why Net Zero now?

- 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)





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

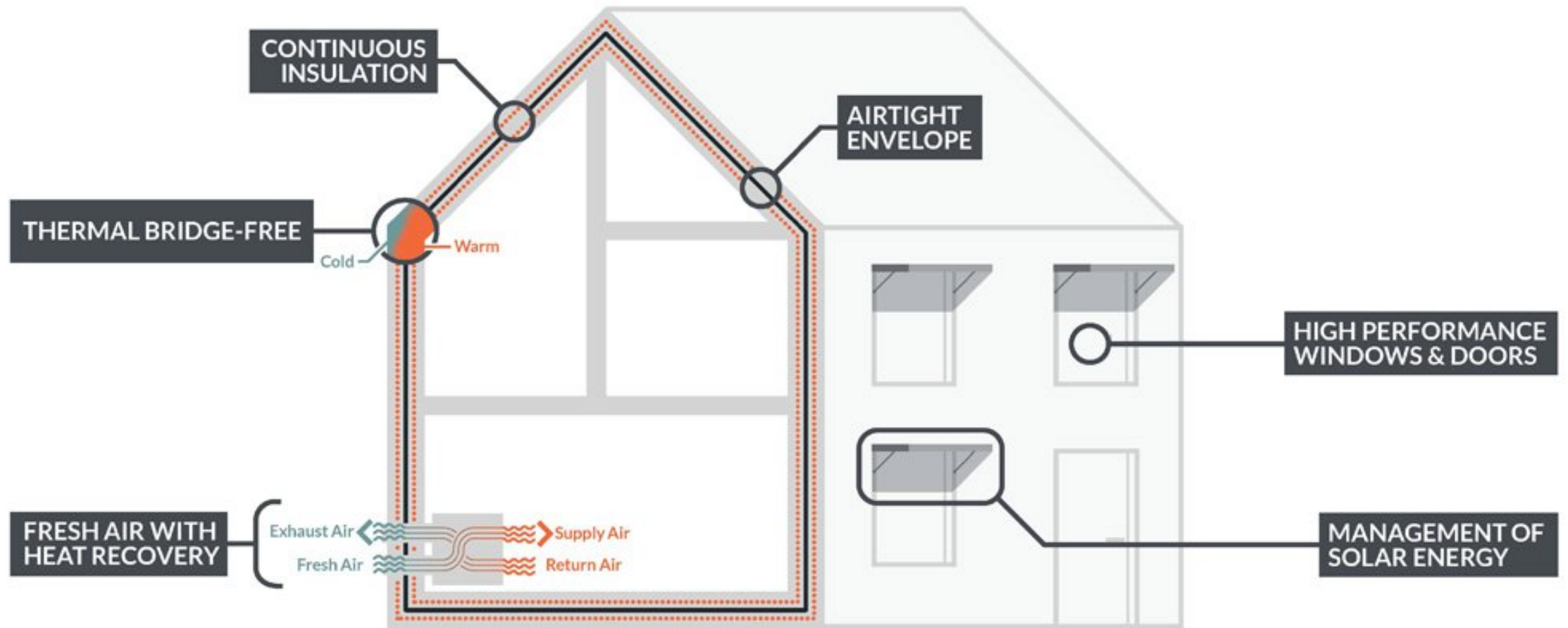
A clear objective but no instructions, and only one piece of the sustainability puzzle

..... **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/m² (10w/m² 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 of an 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
- $3.66 / .7 \text{ efficiency} = 5.25 \text{ kW array}$
- @ \$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)

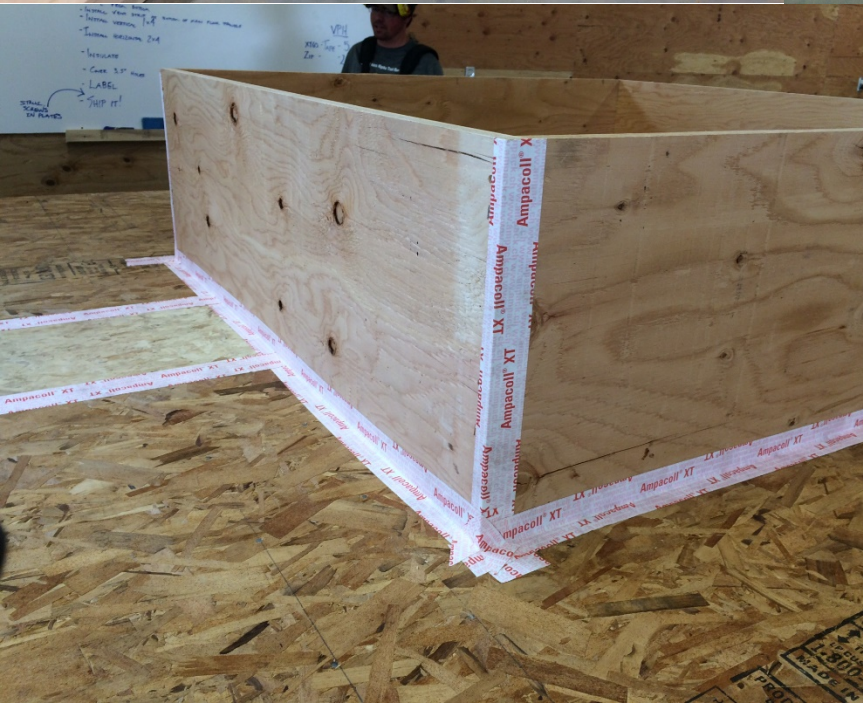
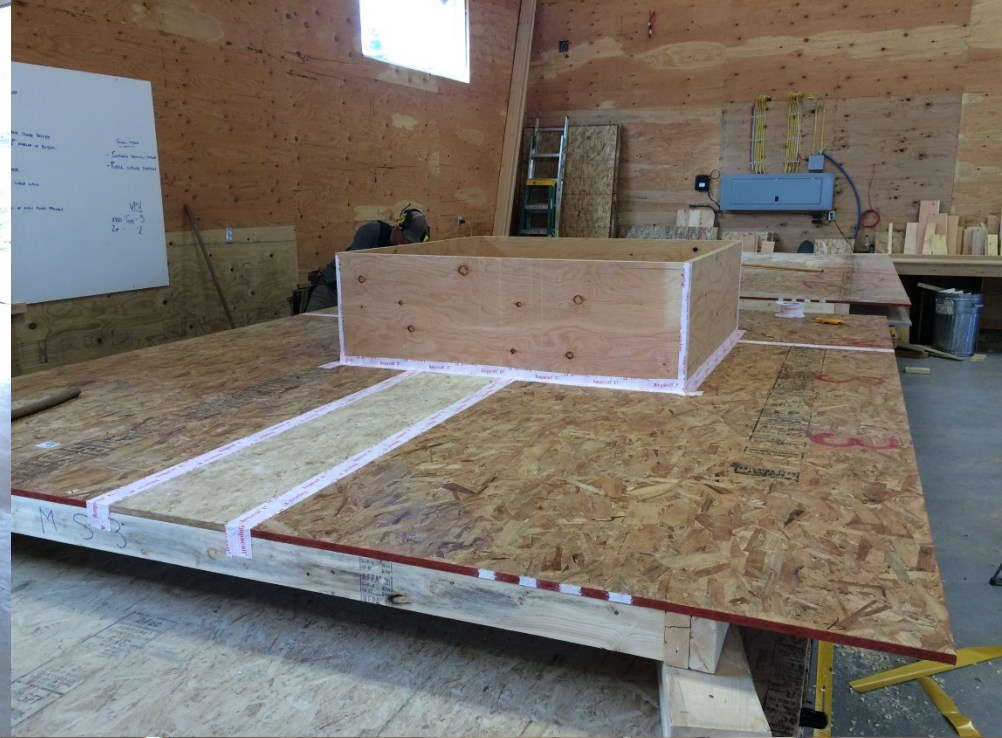
New Materials/Methods:

- 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





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!