zebx DecarbLunch Series

Powered by ZEIC

Advancing the BC Step Code in the East Kootenays

Thu Nov 13, 2025
12 - 1pm PST
Free Webinar
zebx.org

thINK | design | consult
think comfort - think health - think passive house

~ K-Country Homes ~

CITY OF VANCOUVER

BC Hydro

Affordable All-Electric Homes

Climate Zone 6, Design Temperature –26C

Bruce Murdoch, K-Country Homes presentation
November, 2025

I'll admit, I was hesitant at first.

I'm now convinced.
Many of the common concerns are steeped in misinformation.

Our climate is too cold	Equipment is too expensive	Electrification is too expensive	Electricity is more expensive than gas	Can't find a heat pump contractor
Supply chain issues, tariffs	Need a 400 amp service	BC can't produce enough electricity	Steep learning curve	What happens when the power goes out?

1. First, let's talk **heat pumps**

   Do they provide sufficient heating in the East Kootenay climate zone?

Innovation is heating up.

At Samsung, we never settle and neither should you. With high heating capacity at -22°F (-30°C), the new Max Heat® has been upgraded to perform more amazingly than ever before.

The Latest for Cold Climates-- -35C

- Heats down to –40C and at full capacity down to –35C.
- Major manufacturer Midea.

2. What about **supplementary heat** sources?

- Needed for the 2% of extreme low temperature events
- Baseboards or other devices
- Heat pumps continue to provide heat so full back up is not needed.
- I usually use the Amaze convection wall heaters.
- Overdesign is an option, not advisable as it is costs more upfront and is more expensive to operate.

3. Is it **affordable**?

Does all-electric cost more?

4. **Gas furnace + AC** vs. **Heat Pump**

01

The next slide is a comparison of the two systems. These are actual recent quotes from the same HVAC contractor for similar homes.

02

Because the latest Building Code requires at least one air conditioned room, we compare ducted gas furnace + AC vs ductless mini-split heat pump.

03

EL-4 is cheaper upfront than the gas option. The key is that the heat pump option does not require expensive ductwork.

Heating & Ventilation Quotation Comparisons

Of Note: *AC is required by Building Code for one room at 26C max.*

HVAC Price with Gas Furnace, AC and no Hot Water Tank

We hereby submit specifications and estimates for: _____

To Supply & Install the Following:

1-90,000 BTU Lennox ML196 High-Efficient Furnace c/w constant torque Blower (96%)
1-#40 Bradford-White High-Efficient power vented Hot water Heater
1-150 CFM Lennox Heat Recovery Ventilator
1-3-ton Lennox EL17XP 17 Seer Heat Pump
-All ductwork c/w registers & grills
-All gas piping to above appliance's
-All venting of kitchen & bathroom fans
-All refrigeration work
-All CPVC side wall venting
-Gas Permit

For Our Price of $27,844.00 Plus GST

HVAC Price with Heat Pumps and Electric Hot Water Tank

We hereby submit specifications and estimates for: _____

To Supply & Install the Following:

1-95 CFM HRV (Suite) c/w push button timer
1-150 CFM HRV (Main House) c/w push button timer
1-Single Zone Samsung 12,000 BTU Max Heat Pump (Suite)
1-2-Zone Samsung Max Heat Pump (1-9,000 BTU-Bedroom, 1-18,000 BTU Living Space)
-All refrigeration work
-All piping, hoods, grills
1–80-gallon Electric Hot Water Heater

For Our Price of $22,866.00 Plus GST

4. How Does The **Cost** of the Equipment Compare to Alternatives?

Gas Furnace + AC Ducted	Ductless Heat Pump	Ducted Heat Pump
$28,000	**$23,000**	**$32,000**

EL-4 is cheaper than EL-2 or EL-3 because only one fuel source is used in EL-4. Less equipment, less installation labour, less cost.

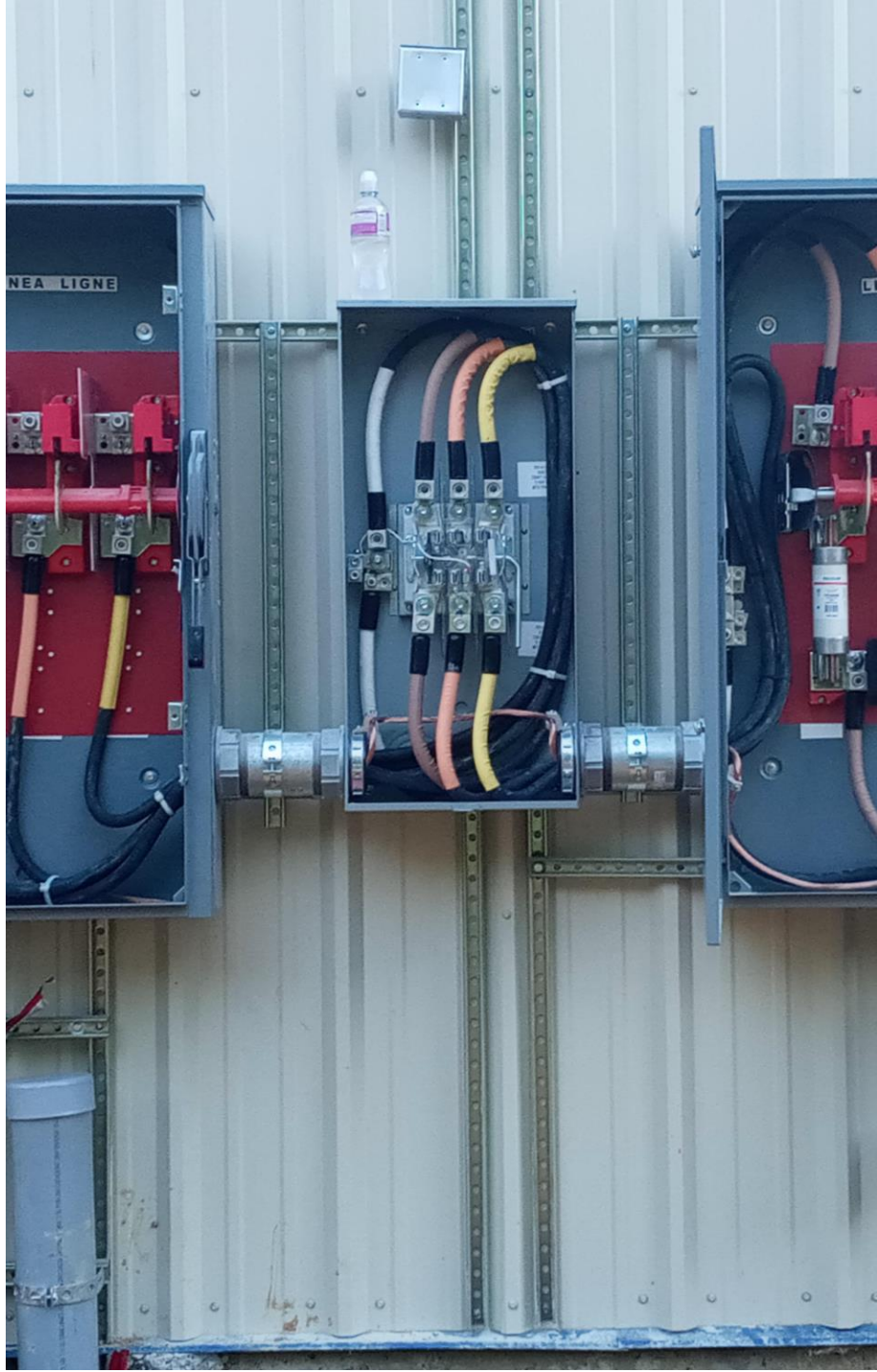
Heat pump hot water tank

- Add $500-700 over gas hot water tank
- Operating cost $100-150/yr (saving of $300-400/year)

  Alternative is electric hot water tank. Saves about $1200 over gas hot water tank. Higher operating costs.

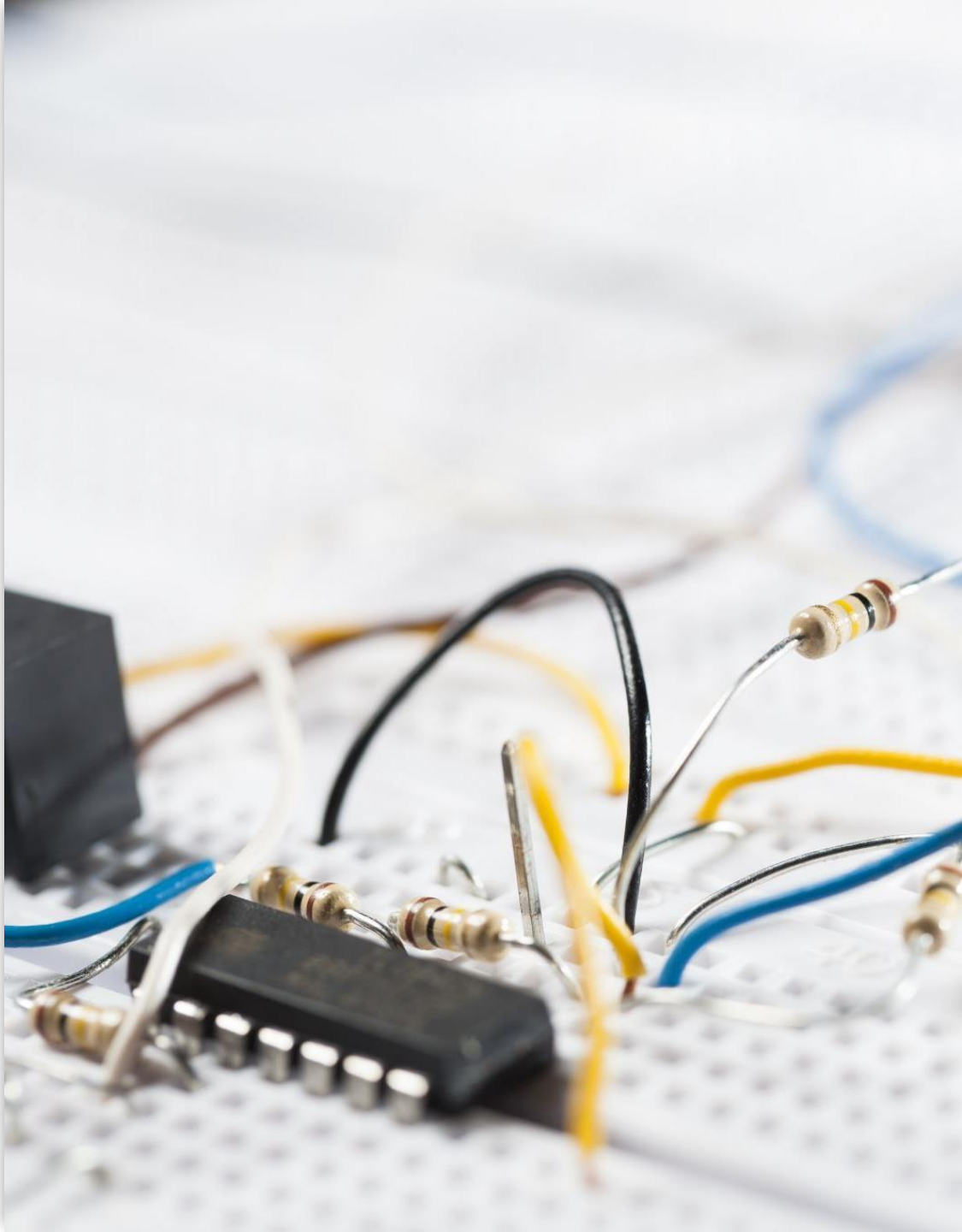
5. Do you need a **larger service**?

Is a 400-amp panel necessary for fully electric?



Electrical loads are remarkably small

- A 200-amp service is ample. With load management systems, all electric can be achieved with a 100-amp service.
- Next slide shows an actual load calculation for an existing house switching to all-electric. The loads with modern heating devices are small. In this case, 127 amps for the whole house.



Canadian Electrical Code (CEC) Rule 8-200(2)

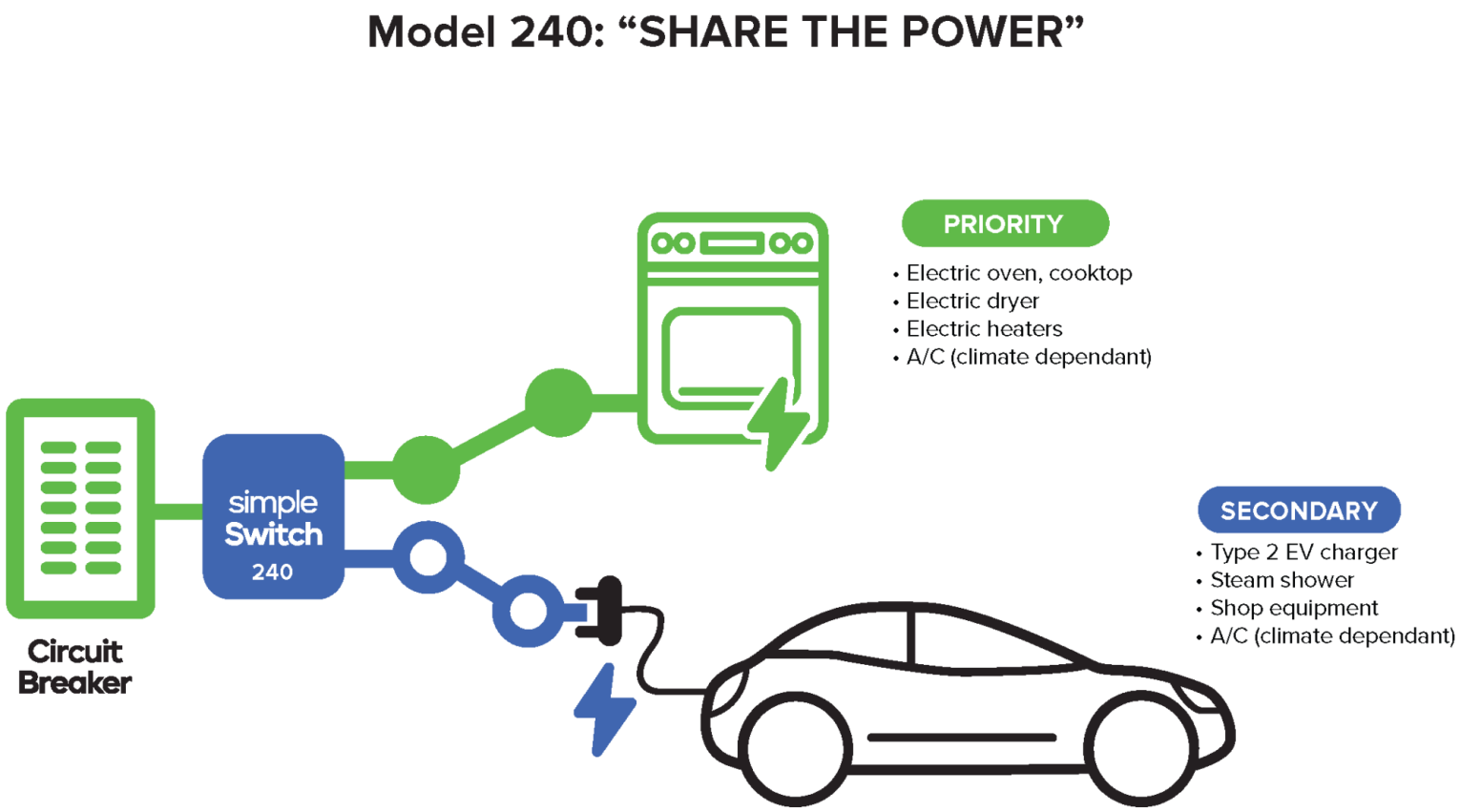
Single Family Dwelling Address (SFD):

Secondary Suite Address (SS):	**Laneway/Backyard Suite Address (LWH):**

CEC Rule 8-200(2) Minimum ampacity of service feeder conductors from a main supplying two or more dwelling units.	SFD m²	SS m²	LWH m²	*Area in m² (1 square meter = 10.764 square feet)
(1)(a)(i) a basic load of 5000 W for the first 90 m² of living area (see Rule 8-110); plus	5000			
(1)(a)(ii) an additional 1000 Wfor each 90 m² or portion thereof in excess of 90 m²; plus	1000		2000	*Contractor to provide accurate m² as calculated per info from Building or Development permit, for the purpose of CEC Rule 8-110.
(1)(a)(iii) any electric space-heating loads (Section 62); plus	5000		5000	
(1)(a)(iii) any AC "Rule 8-106(4)"	7200		6000	
(1)(a)(iv) single electric range: 6000 W + 40%-exceeds 12 kW; plus	7440		0	
(1)(a)(v) electric tankless water heaters or water heaters for steamers, swimming pools, hot tubs, or spas. 100%; plus	3600		hwt heat pump 15a 3600	*To book an inspection when service is ready for the connection, call 311
(1)(a)(vi) electric vehicle charging equipment loads. 100%; plus			Load miser on main conductors	
(1)(a)(vii) additional loads: electric range provided-25% X (>1500 W), or no electric range provided-100% of (>1500 W) up to 6000 W, + 25% X (>6000 W); or	1380 450		washer dryer 15a 450	*The service panelboard and branch circuits from a panel board of SFD or SS or SFD with SS must not be located and connected to outlets or electrical equipment in the Backyard Suite. CEC Rules 26-402(1) 26-724(a).
(1)(b) (i) 100 A, exclusive of basement, is 80 m² or more; or (ii) 60 A, exclusive of basement floor area, is less than 80 m².	1000			
Total calculated demand loads (watts)	15820 30690 W	W	12050 17050 W	
Each Main Breaker, O/C. Type & size of consumer's	127 Cu/Al	Cu/Al	71 Cu/Al	

Load Management Systems

Share circuits for multiple devices



6. Does BC Hydro have enough **capacity**?

- BC Hydro has enough capacity to support electrification efforts in the near term, and will need to increase generation capacity and invest in transmission infrastructure to meet future demand.

- Proposals for projects to increase capacity have been received. Mostly wind.
- Heat pump heating and hot water add remarkably small loads

7. What happens when the **power goes out**?

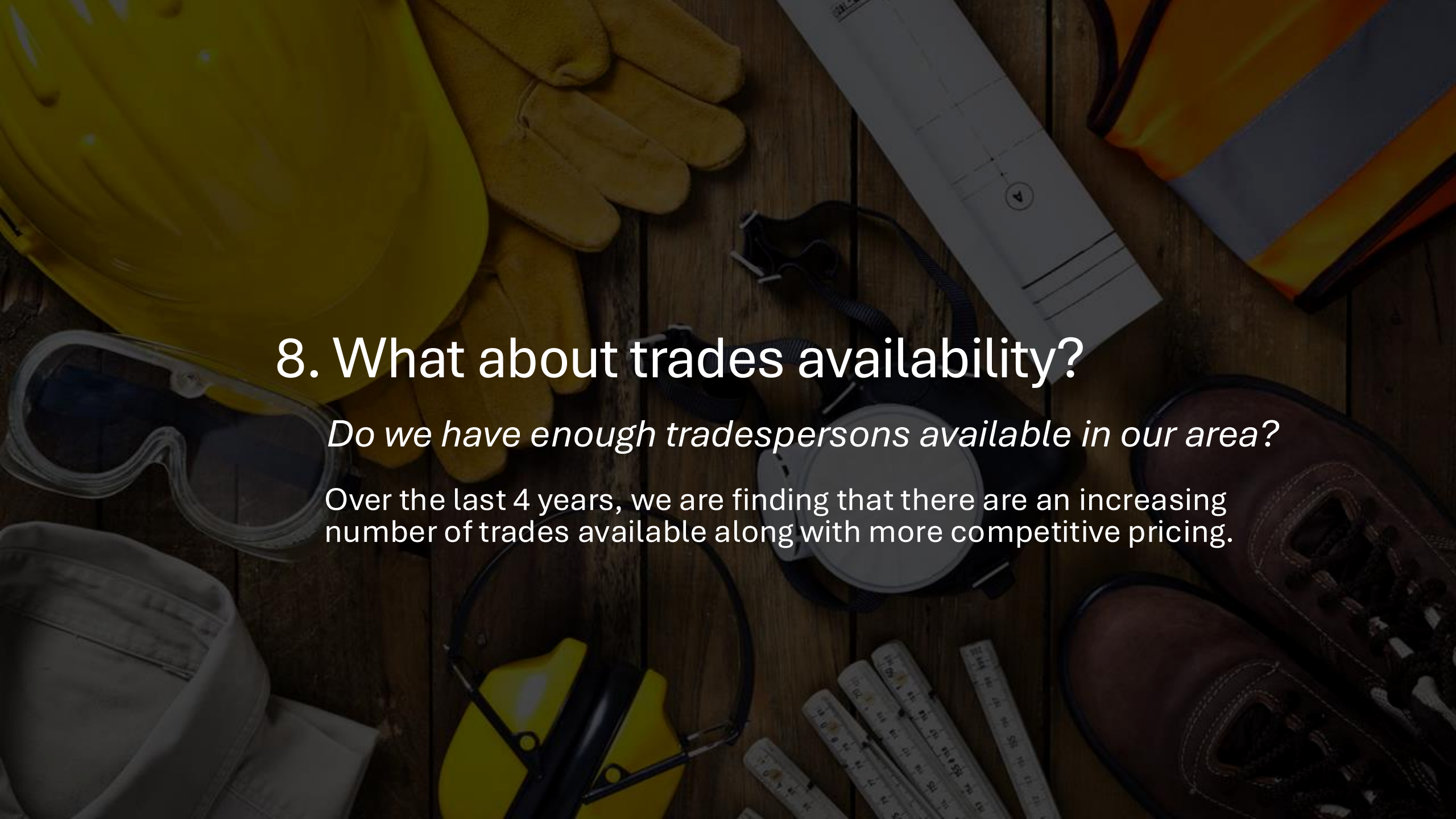
- Gas furnaces and hydronic heating systems require electricity to operate, as does heat pumps. In all cases, heat is lost where there is no back up.

EcoFlow DELTA Pro + Transfer Switch

$3,199.00 CAD

Battery back-up

- Costs of battery back-up systems are coming down quickly.
- Can also be used to cut electricity costs using *Time-of -use* pricing system. Rates are very low at night, and the battery can be used when rates are high. Potential savings up to 40% on power bill.
- Cost start at $3200 up to $12,000+ transfer switch installation.



8. What about trades availability?

Do we have enough tradespersons available in our area?

Over the last 4 years, we are finding that there are an increasing number of trades available along with more competitive pricing.

9. What's the **Learning Curve** to Understand How to Meet the Zero Carbon Step Code?

- Compared to the Energy Step Code, the learning curve for Zero Carbon Step Code is shallow and minimal. 6 months' notice for the building industry is plenty of time to prepare.
- It is simpler to deal with one energy source than two.
- The contractor should have a basic understanding of how heat pumps operate, as their function is like that of air conditioning units, which most are already familiar with.
- Heat pump hot water tanks are not well known. Familiarization would take about an hour.

10. Are there other ways to **lower electricity loads** in any climate but especially in cold climate?

- Heat pump dryer
- Induction Stove
- Drainwater recovery

Heat Pump Clothes Dryer

- $50/year to operate by EnerGuide
- Plugs into 120V 15 amp circuit
- Ventless. Does not exhaust hot air that creates negative pressure and replacement air that needs to be heated again.
- Combo cost $2250

Induction Range

- 2-3X more efficient than gas range.
- 10-15% more efficient than electric resistance
- Extra Cost $400-800
- Savings $15-20/year
- ROI: 2-3%
- Payback: 30-50 years
- Mostly for quick cooking and safety

Drain Water Heat Recovery

- Recovers 50-60% of heat mainly from showers. Cost: $600-700 plus simple install.
- Manufacturers estimate 3-6 year payback, depending on hot water usage.
- ROI 15-30%

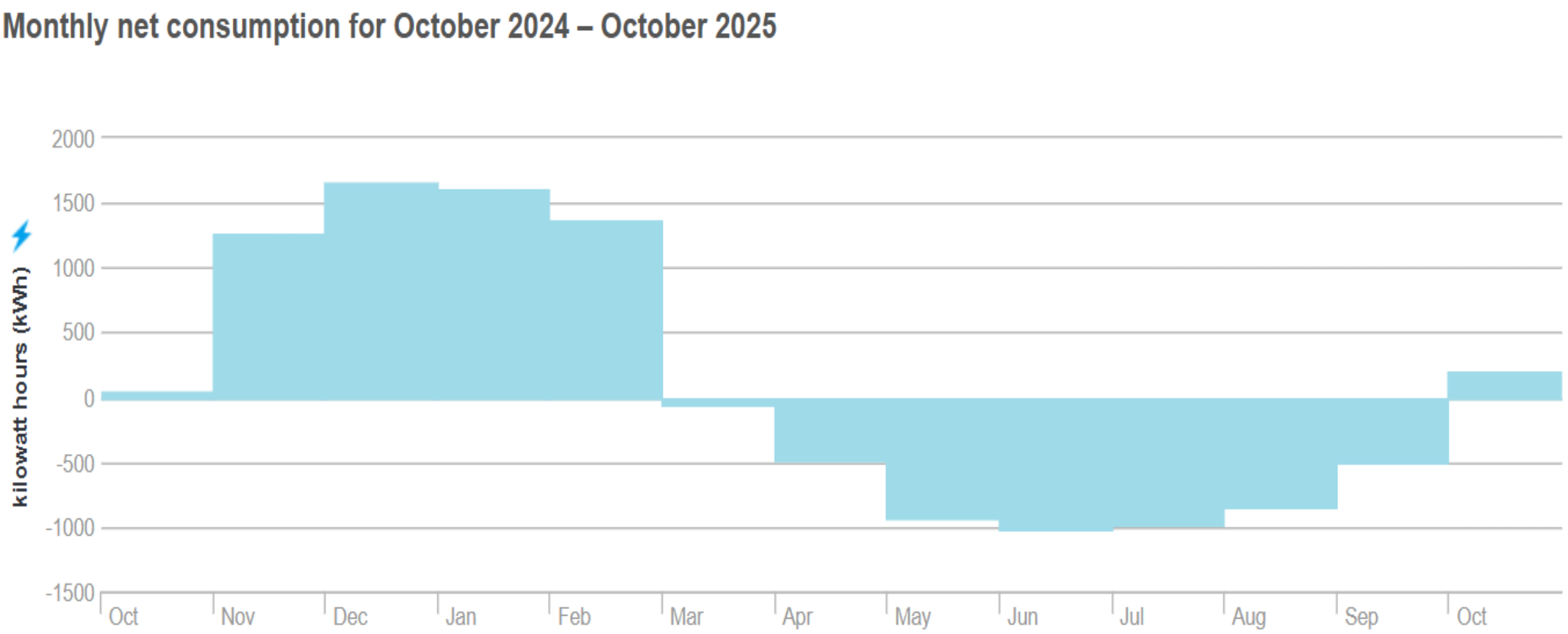
2022 Case Study
Net Zero Home in Cranbrook, BC

Price to build (excl land, dev costs and solar) = $280/sq ft

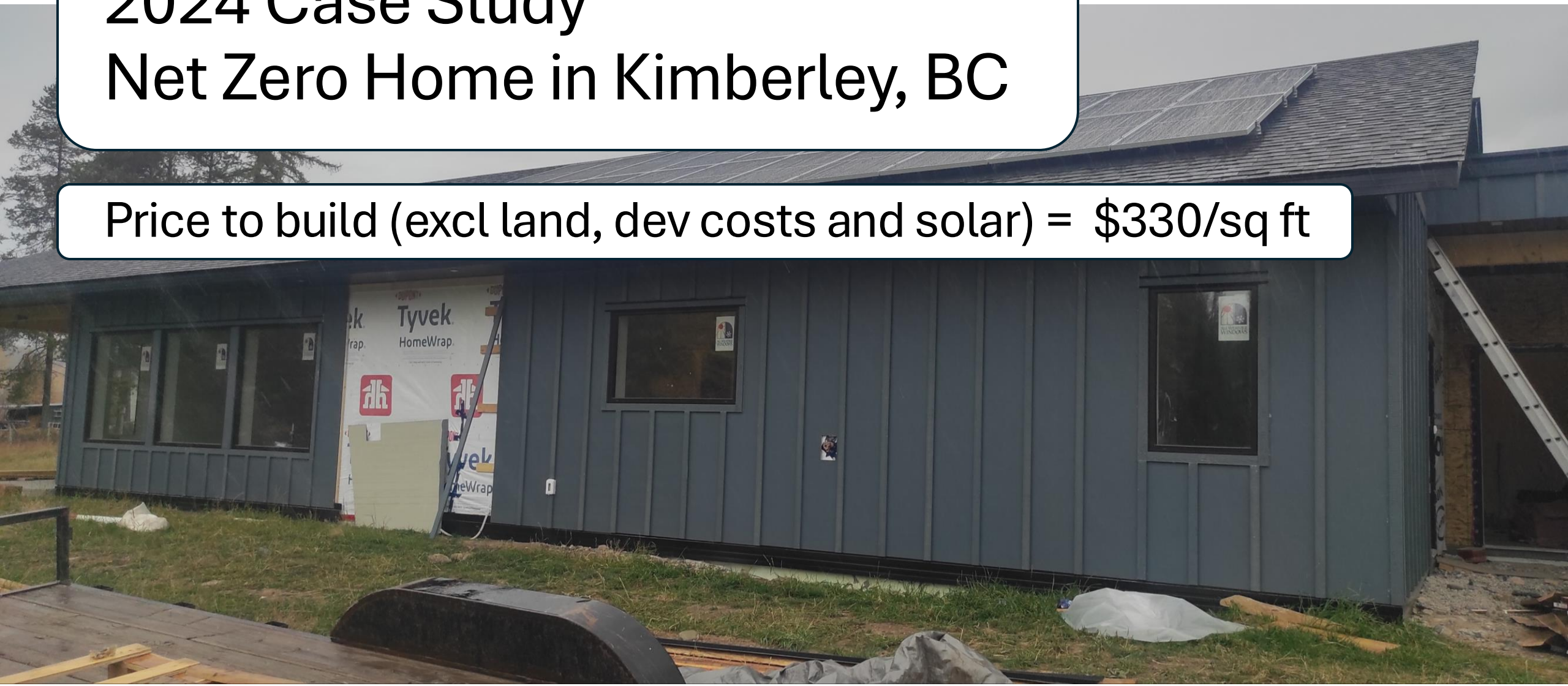
Project Specifications

- 1600 sft plus 800 sft secondary suite
- R-32 EPS wall panels by Greenstone
- R-36 basement wall panels
- Mitsubishi ductless mini splits. 9K BTU/hr basement, 18k BTU/hr upper unit. -26C
- Amaze wall heaters supplementary heat
- Triple glazed windows, eliminate 2 solar panels
- R-13 insulation under floor slab
- R-36 EPS vaulted roof panels by Greenstone
- Rheem heat pump hot water tank.
- 12 kW solar panels

Data from 2022 Net Zero Home



2024 Case Study
Net Zero Home in Kimberley, BC



Price to build (excl land, dev costs and solar) = $330/sq ft

Project Specifications

- R-38 GPS Wall Panels from Greenstone
- Triple glazed windows
- R-15 insulation under floor slab
- R-60 attic
- 18,000BTU/hr Samsung heat pump. Ductless, 2 heads.
- 12 KW solar panels
- Far infrared heating film on 1000 sf of flooring for auxiliary heating. Used for "hours", not "days" for supplementary.
- Rheem heat pump hot water tank.
- 1700 sq ft.

Wall Construction GPS R-38

In conclusion, I was hesitant at first but now **I'm confident** that we in the East Kootenays **are ready to decarbonize our buildings** from a technical and affordability perspective.

Progress on the BC Step Code

Experience from the Rockies:
Advancing the Step Code in the East Kootenays

thINK | design | consult

think comfort - think health - think passive house

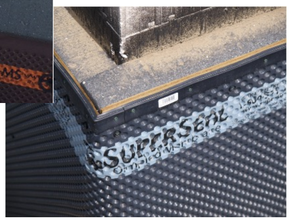
Step 1 to Step 5.6
It’s a journey…















Lessons learned?

Climbing the Steps: Costs

Major cost savings: 3 main strategies

- Utilizing smart design and development processes
- Using building science principles effectively
- Optimizing costs of high performance materials and installations

Goal:

- The most energy efficient home that can reasonably expected to be built, affordably, providing a healthy, comfortable, resilient and durable building.

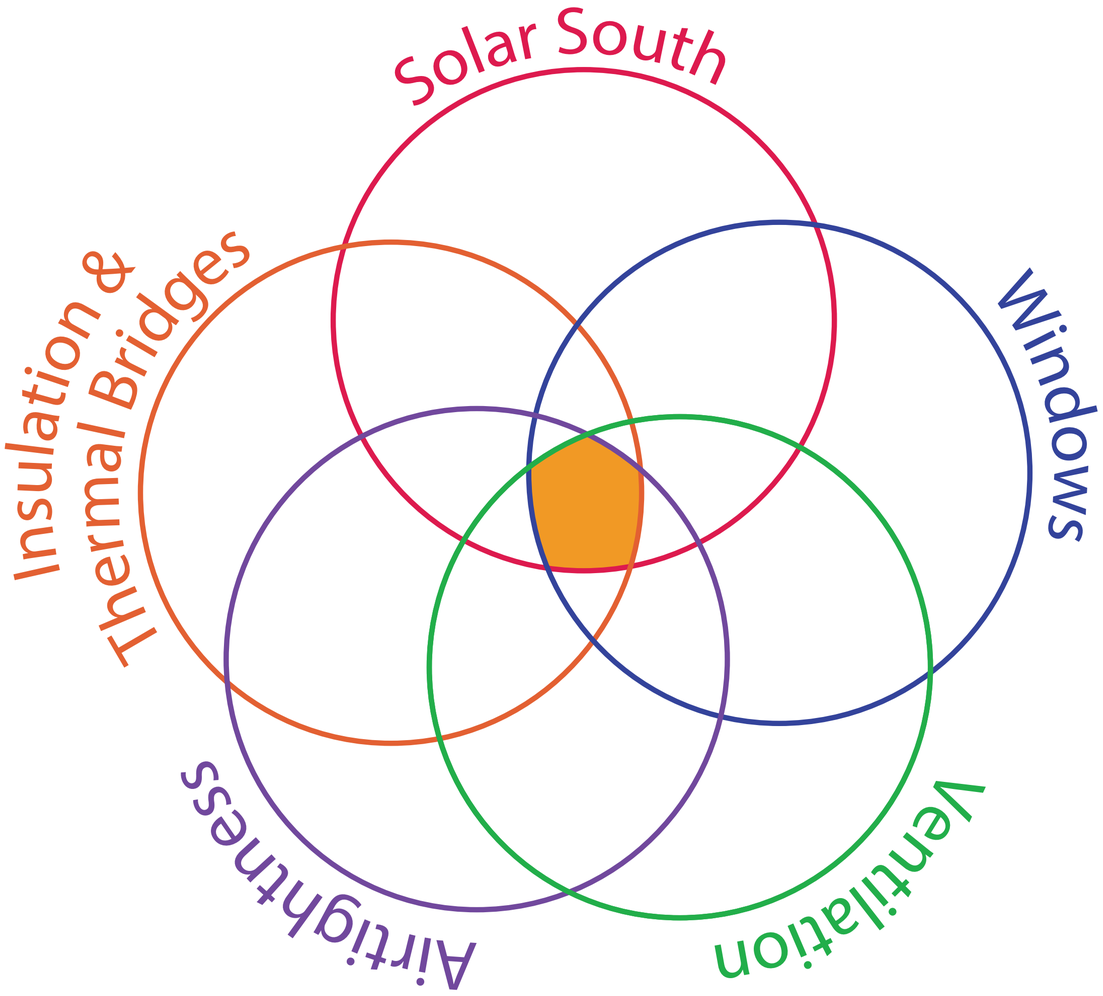
Building as a System

Everything is relative.

Decisions on one component affects the others.

Goal:

- Optimized building
- Optimized costs



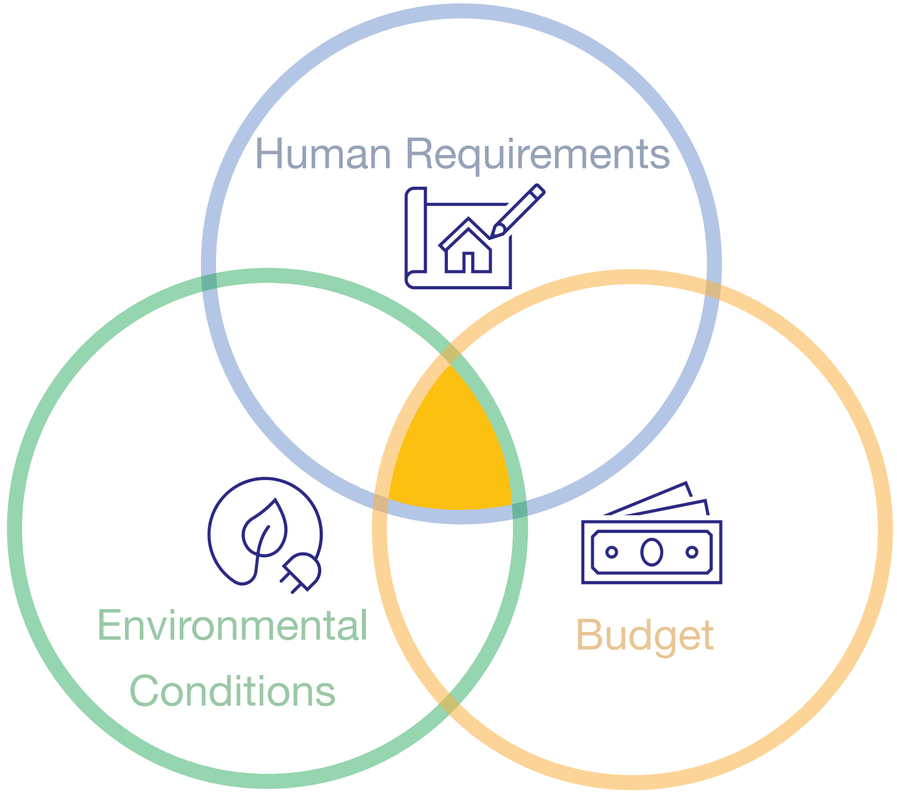
… without breaking the bank.

Which bank? Whose account?

Decisions on one “bank” affects the others.

Goal:

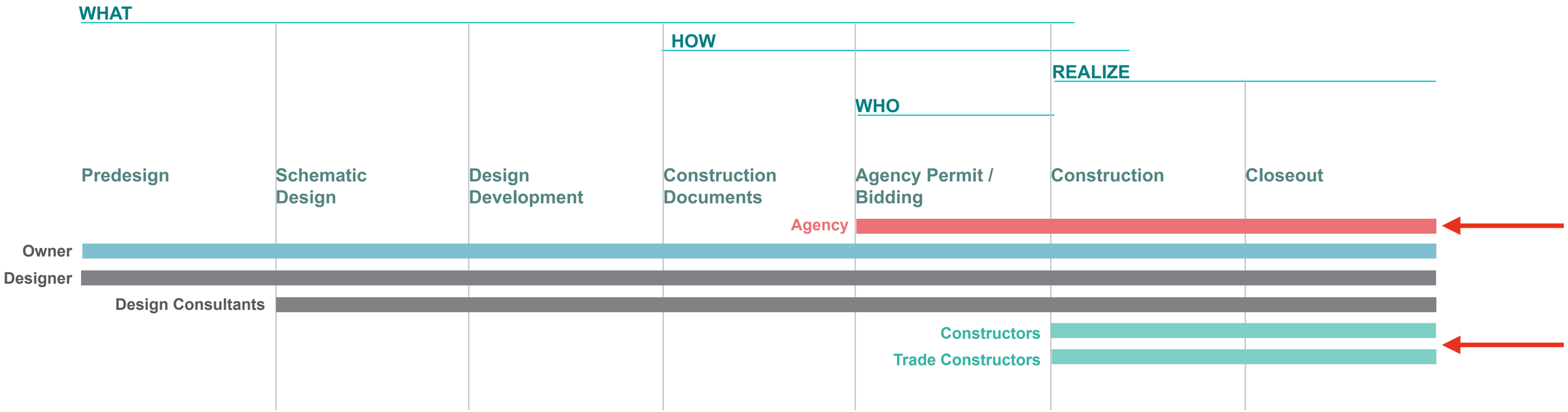
- Optimized building
- Optimized value



Process: Scheduling High Performance

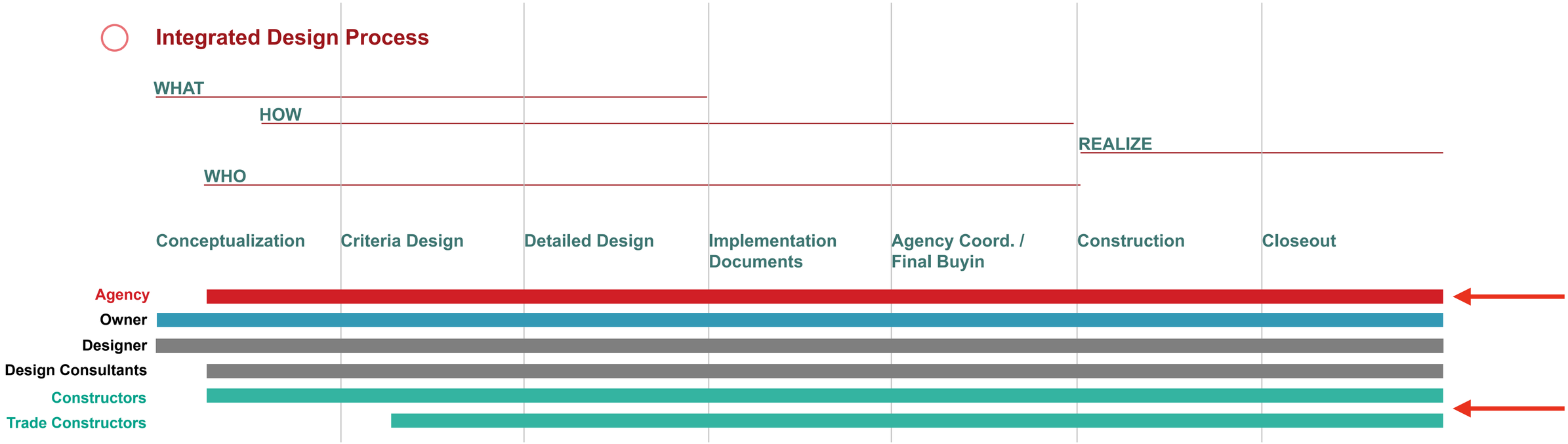
- Design Bid Build

○ **Traditional Design Process**



A Different Timeline for Step Code…

- IPD - Integrated Project Design



Key steps to control costs

IPD: Integrated Project Design makes the difference

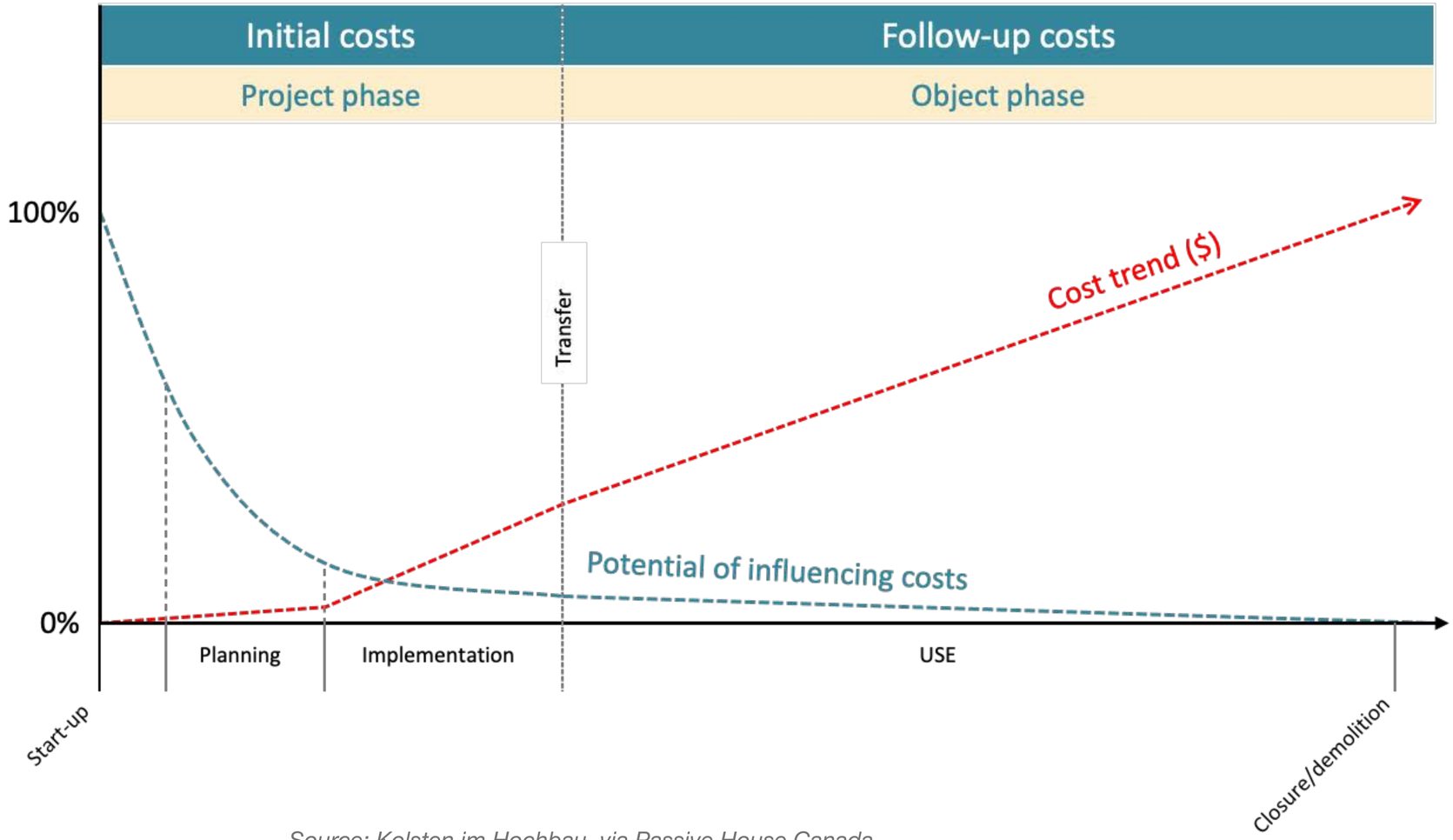
Reduce risk

High performance workflow:

- Plan: everyone gets in on the early planning:
  - Clarifies scope and performance standards
  - Provide input in design: cheaper, faster, better
  - Participants fully understand the job
  - Assign and clarify responsibility as required
  - Opportunities to involve the sub trades
- Clarifies expectations for client, designers, energy consultant, GC
- Clarifies budget

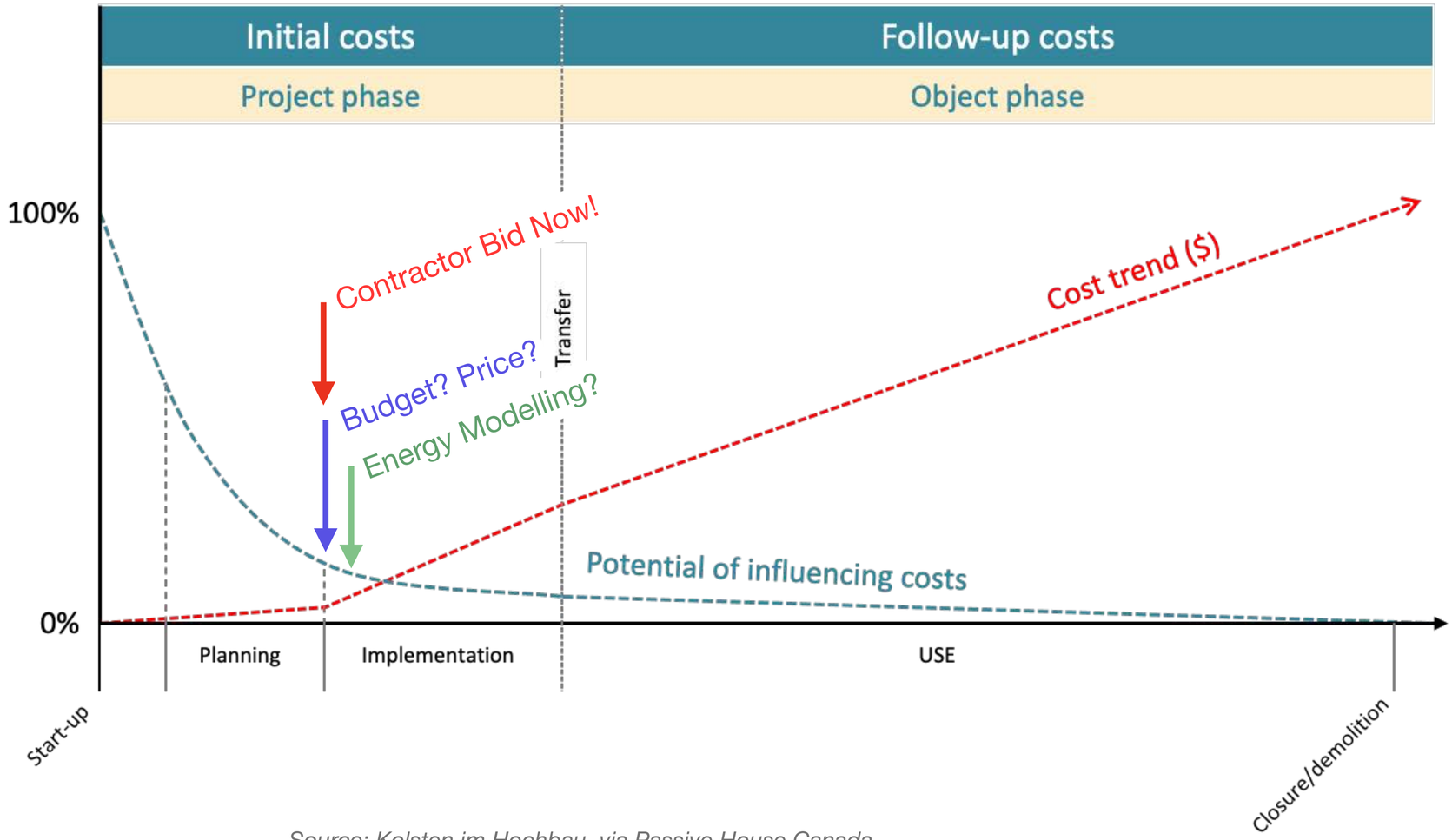
Ability to influence costs

The discipline of the cost curve…



Source: Kolsten im Hochbau, via Passive House Canada

Ability to influence costs



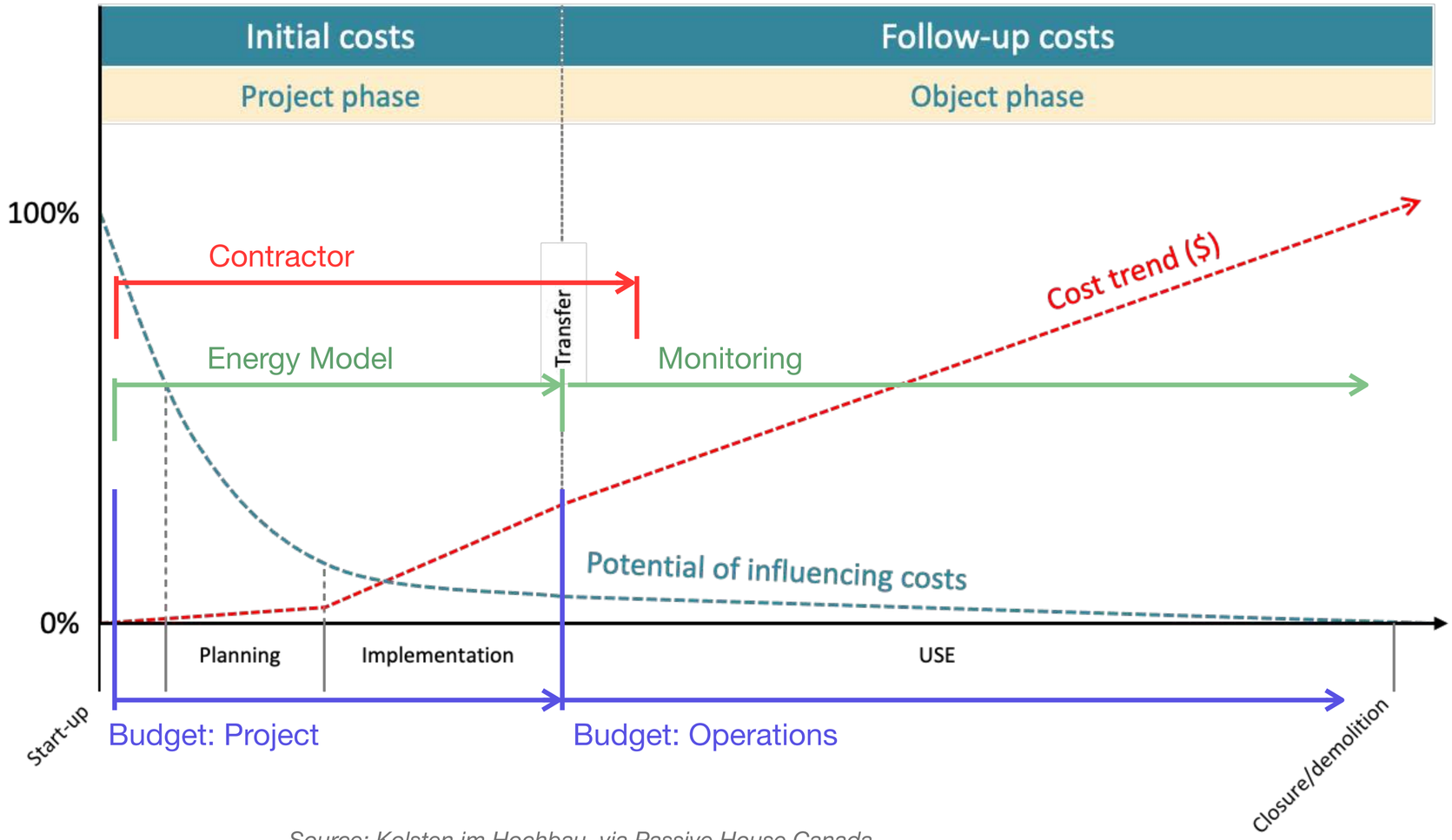
Source: Kolsten im Hochbau, via Passive House Canada

Ability to influence costs

So:

Build the team.

Energy modelling and budgeting:
essential design tools.



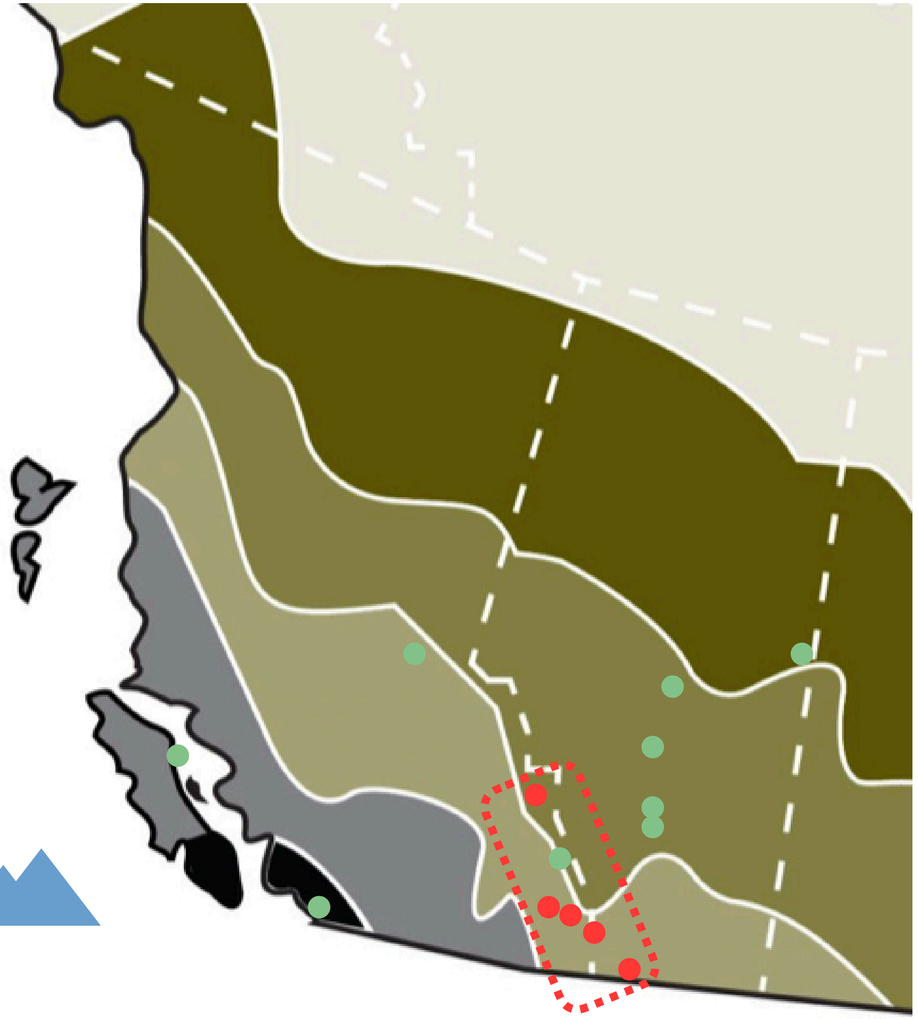
Source: Kolsten im Hochbau, via Passive House Canada

Regional Climate: Cold.

Climate rules all.

East Kootenays

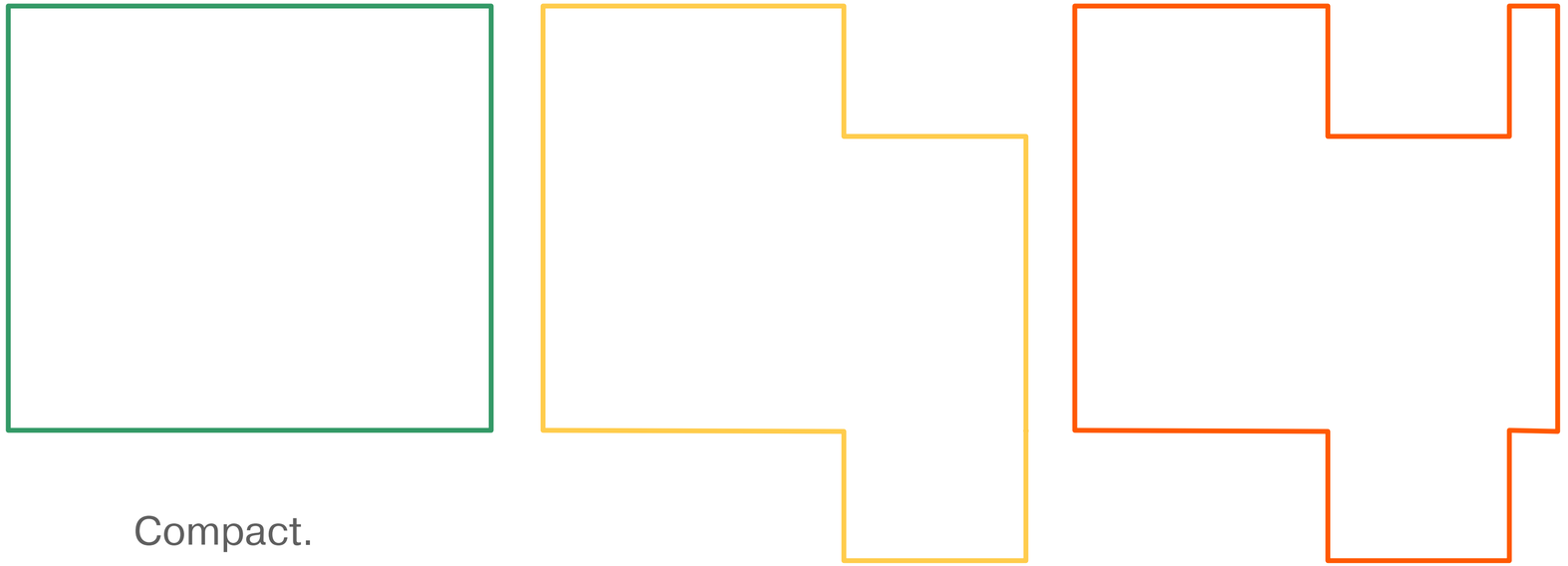
Zone 6 → to 7a ❄ Altitude



4 less than 3000 HDD
5 3000 to 3999 HDD
6 4000 to 4999 HDD
7a 5000 to 5999 HDD
7b 6000 to 6999 HDD
8 more than 7000 HDD

Building Complexity

Complicated is expensive



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.

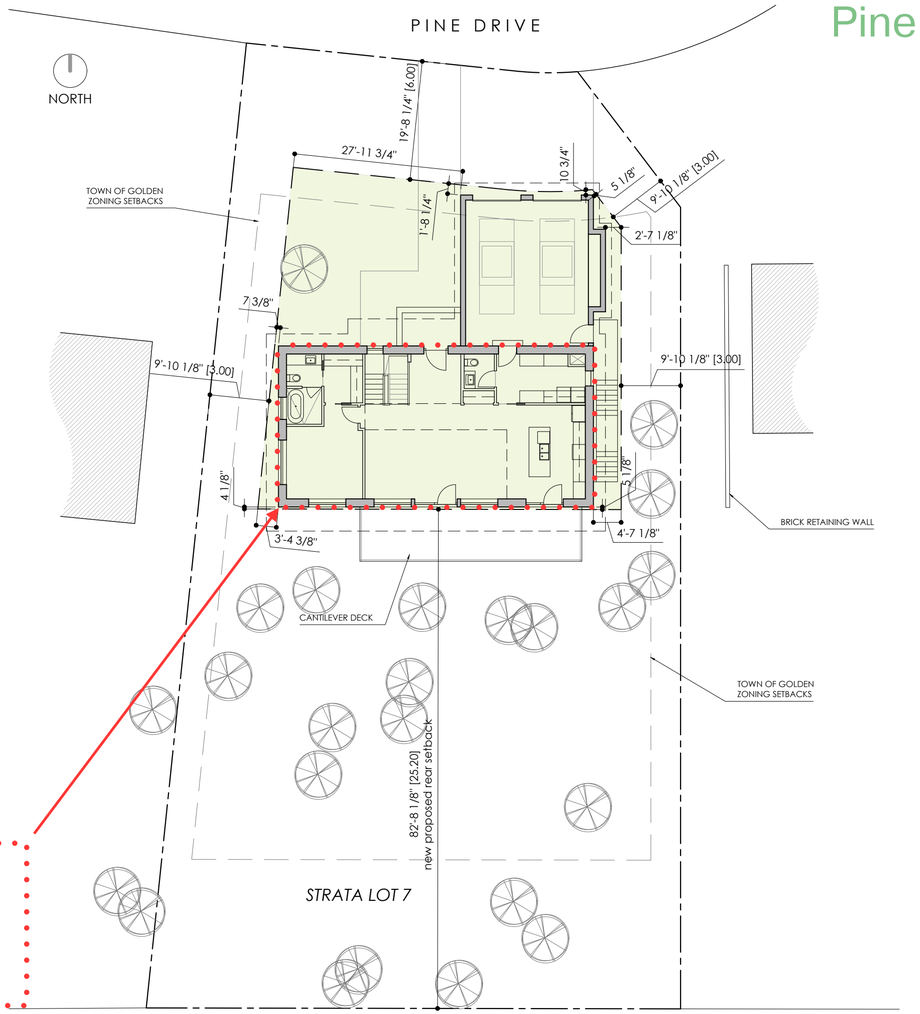
Building Simplicity

Simple is... affordable

Building simplicity on a sloped site:

There are real, measurable savings:

- Construction costs
- Performance costs

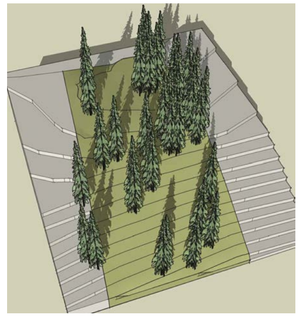


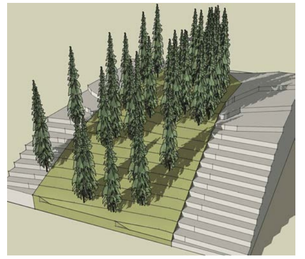
thermal envelope

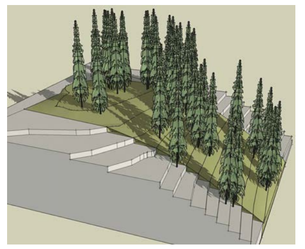
Pine Drive PH, Golden, BC

BUILDING AREA: 287 M2 | 3,089 SQ FT

3D TERRAIN PROFILE







A.1.1
scale | 1/16":1'-0"

PINE DR P.H. | DESIGN DEVELOPMENT
SITE PLAN

thINK | design | consult
think comfort - think health - think passive house

Utilizing Building Science… affordably

People feel comfortable when:

Temperature:	20 - 25° C
Humidity:	35 - 65%
Drafts:	< 0.08 m/s (~⅓ km/h)
Difference in temperature:	
From head to feet, vertically:	< 2°
And arm to arm, horizontally:	< 0.8°
Indoor surface temperatures:	< 4.2°C difference from air temp

Human & Building Health

Temperature
and Humidity

12.6˚C? 80%RH
Mold growth risk

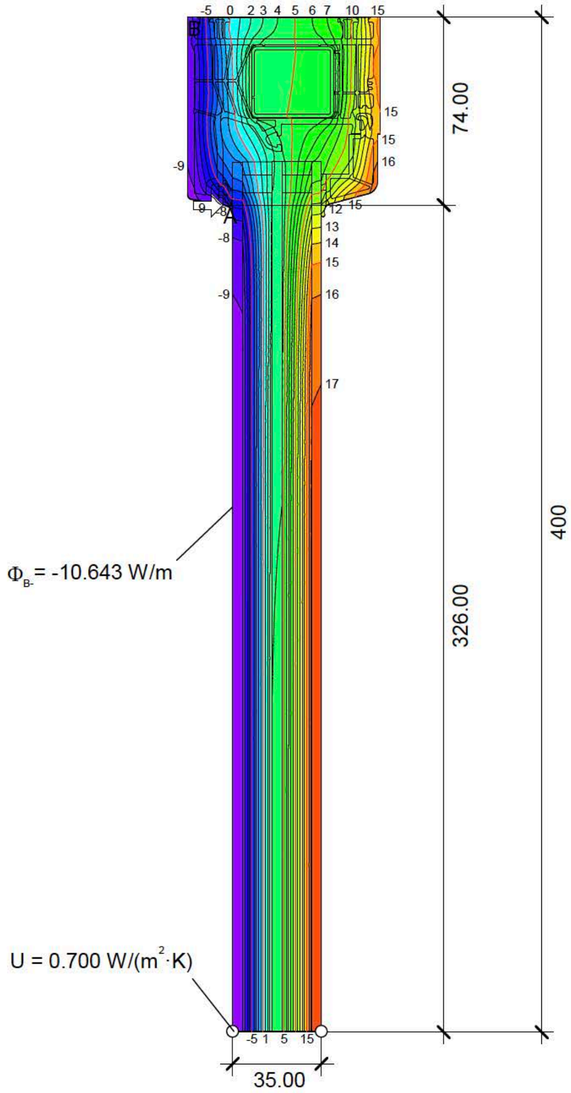
9.3˚C? 100%RH
Condensation risk

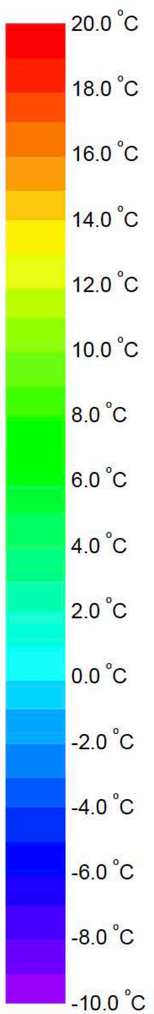
Health

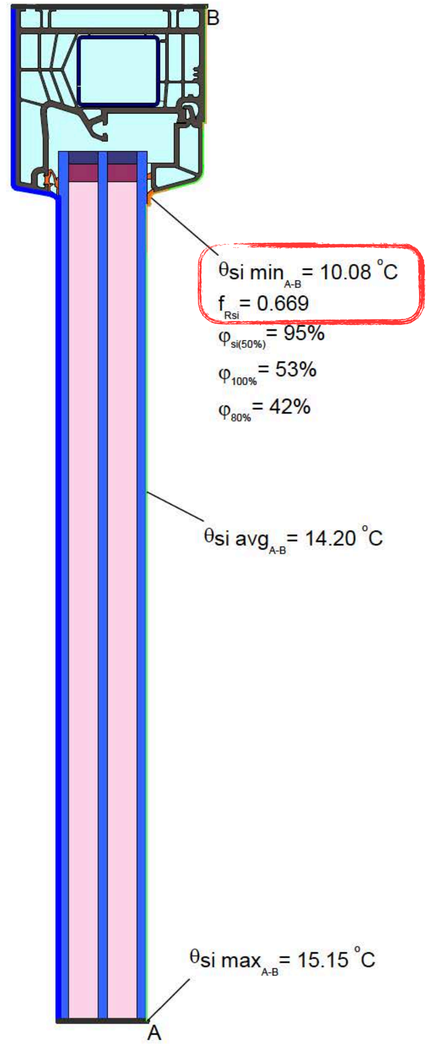
Internal Surface:
Temperature and Humidity

Innotech 76TS Series Window
U_{frame} = 1.24

Edge of glass: 10.08°C
@ -10°C External Temperature







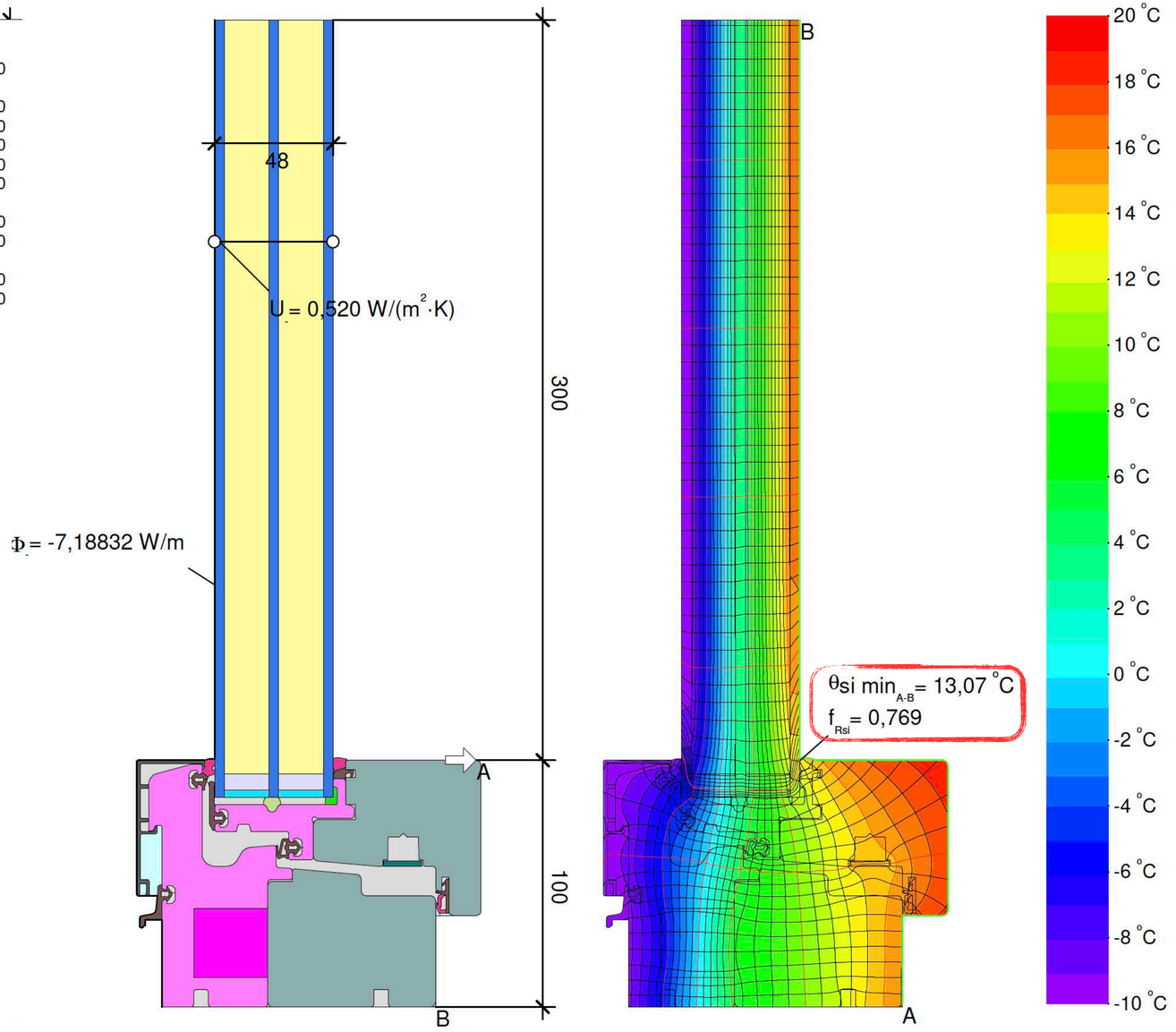
$$\psi_{ed\,A} = \frac{\Phi}{\Delta T} - U_g \cdot b_g - U_f \cdot b_f = \frac{10.643}{30.000} - 0.700 \cdot 0.326 - 1.236 \cdot 0.074 = 0.035\ W/(m \cdot K)$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Exterior, normal		-10.000	0.040	
R-Interior fRSi		20.000	0.250	
Symmetry/Model section	0.000			
Epsilon 0.9				0.900
ε 0.3 (galvanized surface)				0.300

Health

Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160,000	0,900
Ar18 in 48 mm U 0,52	0,021	
ENERcell	0,060	0,900
EPDM	0,250	0,900
EPDM foam | Moosgummi	0,050	0,900
Glass I Glas	1,000	0,900
Glue I Klebestoff	0,310	0,900
Insulation Wärmedämmung 032	0,032	
PE-Insulation I Wärmedämmung 035	0,035	0,900
PU-Seal I PU Dichtung	0,250	0,900
SWISSP. Ultimate Box 2	0,140	
Spruce, Fir I Fichte, Tanne	0,110	0,900
Steel I Stahl	50,000	0,900
Unvent. cavity I unbel. Hohlr. **		
slightly vent. cav. I leicht bel. Hohlr. **		

** EN ISO 10077-2:2017, 6.4.3



Internal Surface: Temperature and Humidity

EnerSign Primus Cold Climate

$U_{frame} = 0.635$

Edge of glass: 13.07°C

@ -10°C External Temperature

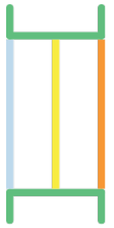
ENERsign®primus

Passive House wood-alu-windows

$$U_{f\,A,B} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{7{,}744}{30{,}000} - 0{,}649 \cdot 0{,}300}{0{,}100} = 0{,}635\ \mathrm{W/(m^2 \cdot K)}$$

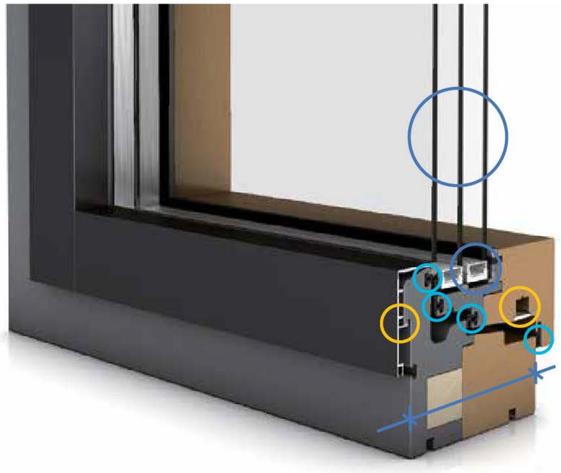
$$\Psi_A = \frac{\Phi}{\Delta T} - U_g \cdot b_g - U_f \cdot b_f = \frac{7{,}188}{30{,}000} - 0{,}520 \cdot 0{,}300 - 0{,}635 \cdot 0{,}100 = 0{,}020\ \mathrm{W/(m \cdot K)}$$

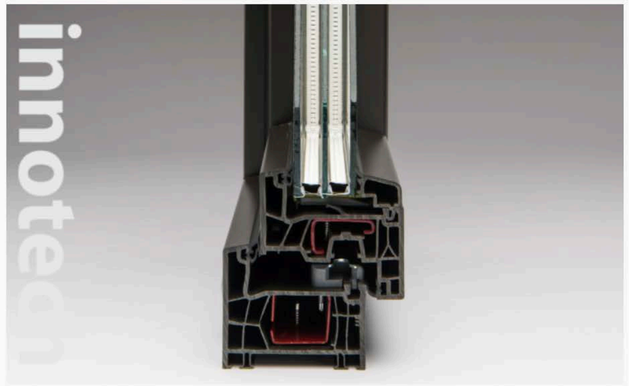
Financial Health



Window Comparison

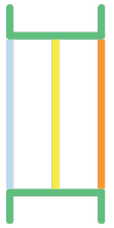
Windows Frame and glazing	Heat Losses kWh/a	Heat Gains kWh/a	Difference kWh/a	Heat Demand kWh/m2/a	Sq M Heated 216.39 Total Demand	Price per kW Total 0.228	Savings over Innotech	Investment over Innotech	Return on investment over 5 years
Innotech 76TS 180/272	6901	2499	-4402	49	10603.11	2417.50908		< 43,137.61 >	-
Enersign Primus Triple	3989	4512	523	26	5626.14	1282.75992	1134.75	$53,341.51	% 10.64





Defender 76TS System

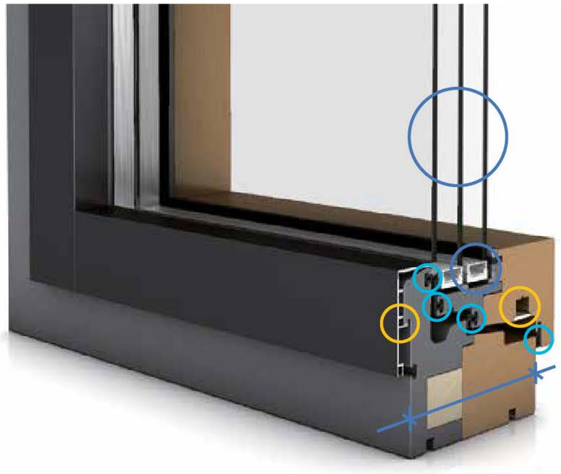
Financial Health

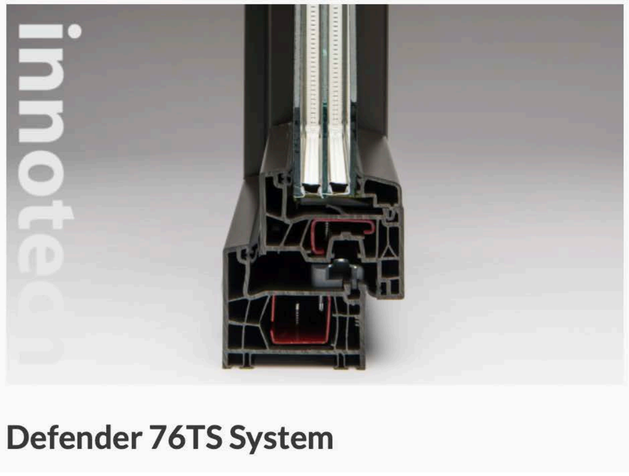


Window Comparison

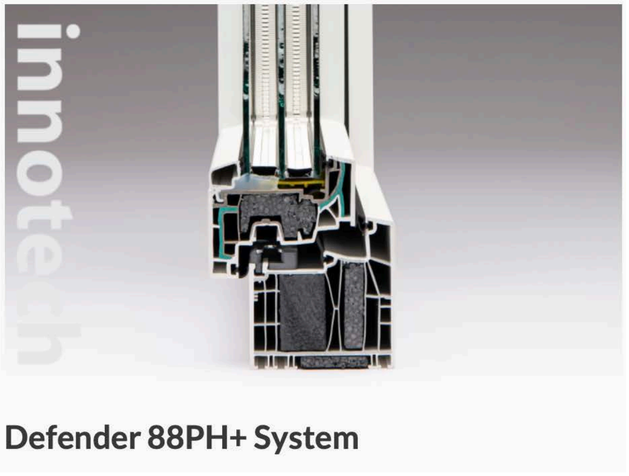
Windows Frame and glazing		Heat Losses kWh/a	Heat Gains kWh/a	Difference kWh/a	Heat Demand kWh/m2/a	Sq M Heated 216.39 Total Demand	Price per kW Total 0.228	Savings over Innotech	Investment over Innotech	Return on investment over 5 years
Innotech 76TS	180/272	6901	2499	-4402	49	10603.11	2417.50908		< 43,137.61 >	-
Pazen Passiv	Triple	3989	4512	523	26	5626.14	1282.75992	1134.75	$53,341.51	% 10.64

Almost 1/2



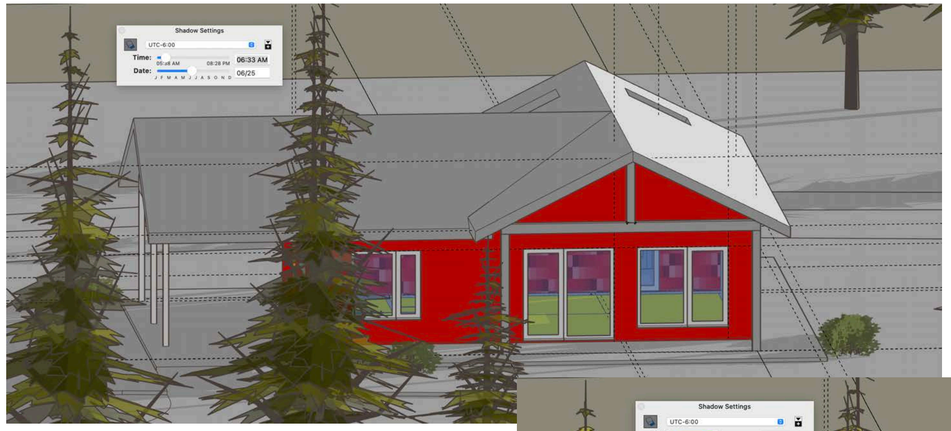


Defender 76TS System



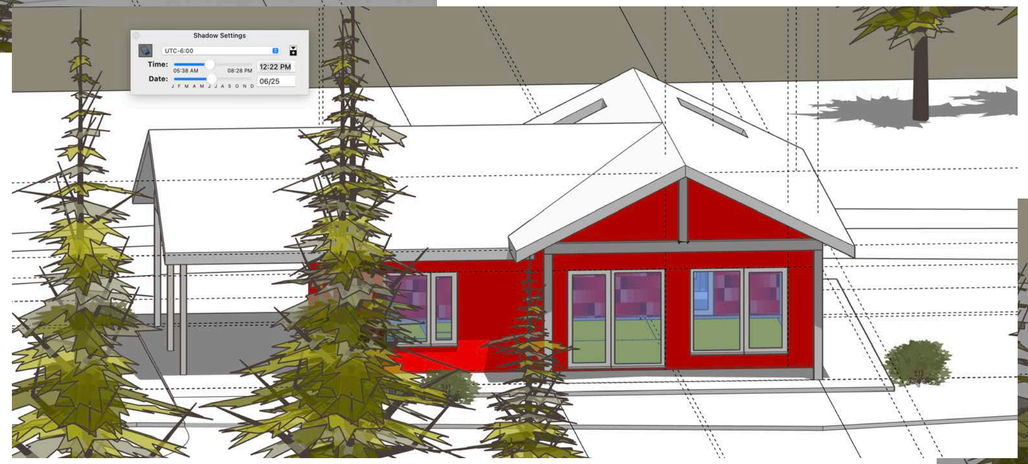
Defender 88PH+ System

Shading: Wasa Passive House

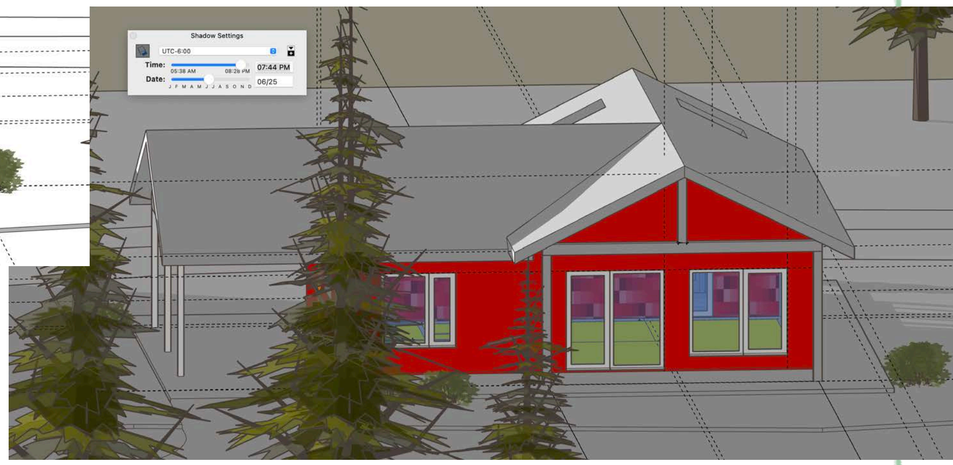


Summer solstice: 6:33 a.m
Sun's up over the Rockies!

Noon is hot! Great shading.
Plus: Plant some deciduous trees…



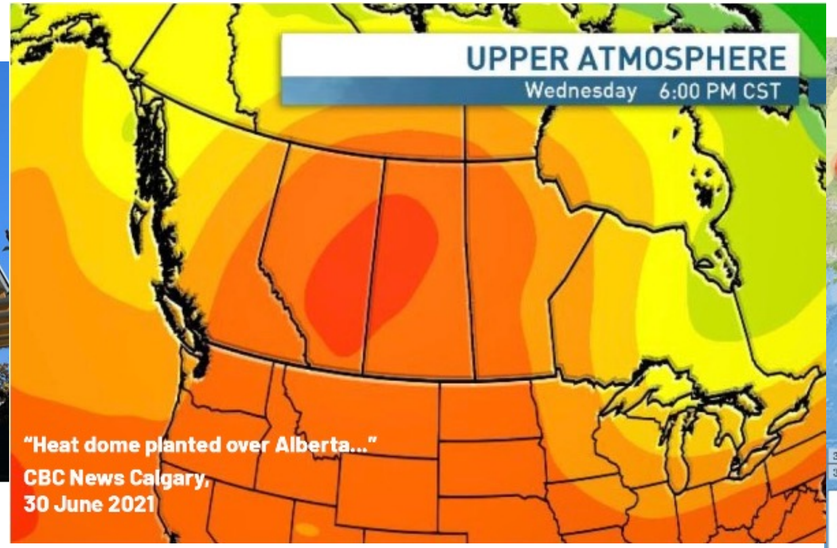
7:44 p.m - sun's down over the mountains…

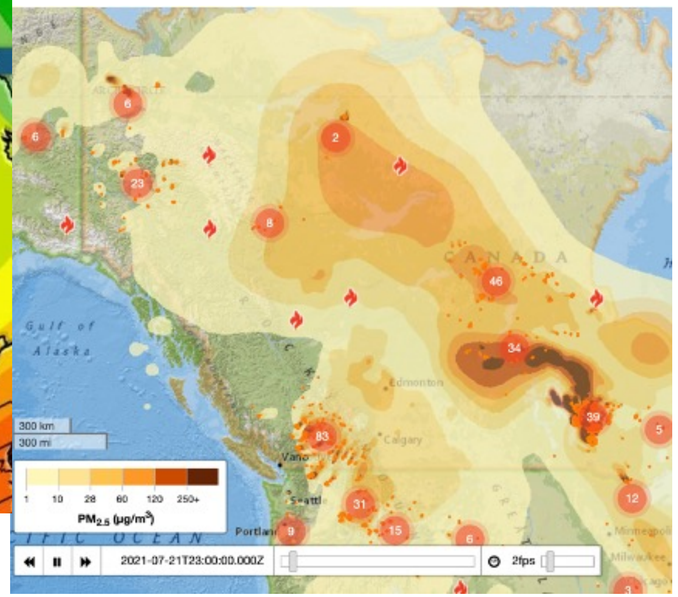


designPH

New: Version 2.0

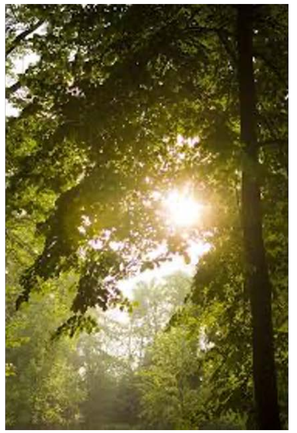
Changing Climate…



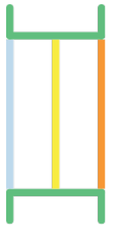


Type of Shading Device	Exterior Position	Interior Position
Blinds, vertical lamellas	6%	70%
Roller blinds/marquees, white	24%	60%
Roller blinds/marquees, grey	12%	80%

% of solar radiation admitted



Shading: F280 & Calculations



F280:
Excellent sensitivity analysis, room by room

Inputs:

- Buiding geometry
- Building location, orientation, shading
- Building assemblies thermal qualities
- Airtightness
- Room purpose: kitchen, bed, bath, gym, etc.

Achieved with:

- Proprietary software
- Verified to meet CAN/CSA F280-12 (R2021)
  Determining the required capacity of residential space heating and cooling appliances.

teca.ca

	Expense		Inter-compatibility
TECA	$475	Purchase	Excel - import/export
HeatCAD	US$525	Subscription $189 renewal	Import from other CAD
Wrightsoft	$500*	Per yr	Closed platform*

*Basic

*CAD and linking features: $

voltaresearch/org

Volta SNAP	$0	Advisory Membership	Online - Can upload Hot2000 file

Nice. What does it cost?

Rosedale Passive House, Inner city Calgary

Certified
Passive House +

New build, 2017
Total Developed Area: 2,778 ft^2

Heating Demand: 14.7 $kWh/m^2/yr$
Air tightness: 0.4 ACH at 50Pa
Total primary energy demand: 80 $kWh/m^2/yr$
Solar system: 76 $kWh/m^2/yr$

Envelope:
R59 above grade walls & R77 roof
R41 below grade walls & slab, R7 windows

Cost: $845,000*, $440 / AG ft^2, $304/ Dev ft^2

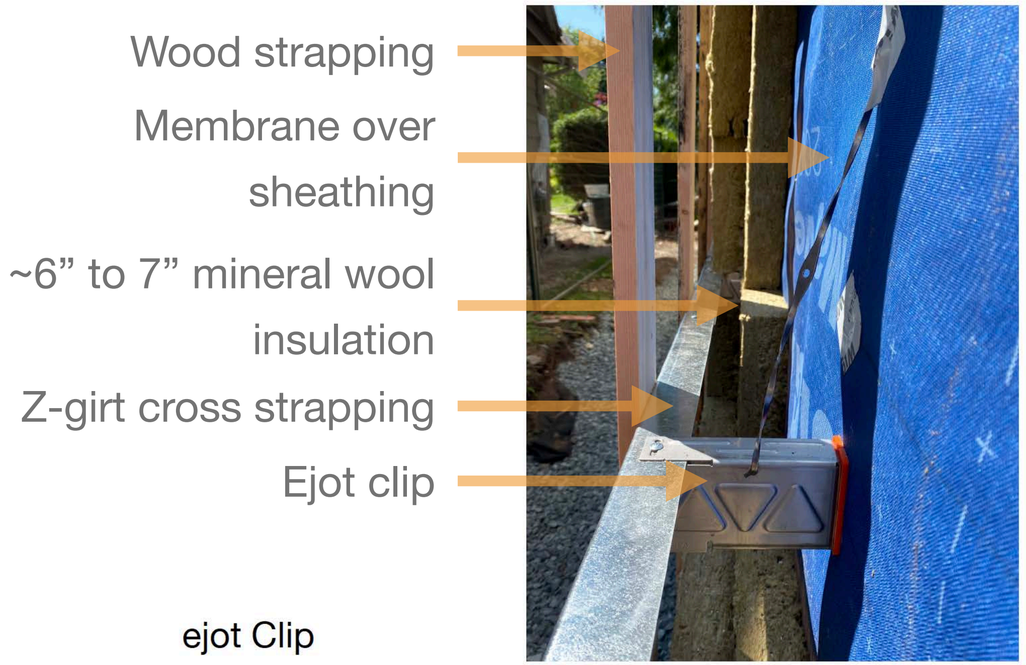
*Not including the price of land.

Challenges

- Skilled labour shortage
  - Hmmm…
    - Opportunity for schools, retraining, youth
    - Opportunities for existing companies
- Expensive components
  - The market is becoming far more competitive
    - NAm manufacturers stepping up
    - Suppliers to Canada establishing “at home” warehousing (tariffs!)
    - Prices are dropping
    - More available: Envelope products, Windows, Ventilation equipment
- Fear factor in pricing
  - Education
  - Experience
  - Site visits
  - Prices are going down as we learn
    - Welcome to our webinar…
    - Lots of free learning resources, courses, webinars
    - Professional certification programs are available

Opportunities

- Exterior finishers
  - Huge opportunity: exterior insulation
  - Every siding install job: opportunity
    - Air & vapour control layers: improvement
    - Insulation: improvement
    - Strapping
    - Siding
- Grab the work! It’s waiting!

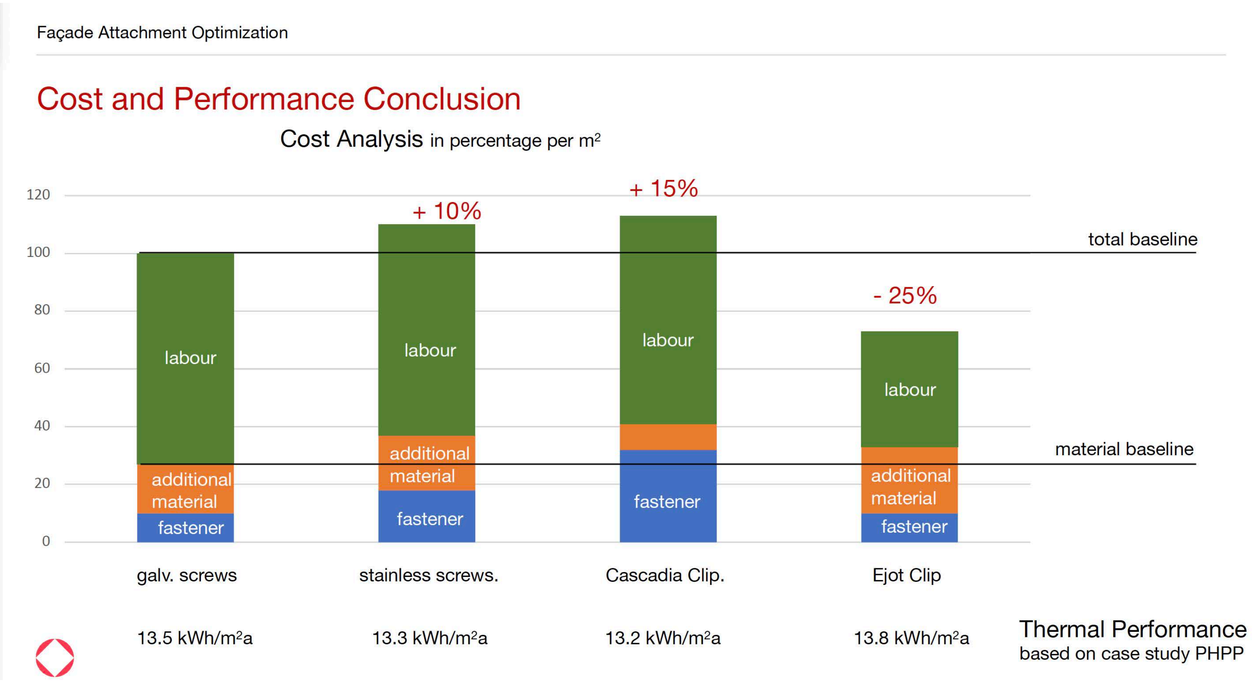


ejot Clip

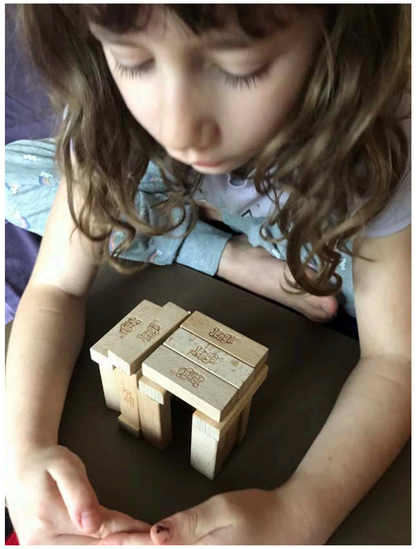
- “knife-blade” cross-section
  -> easy installation of panels
- adjustability for trueing wall
- can accommodate for vertical or horizontal strapping
  -> for 32” spacing additional horizontal metal channel needed
- lighter weight, less dense mineral wool insulation can be used

Opportunities

- Exterior finishers
  - Huge opportunity: exterior insulation
  - Every siding install job: opportunity
    - Air & vapour control layers: improvement
    - Insulation: improvement
    - Strapping
    - Siding
- Grab the work! It’s waiting!



Thanks to Marcel Studer, BCIA, CPHD, Econ Group



My granddaughter Lily
Protecting her design…

Q&A

thINK | design | consult
think comfort - think health - think passive house
kevin@thinkdesignconsult.com