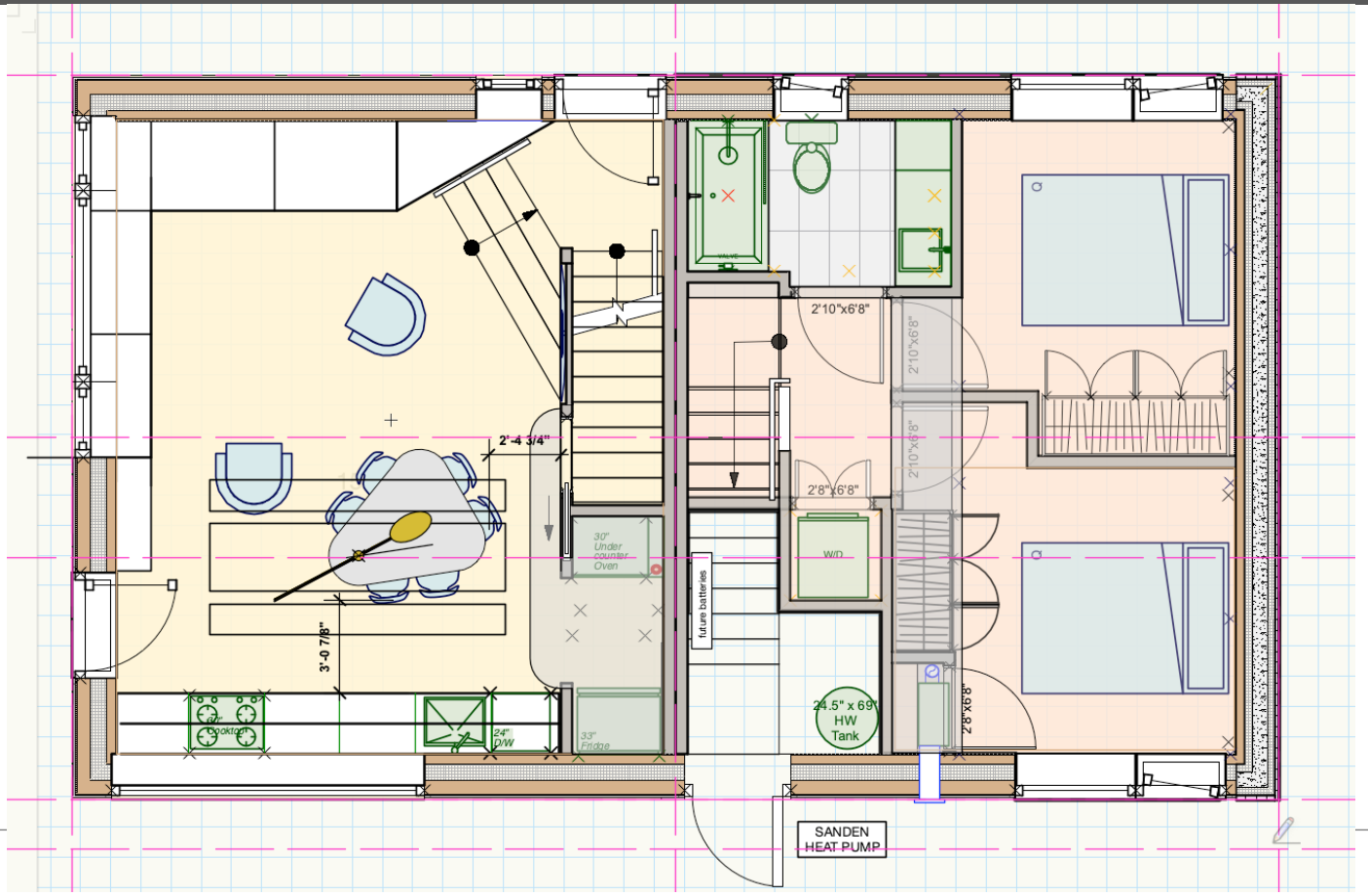
Passive House Duplex

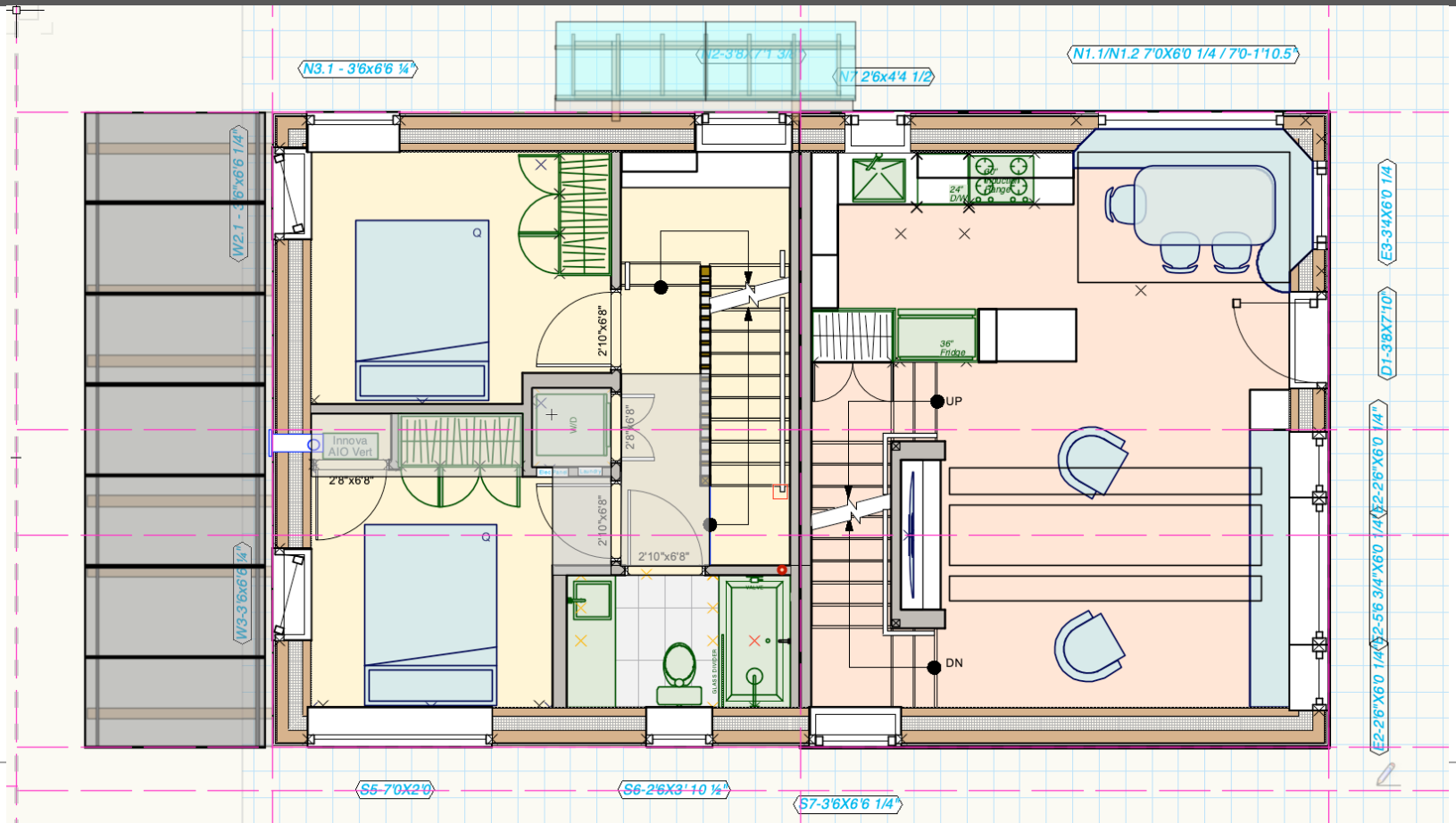
3505 Fleming– Vancouver BC

Passive House Plus

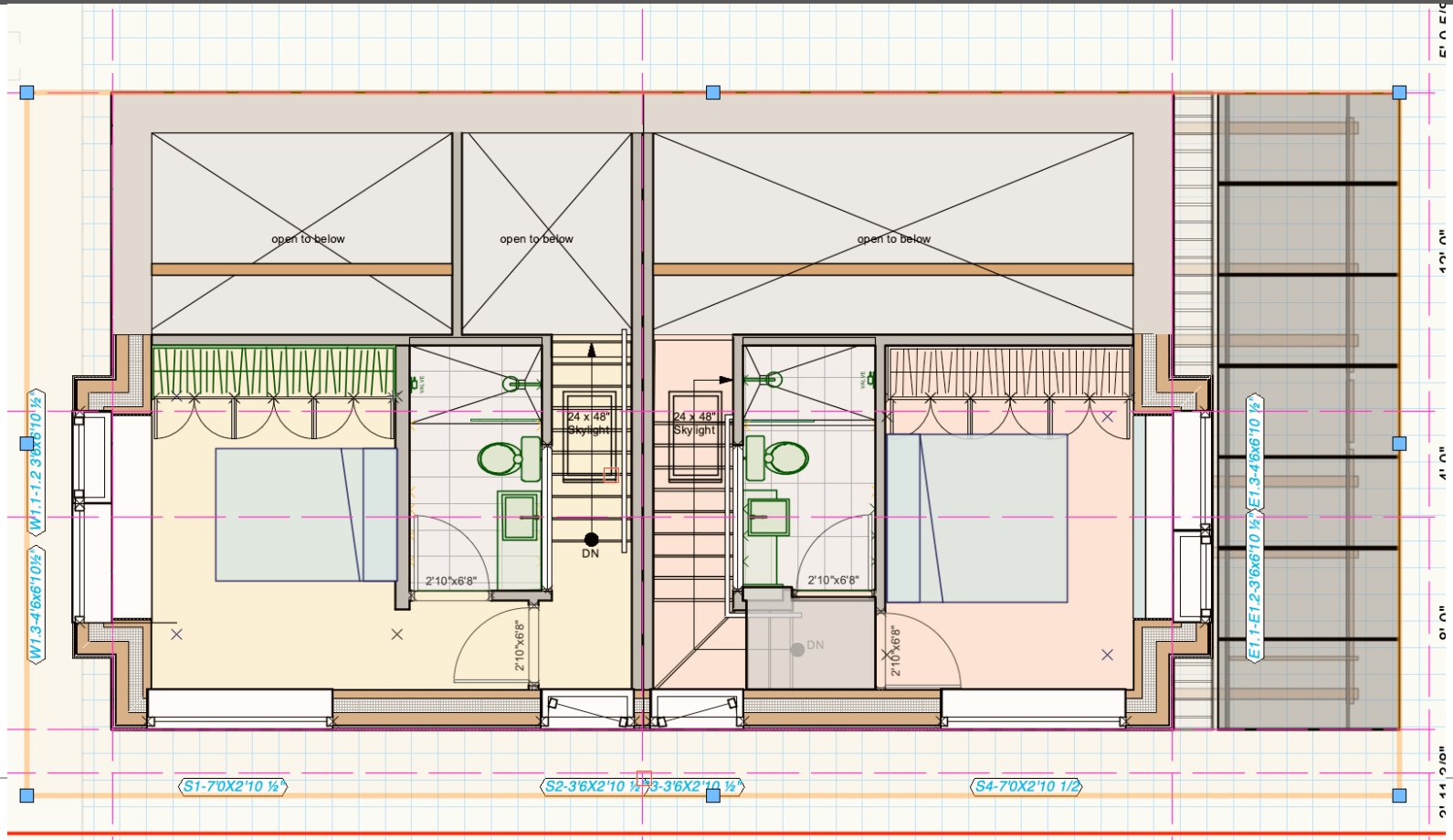
Level 1 Plan


2'10"x6'8"
2'10"x6'8"
2'10"x6'8"
2'8"x6'8"
2'-4 3/4"
3'-0 7/8"
30" Under counter Oven
33" Fridge
24" D/W
W/D
future batteries
24.5" x 69" HW Tank
2'8"x6'8"
SANDEN HEAT PUMP

Level 2 Plan


N3.1 - 3'6x6'6 ¼"
N1.1/N1.2 7'0X6'0 1/4 / 7'0-1'10.5"
N1 2'6x4'4 1/2
W2.1 - 3'6"x6'6 1/4"
W3-3'6x6'6 ¼"
E3-34X60 1/4
D1-38X7'10"
E2-26"X60 1/4"
E2-26"X60 1/4"
2'10"x6'8"
2'8"x6'8"
2'10"x6'8"
2'10"x6'8"
2'8"x6'8"
Innova AIO Vert
W/D
36" Fridge
24" DW
UP
DN
S5-7'0X2'0"
S6-2'6X3' 10 ½"
S7-3'6X6'6 1/4"

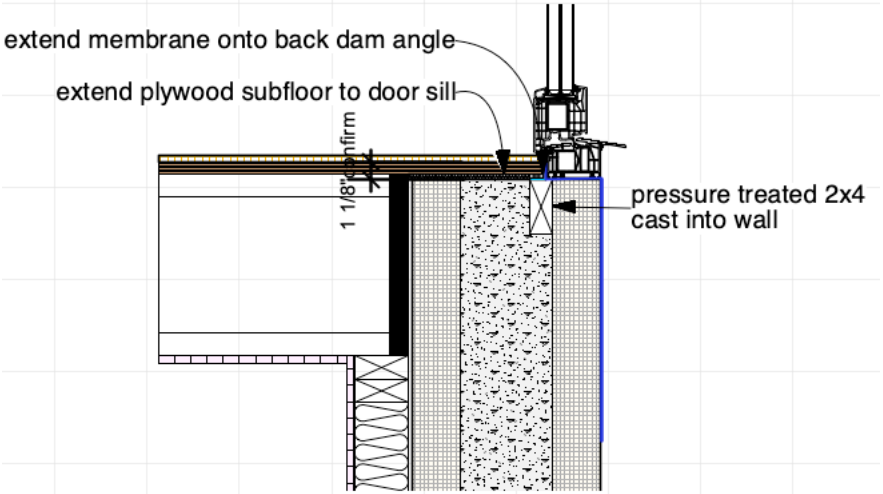
Level 3 Plan


open to below
open to below
open to below
24 x 48" Skylight
24 x 48" Skylight
DN
2'10"x6'8"
2'10"x6'8"
2'10"x6'8"
2'10"x6'8"
DN
W1.1-1.2 3'X6'10 ½"
W1.3-4'6X6'10½"
E1.1-E1.2-3'6X6'10 ½"
E1.3-4'6X6'10 ½"
S1-7'0X2'10 ½"
S2-3'6X2'10 ½"
S3-3'6X2'10 ½"
S4-7'0X2'10 1/2"

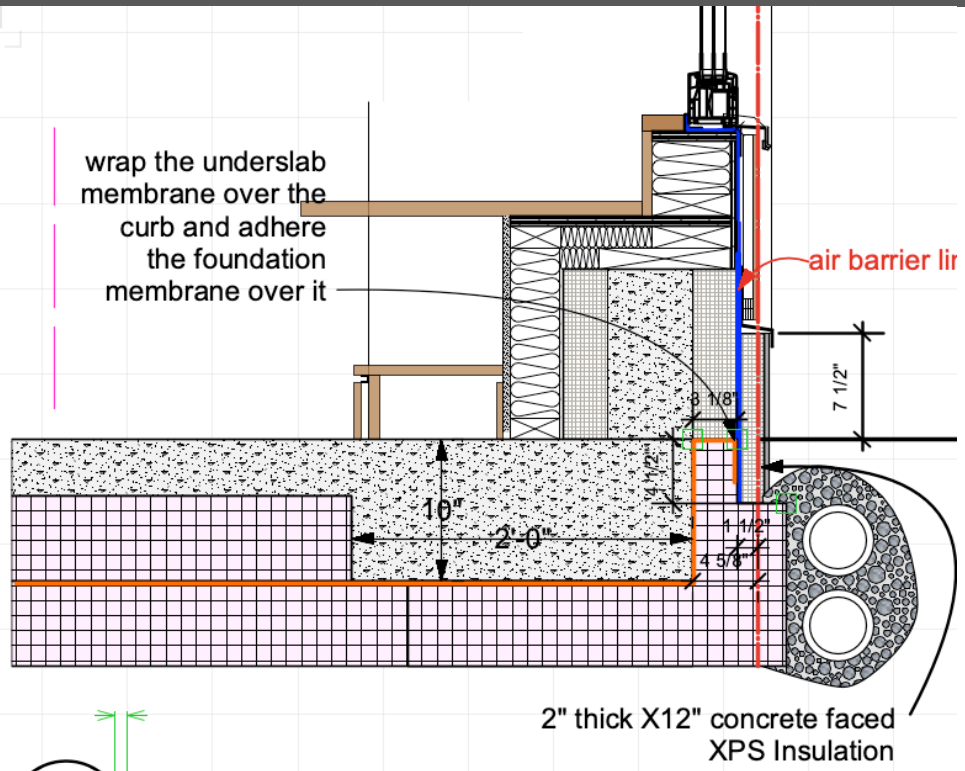
Basic Envelope Statistics

- Walls: R57 effective
- Roof: R88
- Floor: R60
- Thermal Bridge Detailing to Minimal Values (Flixo Modeling)
- Efficient Windows: (R7); compression seals
- Ventilation with HRV's @ 85% efficiency
- Air Tightness .6 Ach/hr @50 Pa (lower actual expected)

Details

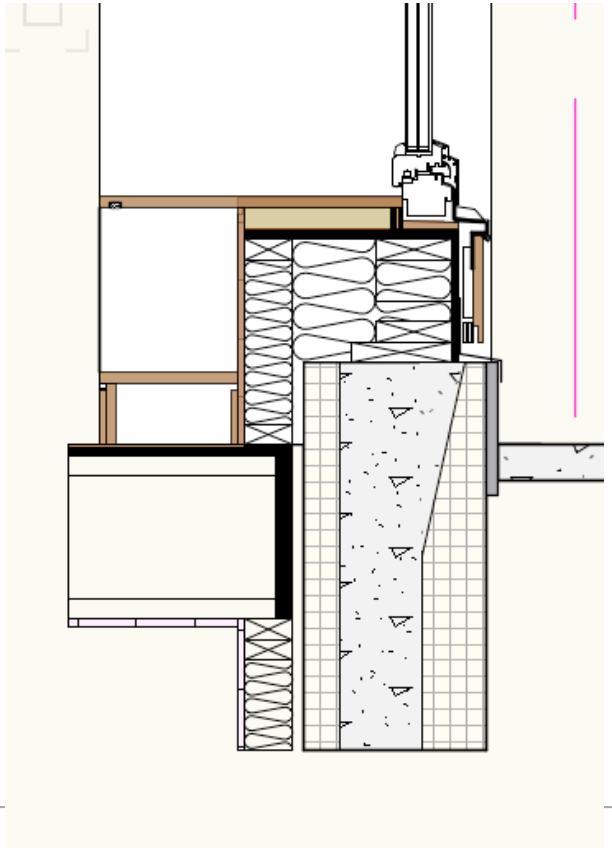


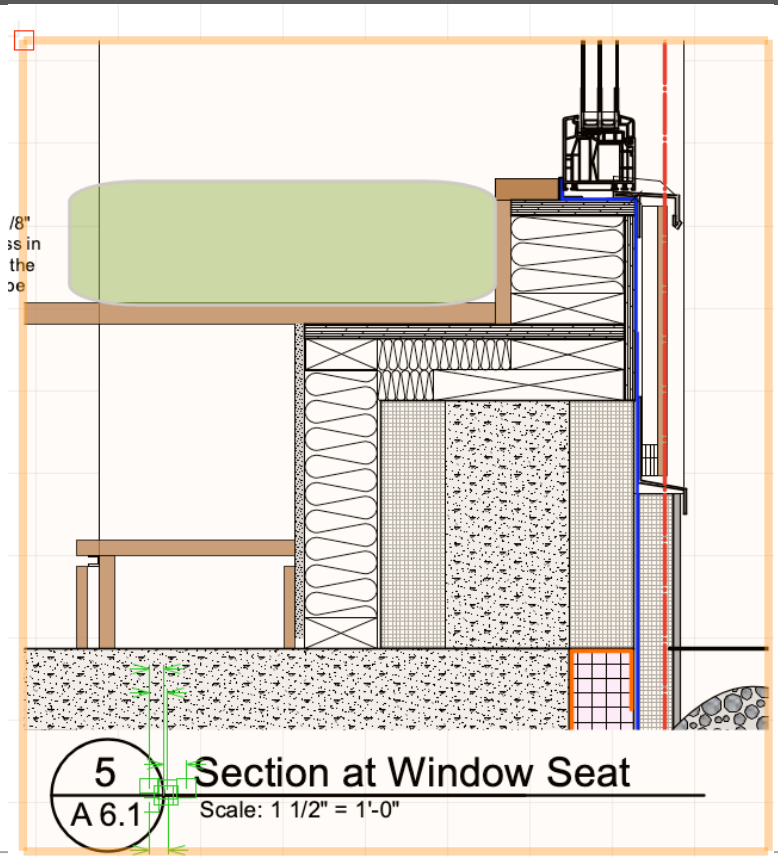
5 / A 6.0 Door Sill at Foundation Wall
Scale: 1" = 1'-0"



1 / A 6.0 Typical Perimeter Foundation
Scale: 1" = 1'-0"

Details





Design PH

Sketch-Up Based envelope input

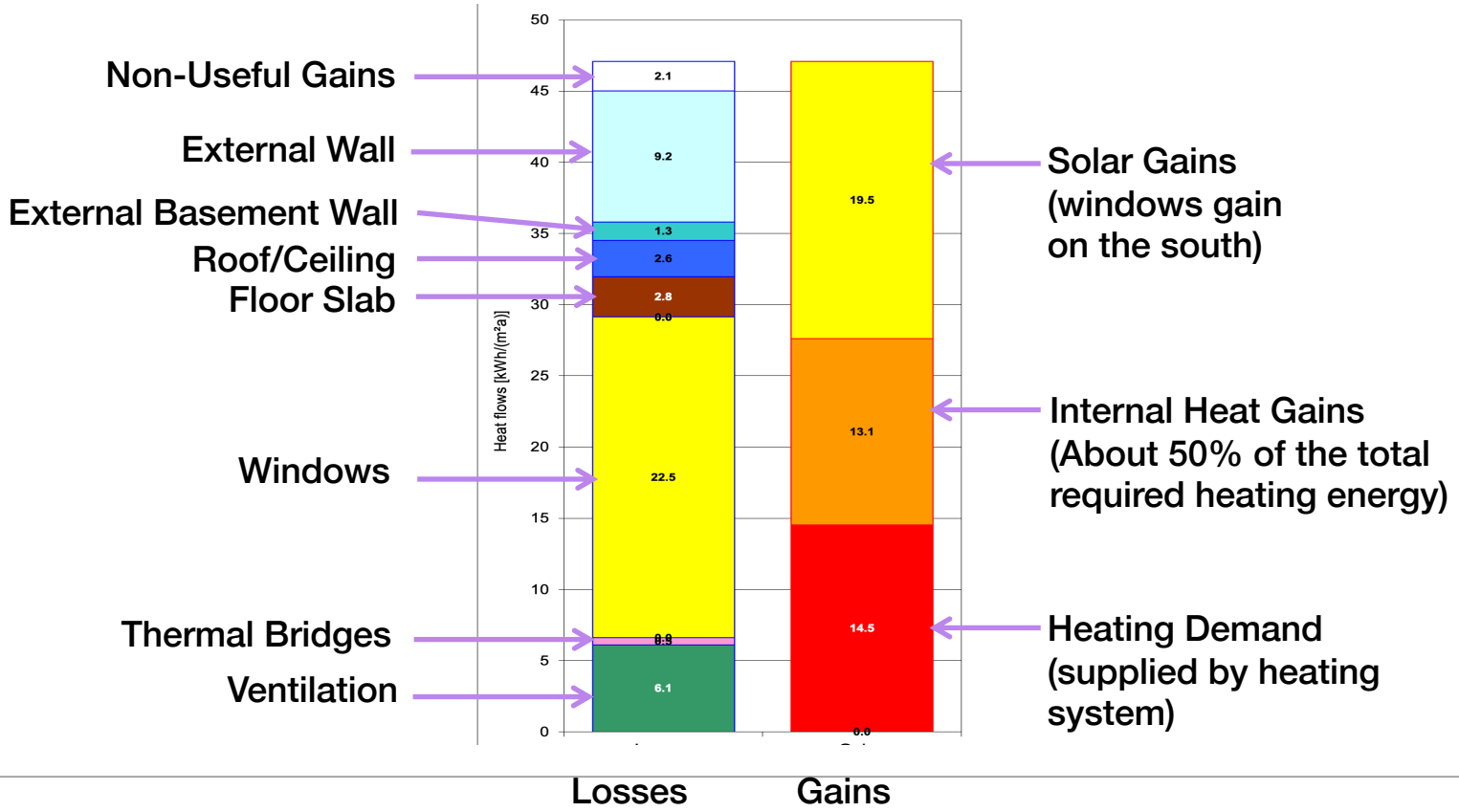
Passive House Planning Package

PHPP Outputs: **Verification**

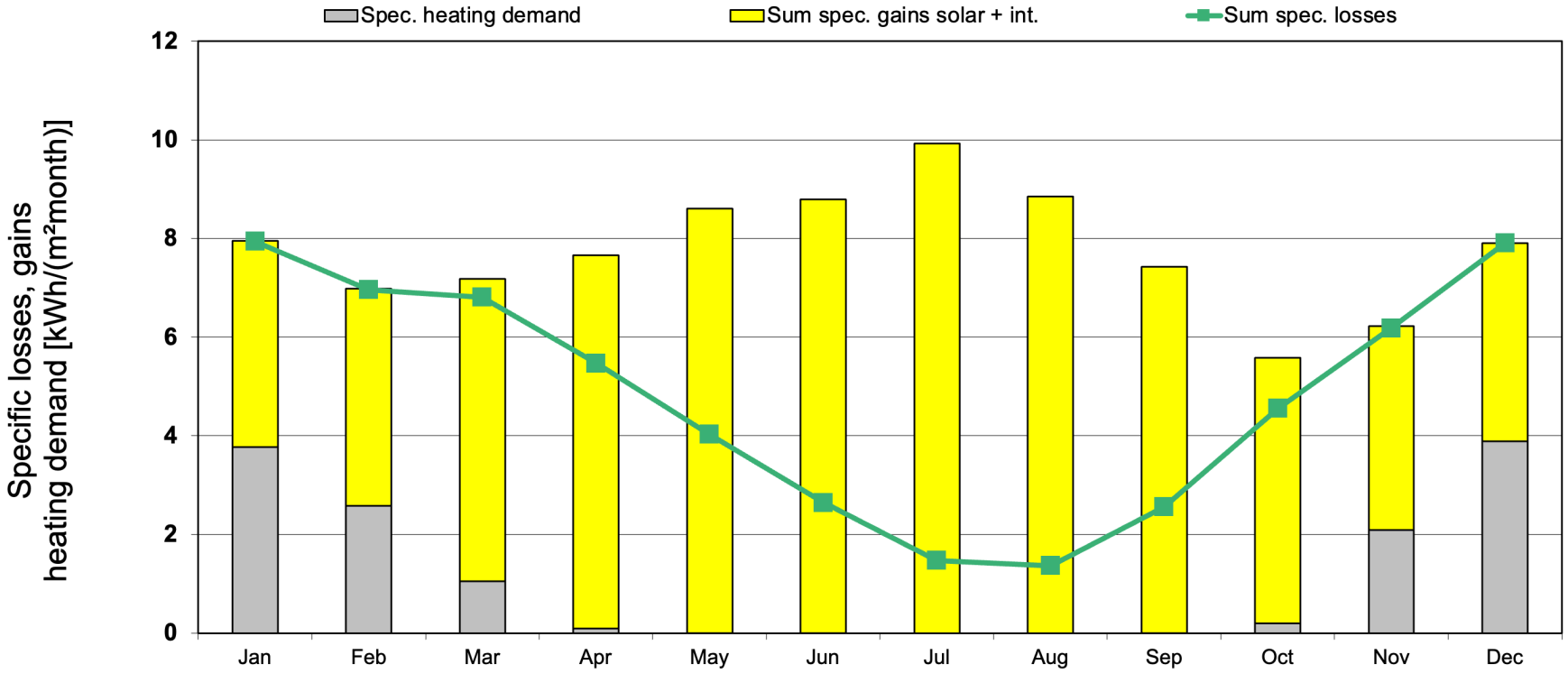
Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	175.5				
Space heating	Heating demand	kWh/(m²a)	**13.69**	≤	15	-	**Yes**
	Heating load	W/m²	**13**	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	**5**	≤	15		**Yes**
	Frequency of overheating (> 25 °C)	%	**-**	≤	-		**-**
	Frequency of excessively high humidity (> 12 g/kg)	%	**0**	≤	10		**Yes**
Airtightness	Pressurisation test result n_{50}	1/h	**0.6**	≤	0.6		**Yes**
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	**93**	≤	-		**-**
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	**41.6**	≤	45	42	**Yes**
	Renew. energy generation (in rel. to projected building footprint area)	kWh/(m²a)	**114**	≥	60	54	

Annual Heating Energy Balance

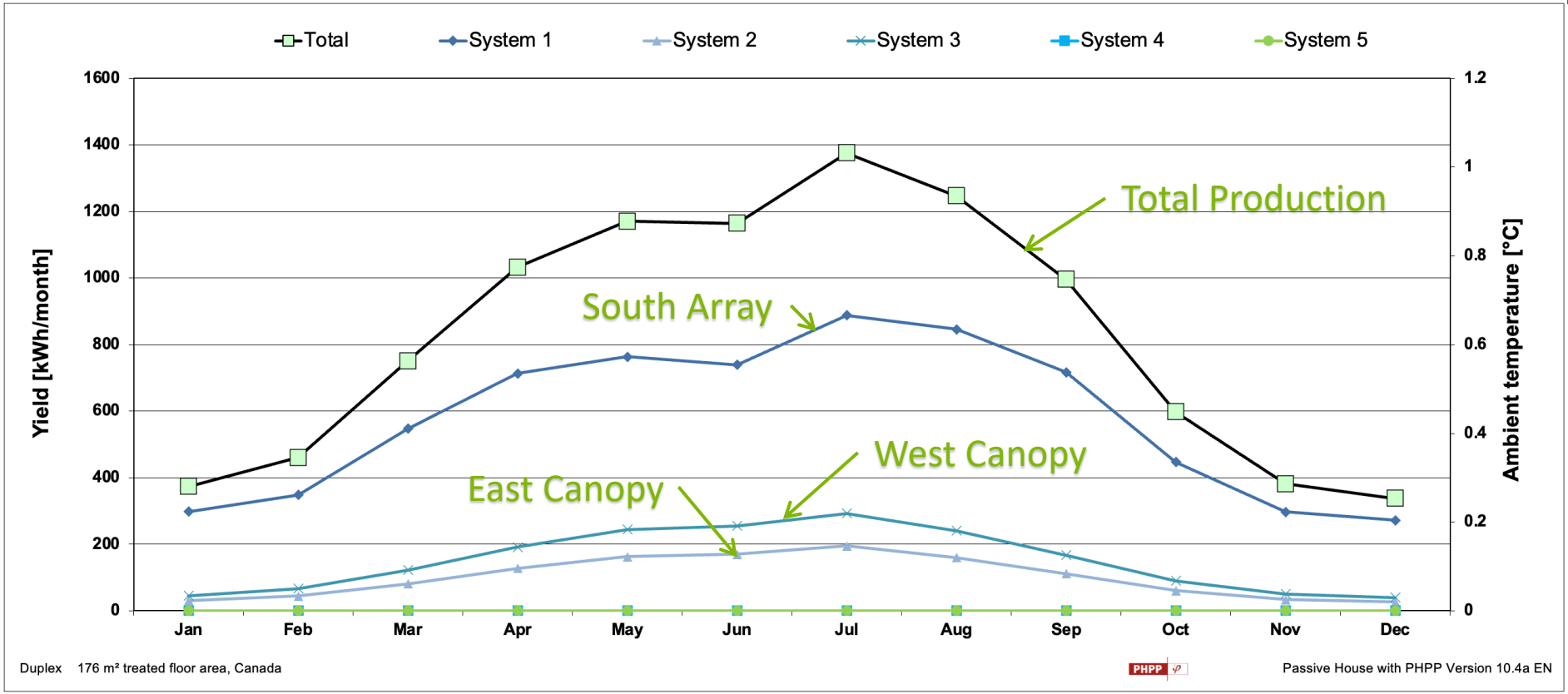


Specific Heating Demand



Duplex 176 m² treated floor area, Canada

Solar Energy Generation



West Canopy Solar Shading

▼ Analyse single window

Analyse single window

Select a single window to analyse using the button below or 'Analyse window shading' from the

NOTE: The settings below will be used for all windows the next time you run analysis. The ener

Analyse selected window

Shading mask resolution: Med-res (45)

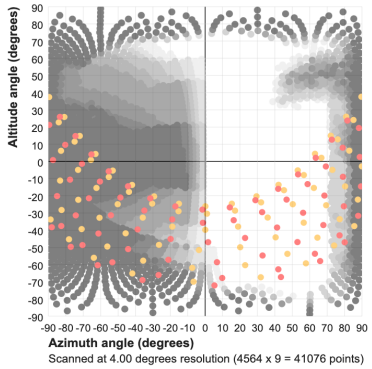
Number of analysis points: 9 points

Season	Unshaded radiation (kW·h/m²·a)	Shaded radiation (kW·h/m²·a)	Shading factor
winter	346.8	215.5	0.62
summer	478.5	300.3	0.63

We used the window shading calculator to analyse the solar panel shading
This suggests that the west canopy solar is shaded such that it is 60% which was input into the calculations

▼ Shading mask

Shading mask diagram (raster)

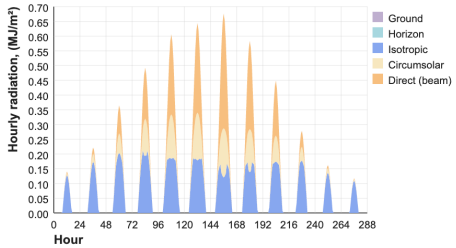


Scanned at 4.00 degrees resolution (4564 x 9 = 41076 points)

▼ Unshaded radiation

Hourly radiation on slope, unshaded

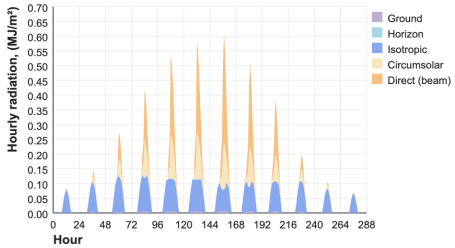
Month -All-



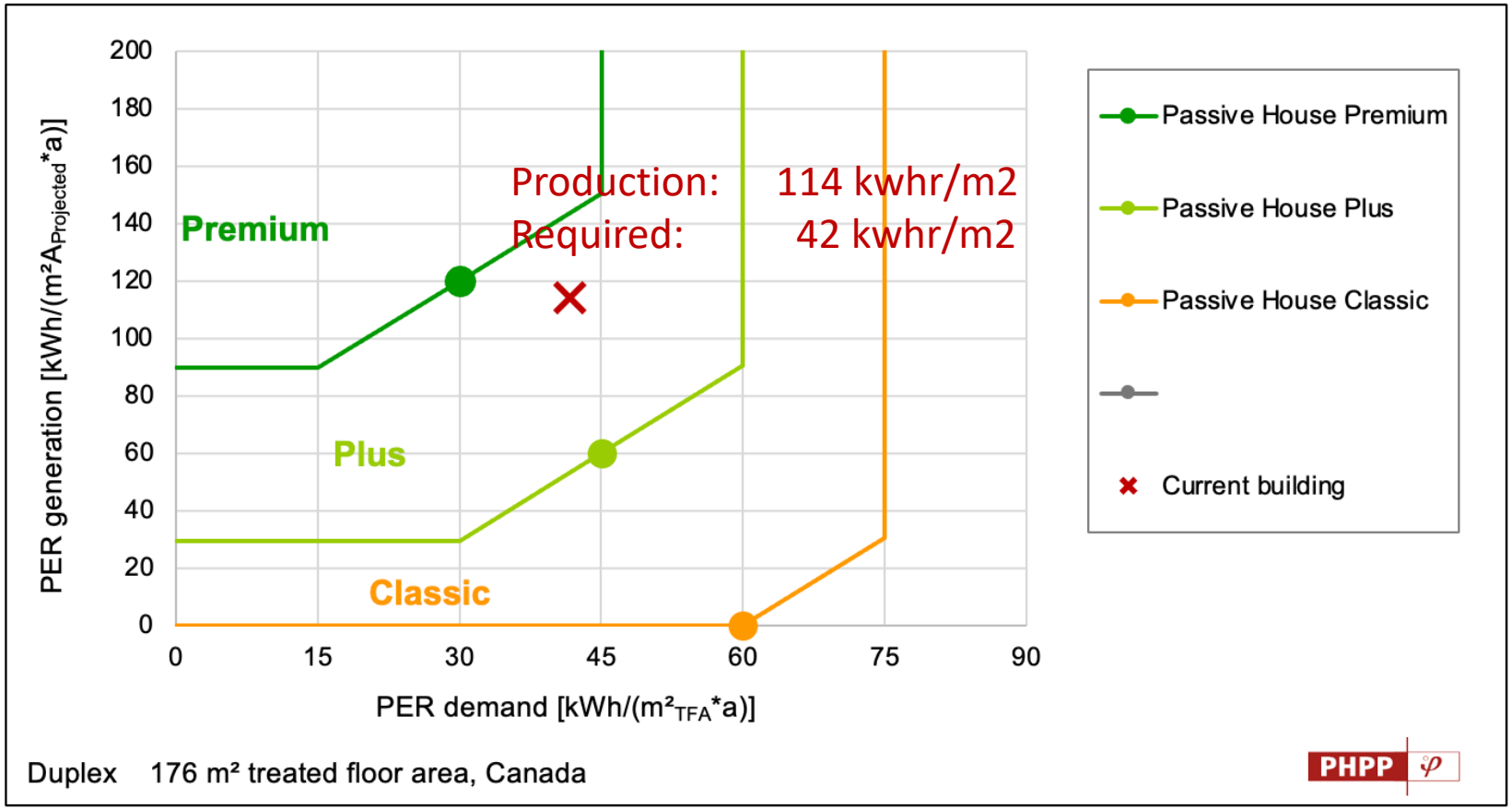
▼ Shaded radiation

Hourly radiation on slope, shaded

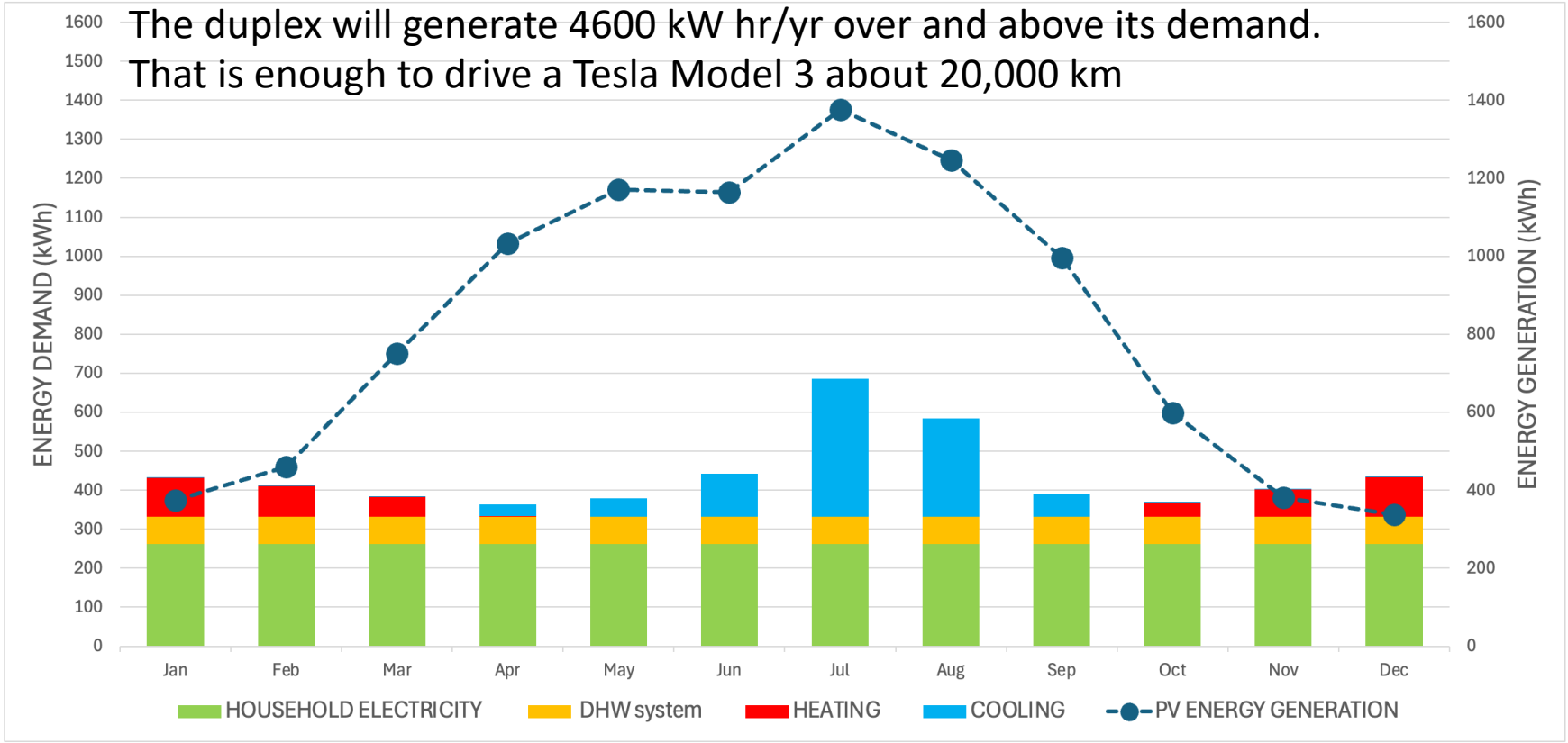
Month -All-



Primary Energy Renewable



Monthly Electrical Energy Balance



Cellulose Insulation

Advantages:

- Low Carbon, Carbon sequestering solution.
- Thermal mass that shifts the temperature
- Good fire resistance because of a lack of oxygen
- Easily fits around electrical and plumbing lines
- Good sound attenuation

Disadvantages:

- Very dusty
- Heavy
- Few trade options
- Local product supply
- Watch the details for inaccessible cavities.

Windows – Triple Glazed

innotech
windows + doors

- triple glazed with low e coatings to suit exposure
- Insulated frames
- Triple weather seals
- New hardware to assist closing the tilt function

Windows - Installation

Installation:

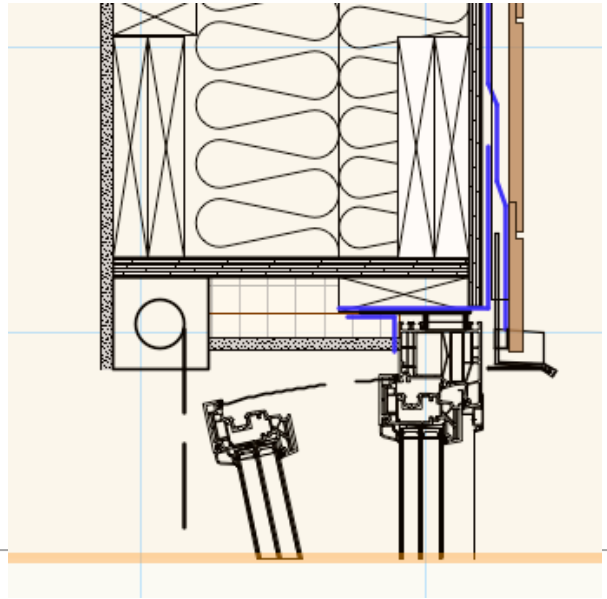
- Best thermal performance about the middle of the wall
- This project installs window at the outside face to align with the moisture barrier and takes an energy use penalty

Outboard Position:

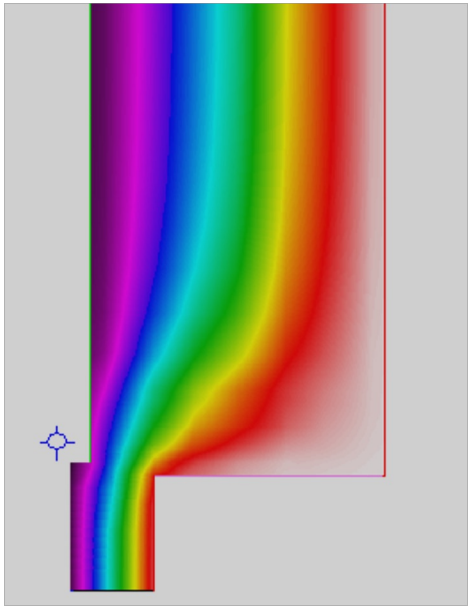
- Outboard works well with outboard moisture barrier
- Conventional for Trades

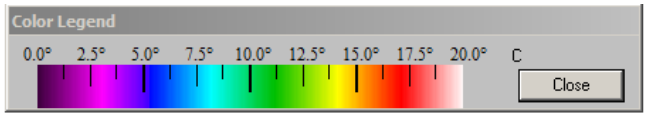
Details:

- Tie-ins to moisture layer
- Tie-ins to air barrier
- Creates a wide interior sill



Windows - Installation

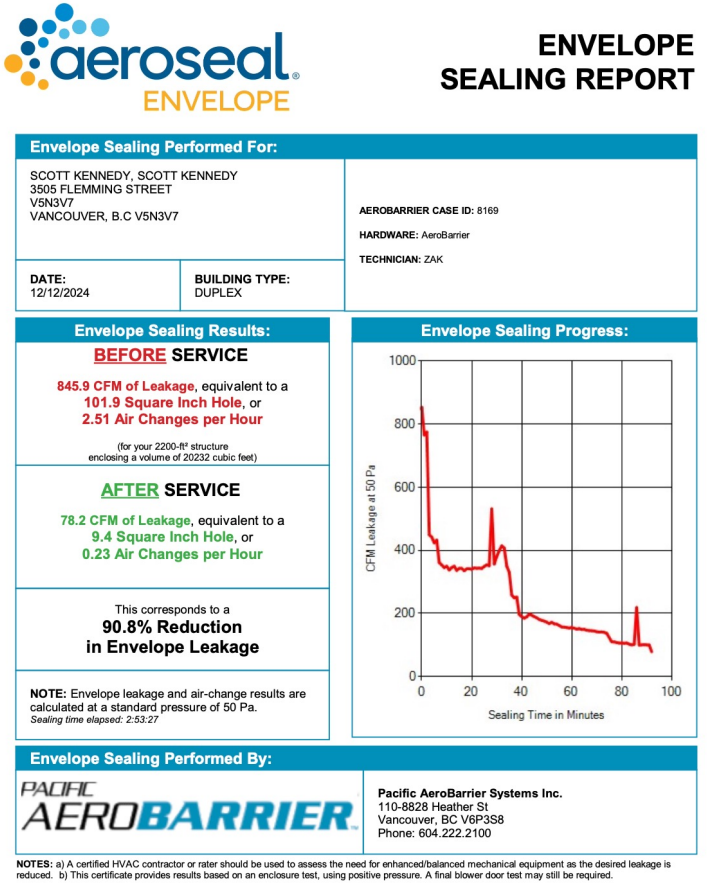




- The model shows a large offset in the temperature contours.
- It is better thermal practice to minimize the offset
- Thermal bridging performance input to PHPP – Ψ value as part of every window

Air Sealing – Pacific AeroBarrier

- Despite a fair bit of attention during the framing and window installation process some of the “floppy bits” were missed and seals installed to the wrong surface.
- Pacific AeroBarrier was enlisted to assist using their fogging type process.
- The Air change rate was dropped from 2.51 Air Changes/Hour to .23 ACH.



aeroseal ENVELOPE

ENVELOPE SEALING REPORT

Envelope Sealing Performed For:

SCOTT KENNEDY, SCOTT KENNEDY
3505 FLEMMING STREET
V5N3V7
VANCOUVER, B.C V5N3V7

AEROBARRIER CASE ID: 8169
HARDWARE: AeroBarrier
TECHNICIAN: ZAK

DATE: 12/12/2024
BUILDING TYPE: DUPLEX

Envelope Sealing Results:

BEFORE SERVICE

845.9 CFM of Leakage, equivalent to a
101.9 Square Inch Hole, or
2.51 Air Changes per Hour

(for your 2200-ft² structure enclosing a volume of 20232 cubic feet)

AFTER SERVICE

78.2 CFM of Leakage, equivalent to a
9.4 Square Inch Hole, or
0.23 Air Changes per Hour

This corresponds to a
90.8% Reduction in Envelope Leakage

NOTE: Envelope leakage and air-change results are calculated at a standard pressure of 50 Pa.
Sealing time elapsed: 2:53:27

Envelope Sealing Progress:

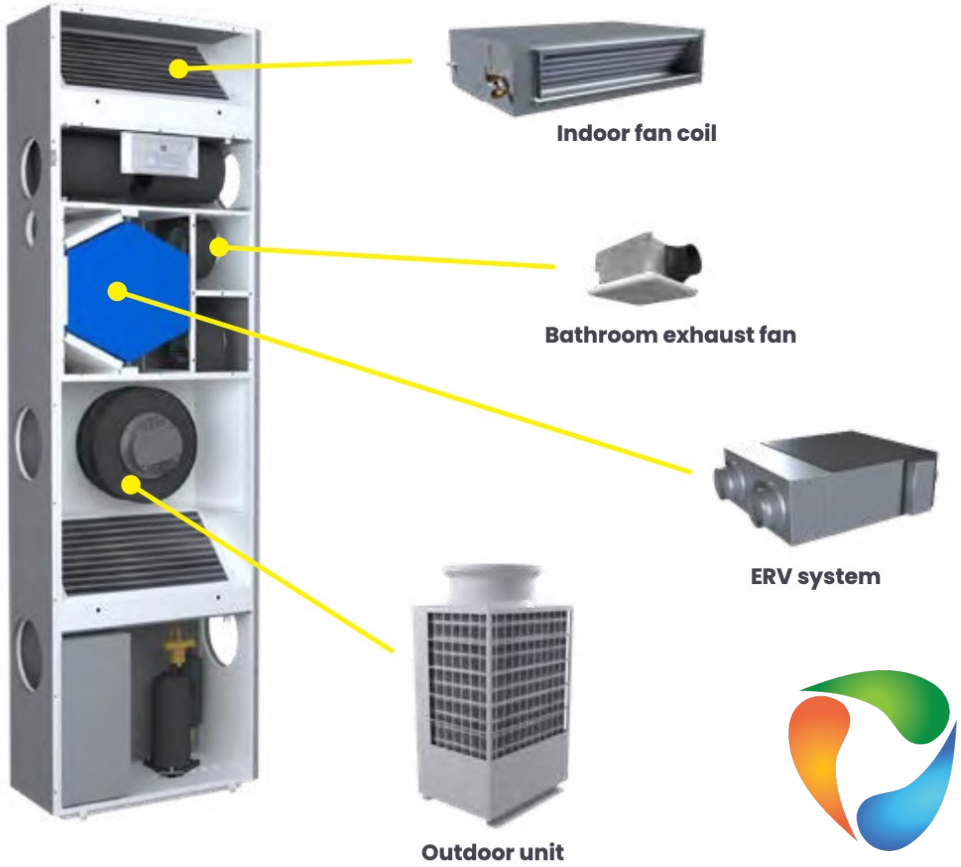
Envelope Sealing Performed By:

PACIFIC AEROBARRIER

Pacific AeroBarrier Systems Inc.
110-8828 Heather St
Vancouver, BC V6P3S8
Phone: 604.222.2100

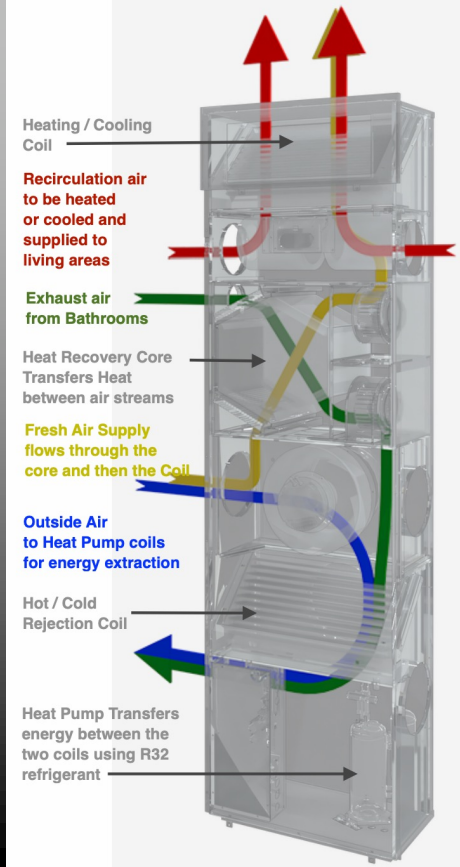
NOTES: a) A certified HVAC contractor or rater should be used to assess the need for enhanced/balanced mechanical equipment as the desired leakage is reduced. b) This certificate provides results based on an enclosure test, using positive pressure. A final blower door test may still be required.

Ventilation - Innova AIO Vertical



Heat Recovery Ventilation is essential with efficiencies in the order of 85%

CLIMA DESIGN TECHNOLOGIES LTD.



Ventilation – Posh Vents

ENEREADY PRODUCTS LTD.

- Targets the exhaust air flow to the source
- The Innova accepts a signal from the PoshTime Control and boosts the exhaust rate
- The power Grill opens

POWER Grille & PoshTime® Control

Ventilation –Van Air Doors

Airflow Performance

Air flows through the core via discreet, staggered ventilation slots on opposing faces, providing the **airflow equivalent of a 12”x12” grille or louver**.

Solid Sound Privacy

While providing excellent airflow, sound is absorbed as it moves through the channel, providing **sound privacy equivalent of a solid core door**.

Hot Water – Sanco CO2

SMALL PLANET SUPPLY™

PLAN IT WITH THE PLANET IN MIND

- 5x more efficient than traditional electric water heater
- Allows use of off-peak power
- Greater first hour rating than all heat pump water heaters
- Faster recovery after hot water draw
- Hot water production down to -20°F & below
- Up to 150°F delivered hot water temperature

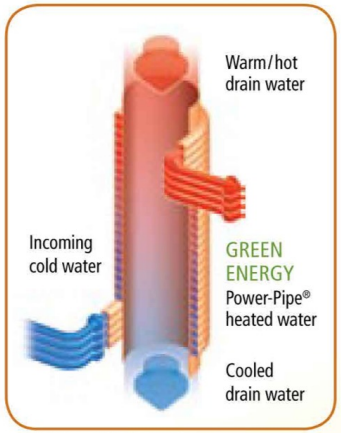
SANCO2

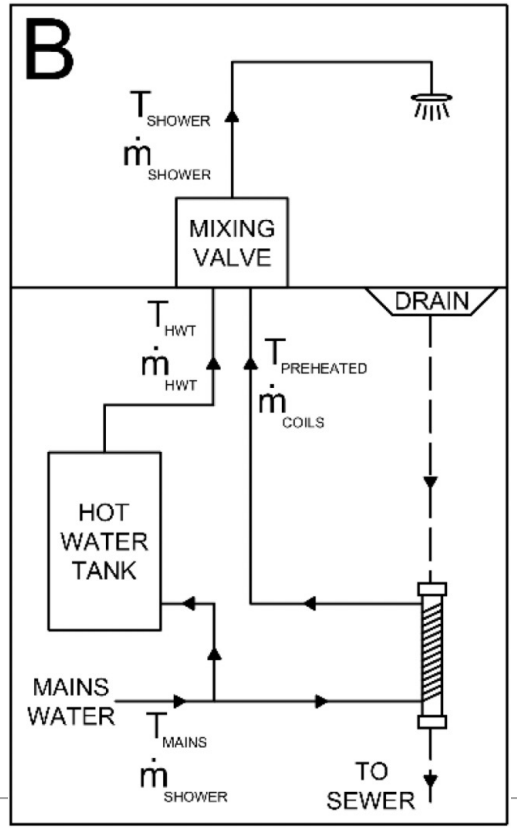
Hot water, *naturally.*

Hot Water – Drain water heat Recovery

Power Pipe

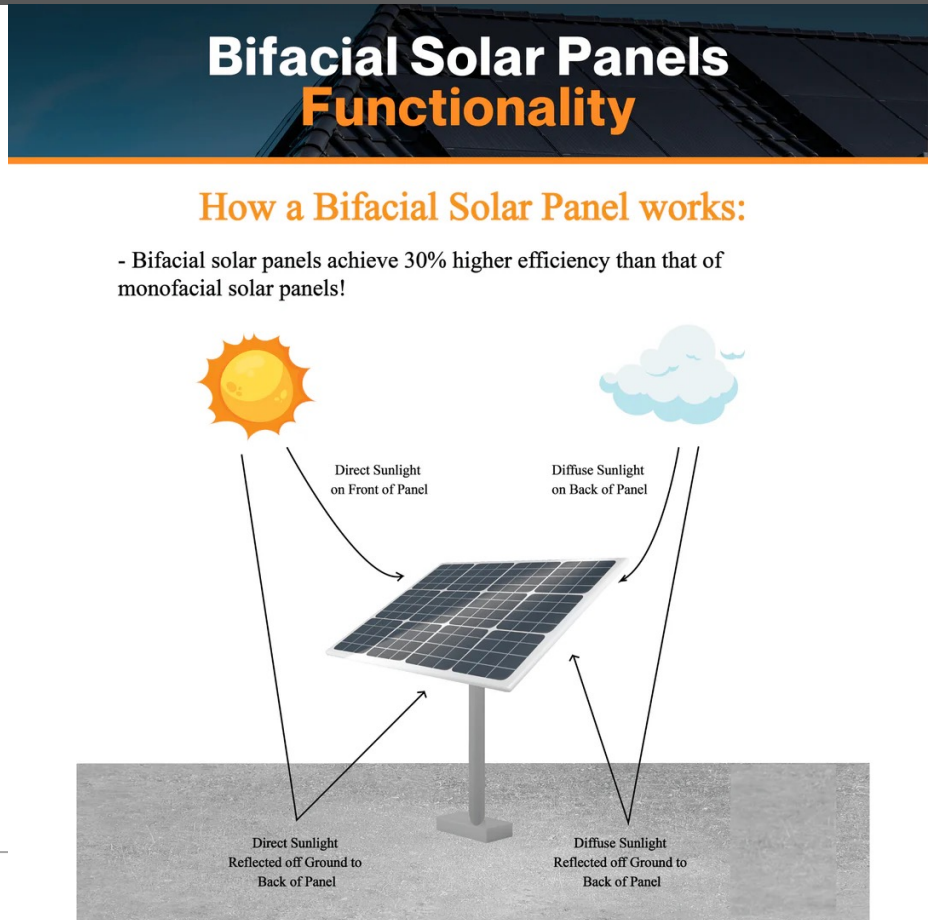
- Piped to the cold water side of the shower valve.
- Reduces hot water consumption.
- Requires the use of the thermostatic hot water valve.





Solar Panels – Longi Bi Facial

- 10-600W bi-facial panels on the south roof
- 7-450W bi-facial panels on each canopy
- 12,300W total capacity



String Inverter vs Micro Inverter

Micro Inverter

- Creates 240V AC at the panel
- Panel by panel monitoring and rapid shutdown
- Typically shuts down when grid power is lost
- Less efficient if twinned with battery storage
- Separate inverter required for the battery
- Redundancy if one inverter fails
- Rooftop access required if the inverter fails

String Inverter

- Handles up to 500V DC current
- Provides
- All or nothing power if inverter fails
- Back-up power simplified with a built-in transfer switch.
- Rapid shutdown can be challenging is some jurisdictions
- DC Power at high voltages is dangerous
- Easy access for servicing

Inverter and Batteries– EG4

Sol49

- EG4 18K Hybrid String Inverter
  - 3 separate MPPT controllers up to 18,000 watts total
  - 12,000 W of power from the batteries
- EG4 14.3 kWhr wall mount battery
  - PHPP suggests one day consumption is XX kW hrs
- BC Hydro rebates
  - $5,000 for Solar Panels
  - $5,000 for Battery

PASSIVEHOUSE CANADA

Build better.
Feel better.

ZERO EMISSIONS INNOVATION CENTRE

Building Decarbonization Team

B2E

NearZero

BC Retrofit ACCELERATOR

CLF Carbon Leadership Forum British Columbia

zebx