

PASSIVE HOUSE AROUND THE SOUND



4,000,067,000 people as of April 1, 2017

-Puget Sound Regional Council



Photo: Buphoff, Wikipedia Commons

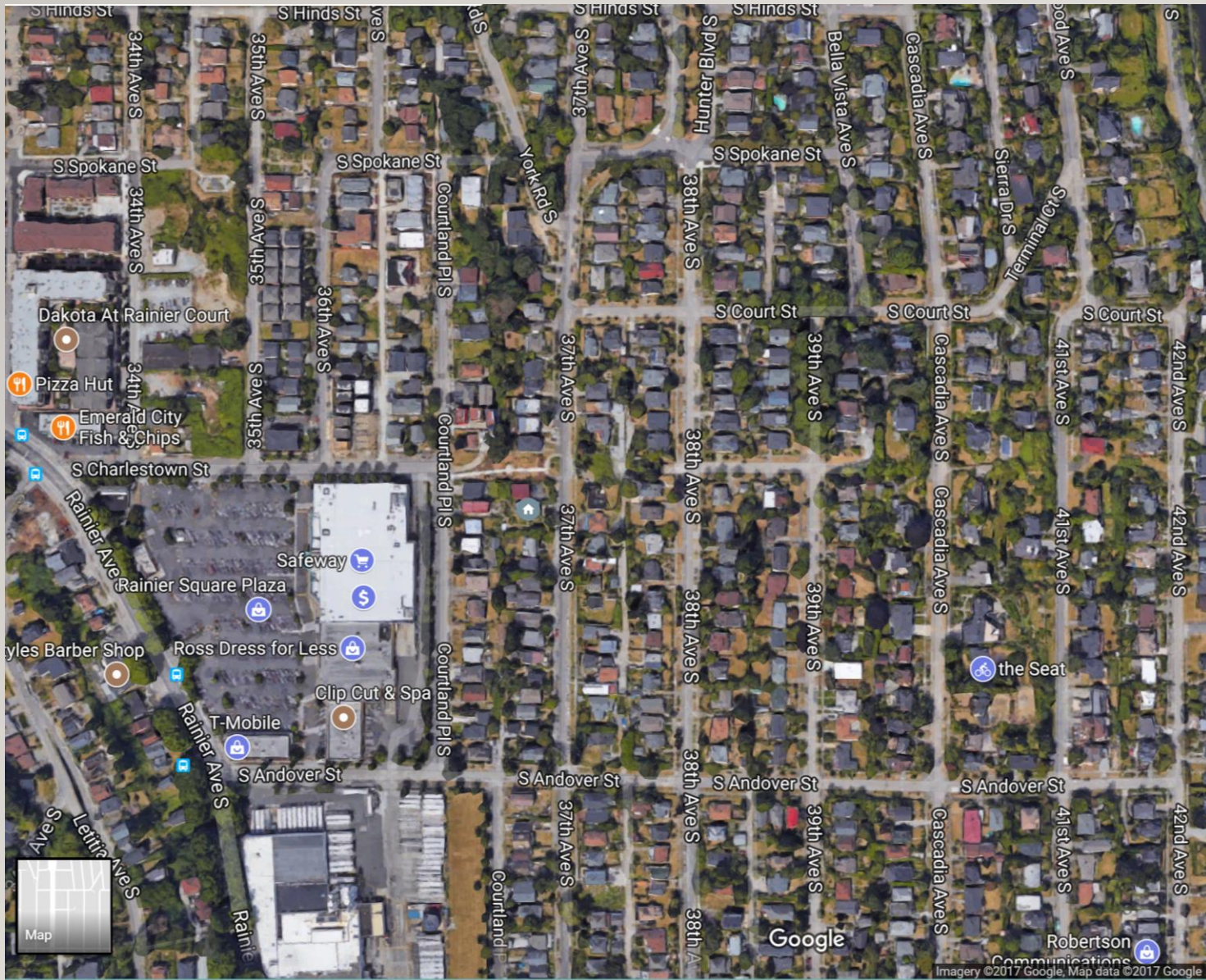




✦ Seattle, Washington

Map of the Salish Sea & Surrounding Basin, Stefan Freelan, WWU, 2009





57% of Developable Land: Single Family Zoned





Lucky 7!!!





Projects Under Construction

- 1. Flora Vista PH #1282
- 2. Phantom Lake PH #1424
- 3. Issaquah Highlands PH #1425
- 4. Madison Park PH #1426



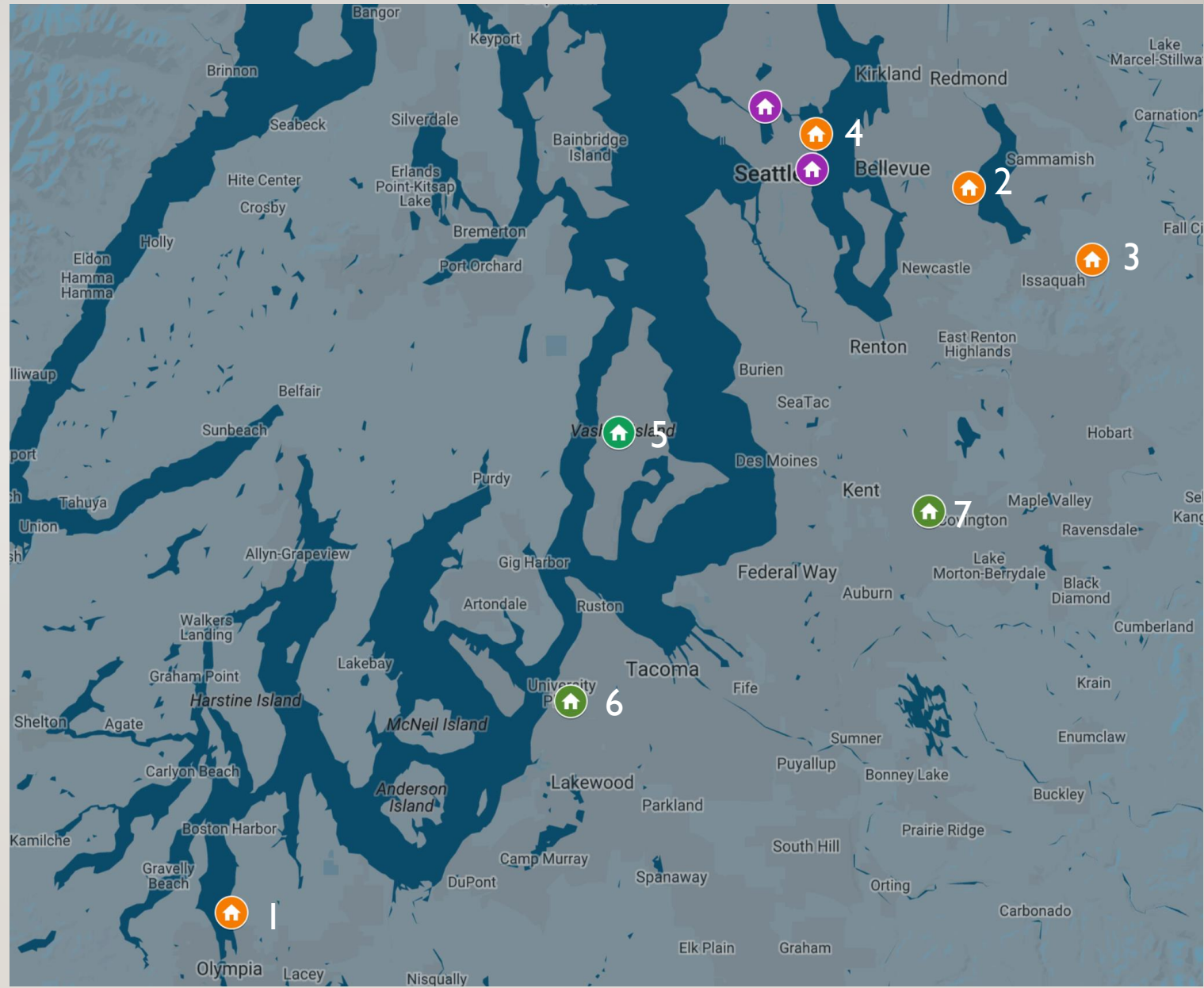
Projects Under Development

- 5. Vashon Island PH
- 6. Mount Tahoma PH
- 7. Lake Meridian PH

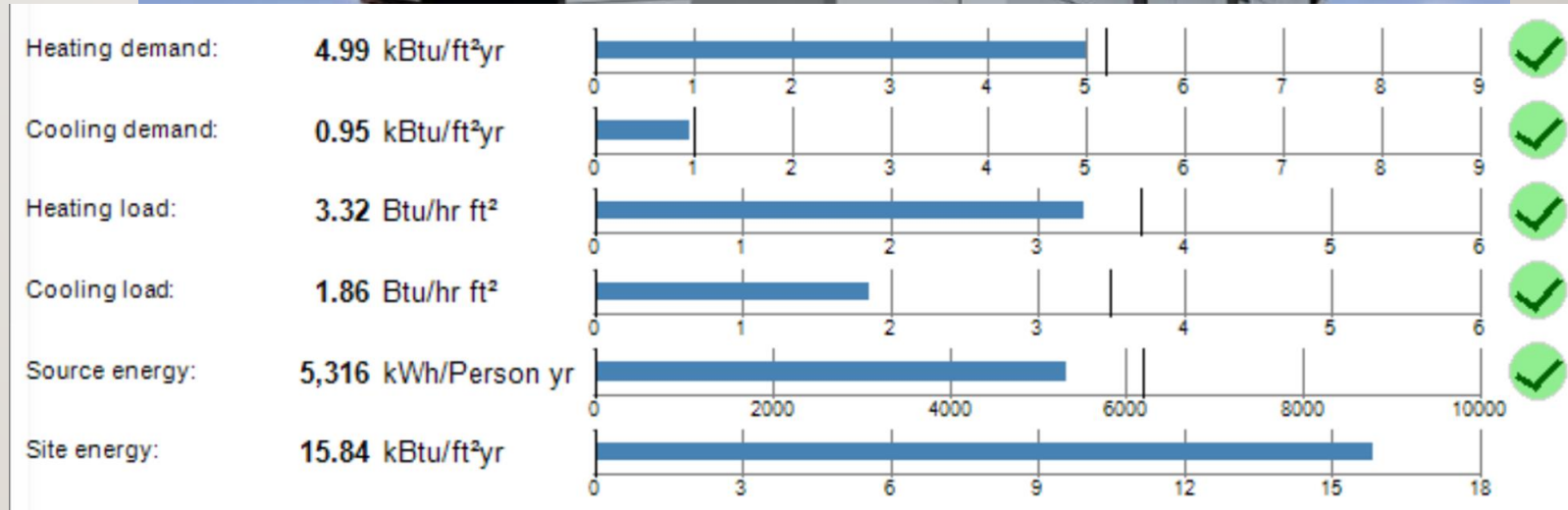


Recently Completed

- A. Madrona PH (2015)



- Projects
-Results



- Projects
 - Results
- Process
 - Team



#1: Flora Vista Passive House



Designer: Roussa Cassel



#2: Phantom Lake Passive House



Image: Velocipede



#3: Issaquah Highlands Passive House



SOUTH



modern sustainable homes



WHITNEY
ARCHITECTURE

Image: Whitney Architecture



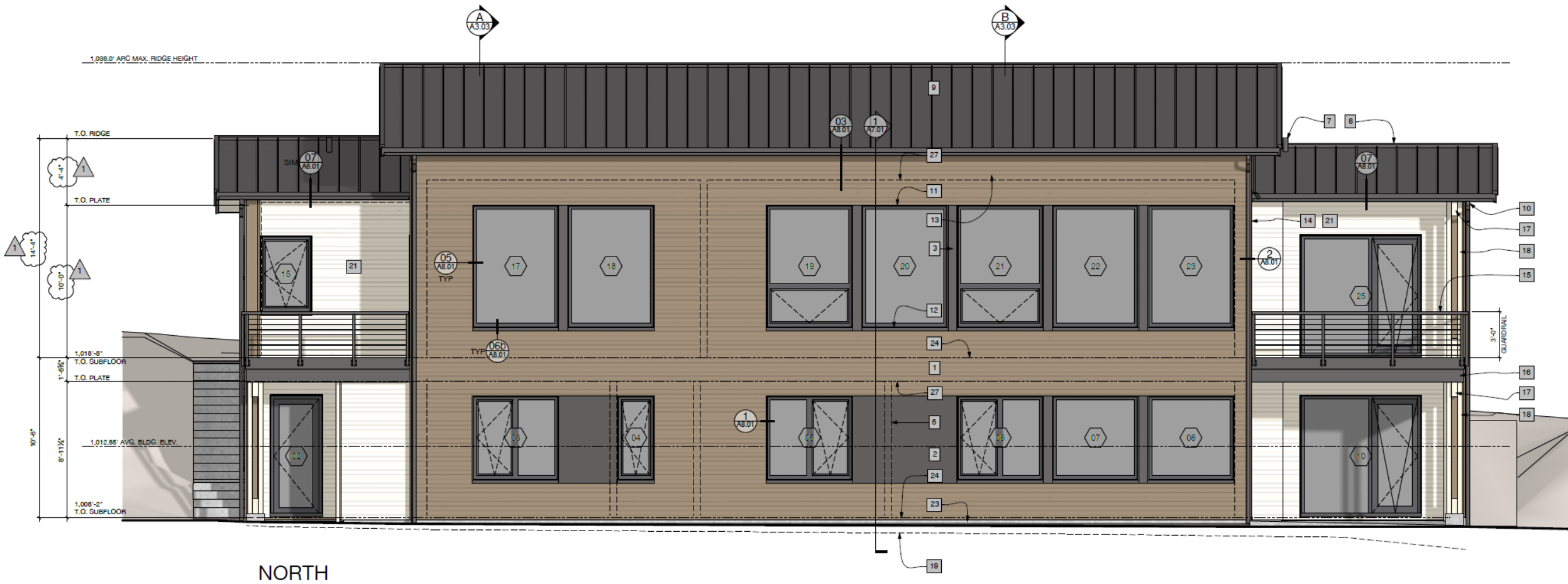


Image: Whitney Architecture



#4: Madison Park Passive House



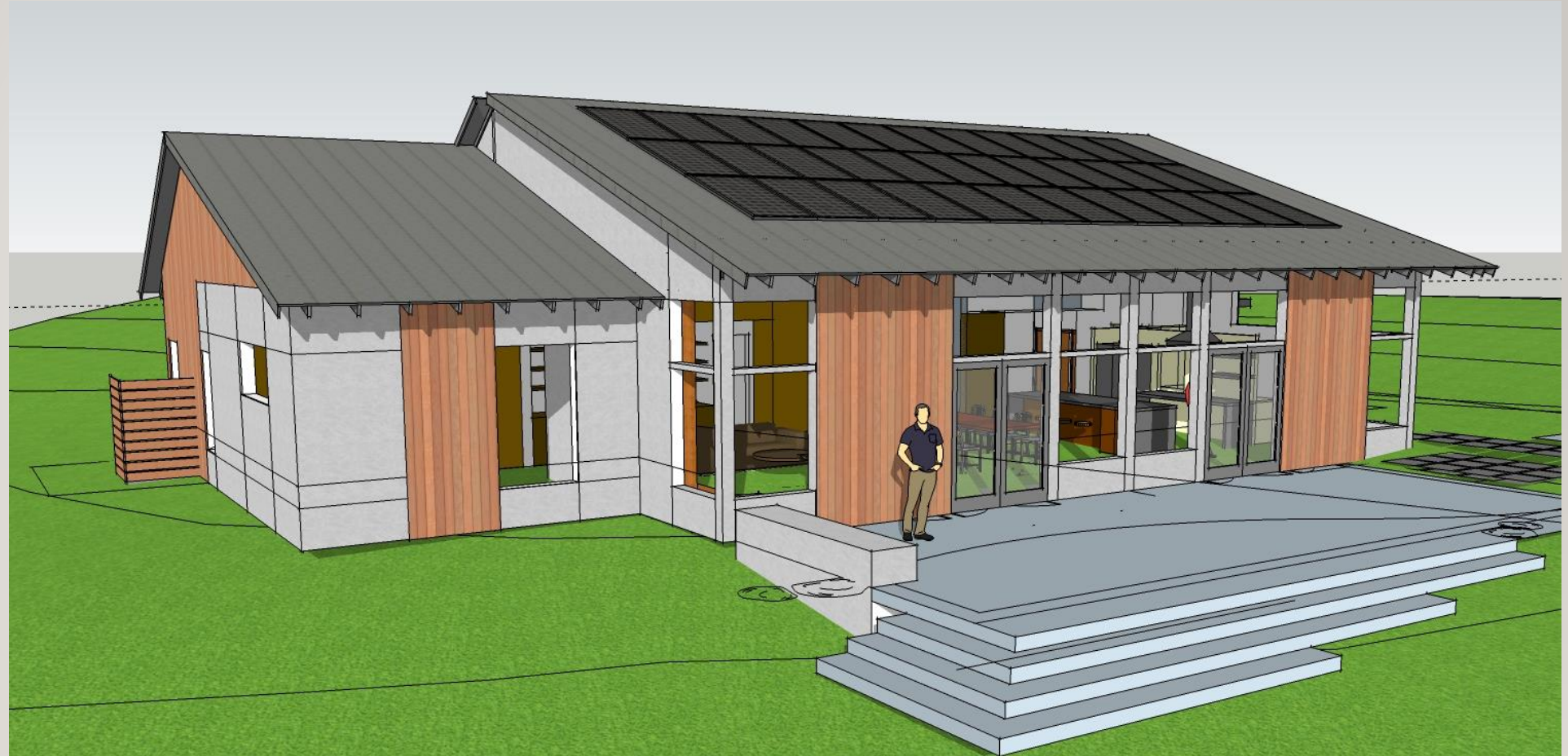
AXIOM

DESIGN + BUILD

Images: Axiom



#5: Vashon Island Passive House



BRUNNER
ARCHITECTS

Image: Brunner Architects



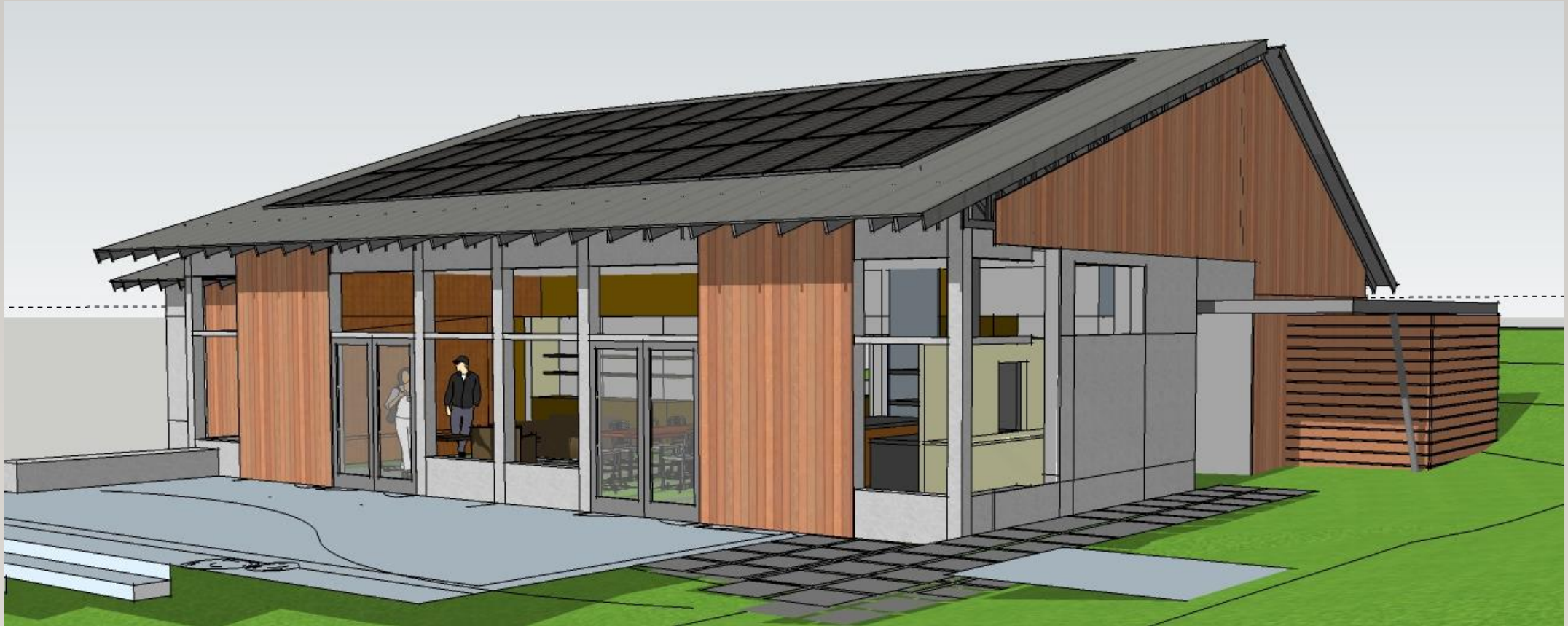


Image: Brunner Architects



#6: Mount Tahoma Passive House

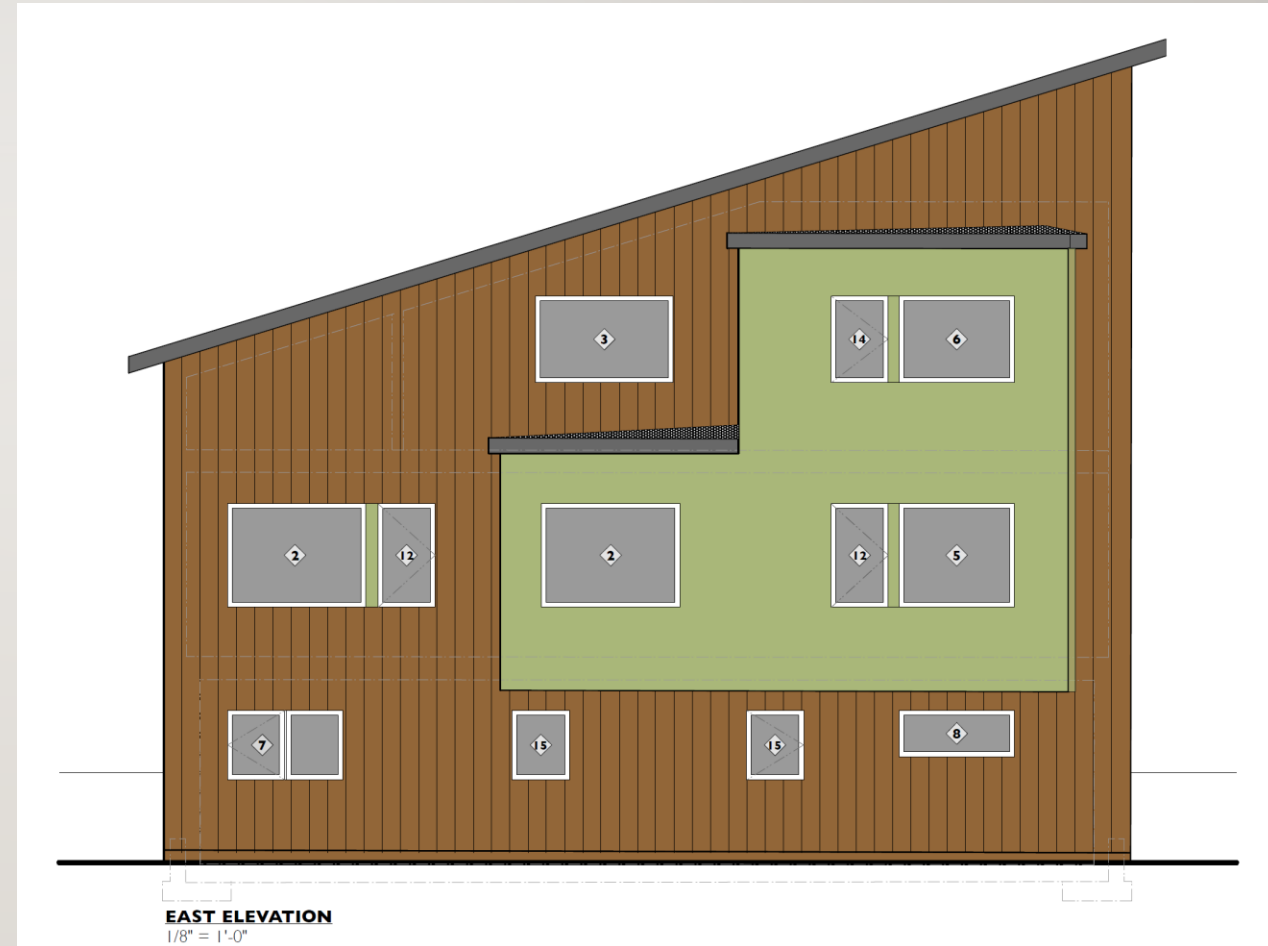
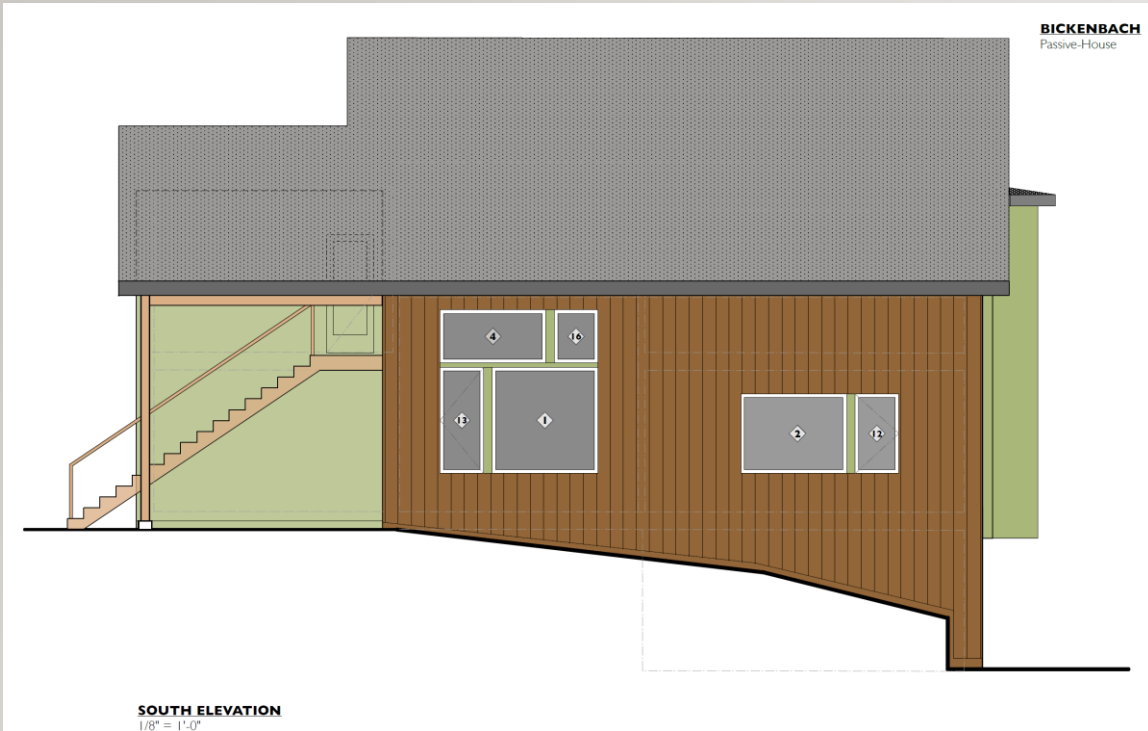


Image: Jay Lazerwitz

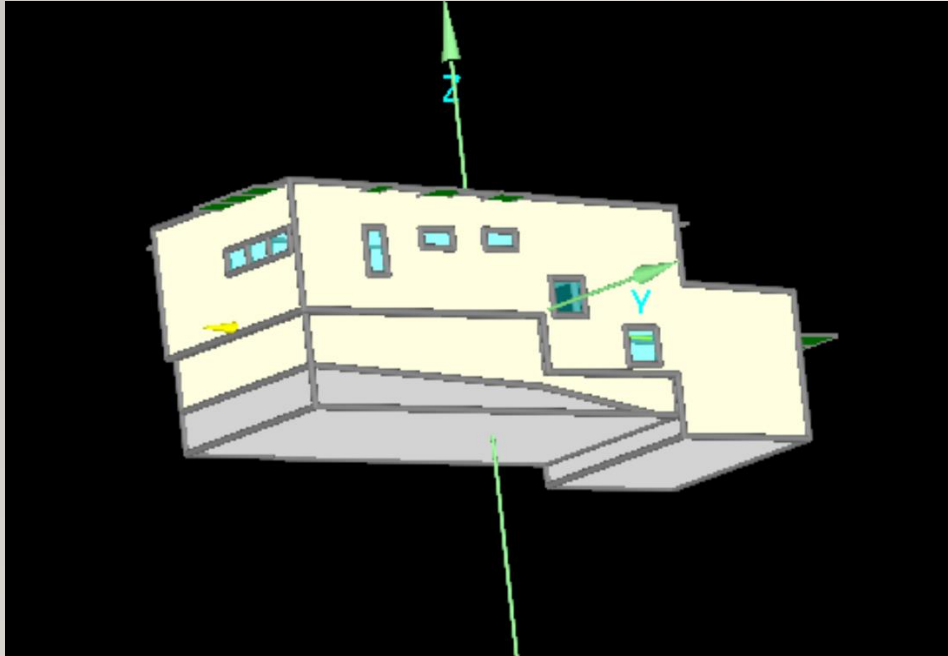


#7: Lake Meridian Passive House

On Hold!!! – Stay Tuned...



#1: Flora Vista



BUILDING INFORMATION

Category:	Residential
Status:	Under construction
Building type:	New construction
Year of construction:	2017
Units:	1
Number of occupants:	5 (Design)

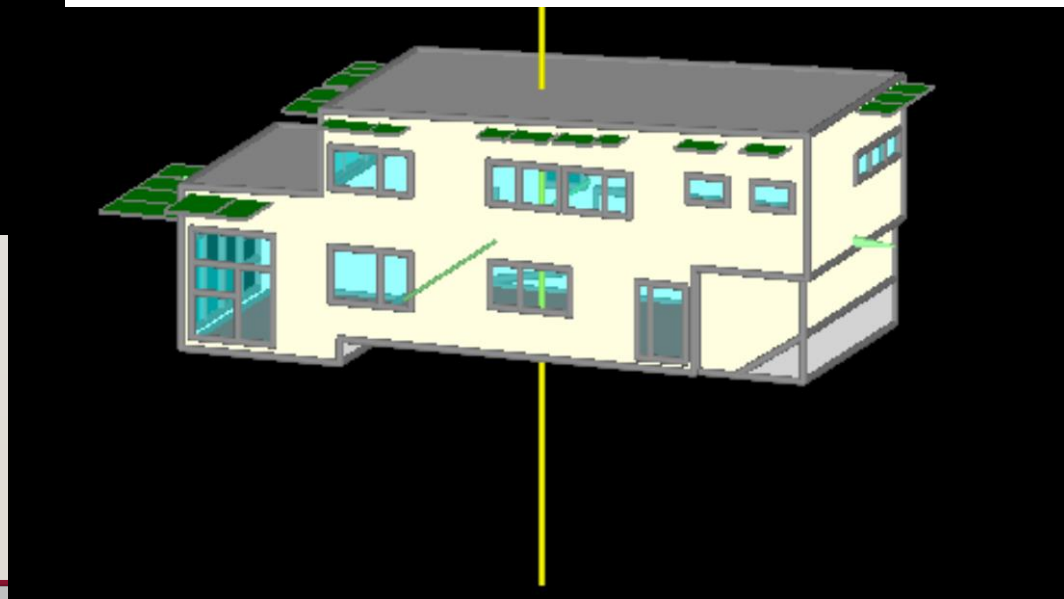


Boundary conditions

Climate:	WA - OLYMPIA AIRPORT (Monthly)
Internal heat gains:	0.9 Btu/hr ft ²
Interior temperature:	68 °F
Overheat temperature:	77 °F

Building geometry

Enclosed volume:	32,149.2 ft ³
Net-volume:	21,323.6 ft ³
Total area envelope:	6,928.9 ft ²
AV ratio:	0.2 1/ft
Floor area:	2,398 ft ²



Heating demand:

5.83 kBtu/ft²yr



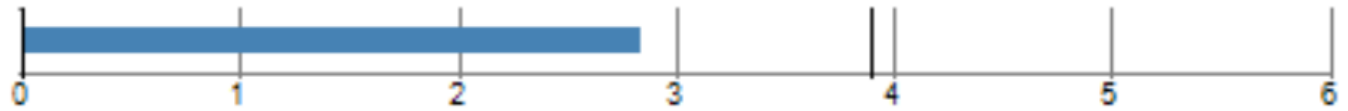
Cooling demand:

0.4 kBtu/ft²yr



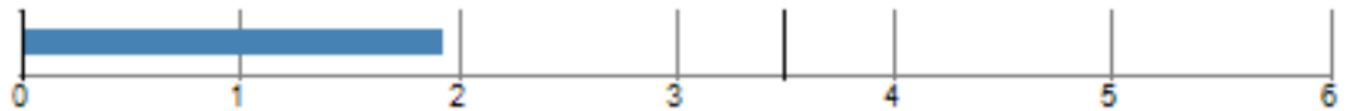
Heating load:

2.84 Btu/hr ft²



Cooling load:

1.93 Btu/hr ft²



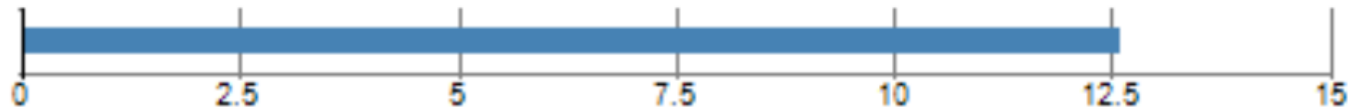
Source energy:

5,601 kWh/Person yr



Site energy:

12.61 kBtu/ft²yr



#2: Phantom Lake

BUILDING INFORMATION

Category:	Residential
Status:	Under construction
Building type:	New construction
Year of construction:	2017
Units:	1
Number of occupants:	5 (Design)

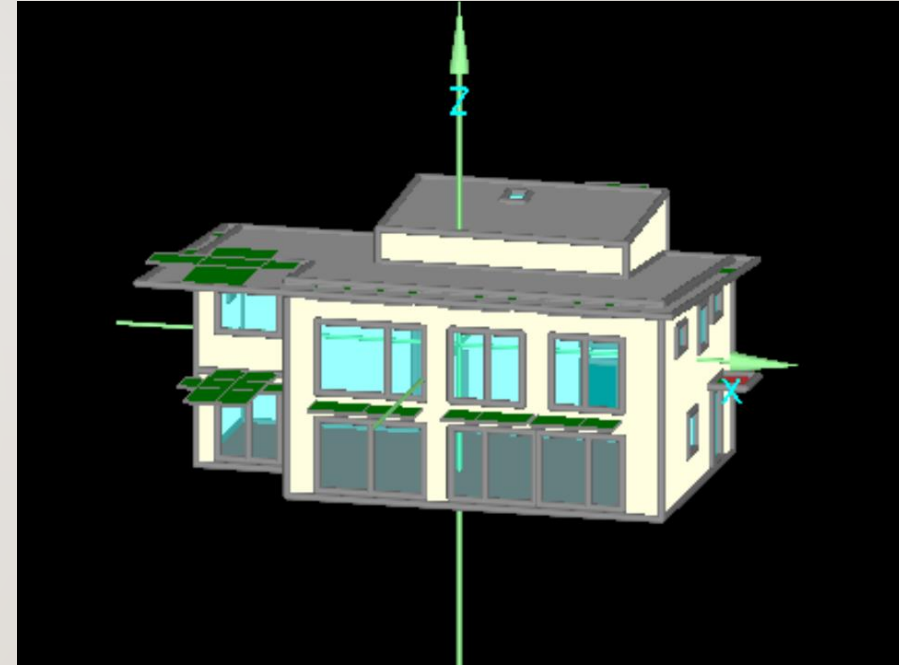


Boundary conditions

Climate:	Renton, WA
Internal heat gains:	0.9 Btu/hr ft²
Interior temperature:	68 °F
Overheat temperature:	77 °F

Building geometry

Enclosed volume:	38,660.4 ft ³
Net-volume:	29,383 ft ³
Total area envelope:	7,651.2 ft ²
AV ratio:	0.2 1/ft
Floor area:	2,790 ft ²



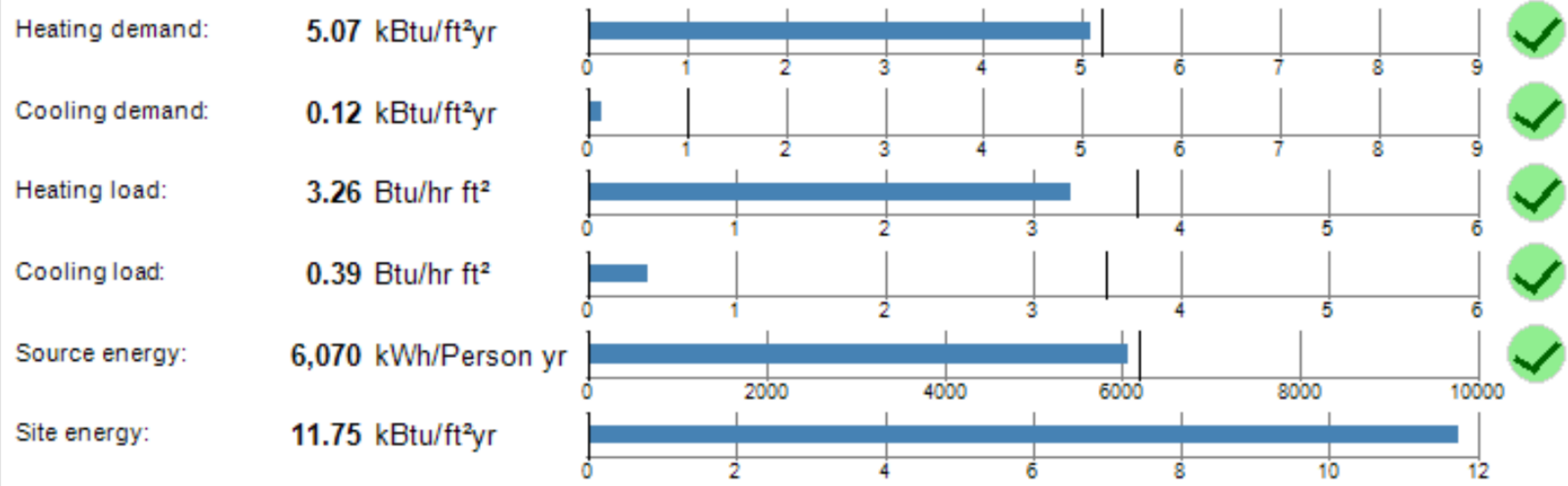




Image: Jon Alexander



#3: Issaquah Highlands

BUILDING INFORMATION

Category:	Residential
Status:	Under construction
Building type:	New construction
Year of construction:	2017
Units:	1
Number of occupants:	7 (Design)

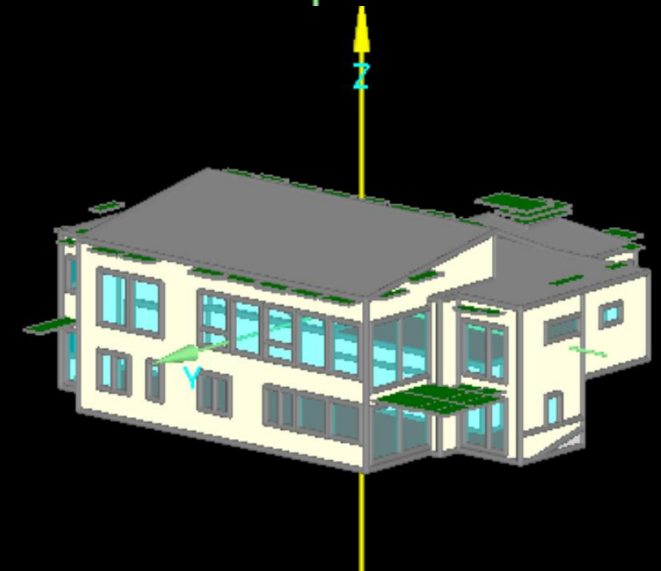
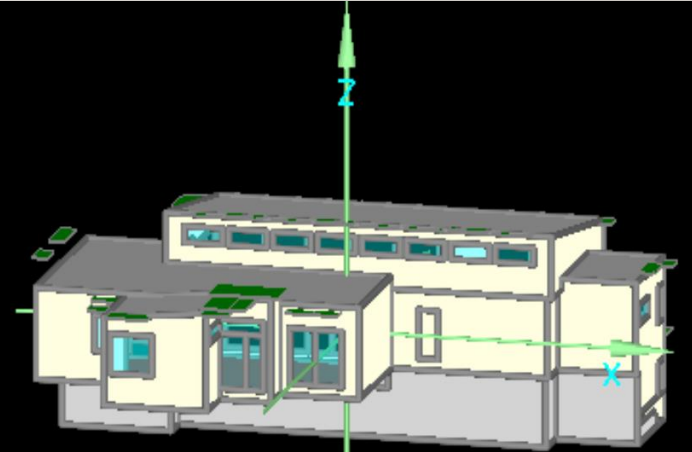


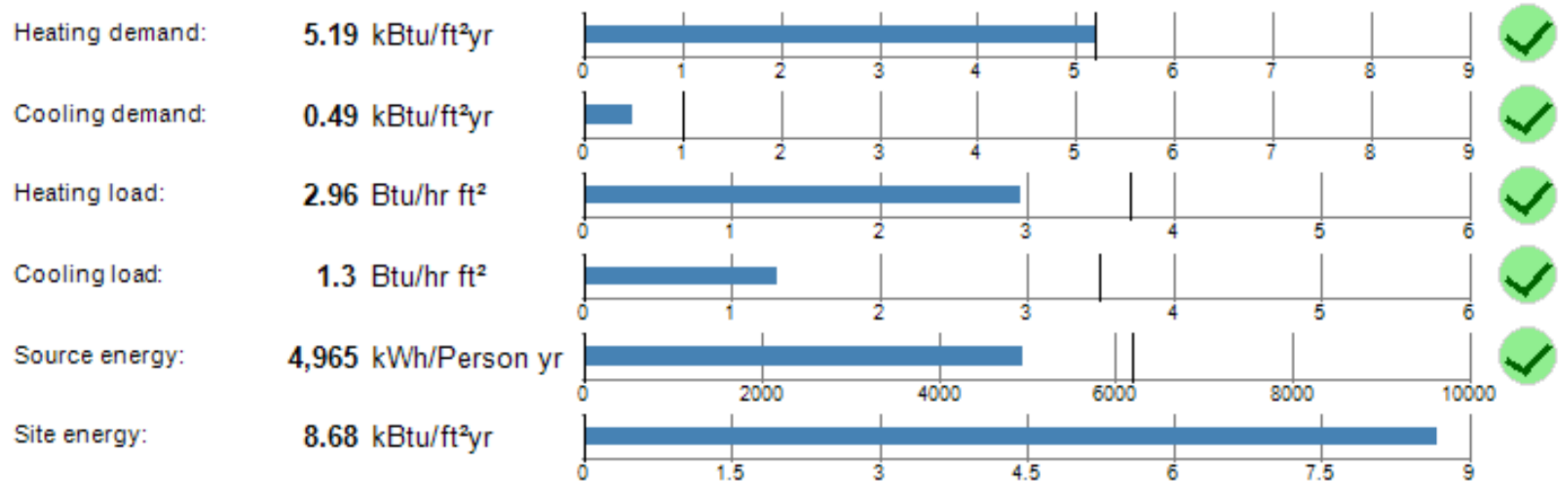
Boundary conditions

Climate:	Renton, WA
Internal heat gains:	0.8 Btu/hr ft²
Interior temperature:	68 °F
Overheat temperature:	77 °F

Building geometry

Enclosed volume:	64,726.3 ft³
Net-volume:	46,065.2 ft³
Total area envelope:	12,567.4 ft²
AV ratio:	0.2 1/ft
Floor area:	4,322 ft²







Images: YS Built



#4: Madison Park

BUILDING INFORMATION

Category:	Residential
Status:	Under construction
Building type:	New construction
Year of construction:	2017
Units:	1
Number of occupants:	6 (Design)

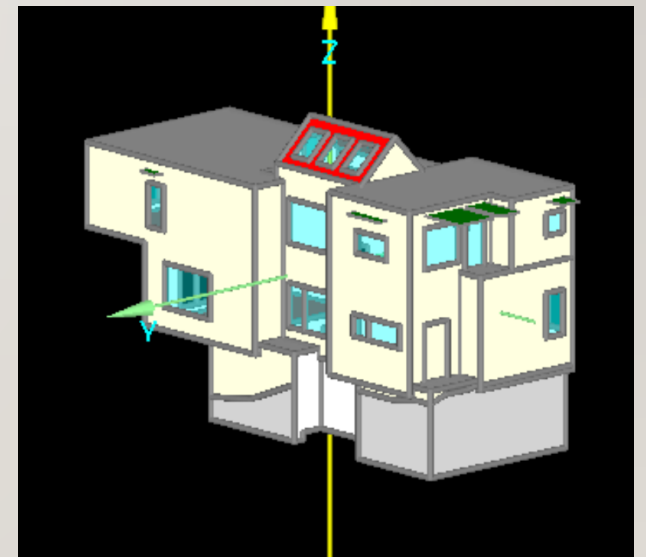
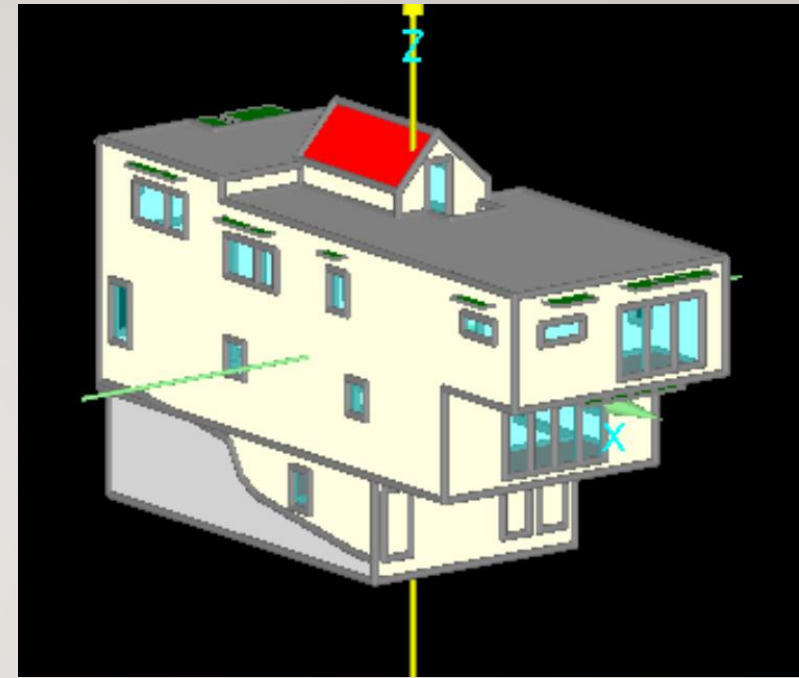


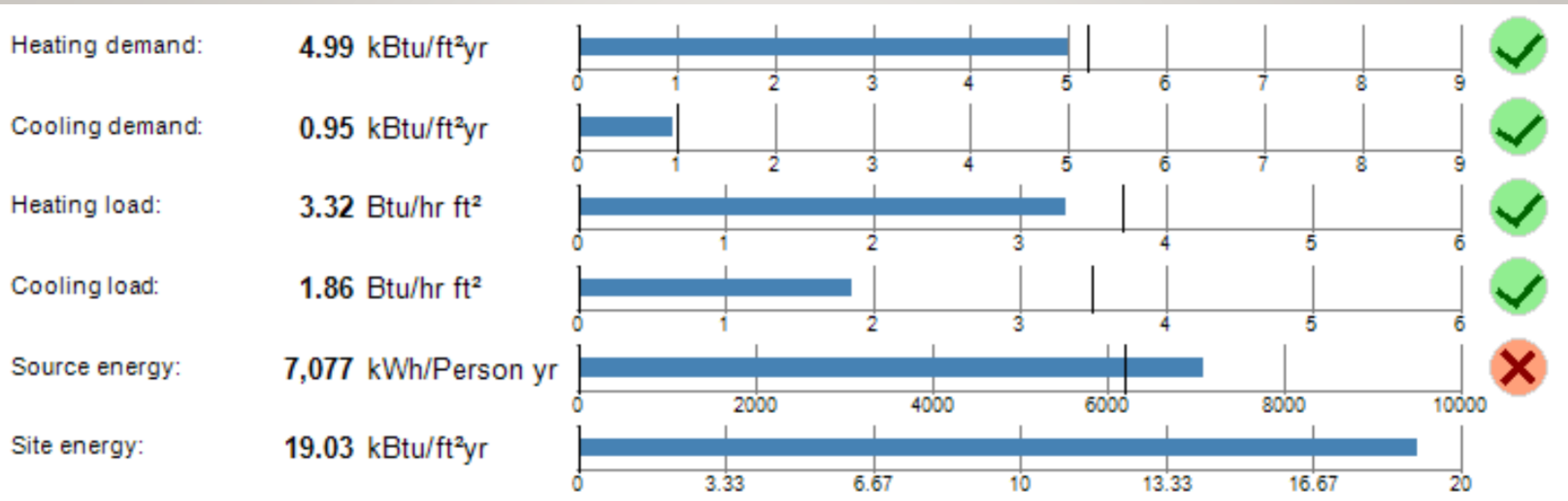
Boundary conditions

Climate:	WA - RENTON MUNI (Monthly)
Internal heat gains:	1 Btu/hr ft²
Interior temperature:	68 °F
Overheat temperature:	77 °F

Building geometry

Enclosed volume:	43,611.3 ft ³
Net-volume:	22,753 ft ³
Total area envelope:	9,490.3 ft ²
AV ratio:	0.2 1/ft
Floor area:	3,323 ft ²

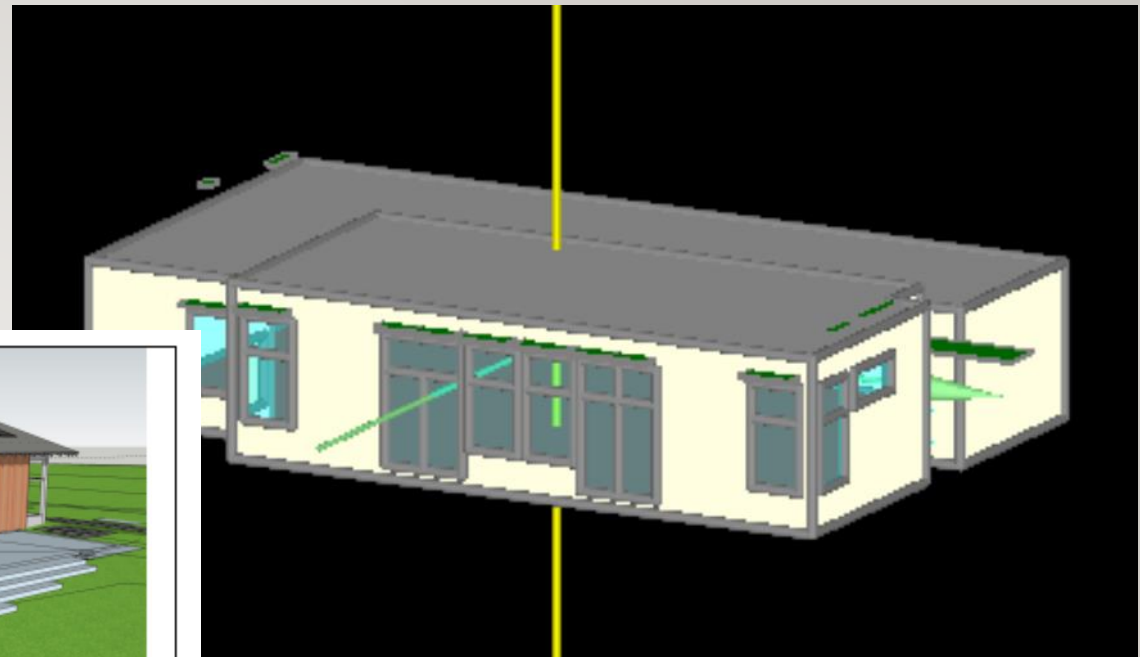




#5: Vashon Island

BUILDING INFORMATION

Category:	Residential
Status:	In planning
Building type:	New construction
Year of construction:	
Units:	1
Number of occupants:	3 (Design)

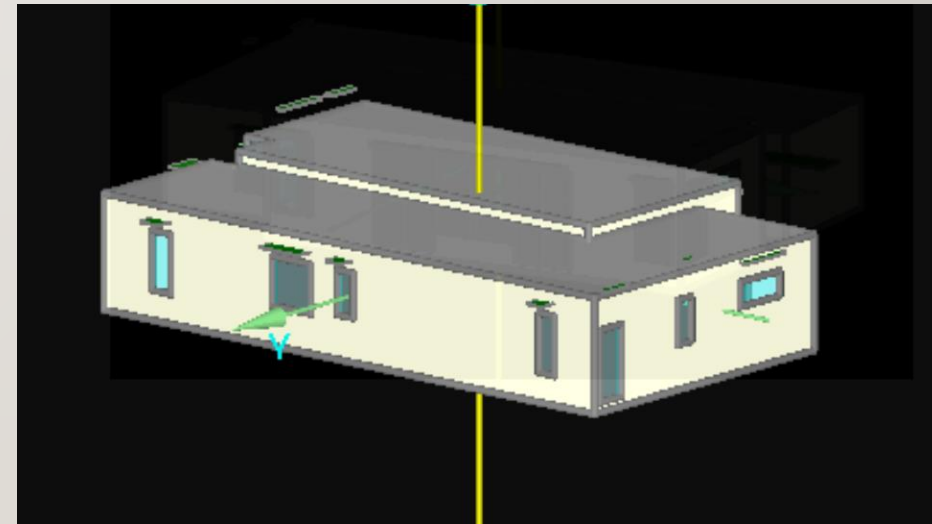


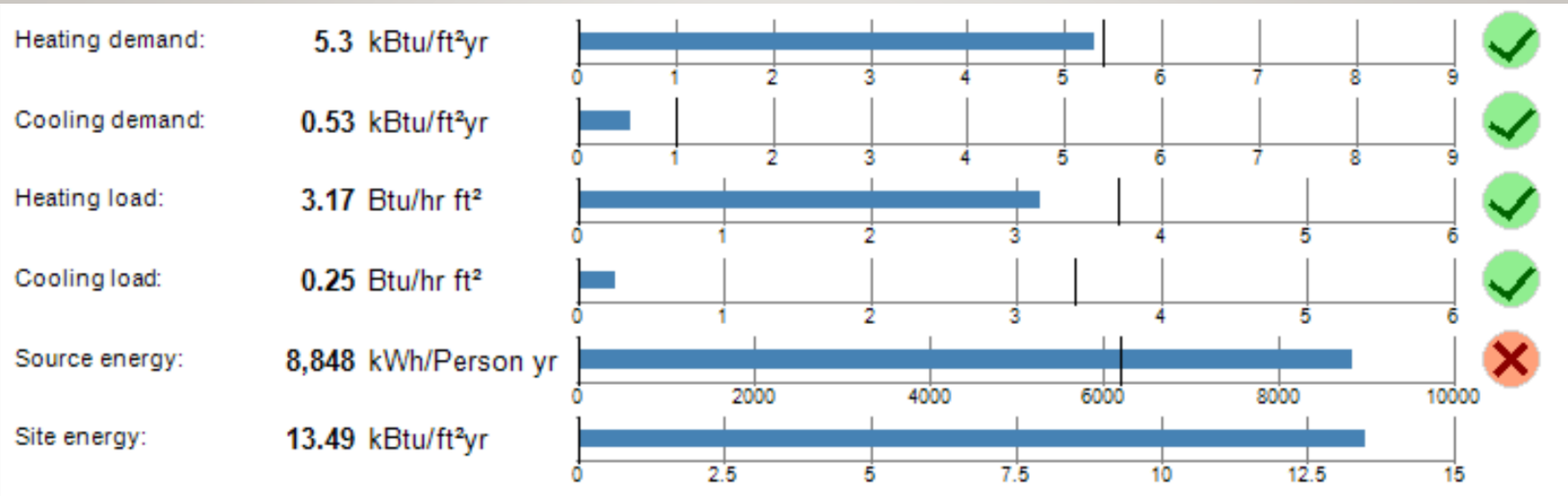
Boundary conditions

Climate:	SEATTLE SEATTLE-TACOMA INTL A WA
Internal heat gains:	1 Btu/hr ft²
Interior temperature:	68 °F
Overheat temperature:	77 °F

Building geometry

Enclosed volume:	28,793.6 ft³
Net-volume:	20,000 ft³
Total area envelope:	7,319.3 ft²
AV ratio:	0.3 1/ft
Floor area:	2,125 ft²

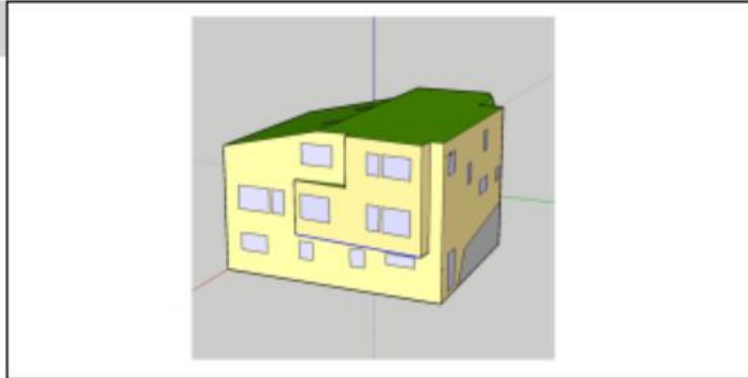




#7: Mount Tahoma

BUILDING INFORMATION

Category:	Residential
Status:	In planning
Building type:	New construction
Year of construction:	2017
Units:	1
Number of occupants:	5 (Design)

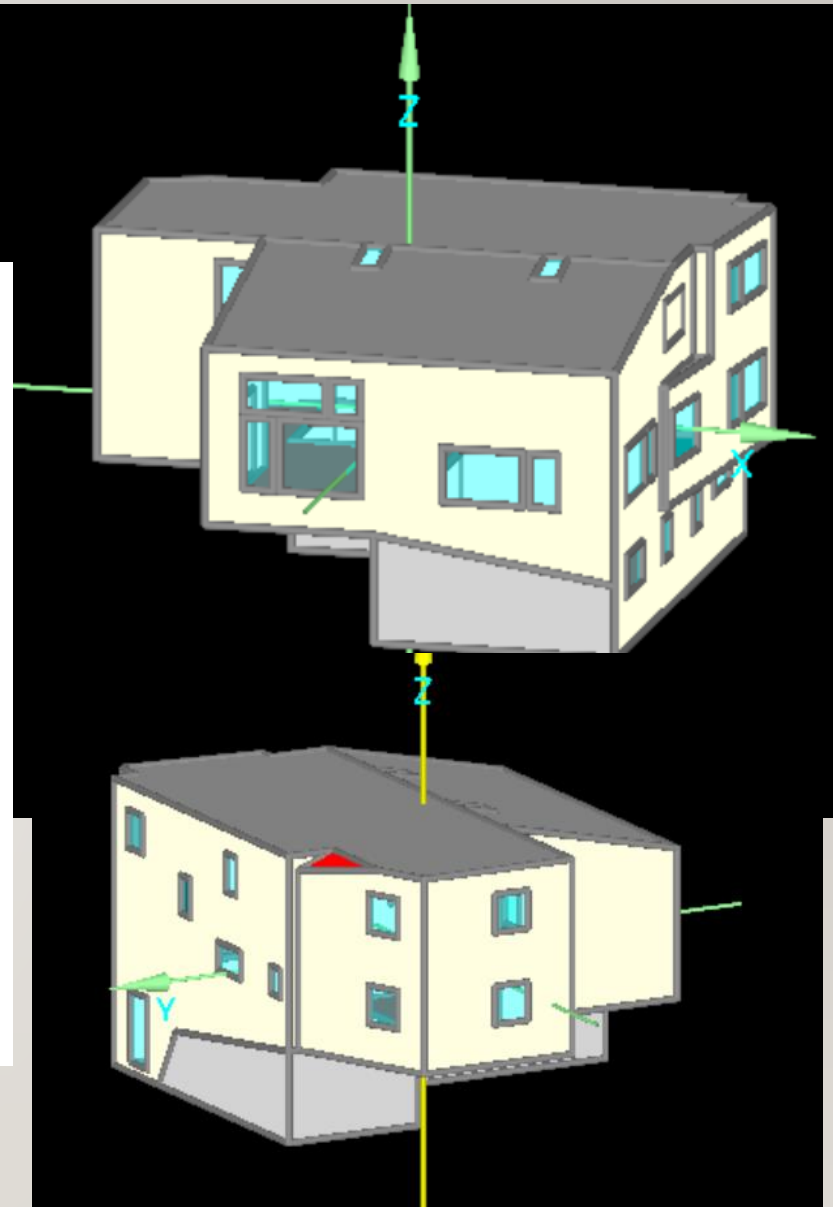


Boundary conditions

Climate:	WA - TACOMA MCCHORD AFB (2) (Monthly)
Internal heat gains:	0.7 Btu/hr ft²
Interior temperature:	68 °F
Overheat temperature:	77 °F

Building geometry

Enclosed volume:	41,371.5 ft³
Net-volume:	35,000 ft³
Total area envelope:	8,096.7 ft²
AV ratio:	0.2 1/ft
Floor area:	3,460 ft²



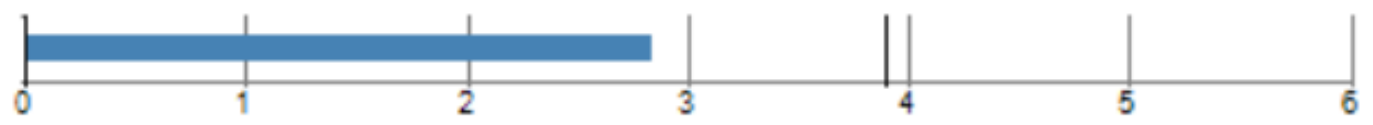
Heating demand: 5.83 kBtu/ft²yr



Cooling demand: 0.53 kBtu/ft²yr



Heating load: 2.84 Btu/hr ft²



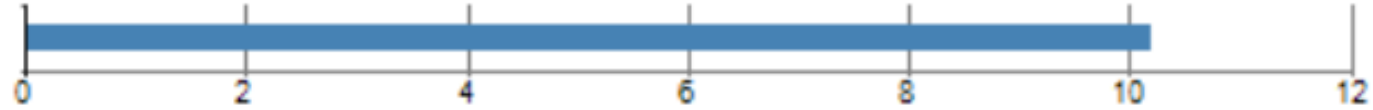
Cooling load: 0.9 Btu/hr ft²



Source energy: 6,544 kWh/Person yr



Site energy: 10.21 kBtu/ft²yr



MAIN UNANIMOUS DECISIONS

- ✓ Continuous exterior insulation
EPS, Poly-Iso, Mineral Wool
- ✓ DHW Re-Circulation
- ✓ Certification... I hope
- ✓ Wood for structure (most are 2x8)
- ✓ Fiberglass BIBs in the walls
- ✓ Top shelf ventilation units

That's all?

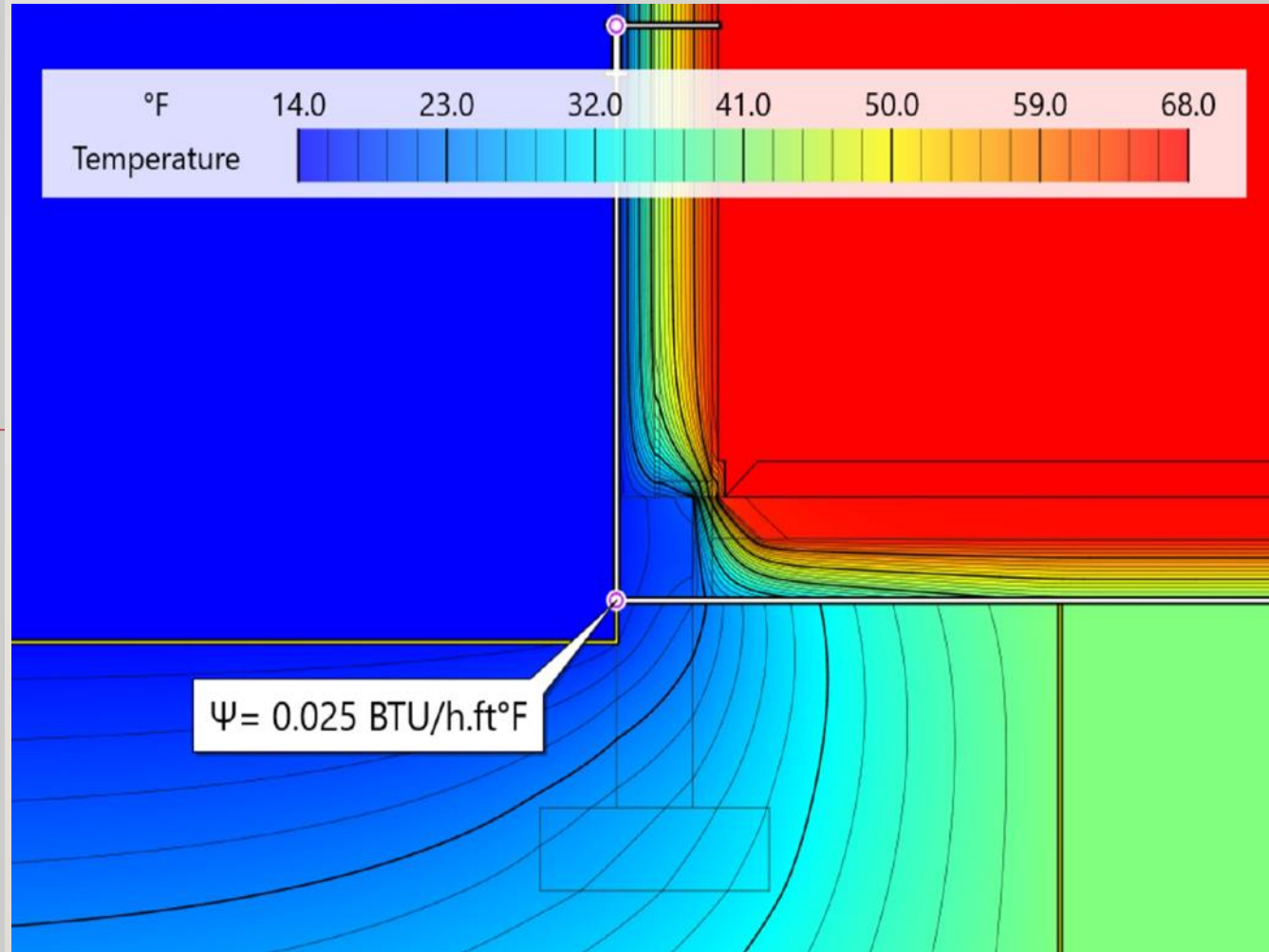
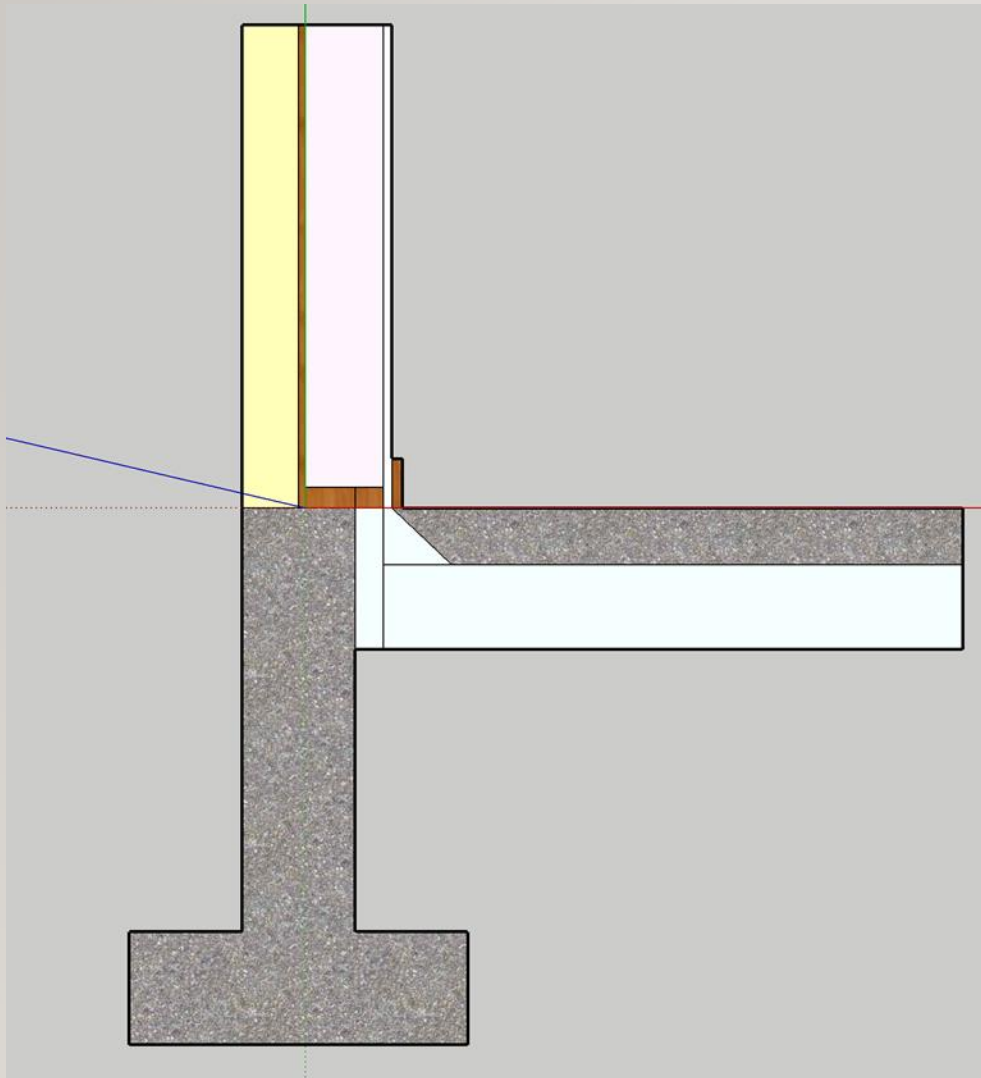


COMMON CONSTRAINTS & DECISIONS

1. Site constraints = Foundation outside of the envelope

- Sloping (5 walk-out basements)
- Poor soil (1 Pin Piles)





COMMON CONSTRAINTS & DECISIONS

1. Primary Energy limit

- Solar PV to the rescue
 - Outdoor elec. resistance heaters!!!!!!

2. All-Electric: 6

3. DHW Recirculation

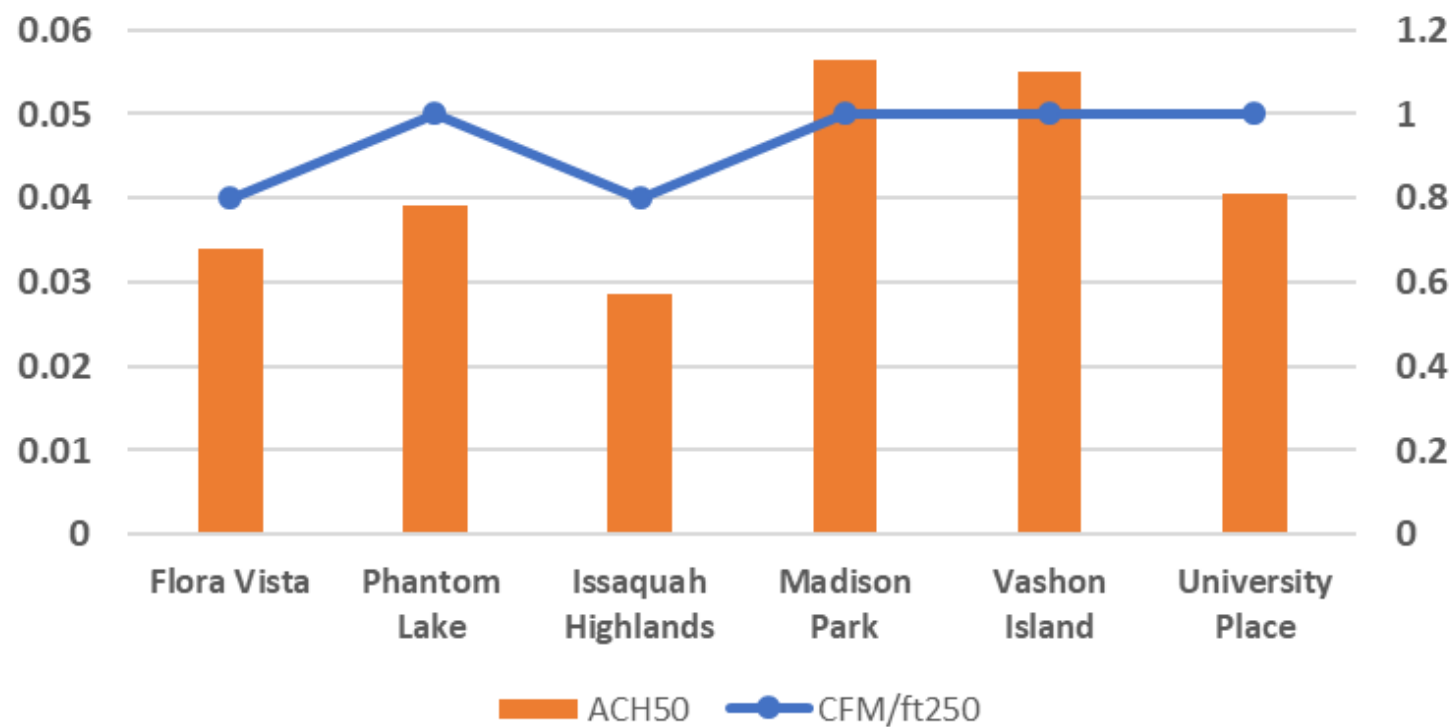


MODELING RESULTS FOR 6

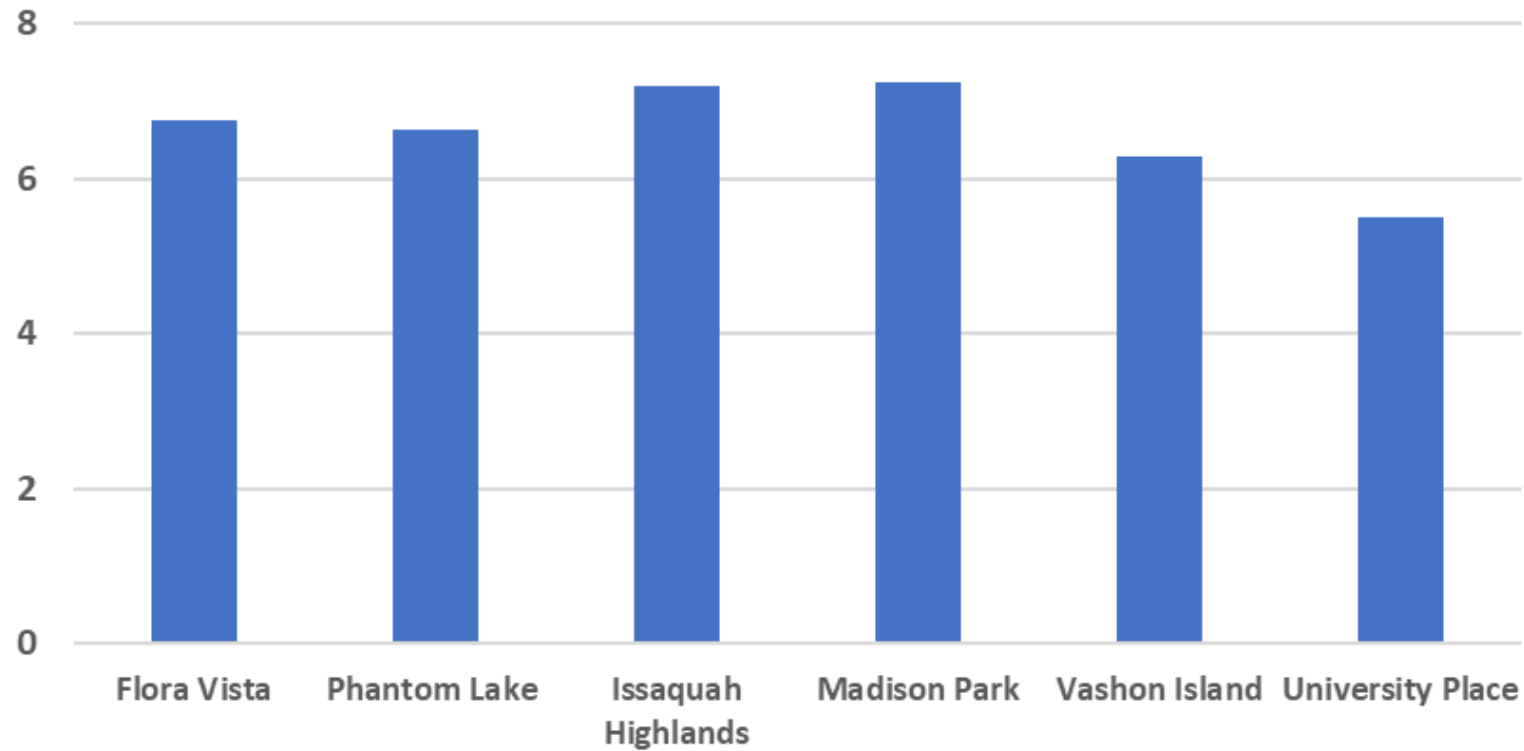
- 95-100% of limit - Annual Heating Demand for ALL
 - Issaquah ~ 100%!
- w/o Solar Photovoltaic: 4 of 6 are over PE Limit



Air Tightness Assumptions



Window R-Value



SHGC Range: 0.39-0.52



Image: YS Built



Window/Wall %

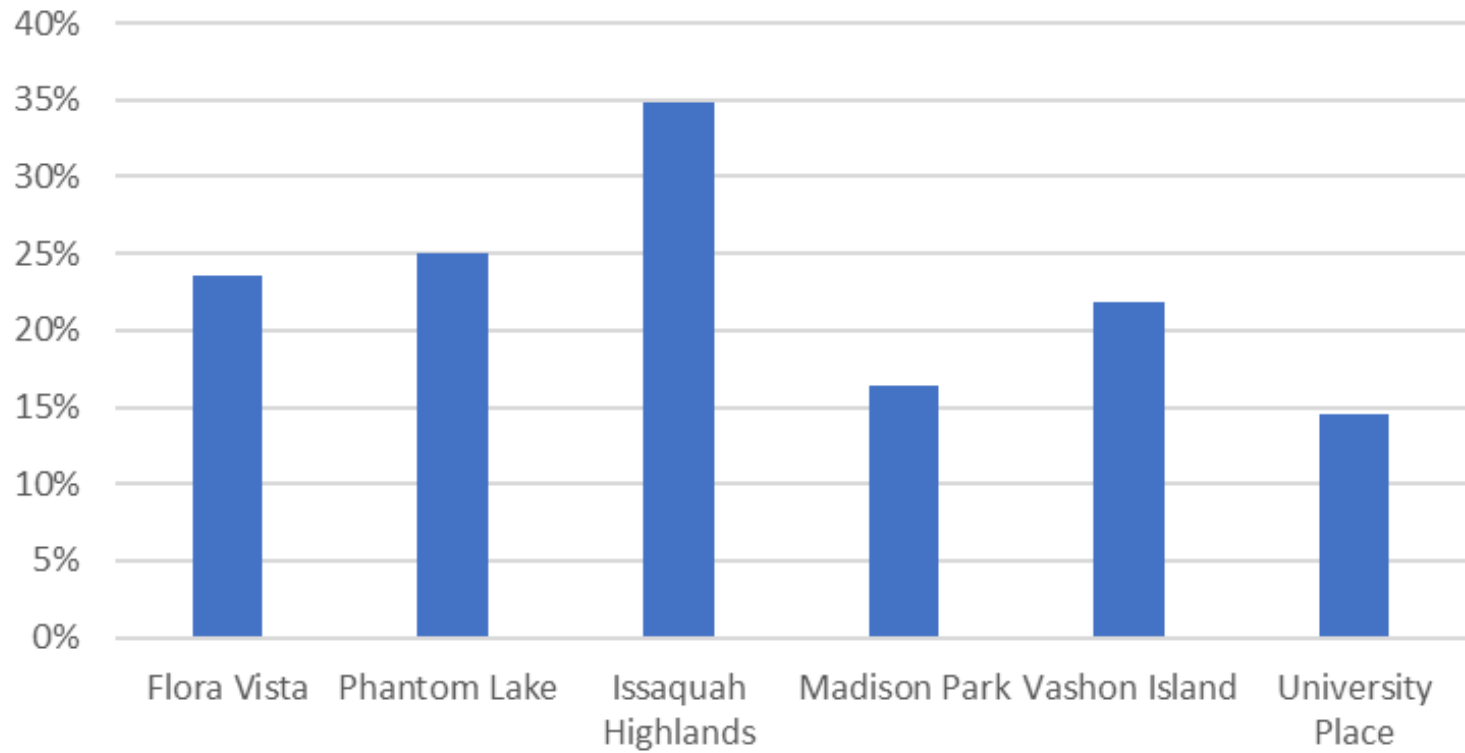


Image: YS Built



Enclosure R-Values

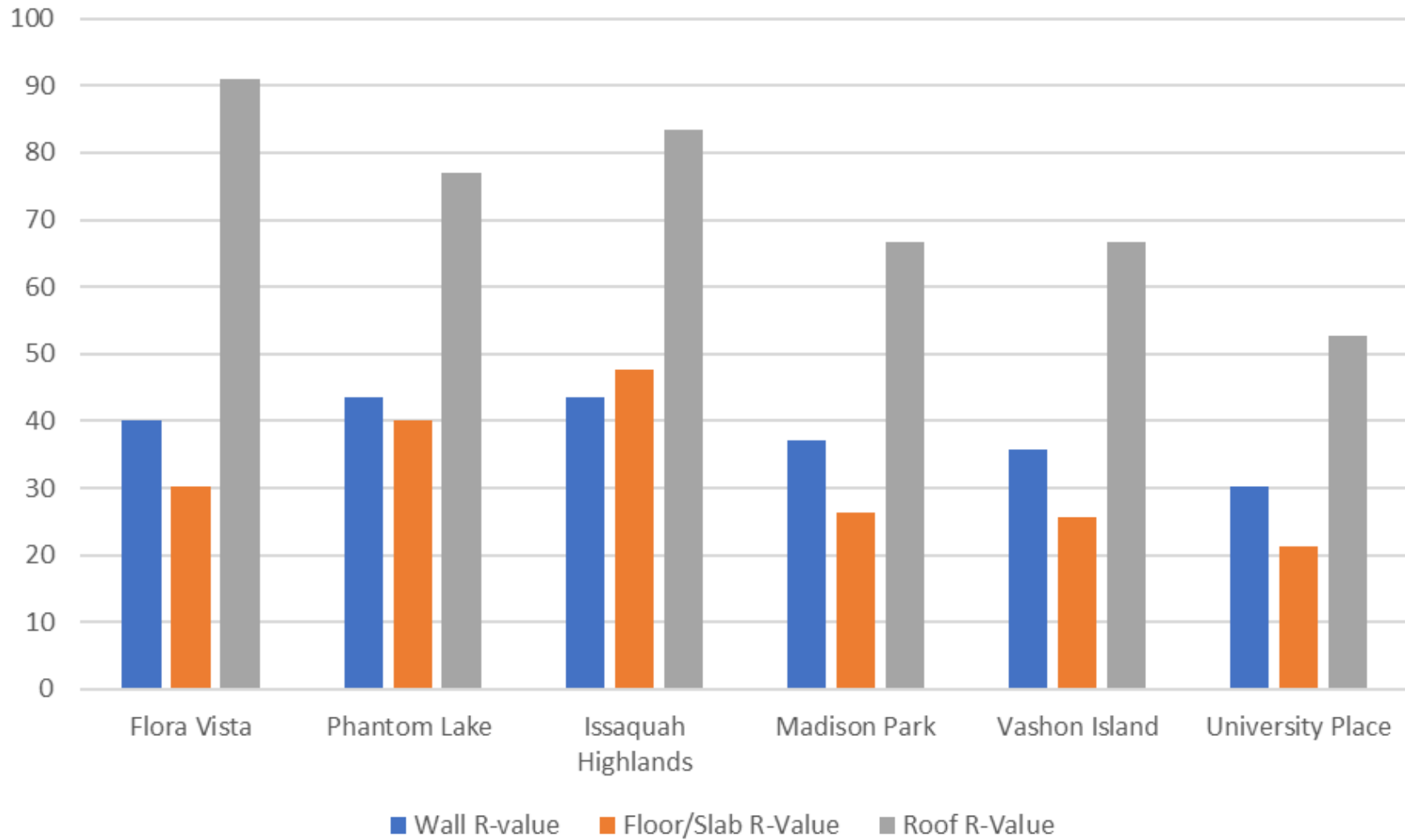


Image: Dan Whitmore



UNIQUE SOLUTIONS

1. HRV in back of Basement: Sub-Garage slab short duct run
2. No visible equipment at exterior: Heat pumps at front of tall crawlspace
3. Large house: reduce ventilation rate to less than 0.3ACH



GUIDES NEEDED FOR SITE SUPERS

- Framing with wood >2x6
- Ventilation best practice
- DHW Re-circulation
- Sub-slab insulation & Air-Barrier detailing
- Window detailing & Installation - customizable



Image: David Gottlieb



Process

7 Custom Single Family Projects

7 Owners

7 Jurisdictions

7 Architects

6 (?) Builders

5(?) Structural Engineers

0 Mechanical Engineers

High variability of experience

LOTS OF COMMUNICATION



Know your strengths
Acknowledge your weaknesses
Backup!



Contract Structure: Hourly each phase

1. Project Development
2. Project Pre-Certification
3. Construction Consulting
4. Rating Support
5. Project Certification

INDICATOR, LLC

3807 37th Ave S, Seattle, WA 98118

dan@indicatorconsulting.com

206-419-6460

UBI:604-056-915

Indicator, LLC Consulting Agreement

This Consulting Agreement ("Agreement") for design and construction consulting is entered into this 19th day of December, 2016, and agreed upon by [REDACTED] ("Client") and Indicator, LLC, a Washington limited liability company ("Indicator").

1. **Scope of Work.** Indicator shall provide the services set forth in Exhibit A hereto (the "Scope of Work"), and this Scope of Work shall not be modified unless agreed to by the parties in writing. In addition to,



BIGGEST PROCESS CHALLENGES

- Communication
 - Follow-through on spoken instructions
- Windows
 - Choices
 - Product information
- T.M.I. - Clients getting overwhelmed



MONITORING RESULTS

- Madrona PH



Image: Shed Architecture



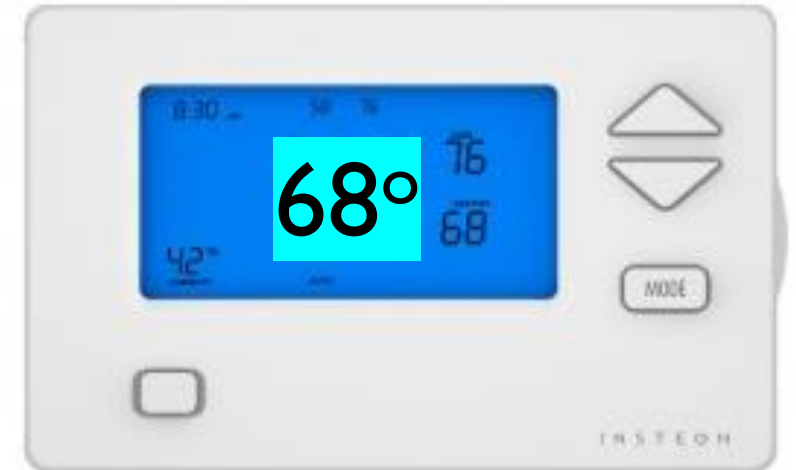
January-July	2016 (kWh)	2017 (kWh)	% Change
Production	7251	7026	-3%
Total Consumption	5544	6241	13%
Car Charging	1343	1494	11%
HPWH	1126	1889	68%
Heating Circulation Pump	50.7	129.1	155%
Other Consumption	3075	2858	-7%



Heating Season (Jan-Apr)

2016		2017	
Usage (kWh)	Avg. Outdoor Temp	Usage (kWh)	Avg. Outdoor Temp
929	48	1676	43

2017



2016	kWh
Household Consumption	7541
Car Charging	2325
Total Consumption	9866
Total Production	10768
Net w/o car	<u>3227</u>
Net w/ car	<u>902</u>

9.8kW Array



Image: Hammer and Hand



Thank You

Dan Whitmore

CPHC, PHIUS Certified Builder

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PHAUS/PHIUS - dan.whitmore@phaus.org

