WRIGHT PATH TO ZERO

WRIGHT PATH TO ZERO

US Department of Energy

Race To Zero Student Design Competition

Attached Housing

TEAM OPTIMIZE

Miami University

Oxford,Ohio

TEAM OPTIMIZE

Presenters:

Margaret Woolf

Daniel Nolan

Peter Witt

Kelly Richter

Alanna Kuether

Shuting Chen

DeAngela Weakely

Justin Wright

Andrew Maloney

Industry & Faculty Partners

Heapy Engineering

Green Building Consulting

Ultimate Air

Miller Valentine

John Becker

Mary Rogero

Padmakar Niskode

Context

10 Minutes

Wright Patterson Child Development Center

Beverly Gardens Elementary

Donato's Pizza

Song's Sushi

20 Minutes

Properties at Wright Field Self Help Store

Shellabarger Park

Saville Elementary Park

5 Minutes

Kroger

Planet Fitness

St. Helen's Parish

Pizza Hut

Burkhardt Road Kinder Care

10 Minutes

Dayton Children's Hospital

The Mall at Fairfield Commons

Beavercreek Golf Club

15 Minutes

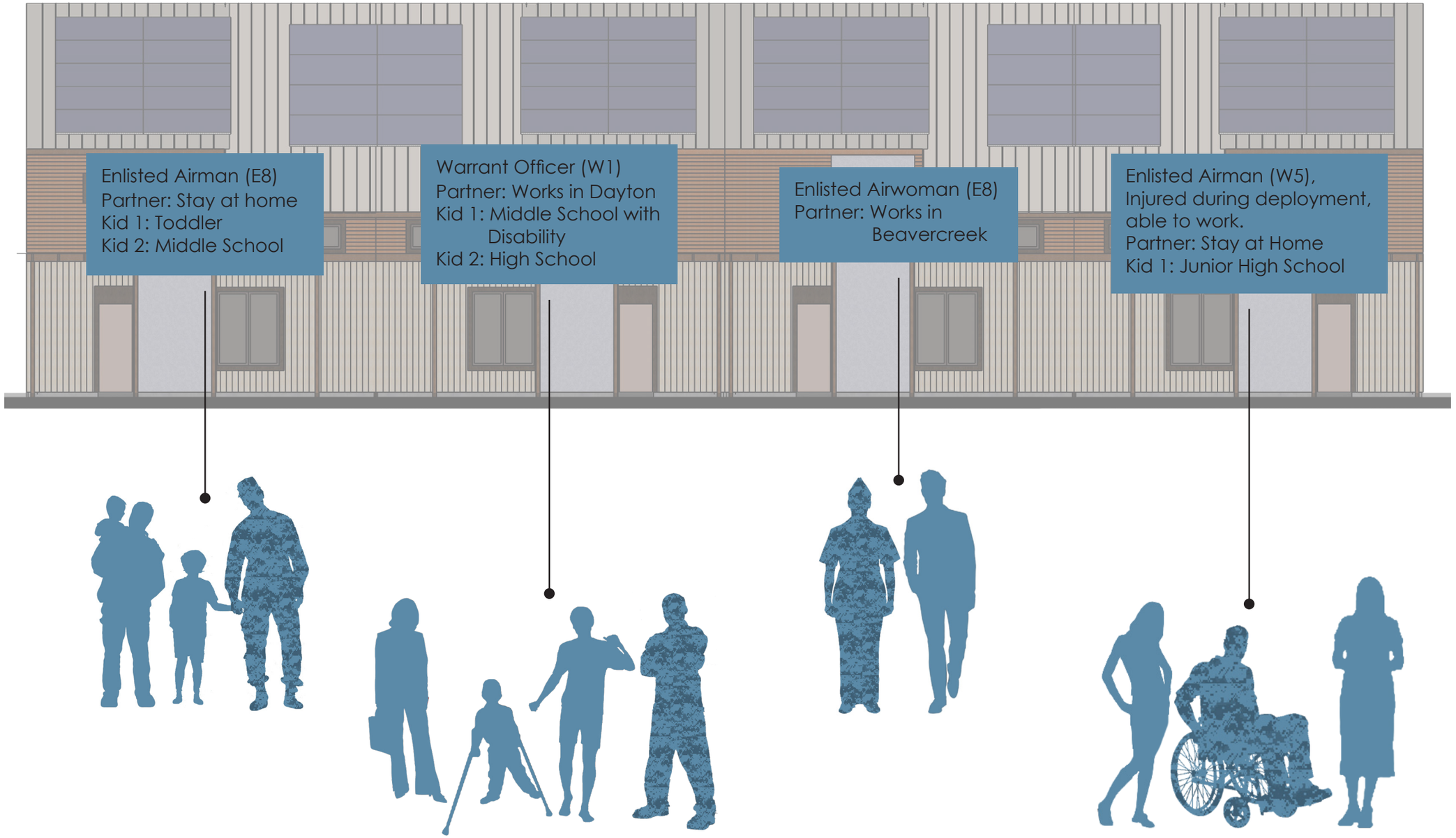
Dayton City Center

Fifth Third Field

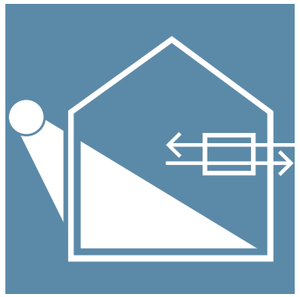
The Dayton Art Institute

Deeds Point Metro Park

Occupants



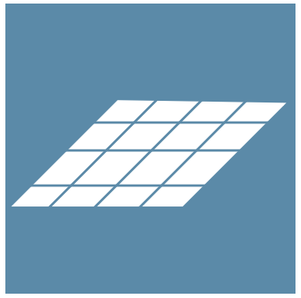
Design Goals



Passive House Standards

Universal Design

Localization of Materials



MicroGrid Energy Source

Personal Impact Realization

Stormwater & Landscaping

Site Plan

Vehicular traffic circulation path

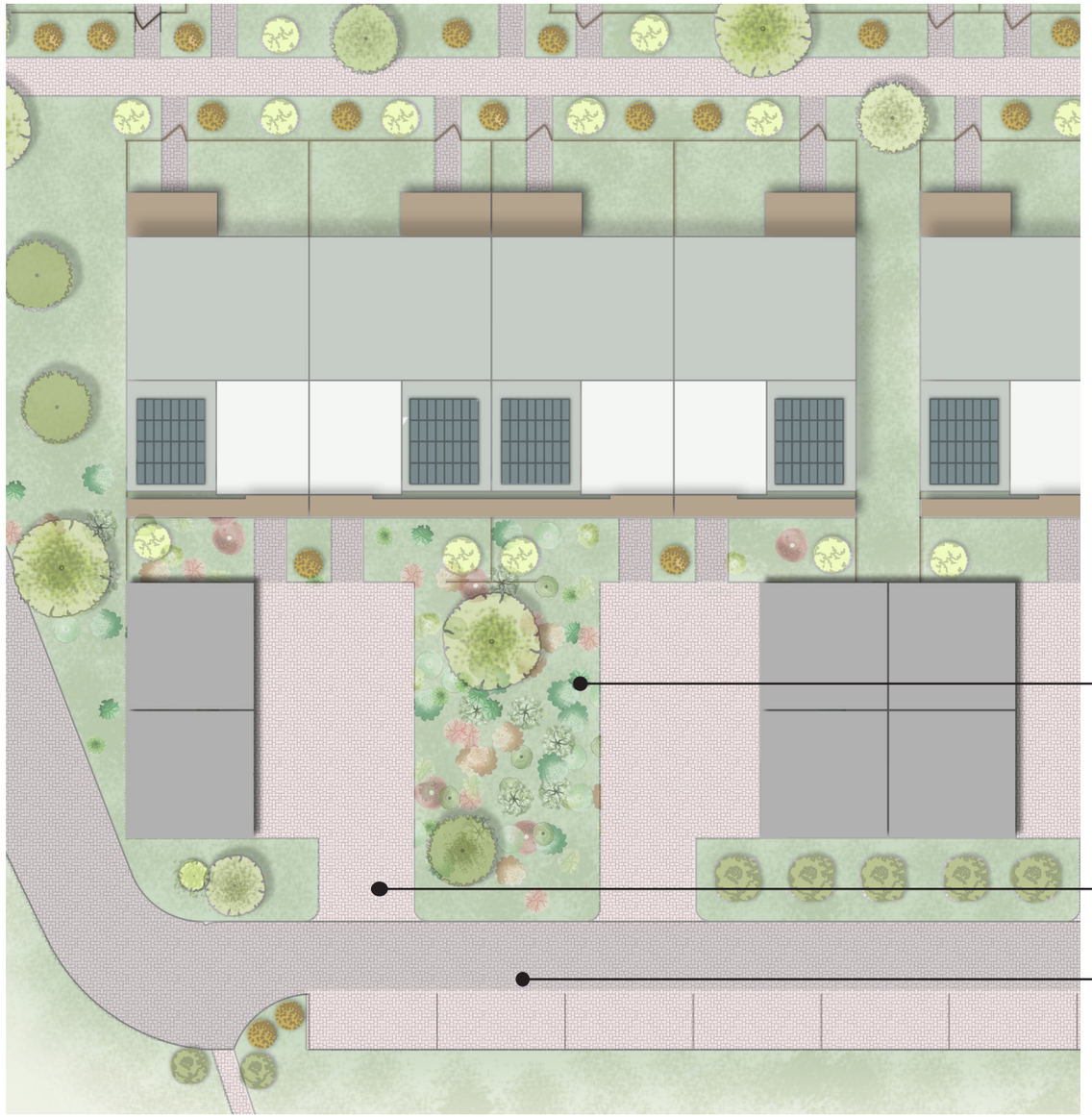
Community Garden Courtyard

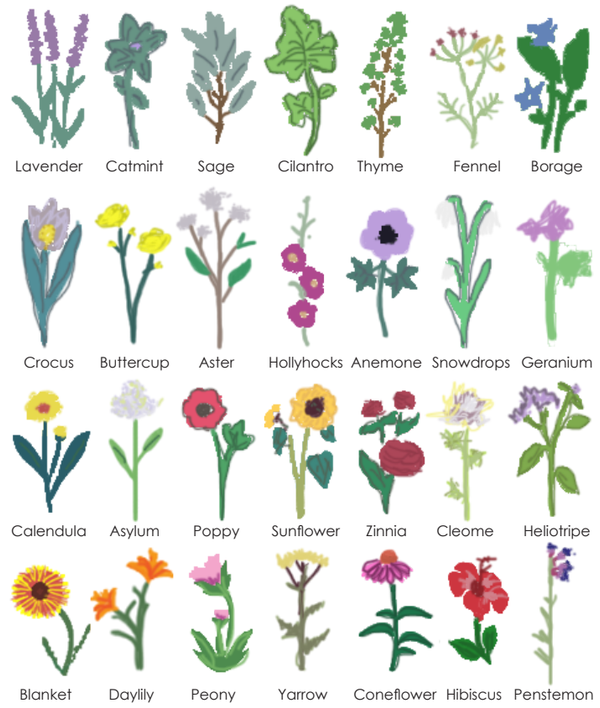
Additional parking for visitors

Community Garden Courtyard

Unit Entrance from Parking

Stormwater & Landscaping

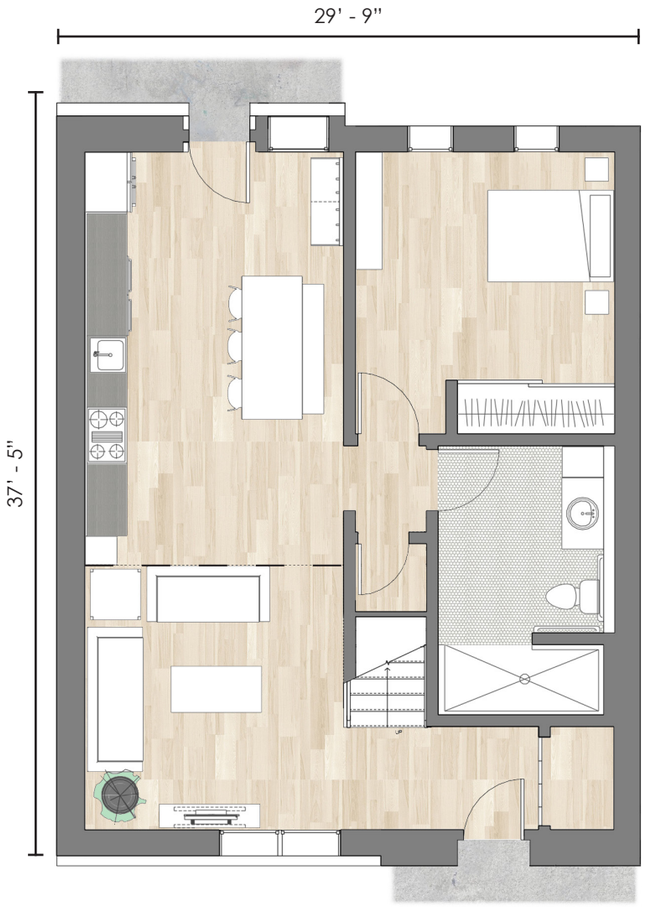




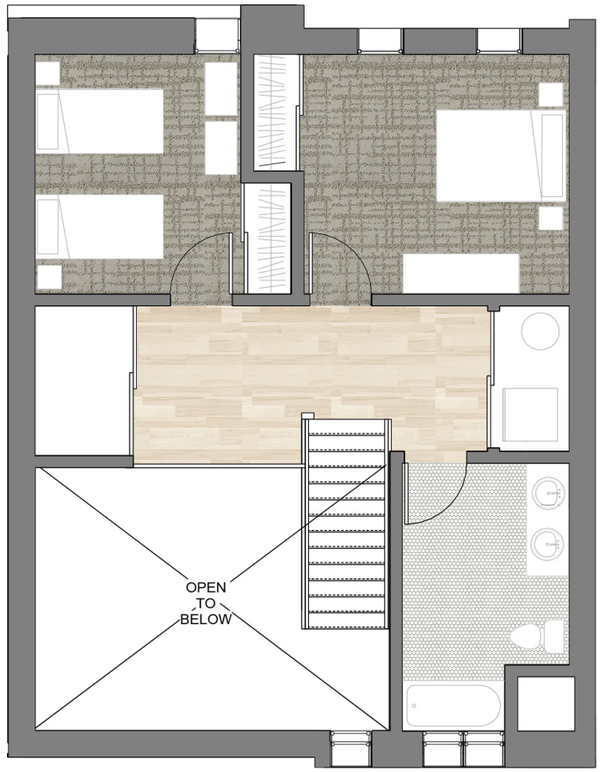
Native Ohio & Bee Fostering Plants

Permeable Pavers

Unit Plan



1st Floor



2nd Floor

Universal Design

Designing the built environment to be usable to the greatest extent possible by everyone, regardless of their age, status in life, **ability, or disability**.

Ramp exit and entry.

Adjustable height cooktop and sink, drawer style dishwasher.

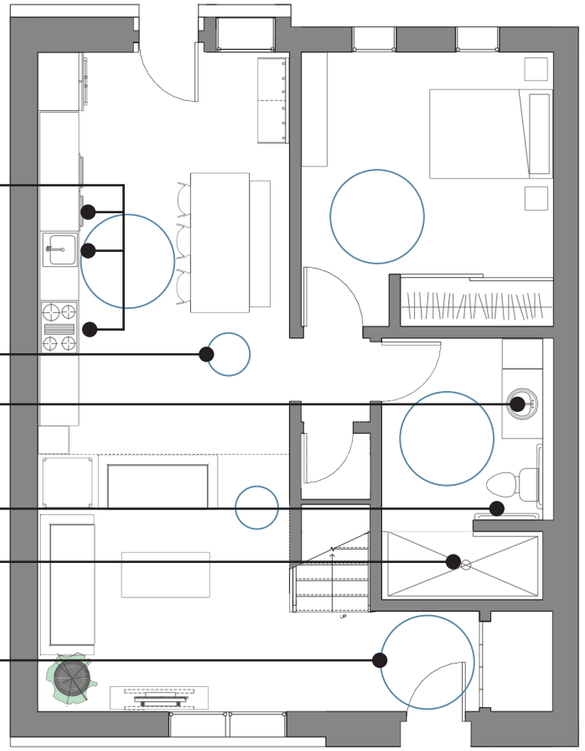
3' moving diameter for ADA Standards.

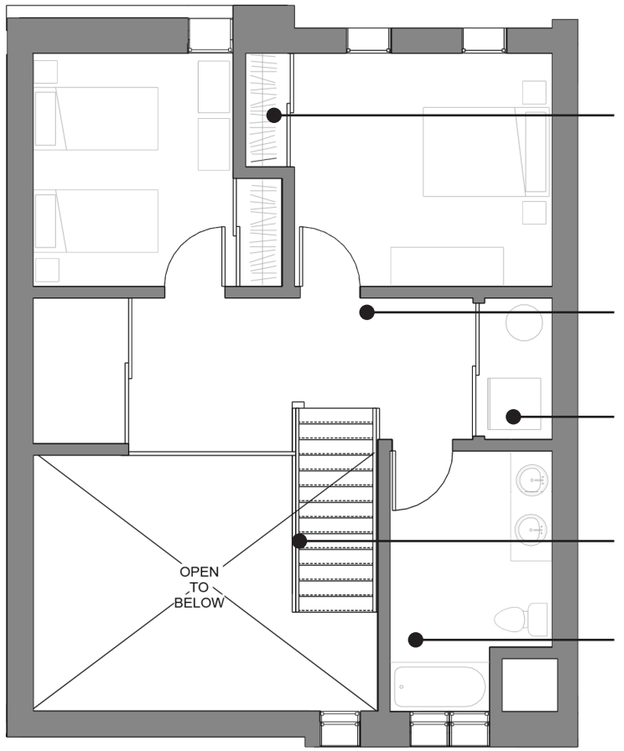
Accessible height bathroom sink.

Grab bars around toilet.

Roll in shower.

Frequent 5' turning diameter clearance for ADA standards.





Wall mounted closet for easy access to hanging clothes for residents with difficulty bending or kneeling.

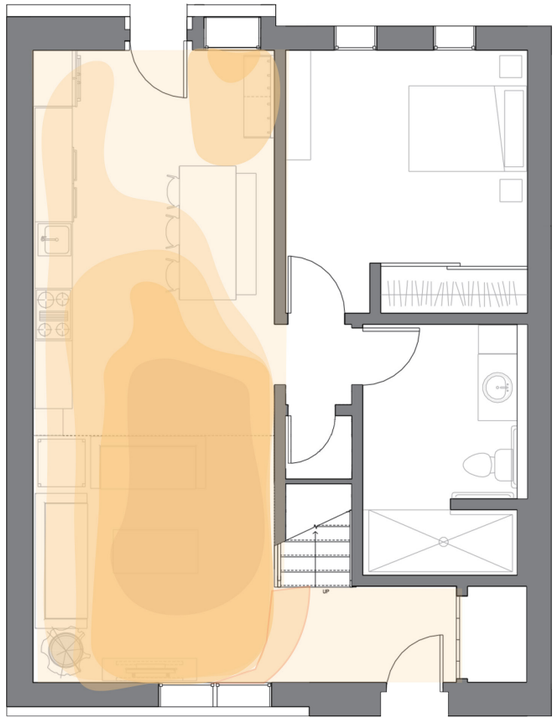
Adequate landing space for residents with limitations of stamina or visually impaired.

Front load washer and dryer for residents with difficulty in handling and fingering.

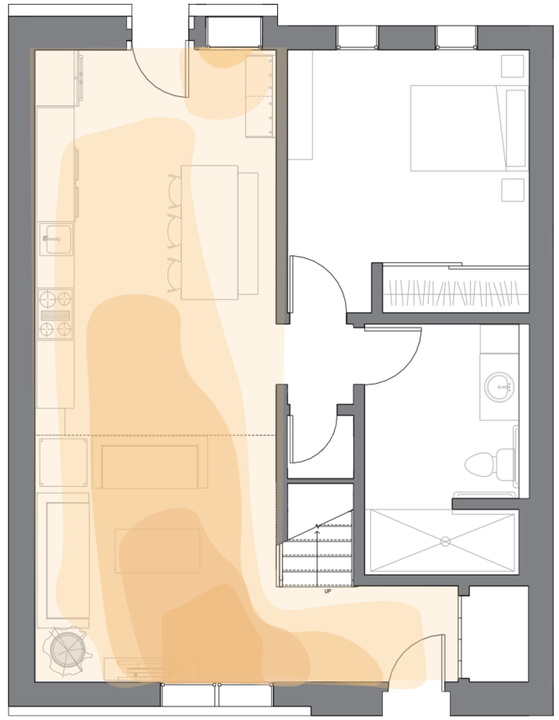
Flush tread and riser clearence to minimize stumble instances.

Non slip wet area tile.

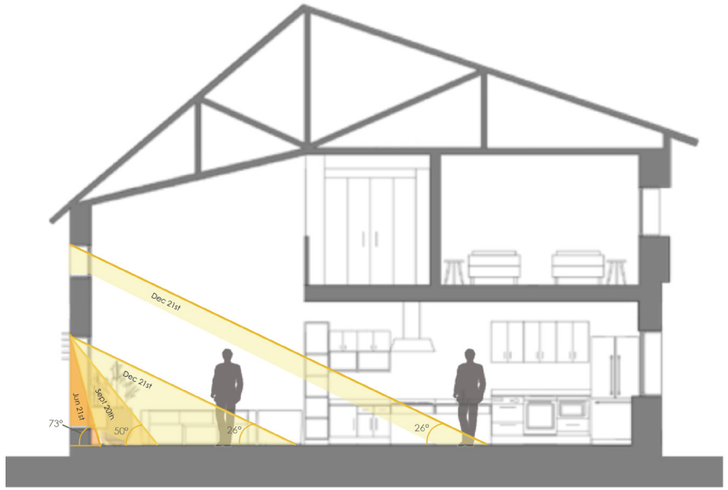
Daylighting



December 21st Sun LUX



June 21st Sun LUX

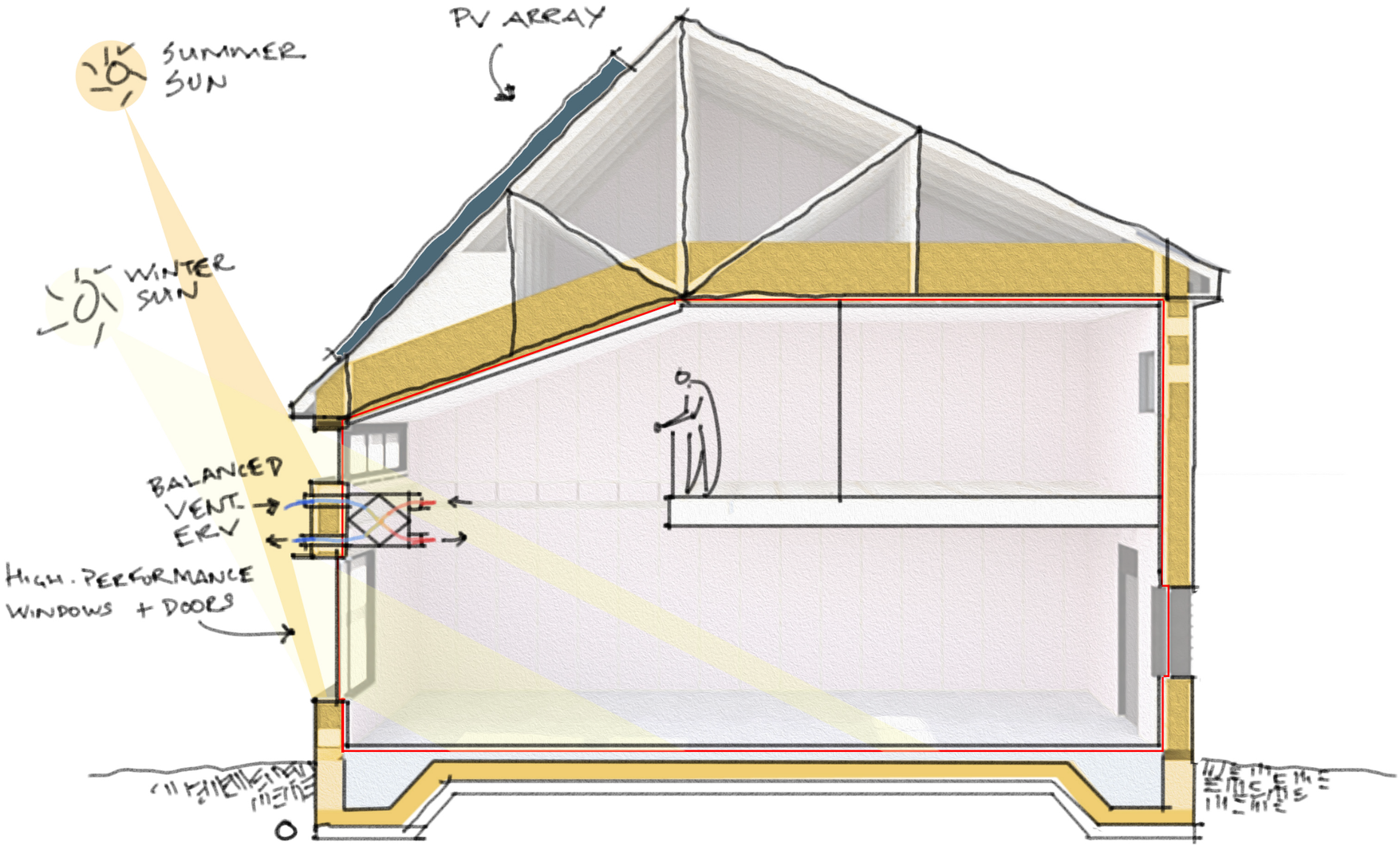


Daylighting Analysis Section

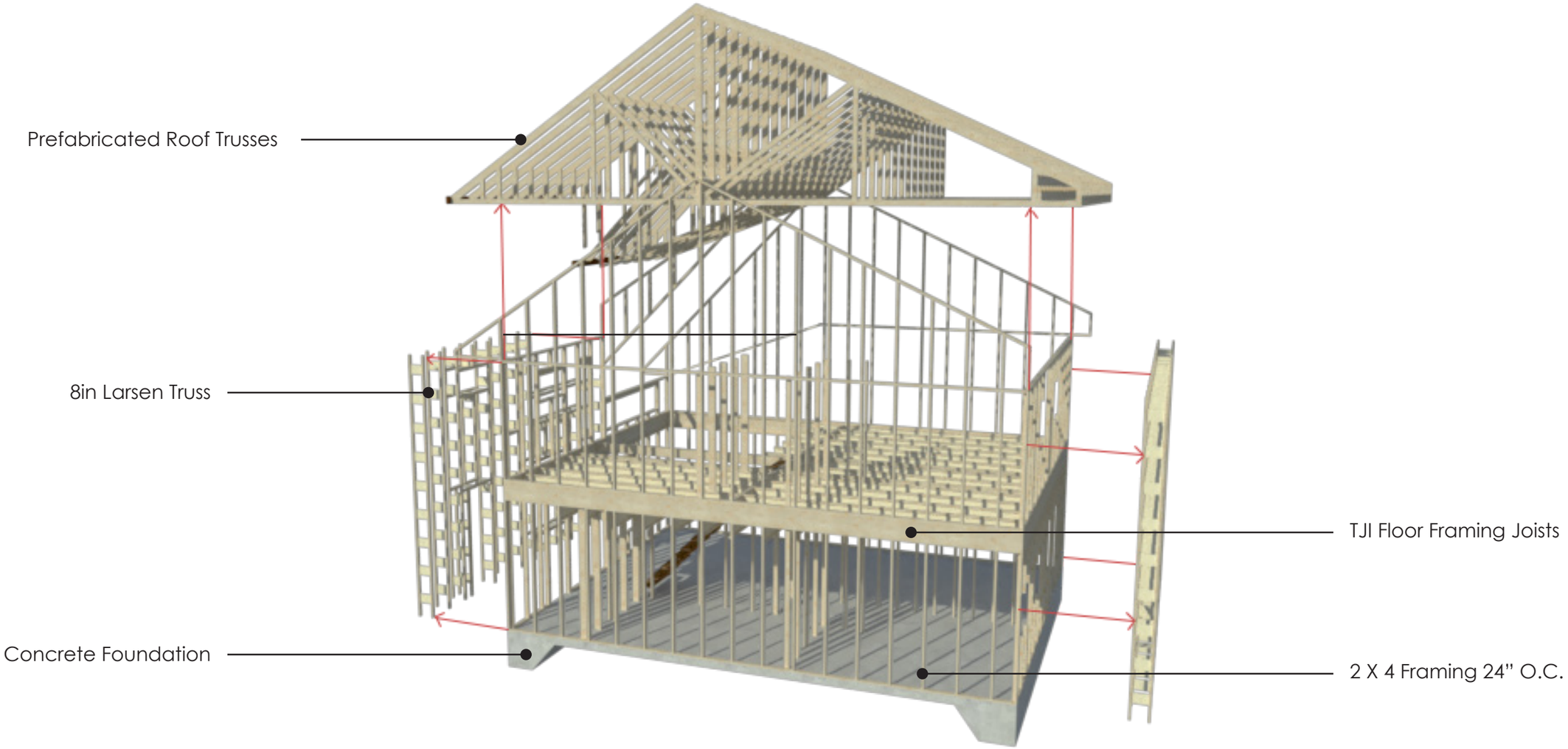
Illuminance(LUX)

100 10,000

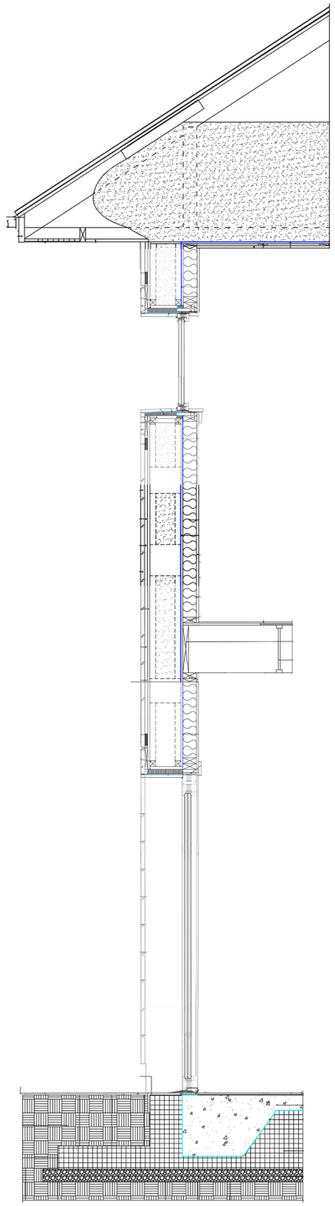
Passive House Strategies

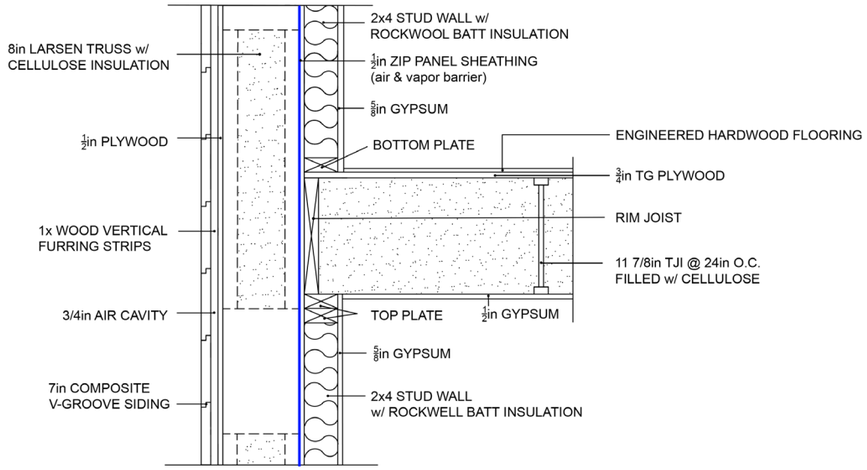


Framing Construction

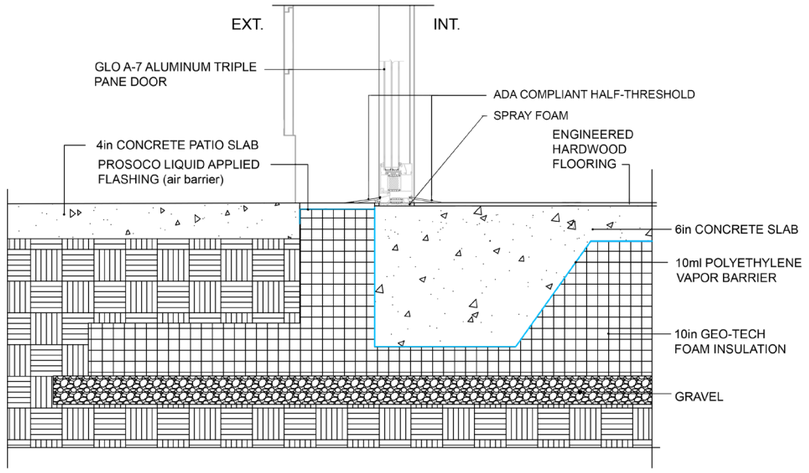


Slab & Wall Construction Detail



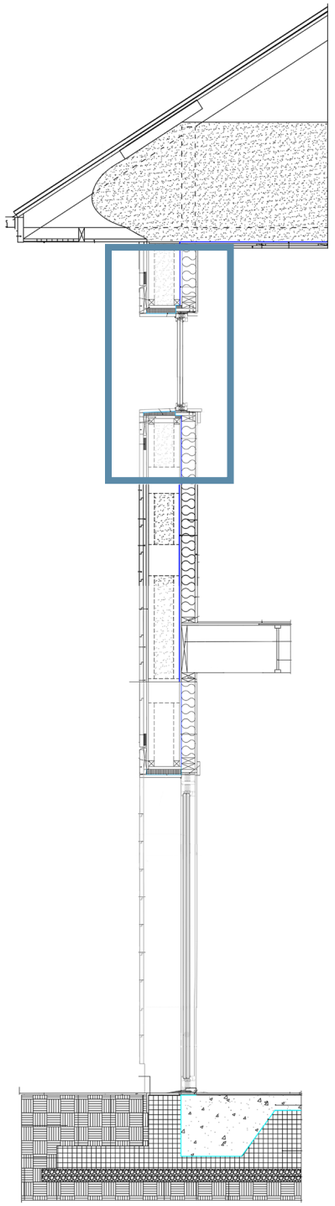


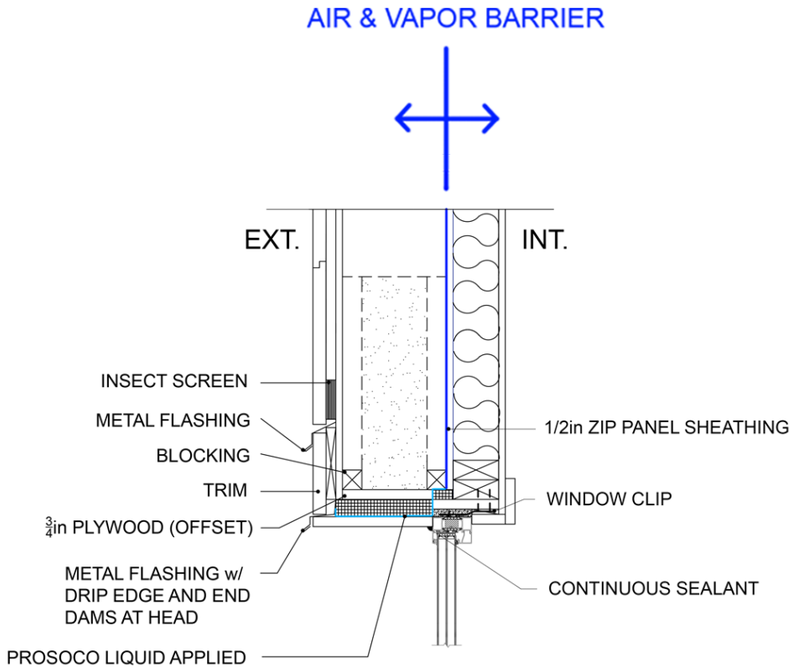
Exterior Wall and Floor Connection



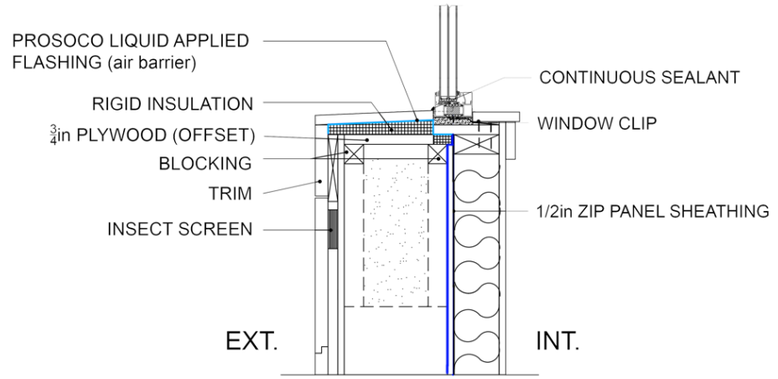
DOOR THRESHOLD DETAIL

Window Construction Details





HEAD DETAIL



SILL DETAIL

Calculation based on ISO 10077-2, EN 673, EN 410

Product name: **GLO A7 Tilt & Turn**

ASHRAE/IECC /DOE North American Climate Zone	South-facing	North, East, West - facing	Whole-window installed U-value W/m2K	Whole-window installed U-value BTU/hr.ft2.F	Center-of-glass properties: GloGlas 74/53/0.5 No Grids — SHGC	Ucog-Value W/m2K	Ucog-Value BTU/hr.ft2.F
Climate specific recommendations:							
8			0.91	0.16	0.526	0.659	0.116
7			0.89	0.16	0.526	0.625	0.110
6			0.85	0.15	0.526	0.572	0.101
5			0.84	0.15	0.526	0.558	0.098
4	☑		0.82	0.14	0.526	0.532	0.094
Marine North	☑		0.82	0.14	0.526	0.531	0.093
Marine South			0.82	0.15	0.526	0.535	0.094
3			0.82	0.14	0.526	0.532	0.094
2 West			0.83	0.15	0.526	0.545	0.096
2 East			0.83	0.15	0.526	0.545	0.096

GLO A7 Tilt & Turn	FRAME: Frame height mm	Frame height in	U-frame W/m2K	U-frame BTU/hr.ft2.F	Psi-spacer Ψ W/mK	Psi-spacer Ψ BTU/hr.ft.F	Psi-opaque W/mK
Head	116	4.59	1.13	0.20	0.010	0.006	0.155
Sill	116	4.59	1.13	0.20	0.010	0.006	BTU/hr.ft.F
left jamb	116	4.59	1.13	0.20	0.010	0.006	0.089
right jamb	116	4.59	1.13	0.20	0.010	0.006	Grade B

Valid through April 2019

Calculation based on ISO 10077-2, EN 673, EN 410

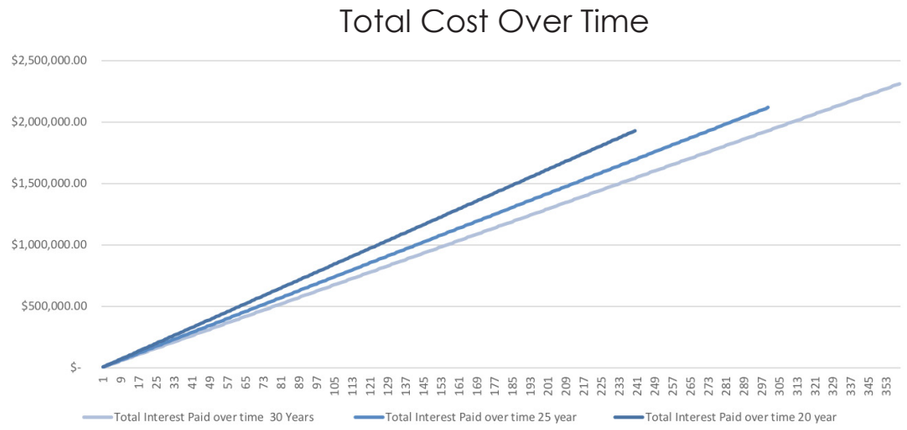
Product name: **GLO A7 Fixed**

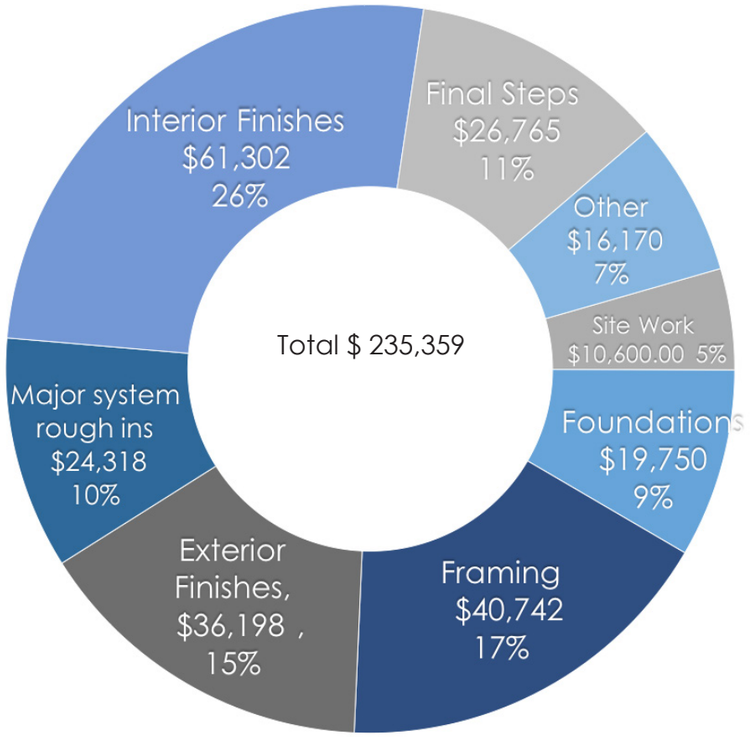
ASHRAE/IECC /DOE North American Climate Zone	South-facing	North, East, West - facing	Whole-window installed U-value W/m2K	Whole-window installed U-value BTU/hr.ft2.F	Center-of-glass properties: GloGlas 74/53/0.5 No Grids — SHGC	Ucog-Value W/m2K	Ucog-Value BTU/hr.ft2.F
Climate specific recommendations:							
8			0.82	0.14	0.526	0.659	0.116
7			0.79	0.14	0.526	0.625	0.110
6	☑	☑	0.75	0.13	0.526	0.572	0.101
5	☑	☑	0.73	0.13	0.526	0.558	0.098
4	☑		0.71	0.13	0.526	0.532	0.094
Marine North	☑		0.71	0.13	0.526	0.531	0.093
Marine South			0.71	0.13	0.526	0.535	0.094
3			0.71	0.13	0.526	0.532	0.094
2 West			0.72	0.13	0.526	0.545	0.096
2 East			0.72	0.13	0.526	0.545	0.096

GLO A7 Fixed	FRAME: Frame height mm	Frame height in	U-frame W/m2K	U-frame BTU/hr.ft2.F	Psi-spacer Ψ W/mK	Psi-spacer Ψ BTU/hr.ft.F	Psi-opaque W/mK
Head	68	2.68	0.93	0.16	0.010	0.006	0.077
Sill	68	2.68	0.93	0.16	0.010	0.006	BTU/hr.ft.F
left jamb	68	2.68	0.93	0.16	0.010	0.006	0.044
right jamb	68	2.68	0.93	0.16	0.010	0.006	Grade A

Valid through April 2019

Projected Construction Cost





Team Name: Wright Path to Zero
Contest Category: Attached Housing

Construction Cost Summary

	Baseline Design	Team Design
Site Work	$ 10,332	$ 10,600
Foundations	$ 21,492	$ 19,750
Framing	$ 33,426	$ 40,742
Exterior Finishes	$ 27,918	$ 36,198
Major Systems Rough-ins	$ 24,318	$ 23,832
Interior Finishes	$ 55,008	$ 61,302
Final Steps	$ 12,564	$ 26,765
Other	$ 864	$ 16,170
Total Construction Costs	$ 185,922	$ 235,359

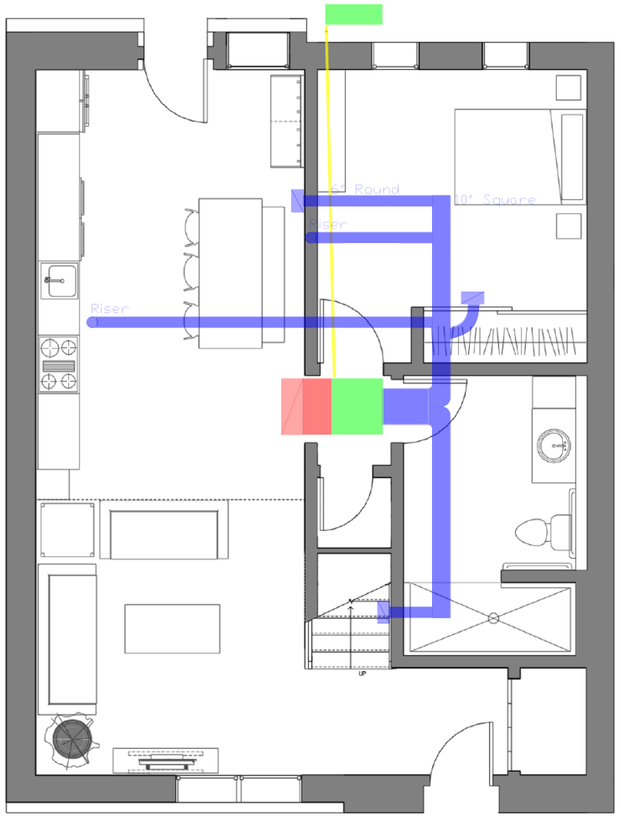
Sales Price Summary and Cost of Living

	Baseline Design	Team Design
Total Sales Price	$ 301,403	$ 352,584
Monthly Household Debt (0.5% MFI)	$ 295	$ -
Operations and Maintenance Costs	$ 196	$ 200
Monthly Utility Costs	$ 160	$ 38
Property Tax	$ 332	$ 320
Insurance	$ 79	$ 79
Mortgage	$ 1,405	$ 1,425
Total	**$ 2,467**	**$ 2,062**
Estimated Target Family Income	$ 59,039	$ 68,000
Debt to Income Ratio	50%	36%

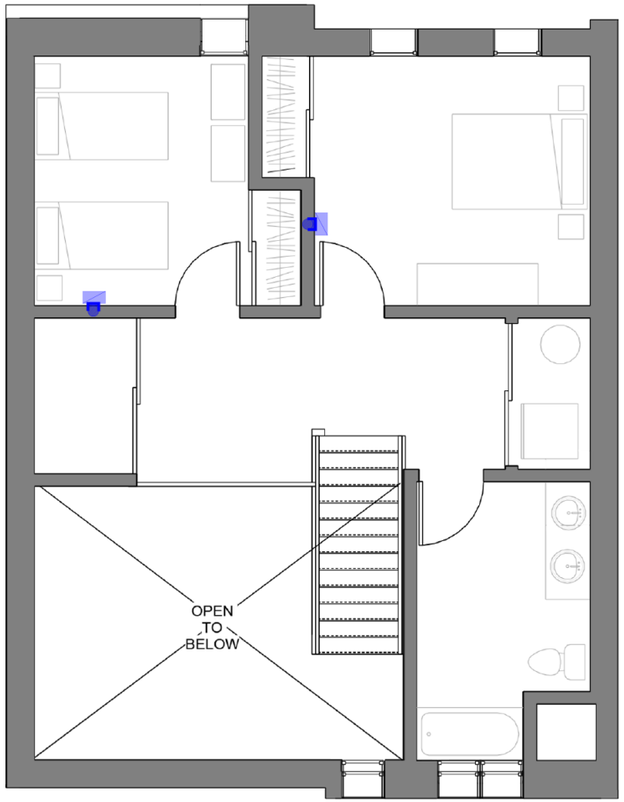
Chart 10: Financial Summary

Mechanical

* Mini-Split breaks through envelope between ceiling and floor.



1st Floor Mechanical Plan



2nd Floor Mechanical Plan

Mitsubishi Indoor Unit
SEZ-KD15NAR1.TH

Mitsubishi Outdoor Unit
SUZ-KA15NA.TH

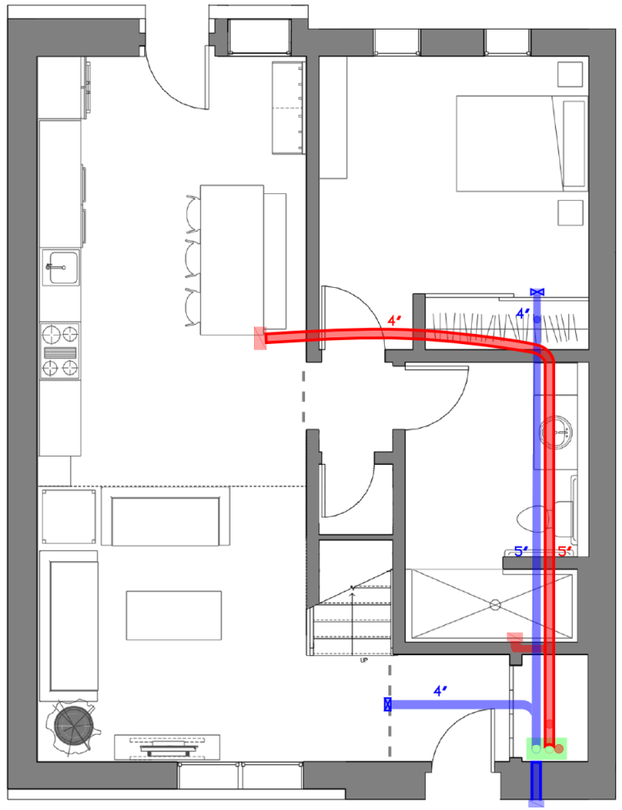
Outdoor Condensing Unit & Indoor Unit

Supply

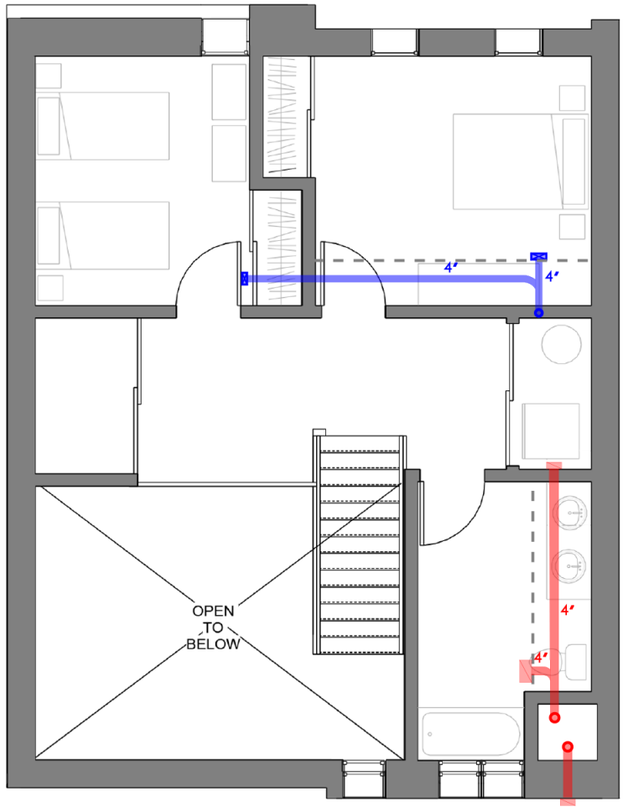
Return

Mini-Split Line Set

Energy Recovery Ventilator

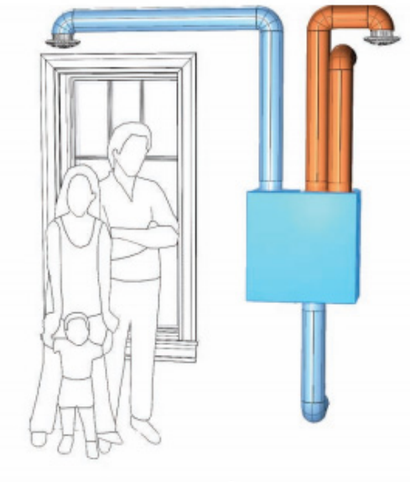


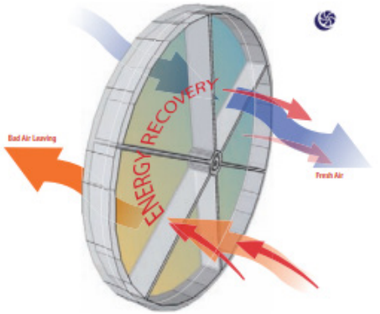
1st Floor ERV Plan



2nd Floor ERV Plan

Ultimate Air
ER80 ERV



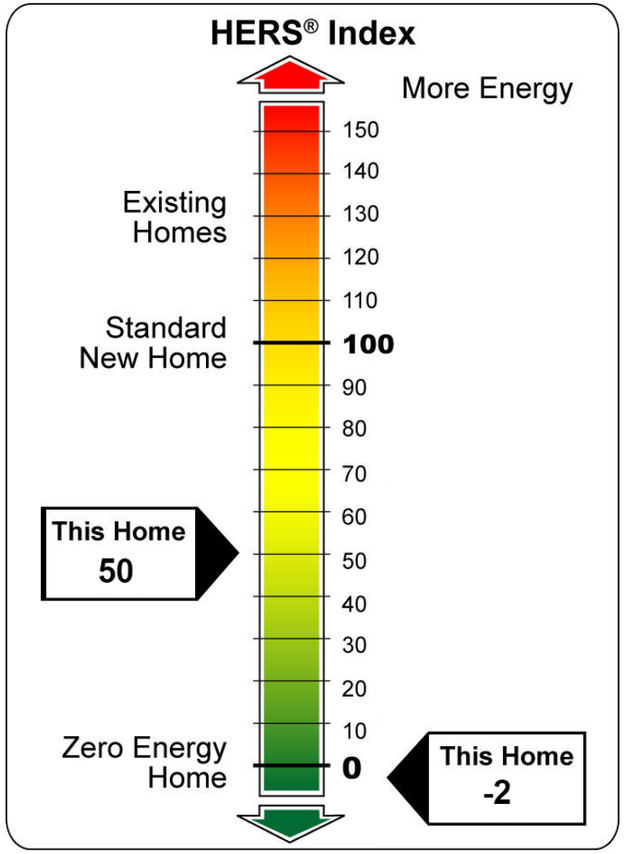


Exhaust

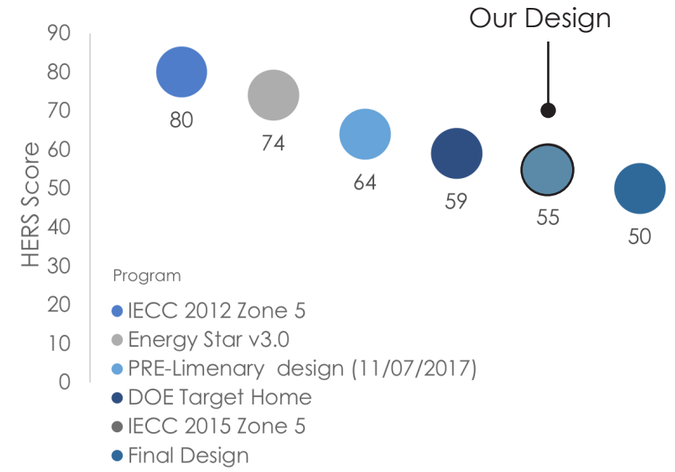
Supply

ERV Unit

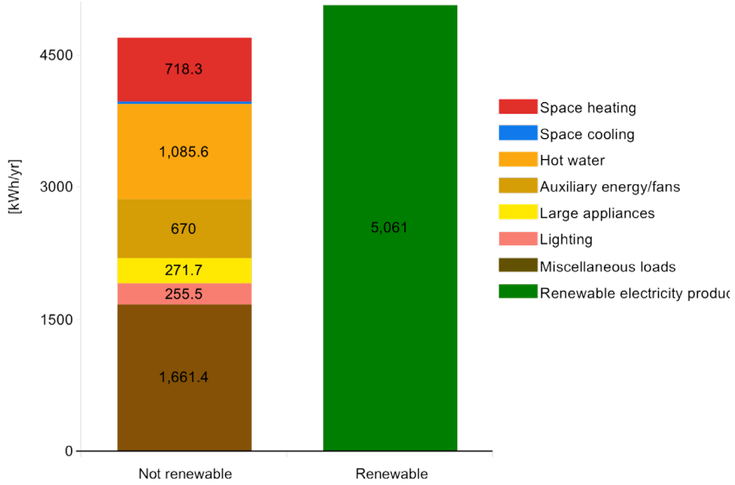
HERS Rating



HERS Analysis for South - Facing Quadplex



Hers Rating Comparison



UNIT 1	UNIT 2	UNIT 3	UNIT 4
HERS 50	HERS 50	HERS 50	HERS 50

All four units produce a HERS score of 50 without photovoltaics and a HERS Score of -2 with Photovoltaics.

MicroGrid PV System

45 Degree **1,737 kWh/Year***

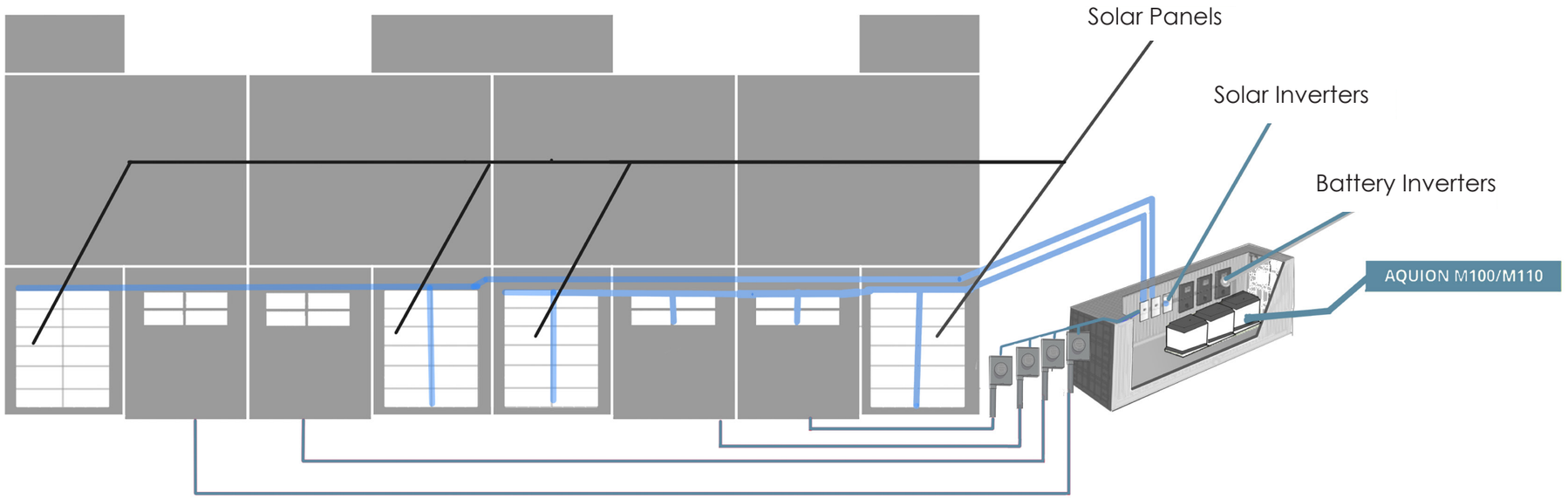
System output may range from 1,658 to 1,804kWh per year near this locatic

33 Degree **4,344 kWh/Year***

System output may range from 4,145 to 4,510kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	2.94	108	13	2.94	269	32
February	3.44	111	13	3.44	277	33
March	4.07	143	17	4.07	356	42
April	5.26	172	20	5.26	429	51
May	5.53	179	21	5.53	448	53
June	5.79	177	21	5.79	442	52
July	5.66	178	21	5.66	444	52
August	5.82	183	22	5.82	456	54
September	5.05	155	18	5.05	389	46
October	4.68	156	18	4.68	389	46
November	2.78	95	11	2.78	237	28
December	2.25	82	10	2.25	206	24
Annual	4.44	1,739	$ 205	4.44	4,342	$ 513

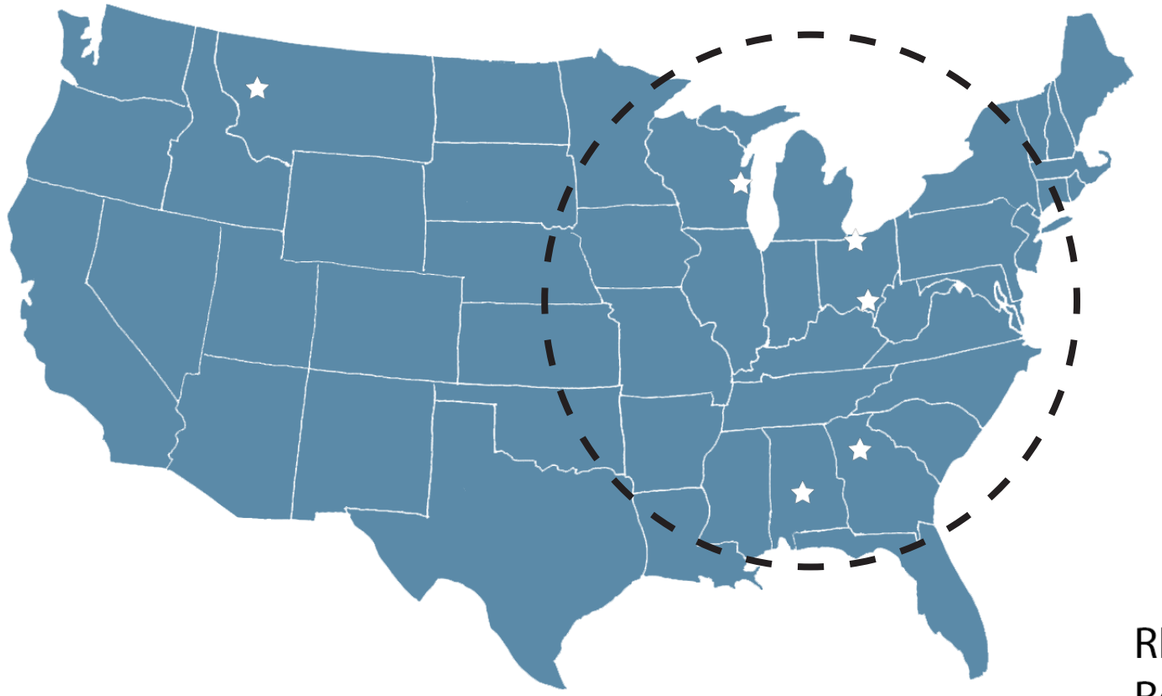
Block of 4
Size of System (kW)
17
Price Per Panel ($)
1090.2
of Panels
56
Price of System ($)
53720
After Tax Credit Price ($)
37604
Cost of Electricity (cents/kW)
0.084
Energy Value Saved ($)
2120
Pay-Back Period ($)
17.73773585



Localization of Materials

GLO Windows and Doors
Missoula, Montana

Kohler Fixtures
Kohler, Wisconsin

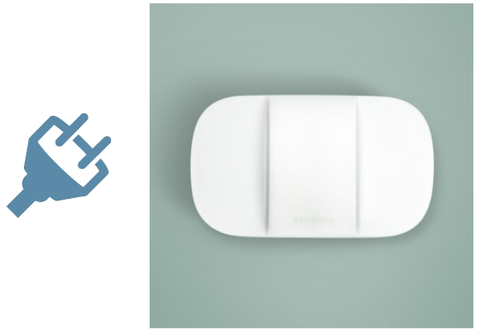


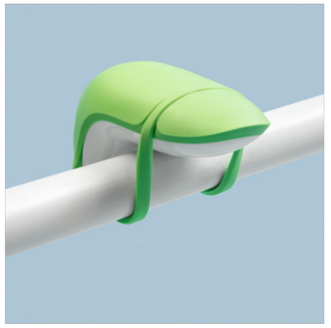
USG Gypsum Board
Gypsum, OH

Ultimate Air ERV
Athens, OH

RHEEM Water Heater
Roswell, Georgia

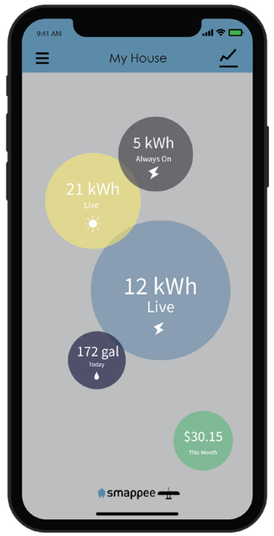
HardiPlank Exterior Siding
Prattville, Alabama

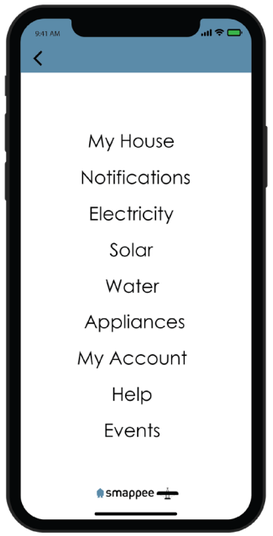




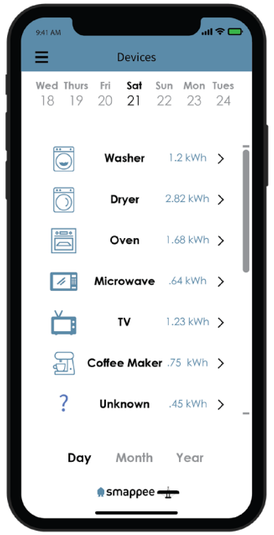
Personal Impact Realization

Energy Displays

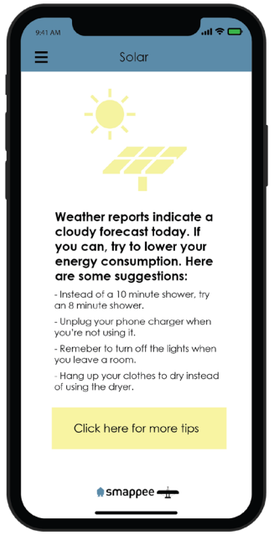




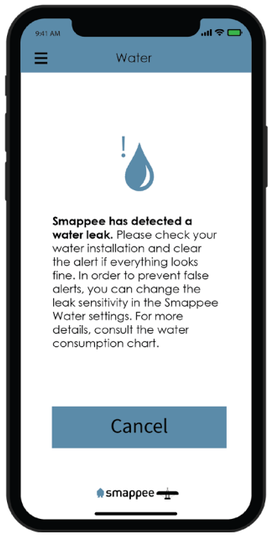
Devices



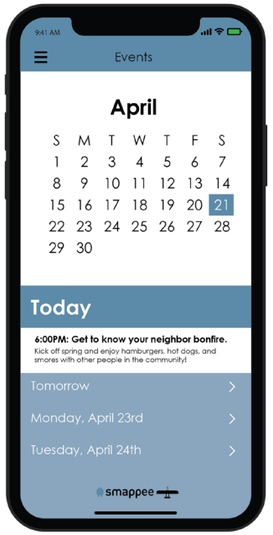
Solar



Water



Events



Our Vision:

To create housing for active duty military families that provides **highly energy efficient** and **comfortable living**.

To develope a **new model of urban planning** that can be adopted for further adaptation across the United States to improve the standard of military living.

To minimize our **carbon footprint** from the construction to the current living condition.

To design successfully a **home** for the men and women who sacrifice their lives on a daily basis.