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HOUSTON 2023

Navigating New Climates: Three ICF & SIP Passive Houses in North Texas

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University of Texas at Arlington

Navigating New Climates: Three ICF & SIP Passive Houses in North Texas

I Welcome to DFW
II Two ICF / SIP Houses
III Design Build at UTArlington

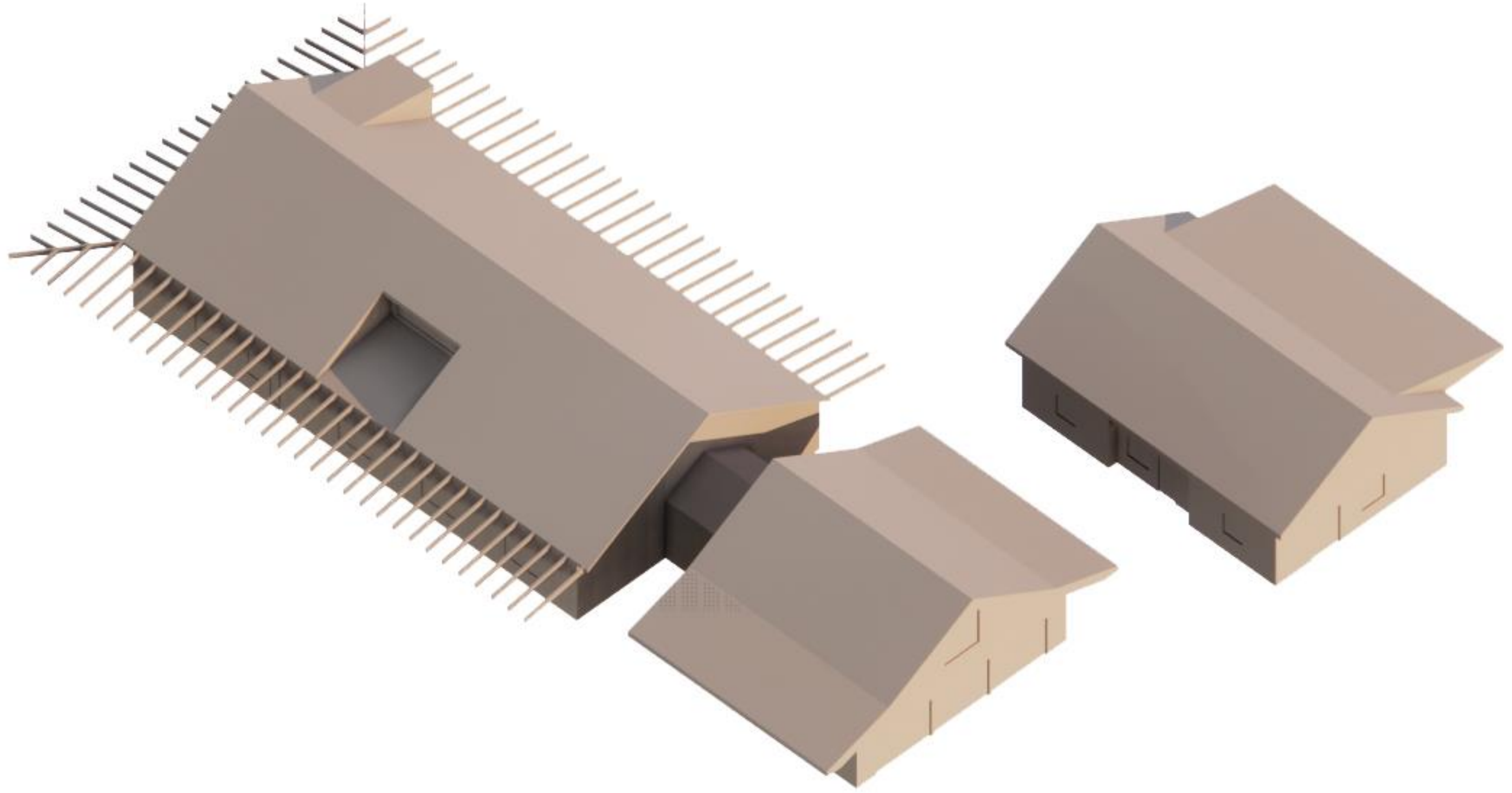
US/CAN largest metropolitan areas

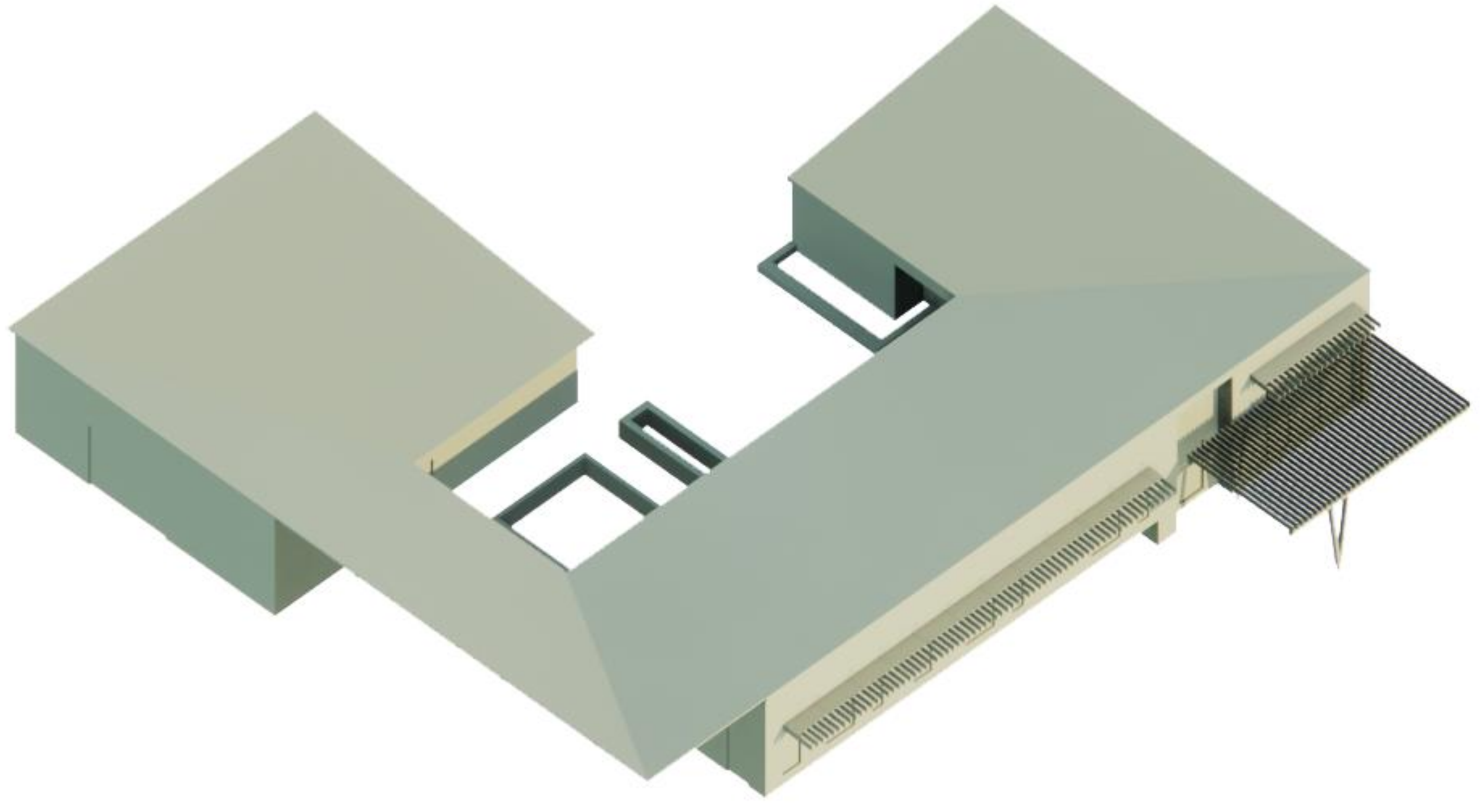
2020 US Census; 2016 Canadian Census

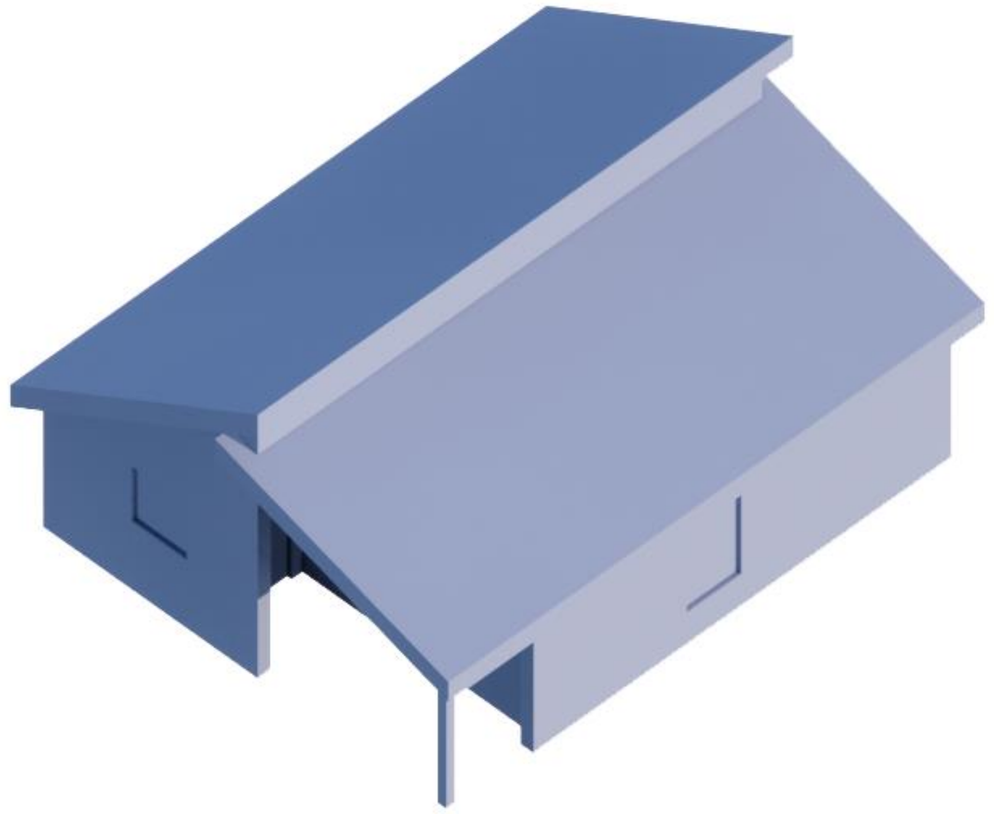
Celeste

Palo Pinto

Arlington







Hunt County Passive House & Passive Guest House

location **Celeste TX**

status **construction begins Dec 2023**

iCFA **3186 sf (house) / 1320 sf (guest)**

construction **ICF walls / SIP roof**

climate zone / HDD / CDD **3A / 2250 / 2419**

design certification **Phius ZERO (2021)**

Brazos Passive House

location **Palo Pinto TX**

status **construction begins Jan 2024**

iCFA **2465 sf (house)**

construction **ICF walls / SIP roof**

climate zone / HDD / CDD **3A / 2497 / 3364**

design certification **Phius ZERO (2021)**

Wynn Terrace Senior Living Cottages Passive House

location **Arlington TX**

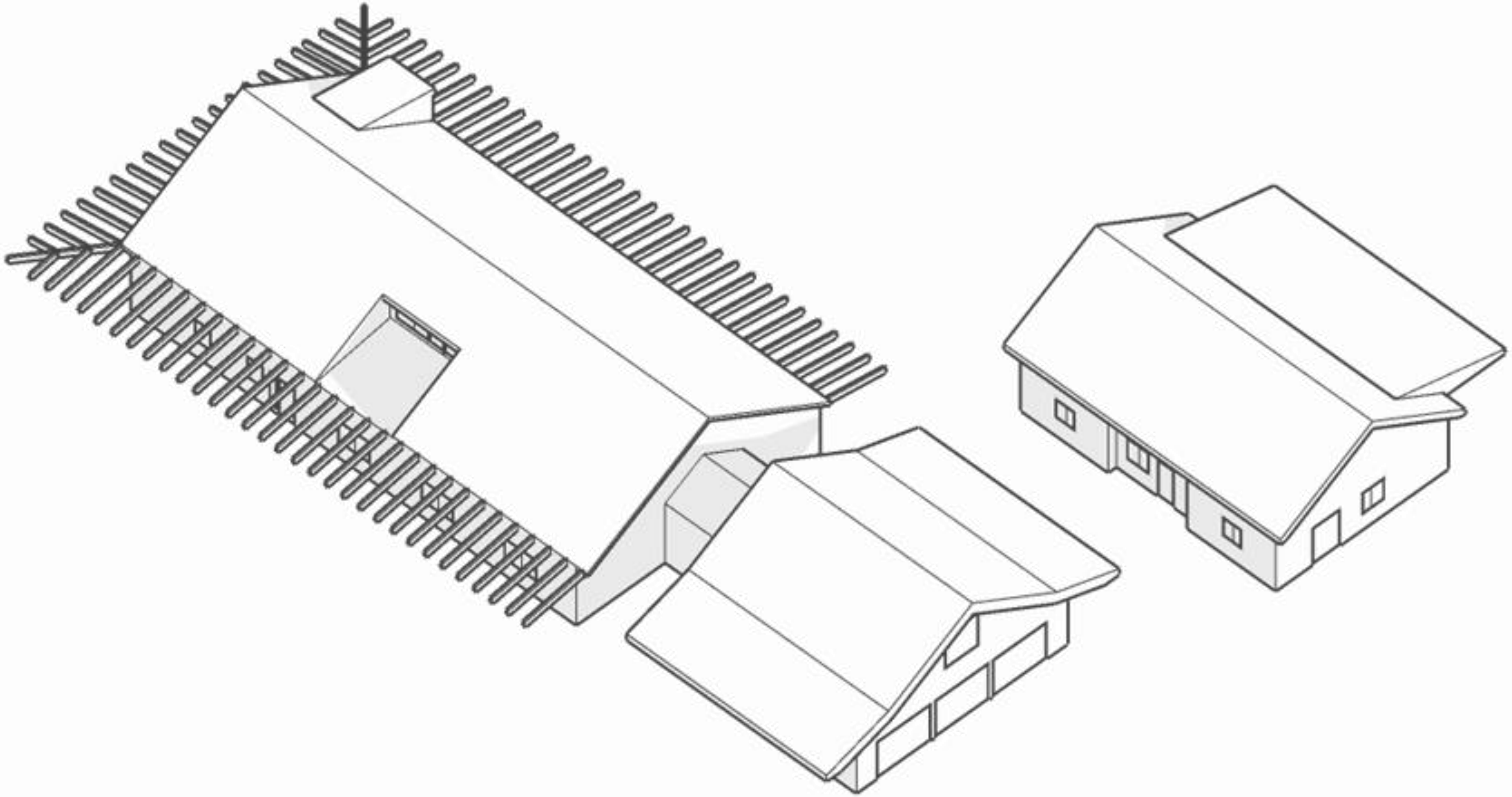
status **construction began Sep 2023**

iCFA **482 sf**

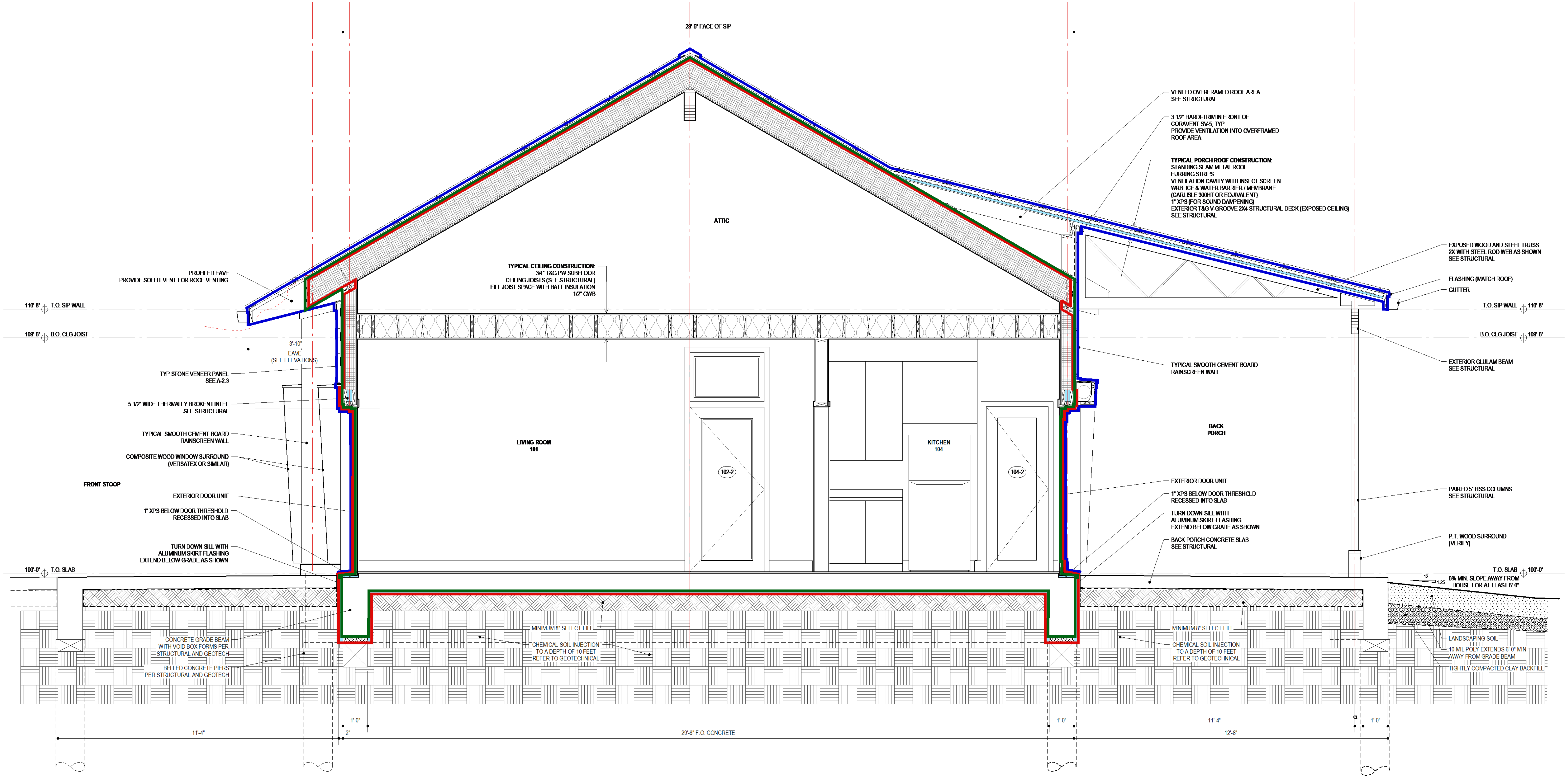
construction **ICF walls / SIP roof**

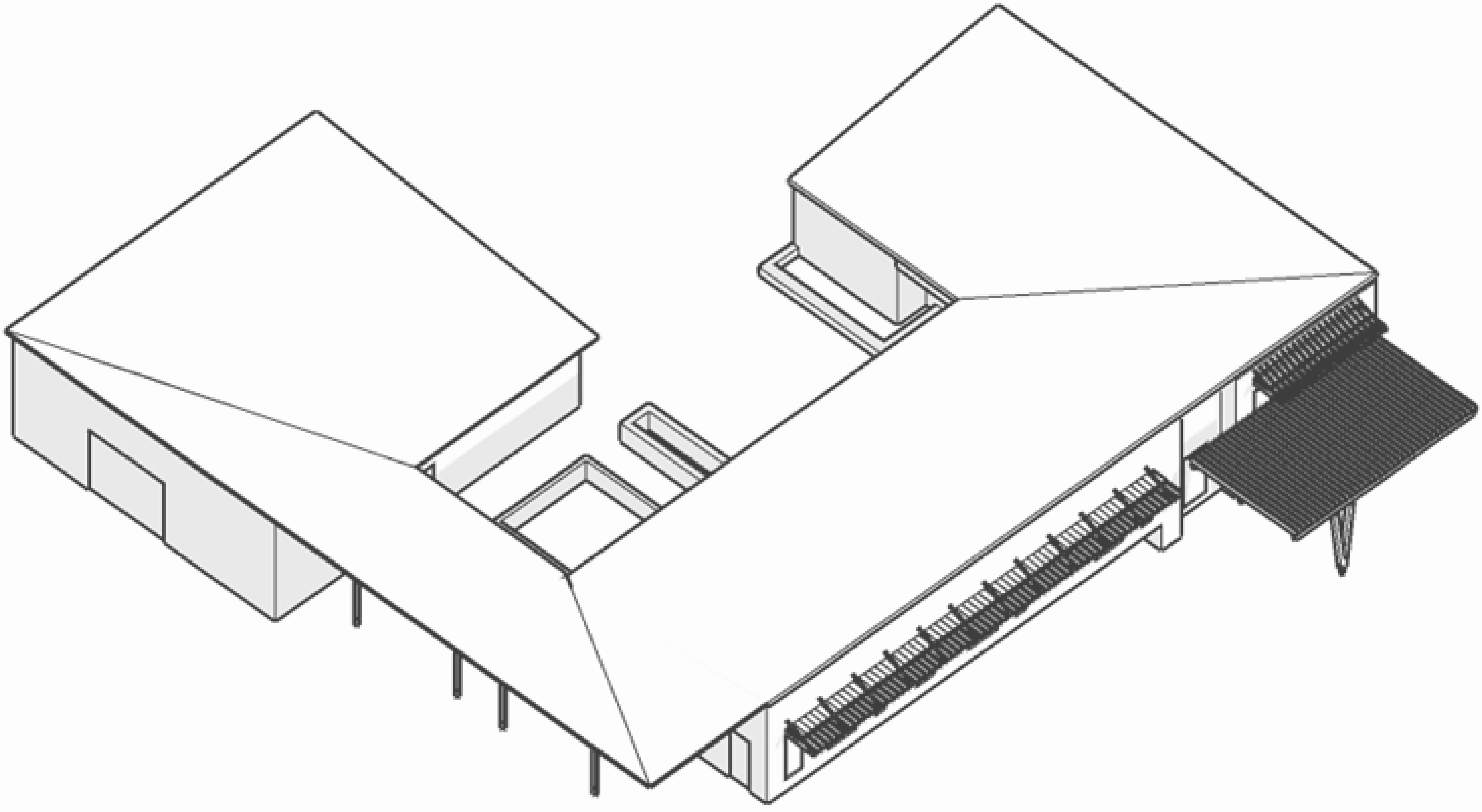
climate zone / HDD / CDD **2A / 2342 / 3284**

design certification **Phius ZERO (2021)**

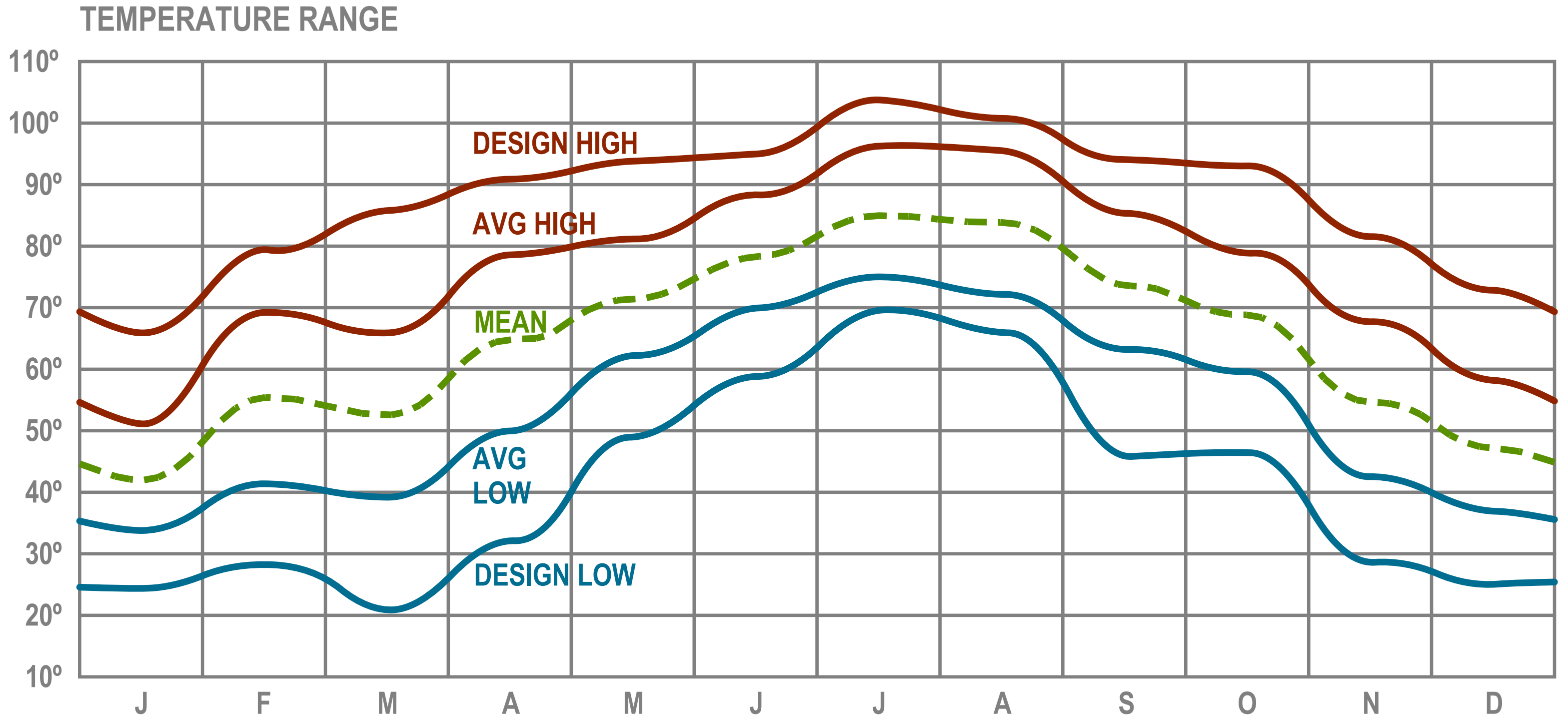


Hunt County Passive House & Passive Guest House, Celeste TX

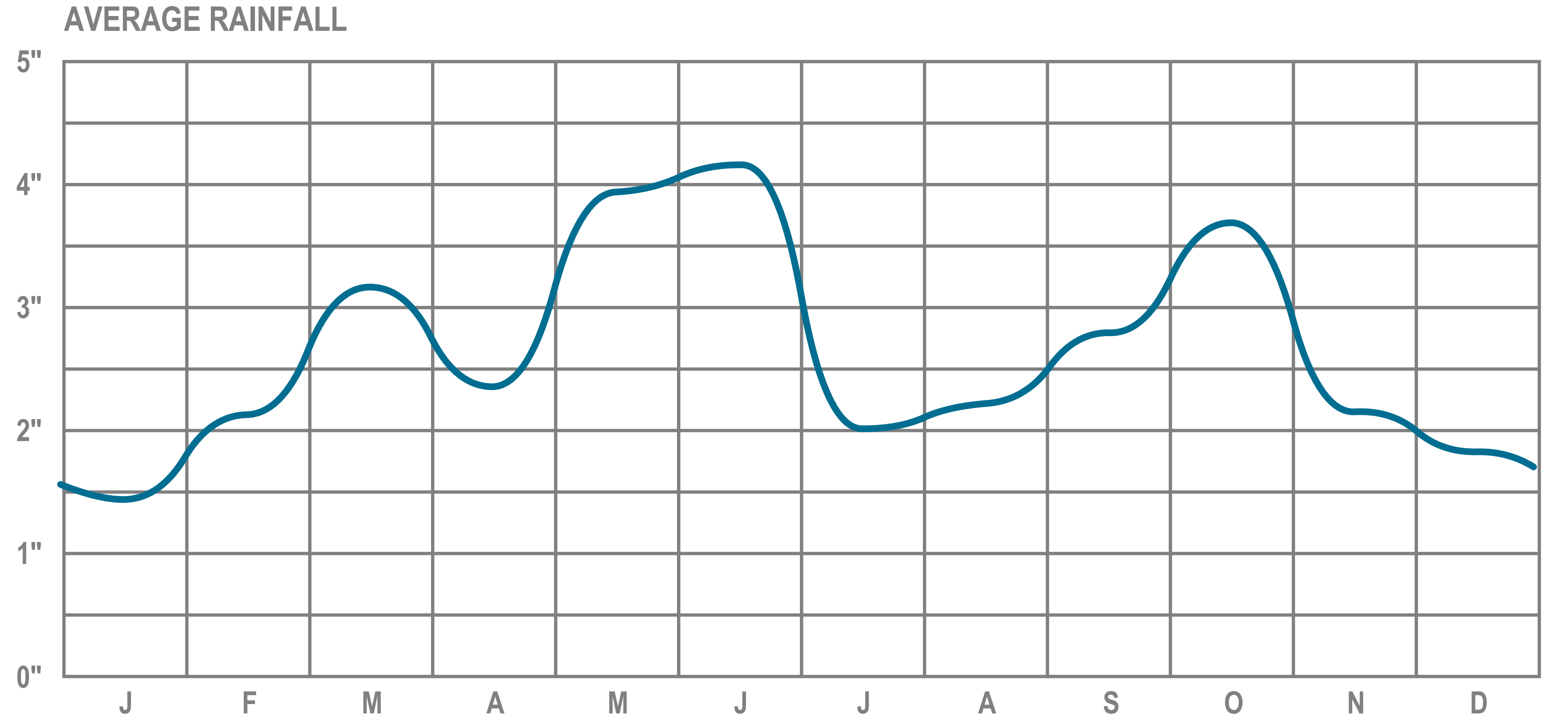

29'-6" FACE OF SIP
ATTIC
VENTED OVERFRAMED ROOF AREA
SEE STRUCTURAL
3 1/2" HARDI-TRIM IN FRONT OF
CORAVENT SV-5, TYP
PROVIDE VENTILATION INTO OVERFRAMED
ROOF AREA
TYPICAL PORCH ROOF CONSTRUCTION:
STANDING SEAM METAL ROOF
FURRING STRIPS
VENTILATION CAVITY WITH INSECT SCREEN
WRB: ICE & WATER BARRIER / MEMBRANE
(CARLISLE 300HT OR EQUIVALENT)
1" XPS (FOR SOUND DAMPENING)
EXTERIOR T&G V-GROOVE 2X4 STRUCTURAL DECK (EXPOSED CEILING)
SEE STRUCTURAL
EXPOSED WOOD AND STEEL TRUSS
2X WITH STEEL ROD WEB AS SHOWN
SEE STRUCTURAL
FLASHING (MATCH ROOF)
GUTTER
PROFILED EAVE
PROVIDE SOFFIT VENT FOR ROOF VENTING
TYPICAL CEILING CONSTRUCTION:
3/4" T&G PW SUBFLOOR
CEILING JOISTS (SEE STRUCTURAL)
FILL JOIST SPACE WITH BATT INSULATION
1/2" GWB
110'-8" T.O. SIP WALL
109'-6" B.O. CLG JOIST
3'-10"
EAVE
(SEE ELEVATIONS)
T.O. SIP WALL 110'-8"
B.O. CLG JOIST 109'-6"
TYP STONE VENEER PANEL
SEE A-2.3
5 1/2" WIDE THERMALLY BROKEN LINTEL
SEE STRUCTURAL
TYPICAL SMOOTH CEMENT BOARD
RAINSCREEN WALL
COMPOSITE WOOD WINDOW SURROUND
(VERSATEX OR SIMILAR)
FRONT STOOP
EXTERIOR DOOR UNIT
1" XPS BELOW DOOR THRESHOLD
RECESSED INTO SLAB
TURN DOWN SILL WITH
ALUMINUM SKIRT-FLASHING
EXTEND BELOW GRADE AS SHOWN
100'-0" T.O. SLAB
LIVING ROOM
101
102-2
KITCHEN
104
104-2
TYPICAL SMOOTH CEMENT BOARD
RAINSCREEN WALL
EXTERIOR GLULAM BEAM
SEE STRUCTURAL
BACK
PORCH
EXTERIOR DOOR UNIT
1" XPS BELOW DOOR THRESHOLD
RECESSED INTO SLAB
TURN DOWN SILL WITH
ALUMINUM SKIRT-FLASHING
EXTEND BELOW GRADE AS SHOWN
BACK PORCH CONCRETE SLAB
SEE STRUCTURAL
PAIRED 5" HSS COLUMNS
SEE STRUCTURAL
P.T. WOOD SURROUND
(VERIFY)
T.O. SLAB 100'-0"
12
1.25
6% MIN. SLOPE AWAY FROM
HOUSE FOR AT LEAST 6'-0"
CONCRETE GRADE BEAM
WITH VOID BOX FORMS PER
STRUCTURAL AND GEOTECH
BELLED CONCRETE PIERS
PER STRUCTURAL AND GEOTECH
MINIMUM 8" SELECT FILL
CHEMICAL SOIL INJECTION
TO A DEPTH OF 10 FEET
REFER TO GEOTECHNICAL
MINIMUM 8" SELECT FILL
CHEMICAL SOIL INJECTION
TO A DEPTH OF 10 FEET
REFER TO GEOTECHNICAL
LANDSCAPING SOIL
10 MIL POLY EXTENDS 6'-0" MIN
AWAY FROM GRADE BEAM
TIGHTLY COMPACTED CLAY BACKFILL
1'-0"
2"
11'-4"
29'-6" F.O. CONCRETE
1'-0"
11'-4"
CL
1'-0"
12'-8"



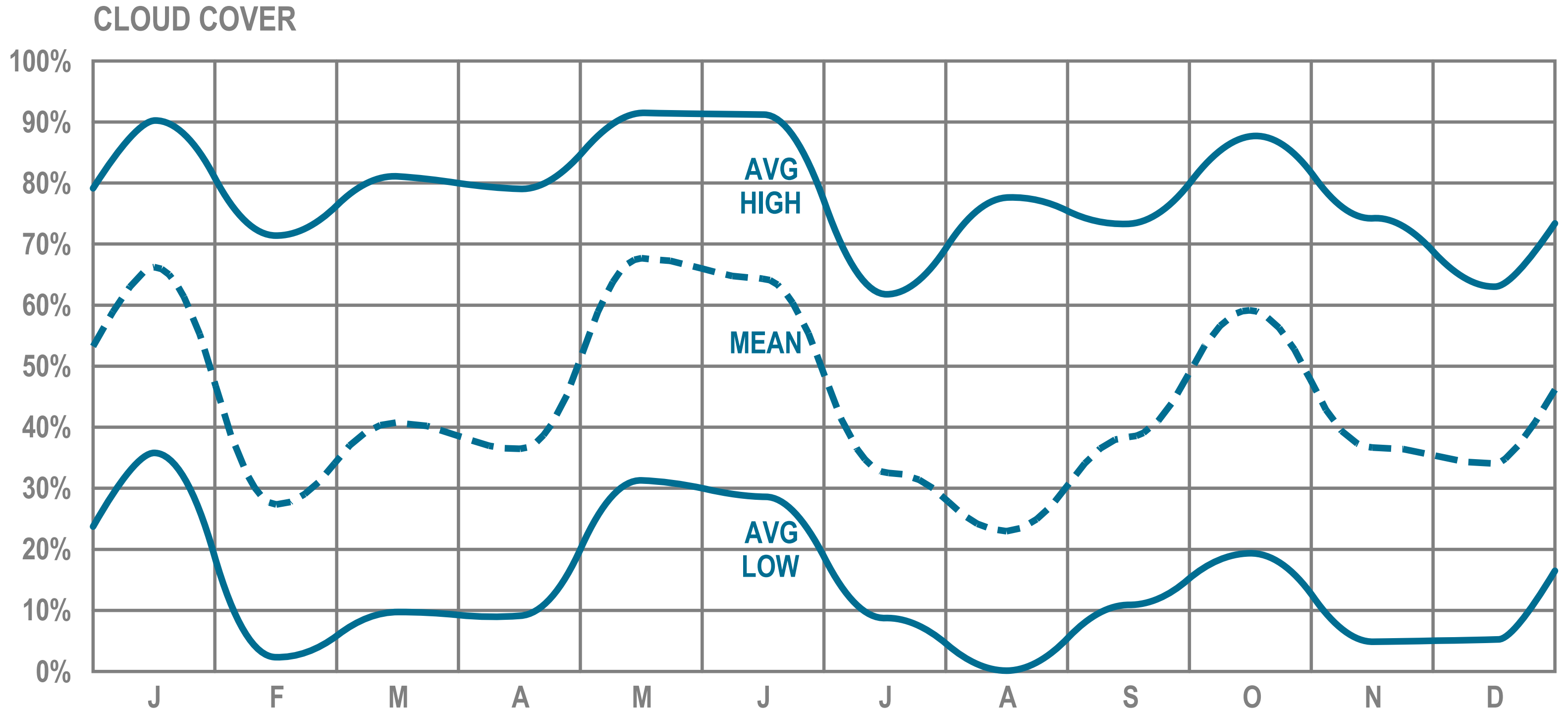
Brazos Passive House
Palo Pinto TX



TEMPERATURE RANGE



AVERAGE RAINFALL



CLOUD COVER

Integrative Systems Strategies

ACTIVE SYSTEMS
- low-volume heating/cooling mini-splits
- energy recovery ventilation (ERV)
- independent dehumidification system
- heat pump water heater
- project meets Indoor airPLUS

SITE DESIGN
- save existing old growth trees
- utilize slope with lower walk-out Lining Room
- reuse sandstone outcroppings
- landscape to use only native plants & trees

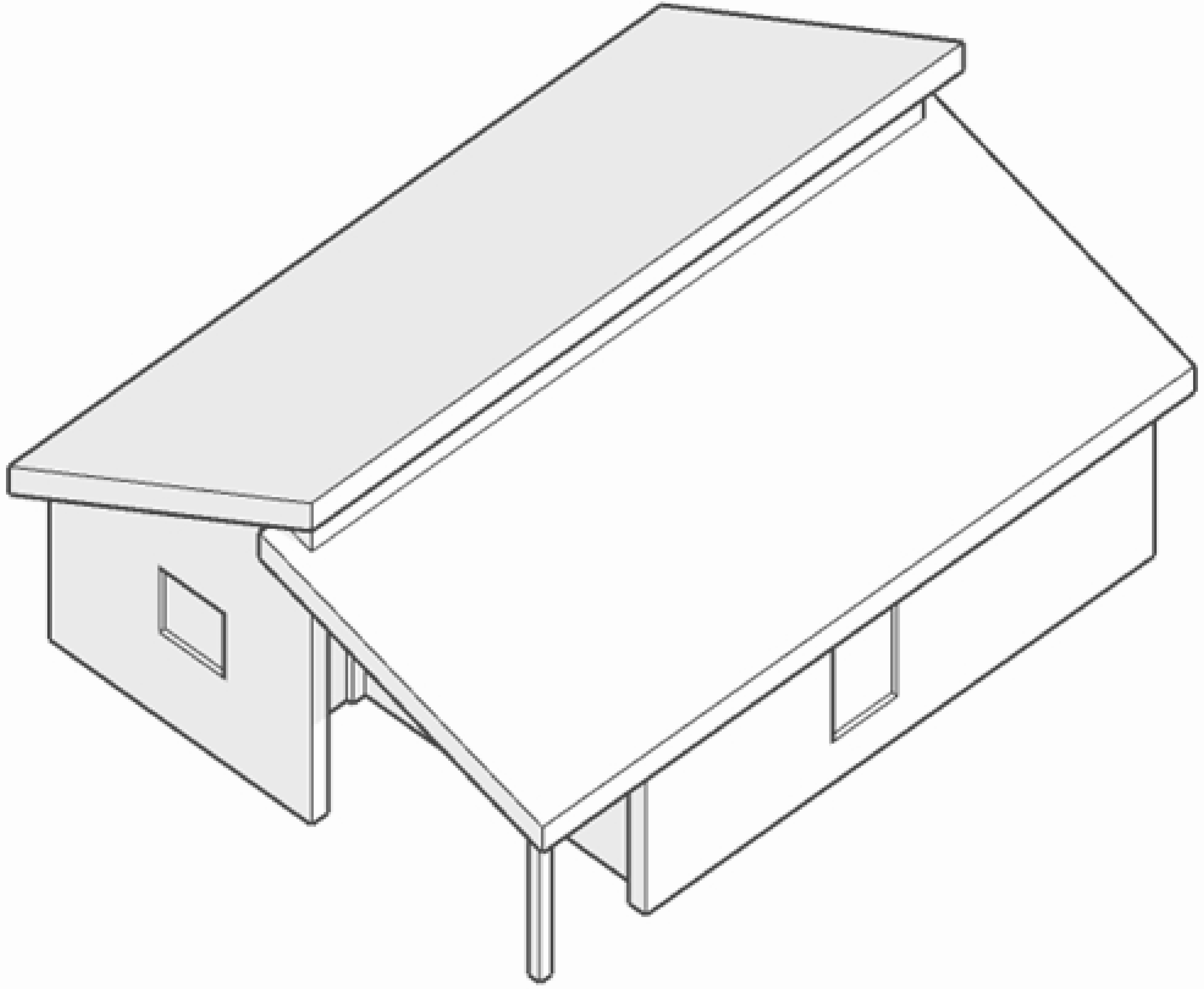
APPLIANCES & FIXTURES
- all appliances meet EnergyStar
- all fixtures meet WaterSense
- ventless heat pump clothes dryer

WATER MANAGEMENT
- rainwater harvesting for all potable water
- greywater recycling for irrigation water
- enlarged roof increases catchment area
- courtyard creates central water collection area

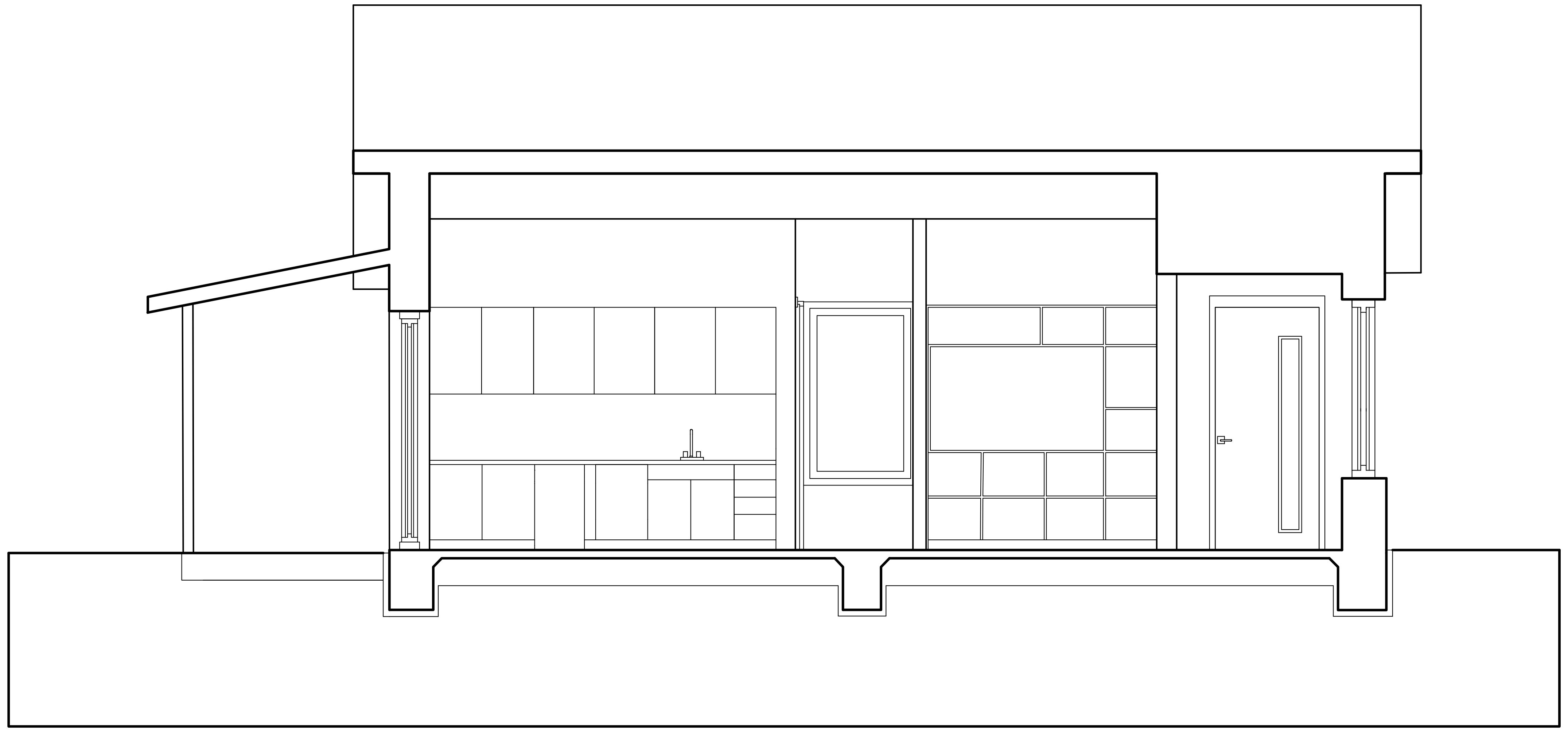
DAYLIGHTING
- south wall managed heat gain & solar access
- triple pane windows U=0.16 SHGC=0.274
- use of clerestory to reduce artificial lighting

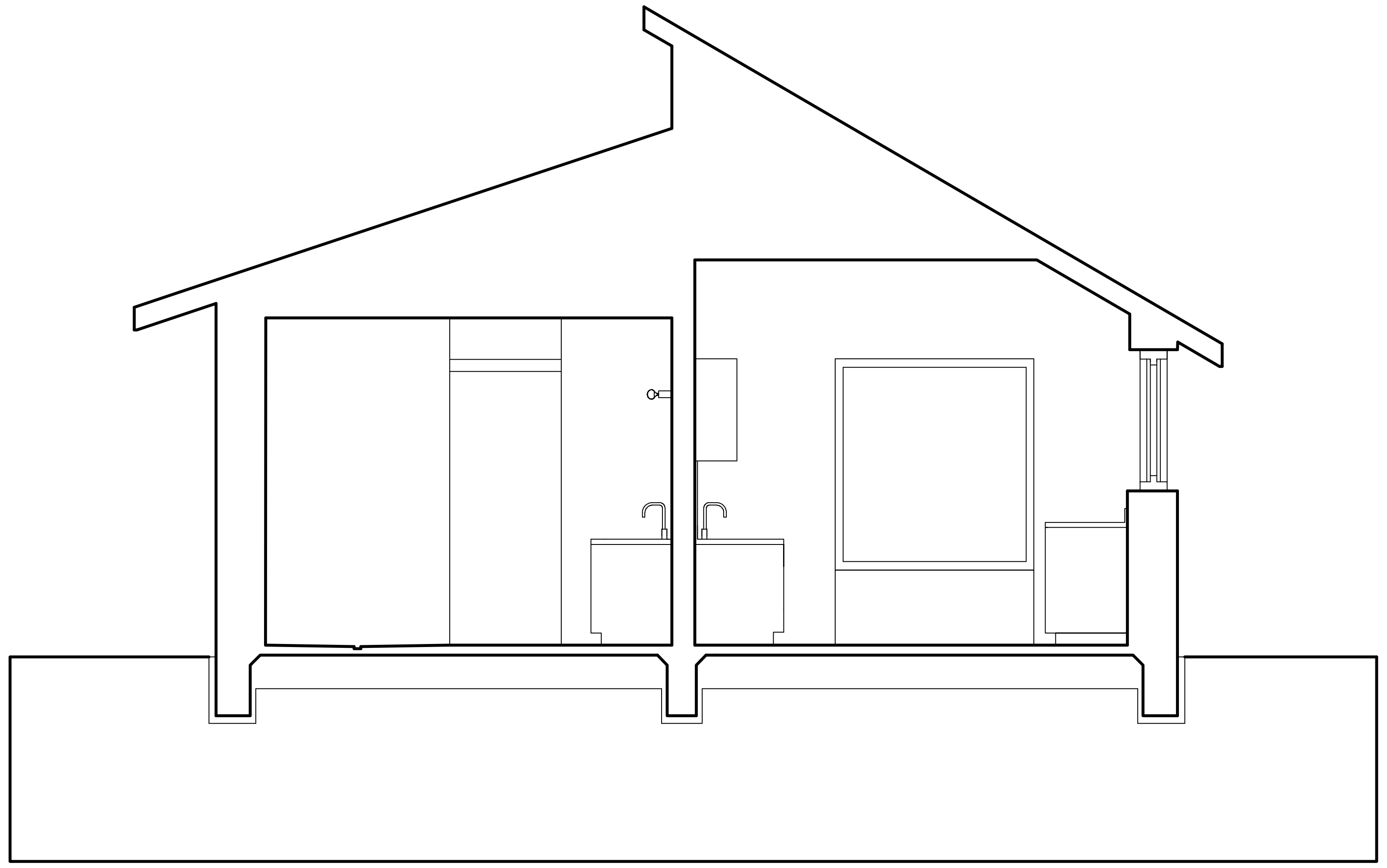
EFFICIENT ENVELOPE
- increased air-tightness < 0.6 ACH_{50}
- continuous insulation / no thermal bridges
- insulated concrete form (ICF) wall (R-28)
- structural insulated panel (SIP) roof (R-54)
- below-slab insulation (R-11)
- rainscreen cementitious cladding

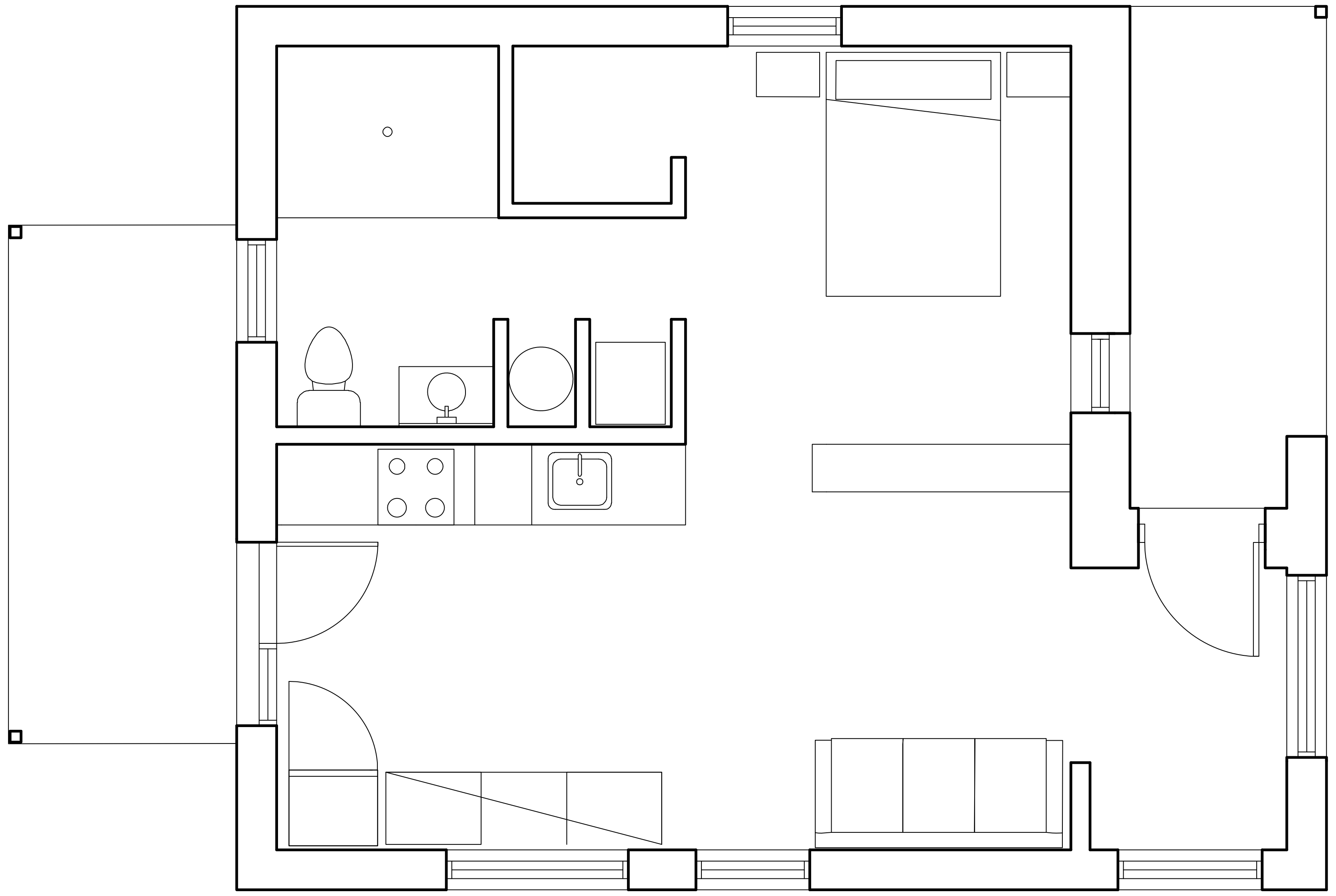
SOLAR PV
- 13kW pole-mounted array
- will achieve project net-zero energy



Wynn Terrace Senior Living Cottages
Passive House, Arlington





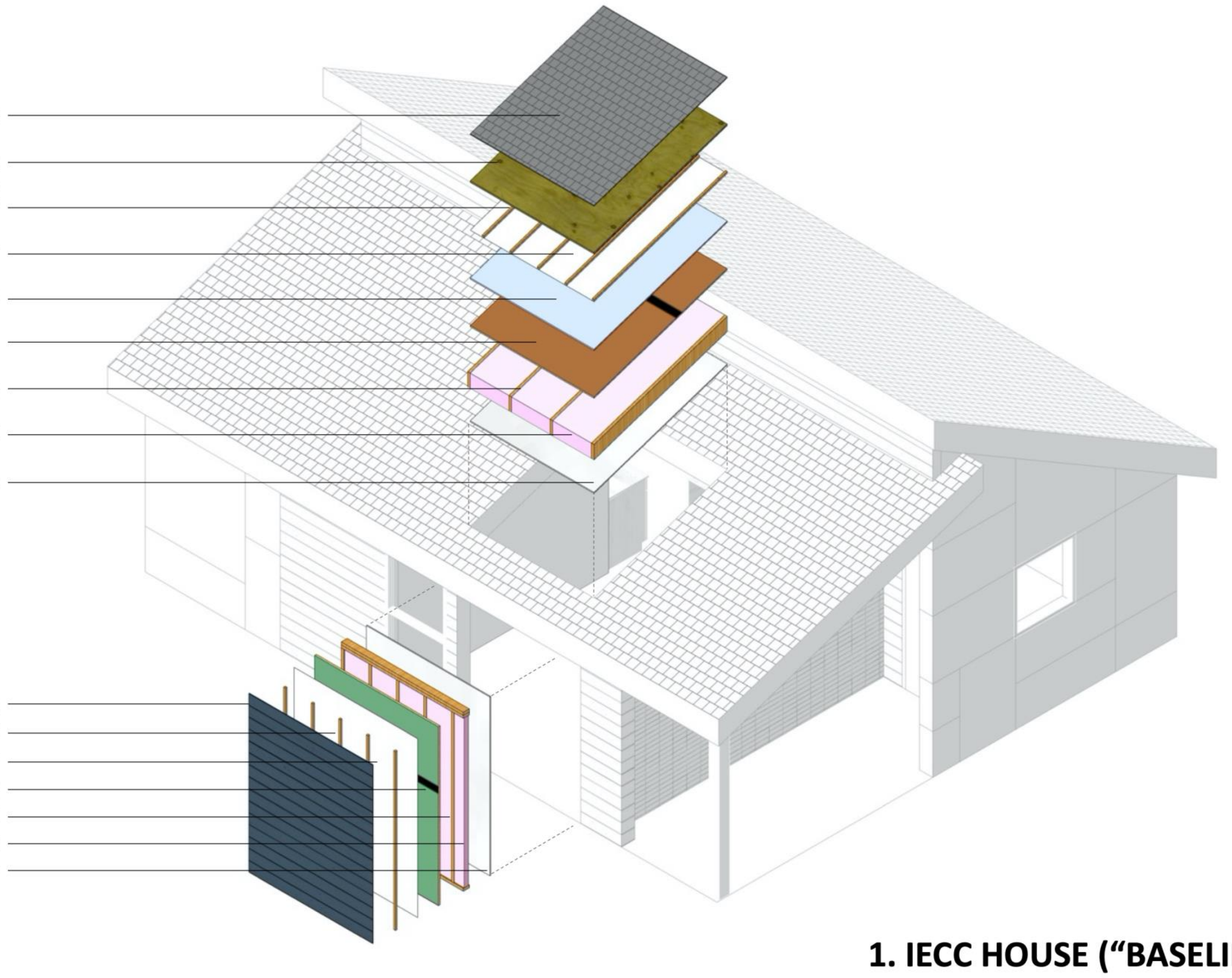


IECC / Baseline House

EnergyStar House

DoE ZERH House

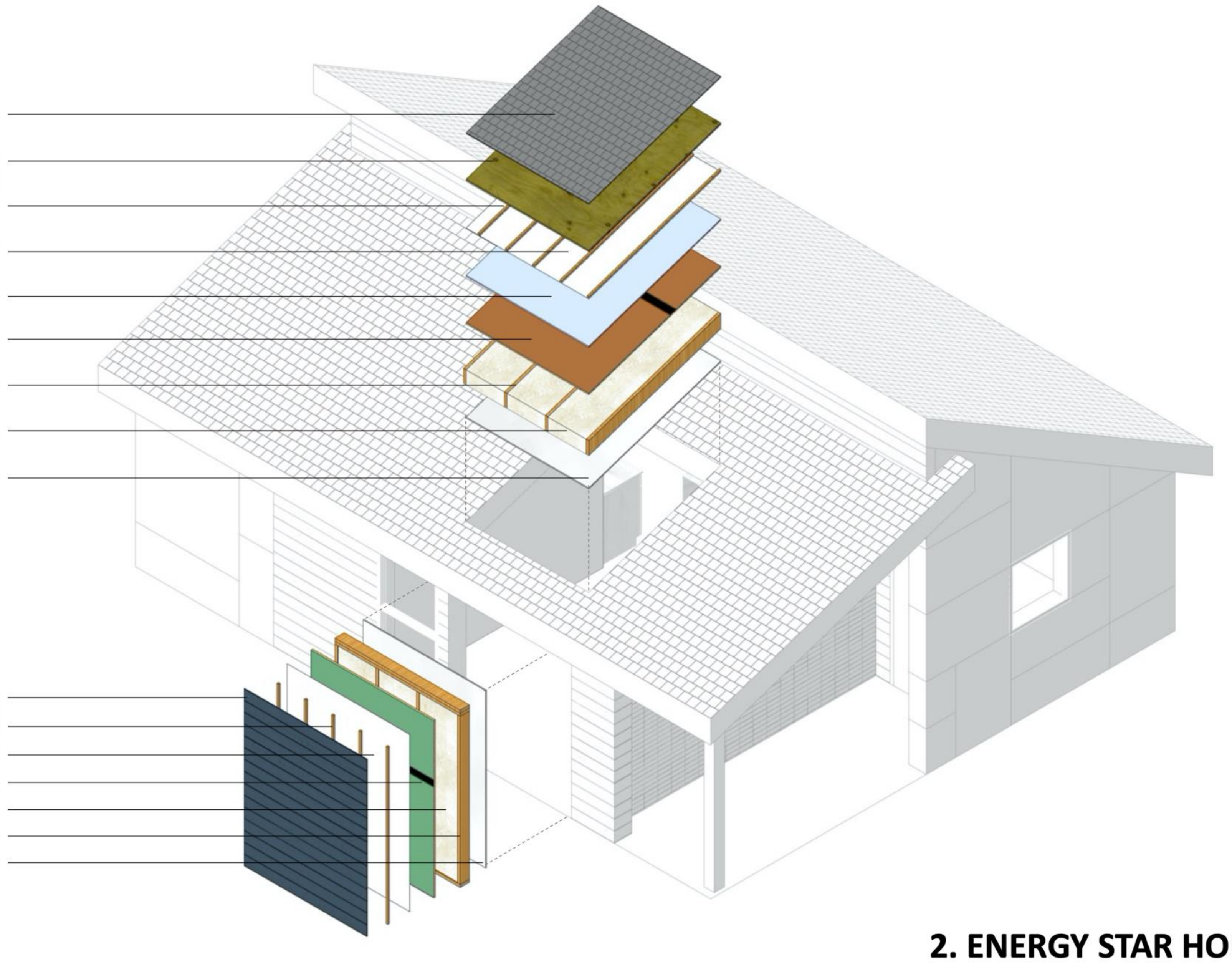
Phius Passive House



ASPHALT / COMPOSITE SHINGLES
3/4" PLYWOOD UNDERLAYMENT W/ ICE AND WATER SHIELD
1x1 FURRING STRIPS AND VENTILATION CAVITY
ICE & WATER WRB UNDERLAYMENT
R-4 CONTINUOUS INSULATION
7/16" ZIP SYSTEM ROOF DECK
2x8 RAFTERS
R-24 BATT CAVITY INSULATION
1/2" GYPSUM BOARD

5/16" CEMENTITIOUS RAINSCREEN CLADDING
1x1 VERTICAL FURRING STRIPS
WRB TAMLYN WRAP
1" ZIP R-3.6 SYSTEM SHEATHING W/ PROSCO R-GUARD
R-13 BATT INSULATION
2x4 WOOD FRAMING
1/2" GYPSUM BOARD

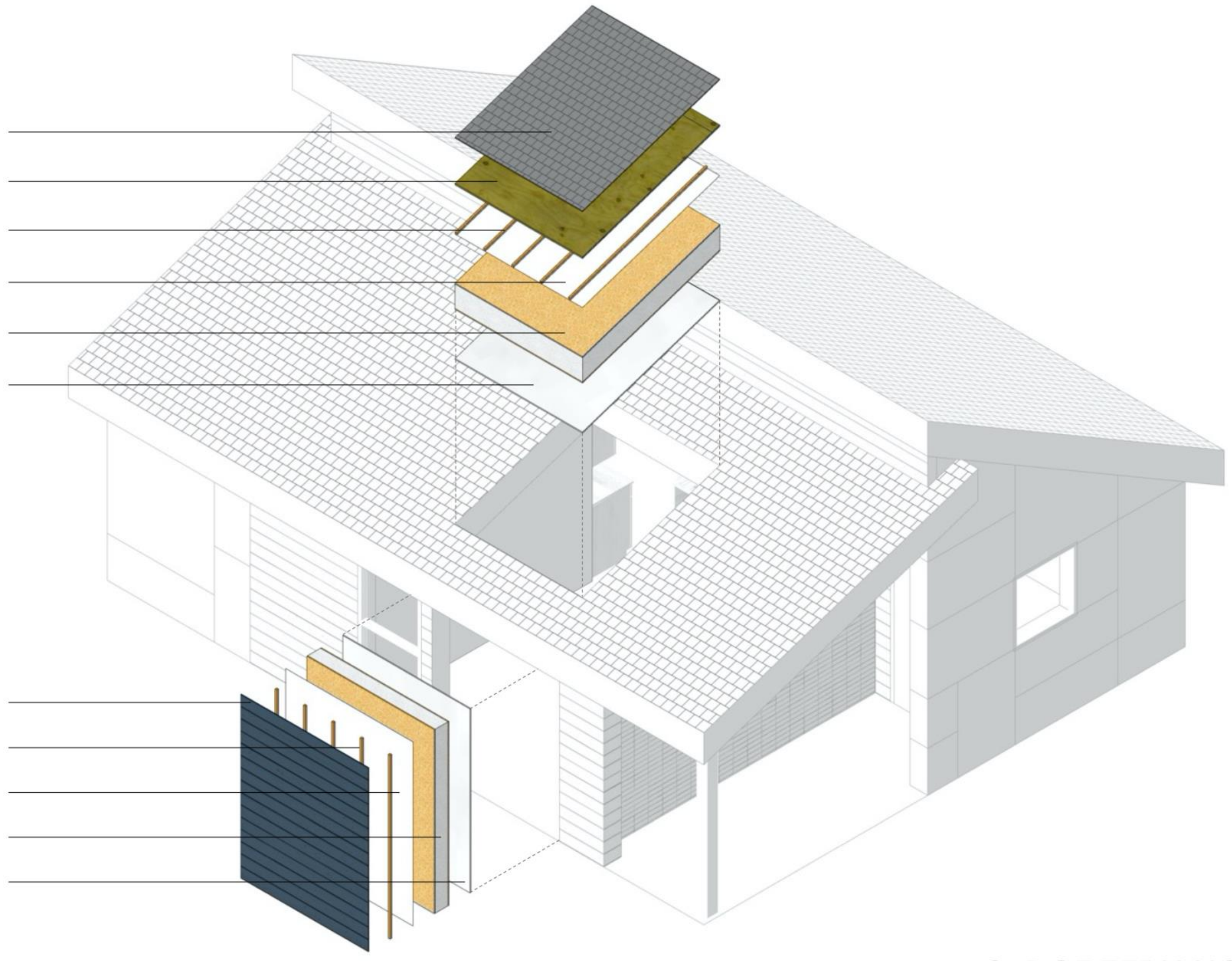
1. IECC HOUSE ("BASELINE")



ASPHALT / COMPOSITE SHINGLES
3/4" PLYWOOD UNDERLAYMENT W/ ICE AND WATER SHIELD
1x1 FURRING STRIPS AND VENTILATION CAVITY
ICE & WATER WRB UNDERLAYMENT
R-4 CONTINUOUS INSULATION
7/16" ZIP SYSTEM ROOF DECK
2x8 RAFTERS
R-24 OPEN CELL SPRAY FOAM CAVITY INSULATION
1/2" GYPSUM BOARD

5/16" CEMENTITIOUS RAINSCREEN CLADDING
1x1 VERTICAL FURRING STRIPS
WRB TAMLYN WRAP
1" ZIP R3.6 SYSTEM SHEATHING W/ PROSCO R-GUARD
R-20 OPEN CELL SPRAY FOAM INSULATION
2x6 WOOD FRAMING
1/2" GYPSUM BOARD

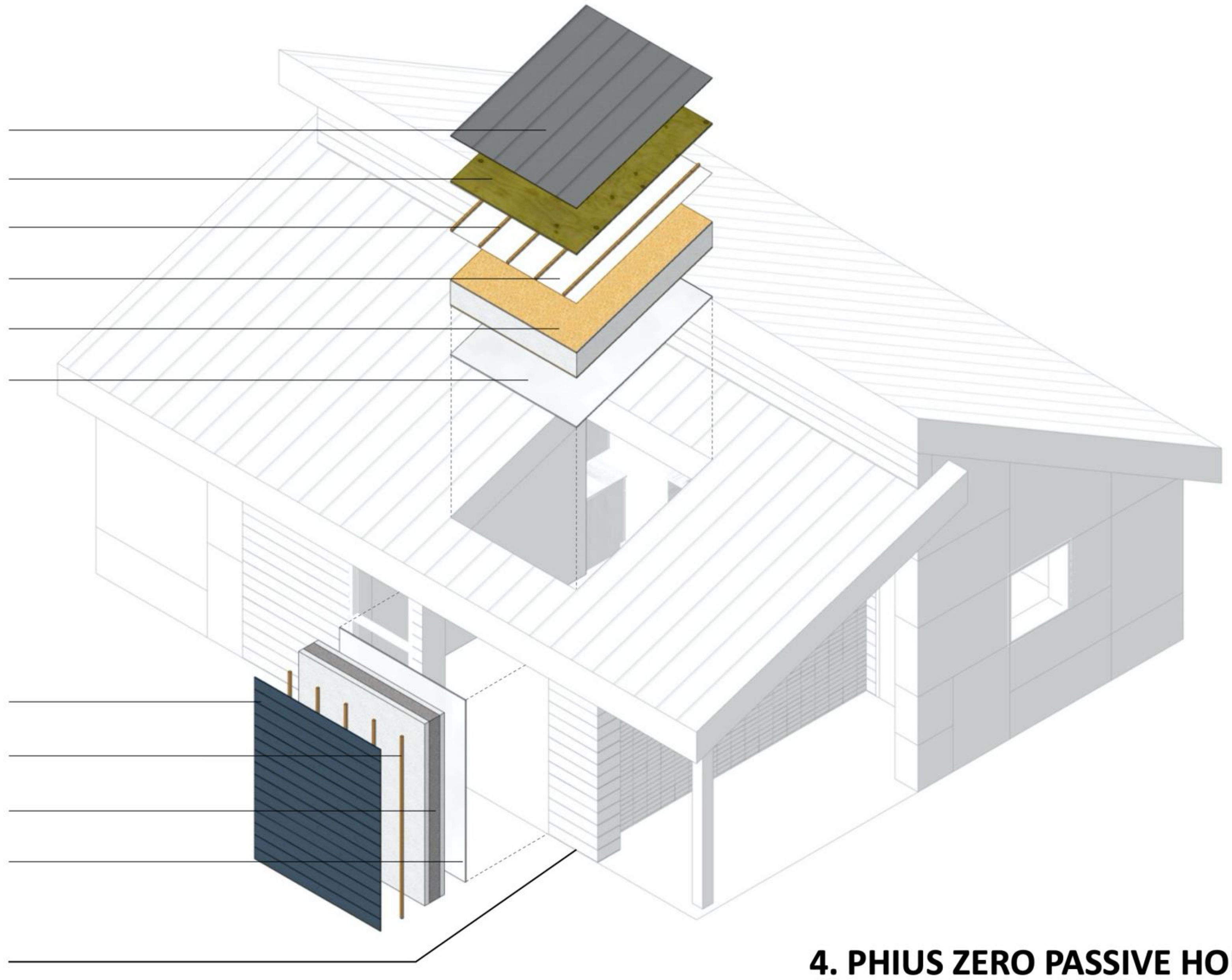
2. ENERGY STAR HOUSE



ASPHALT SHINGLES
3/4" PLYWOOD UNDERLAYMENT W/ ICE AND WATER SHIELD
1x1 FURRING STRIPS AND VENTILATION CAVITY
ICE & WATER WRB UNDERLAYMENT
R-44.7 SIP (12 1/4")
1/2" GYPSUM BOARD

1/4" CEMENTITIOUS RAINSCREEN CLADDING
1x1 VERTICAL FURRING STRIPS
WRB TAMLYN WRAP
R-22.6 SIP (6 ½") WITH PROSOCO R-GUARD
1/2" GYPSUM BOARD

3. DOE ZERH HOUSE

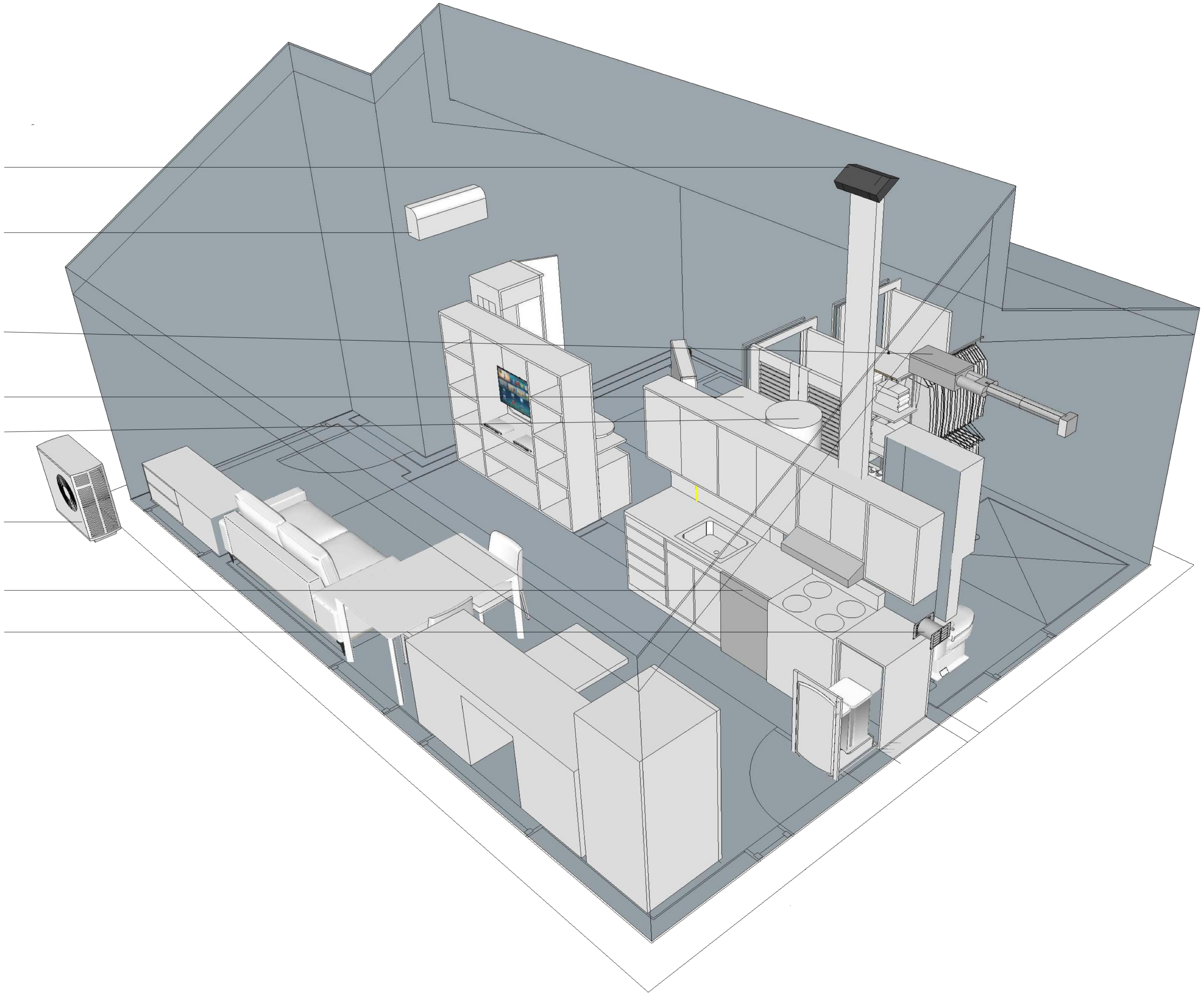


METAL ROOF W/ VENTILATED BATTENS AND RADIATE BARRIER
3/4" PLYWOOD UNDERLAYMENT W/ ICE AND WATER SHIELD
1x1 FURRING STRIPS AND VENTILATION CAVITY
ICE & WATER WRB UNDERLAYMENT
R-44.7 SIP (12 1/4")
1/2" GYPSUM BOARD

5/16" CEMENTITIOUS RAINSCREEN CLADDING
1x1 VERTICAL FURRING STRIPS
11 1/4" ICF WALL (6" CONCRETE CORE) W/ PROSCO R-GUARD
1/2" GYPSUM BOARD

R-10 CONTINUOUS INSULATION
AROUND PERIMETER & UNDER SLAB

4. PHIUS ZERO PASSIVE HOUSE



Cooktop Roof Exhaust (houses 1-3)
Recirculating Range Hood (house 4)

Minisplit Inside Cassette (all houses)

Attic space:
Continuous boost ERV (houses 2-4)
Bathroom only ERV (house 1)
Whole house ducted dehumidifier (all houses)

Stackable Washer/Dryer: Vented (houses 1-3)
Ventless Heat Pump Dryer (house 4)

Tankless/on-demand electric water heater location (all houses)

Minisplit Outside Unit (all houses)

EnergyStar Appliances (all houses)

Kitchen make-up air (houses 1-3)

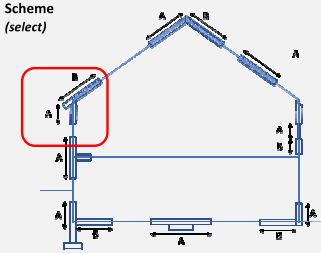
	Code House	Energy Star	DOE ZERH	Passive House
	Lot A	Lot C	Lot B	Lot D
	IECC	HERS/ES	HERS/ES/ZERH	HERS/ES/ZERH/WUFI
HERS Rating/ES Target	45	43/63	42/63	36/63
Energy Star Rpt		Exceeds	Exceeds	Exceeds
ZERH Rpt			Exceeds	Exceeds
WUFI Passive				
KWh/Year	4864	5019	4747	4622
CO2 emissions (Tons)	3	3	3	3
Annual Savings	$739	$722	$754	$767
Interior Conditioned Area (SheetRock to SheetRock)				
Perimeter (ft) Area (ft2)	94.84 481.63	94.84 481.63	94.84 481.63	94.84 481.63
Exterior Slab measurements				
Perimeter (ft) Area (ft2)	97.51 513.68			
Exterior Thermal Boundary measurements				
Perimeter (ft) Area (ft2)	98.17 521.84			

PHIUS+ Thermal Bridging
Psi-Value Calculator & Report v2.2

Detail

Description	Roof_Soffit_LOWER_ROOF
File name	Thermal_Bridge_Psi_Summary_Report
Project name	Cappa Tiny House Project
Project #	
Date	11/17/2022
Company	DwellGreen

General
Scheme
(select)



Boundary Conditions	T (F)	Surface Film Resist. (R-Value)	Hc
Indoor			
Wall	68	0.74	1.35
Roof	68	0.57	1.75
Floor	68	0.97	1.03
Outdoor			
Ambient Exposed	14	0.23	4.35
Ambient Screened	14	0.45	2.22
Ground Surface	14	0.17	5.88
Ground Dirt (R.1/in)	41	0	999999

**Enter values from THERM into yellow cells*

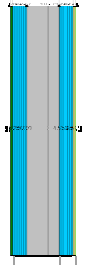
2D model		U (btu/hr.sf.F)	dT (F)	L (in)	ULdT (btu/hr.ft)	error (%)
	INT	0.0307	54	114.02	15.75	3.84%
	EXT	0.0219	54	159.99	15.77	3.84%

Component		U (btu/hr.sf.F)	dT (F)	L (in)	ULdT (btu/hr.ft)	error (%)
Component A	INT	0.0411	54	67.74	12.53	0.02%
Wall	EXT	0.0411	54.00	67.74	12.53	0.02%
Component B	INT	0.0216	54	72.002	7.00	0.00%
Roof	EXT	0.0216	54.00	72.00	7.00	0.00%

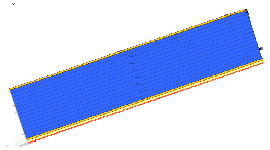
Psi		PsidT (btu/hr.ft)	dT (F)	Psi (btu/hr.ft.F)	Psi for WUFI (btu/hr.ft.F)
	INT	-3.78	54.00	-0.070	**-0.070**
	EXT	-3.76	54.00	-0.070	

PHIUS recommends against taking negative thermal bridges in the design phase. See Thermal Bridges section in Certification Guidebook.

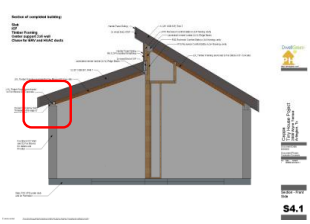
Component A



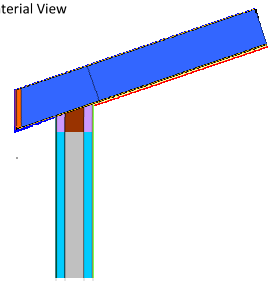
Component B



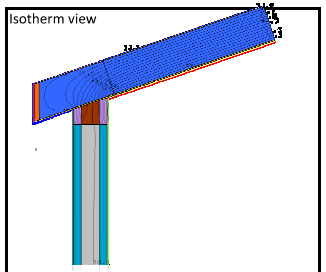
Detail view



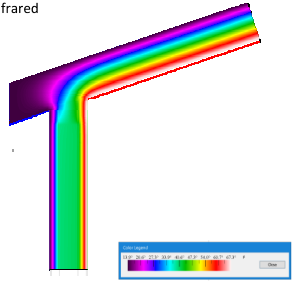
Material View



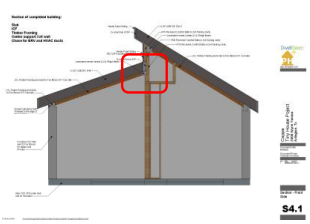
Isotherm view



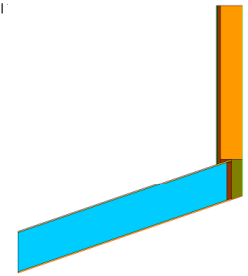
Infrared



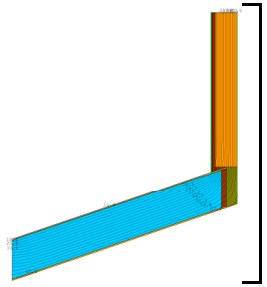
Detail view



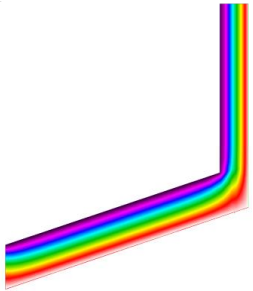
Material



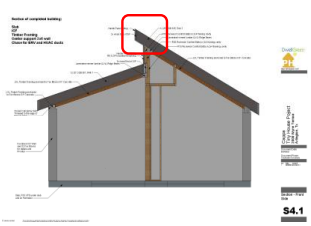
Isother



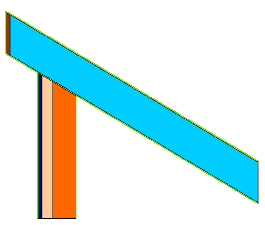
Infrare



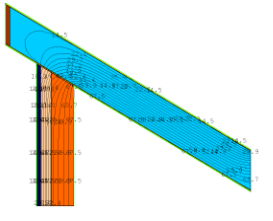
Detail view



Material View



Isotherm view



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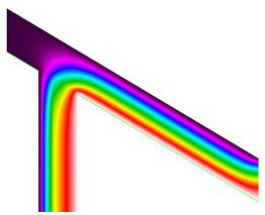
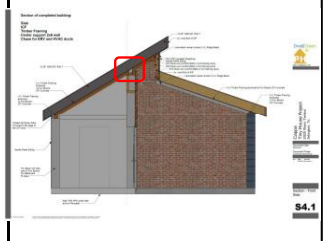


Detail view



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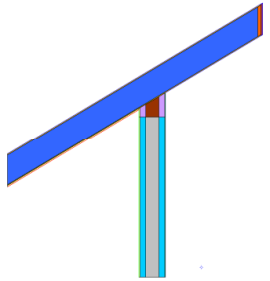
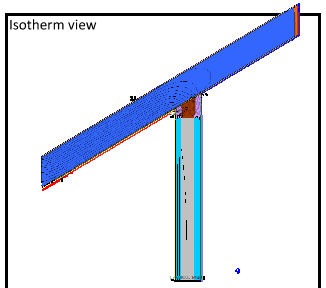
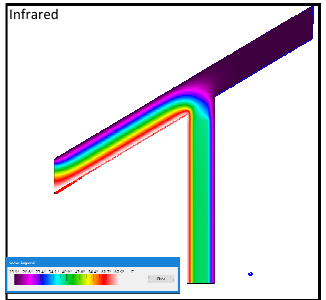


Isotherm view



Infrared



SOUTH WALL 238.55 SQ.FT.

CLADDING SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Cementitious Cladding	James Hardee, 5/16” Panels	0.48	0.15
WRB Wrap	Tamlyn, Tamlyn Wrap WRB 1.5	-	0.17
ICF	Foxblocks, 6” Concrete Core	4.17	22.0
Gypsum Board	Sheetrock	-	0.45
Interior Film	-	-	0.74
Total Component R-Value	23.96		
Total Component Sq.Ft.	198.92 Sq. Ft.		
Total Component Percentage	83.39%		

DOOR SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Door 1	Thermatru Doors, 6’-8”, Classic Glass	-	3.33
Interior Film	-	-	0.74
Total Component R-Value	4.52		
Total Component Sq. Ft.	23.1 Sq. Ft.		
Total Component Percentage	9.68%		

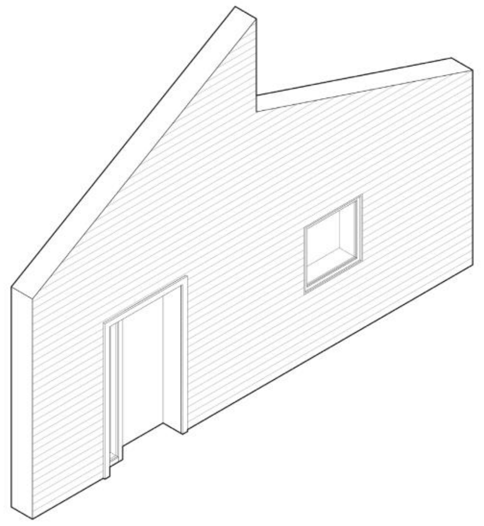
DOOR SIDELITE SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Window 2	Thermatru Doors, 8x66 Sidelite	-	4.00
Interior Film	-	-	0.74
Total Component R-Value	5.19		
Total Component Sq.Ft.	7.53		
Total Component Percentage	3.16%		

WINDOW SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Window 1	Alpen, Zenith ZR-6	-	5.30
Interior Film	-	-	0.74
Total Component R-Value	6.49		
Total Component Sq.Ft.	9 Sq. Ft.		
Total Component Percentage	3.77%		

Total Assembly R-Value 20.66



NORTH WALL 268.75 SQ.FT.

BRICK SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Brick		-	0.44
Air Gap	-	-	1.00
WRB Wrap	Tamlyn, Tamlyn Wrap WRB 1.5	-	0.17
ICF	Foxblocks, 6” Concrete Core	4.17	22.0
Gypsum Board	Sheetrock	-	0.45
Interior Film		-	0.74
Total Component R-Value	25.25		
Total Component Sq. Ft.	130.81 Sq. Ft.		
Total Component Percentage	48.67%		

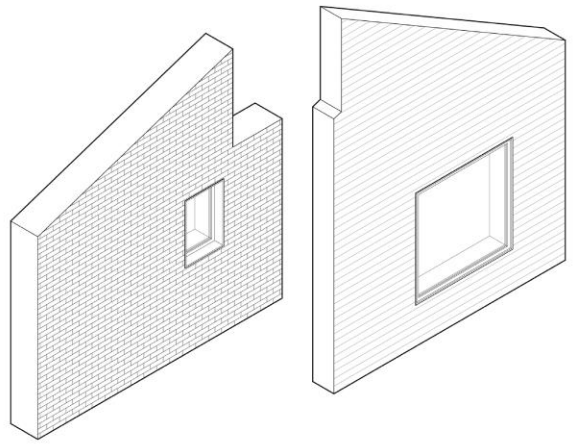
CLADDING SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Cementitious Cladding	James Hardee, 5/16” Panels	0.48	0.15
WRB Wrap	Tamlyn, Tamlyn Wrap WRB 1.5	-	0.17
ICF	Foxblocks, 6” Concrete Core	4.17	22.0
Gypsum Board	Sheetrock	-	0.45
Interior Film	-	-	0.74
Total Component R-Value	23.96		
Total Component Sq. Ft.	106.94 Sq. Ft.		
Total Component Percentage	39.79%		

WINDOWS

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Window 1	Alpen, Zenith ZR-6	-	5.30
Interior Film	-	-	0.74
Total Component R-Value	6.49		
Total Component Sq. Ft.	31 Sq. Ft.		
Total Component Percentage	11.53%		

Total Assembly R-Value 22.57

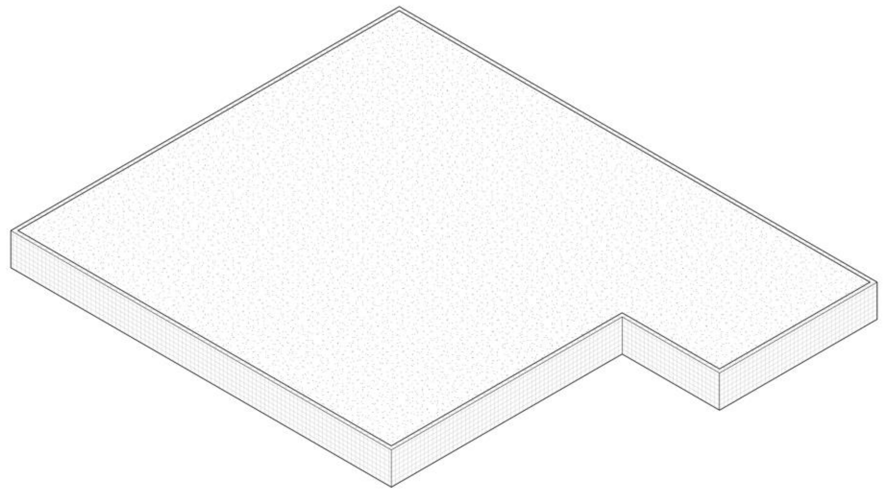


FOUNDATION 575.5 SQ.FT.

FOUNDATION SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Downward Heat Flow	-	-	0.97
Concrete	-	0.08	0.48
Insulation	Henry, R-Tech, 2” Insulation	-	10.50
Soil Surface	-	-	0.17

Total Assembly R-Value 12.12



EAST WALL 296.20 SQ.FT.

BRICK SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Brick		-	0.44
Air Gap	-	-	1.00
WRB Wrap	Tamlyn, Tamlyn Wrap WRB 1.5	-	0.17
ICF	Foxblocks, 6” Concrete Core	4.17	22.0
Gypsum Board	Sheetrock	-	0.45
Interior Film		-	0.74
Total Component R-Value	25.25		
Total Component Sq. Ft.	43.98 Sq. Ft.		
Total Component Percentage	14.85%		

TOP CLADDING SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Cementitious Cladding	James Hardee, 5/16” Panels	0.48	0.15
WRB Wrap	Tamlyn, Tamlyn Wrap WRB 1.5	-	0.17
Sheathing	1” ZIP R3.6 w/ Prosco R-Guard	3.60	3.60
Wood Framing	2x6 Wood Framing @ 24” O.C.	-	6.88
Open Cell Spray Foam	R-20 Open Cell Spray Foam Ins.	-	20.0
Gypsum Board	Sheetrock	-	0.45
Interior Film	-	-	0.74
Total Component R-Value	24.25		
Total Component Sq. Ft.	41.12 Sq. Ft.		
Total Component Percentage	13.88%		

CLADDING SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Cementitious Cladding	James Hardee, 5/16” Panels	0.48	0.15
WRB Wrap	Tamlyn, Tamlyn Wrap WRB 1.5	-	0.17
ICF	Foxblocks, 6” Concrete Core	4.17	22.0
Gypsum Board	Sheetrock	-	0.45
Interior Film	-	-	0.74
Total Component R-Value	23.96		
Total Component Sq. Ft.	173 Sq. Ft.		
Total Component Percentage	58.41%		

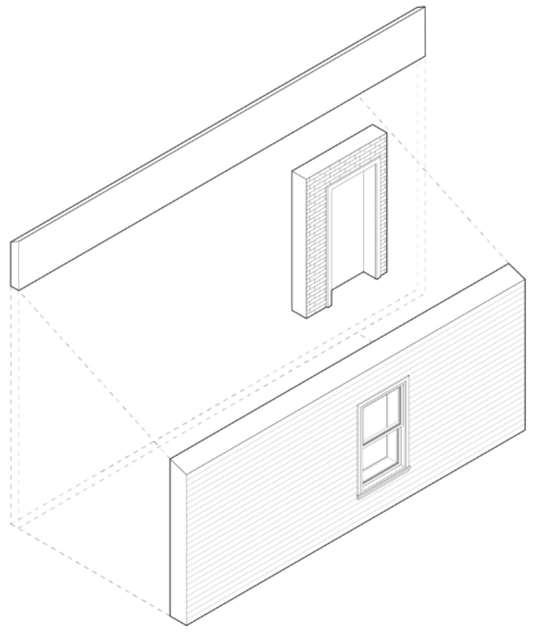
WINDOW SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Window 1	Alpen, Zenith ZR-6	-	5.30
Interior Film	-	-	0.74
Total Component R-Value	6.49		
Total Component Sq. Ft.	15 Sq. Ft.		
Total Component Percentage	5.06%		

DOOR SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Door 1	Thermatru Doors, 6’-8”, Fiber Classic	-	5.88
Interior Film	-	-	0.74
Total Component R-Value	7.07		
Total Component Sq. Ft.	23.1 Sq. Ft.		
Total Component Percentage	7.80%		

Total Assembly R-Value 18.05



WEST WALL 228 SQ.FT.

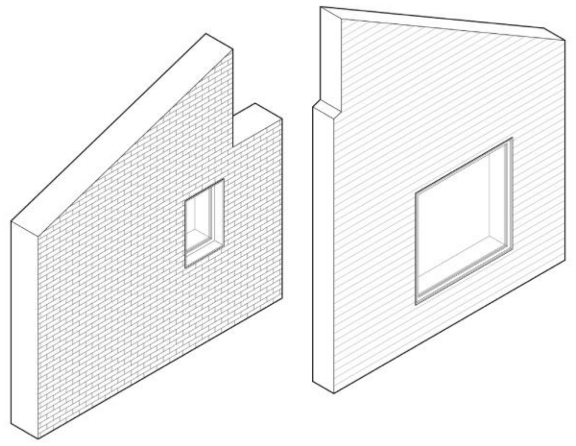
SIDING SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Cementitious Cladding	James Hardee, 5/16” Panels	0.48	0.15
WRB Wrap	Tamlyn, Tamlyn Wrap WRB 1.5	-	0.17
ICF	Foxblocks, 6” Concrete Core	4.17	22.0
Gypsum Board	Sheetrock	-	0.45
Interior Film	-	-	0.74
Total Component R-Value	23.96		
Total Component Sq.Ft.	186 Sq. Ft.		
Total Component Percentage	81.58%		

WINDOW SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Window 1	Alpen, Zenith ZR-6	-	5.30
Interior Film	-	-	0.74
Total Component R-Value	6.49		
Total Component Sq.Ft.	42 Sq. Ft.		
Total Component Percentage	18.42%		

Total Assembly R-Value 20.74

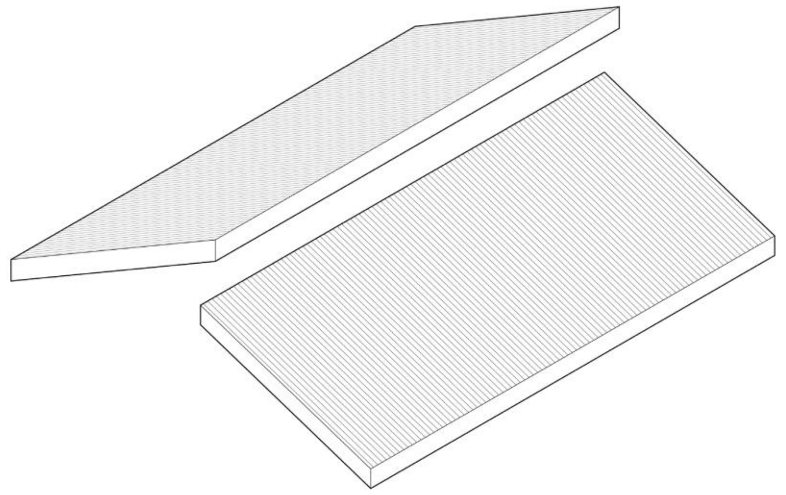


ROOF 999.5 SQ.FT.

ROOF SECTION

Components	Manufacturer	R-Value/in.	Total R-Value
Exterior Film	-	-	0.45
Asphalt Shingles	Owens Corning	-	0.44
Plywood	-	-	0.93
WRB Wrap	Tamlyn, Tamlyn Wrap WRB 1.5	-	0.17
12 1/4” SIP	Extreme Panel	-	42.0
Gypsum Board	Sheetrock	-	0.45
Interior Film	-	-	0.74

Total Assembly R-Value 44.79

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