



Massachusetts ADU Design Challenge | Project Cover Sheet

1. Design Team

Lead Applicant: Rashmi Ramaswamy

Additional Applicants:

Design Firm Name (If Applicable): SHED Studio

Contact Info: shedboston@gmail.com

2. Design Information

EntryID (randomly assigned by HLC for tracking purposes): 3560

Design Name: Modular Passive ADU for MA

ADU Gross Floor Area (square footage): 894

Unit Layout: Two-Bedroom or more

ADU Height (feet): 20.2

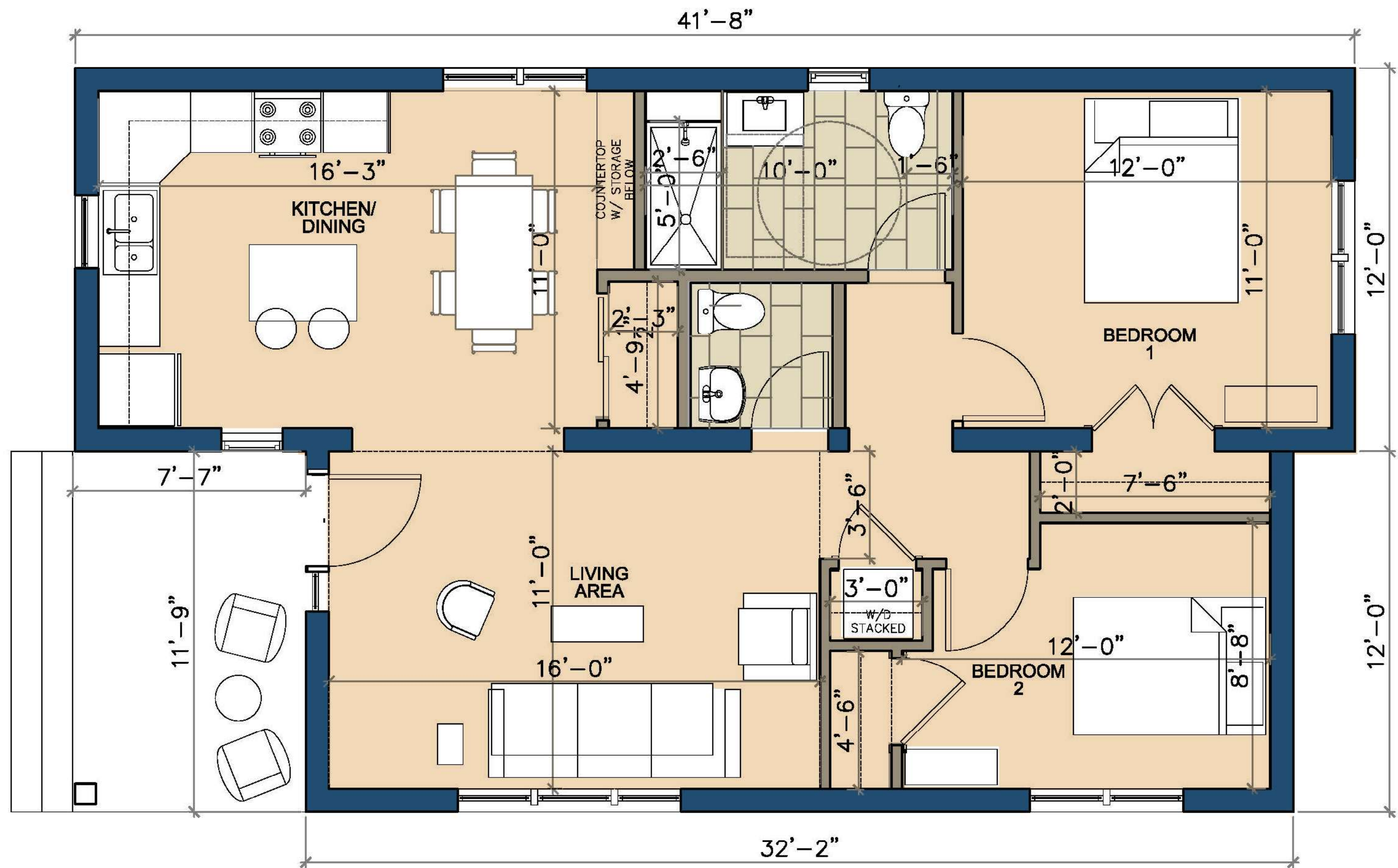
Window/Wall Ratio: 0.14

Foundation Type: Frost Proof Slab Foundation

3. Project Narrative

This project proposes a <900 SF, one-story, two-bedroom modular ADU in Massachusetts designed to meet PHIUS passive building principles. The home is constructed from 12-foot-wide factory-built modules set on a frost-protected shallow foundation, reducing site time and material use. Modules are craned into place and sealed with continuous exterior insulation, air barrier, and high-performance cladding to achieve a passive envelope. The south-facing roof supports photovoltaic panels, clerestory windows bring daylight deep into the plan, and preserved northern landscape area manages stormwater. The ADU shares yard space with the primary residence while maintaining private outdoor space.

Please note that the information contained in this file was submitted to the Executive Office of Housing and Livable Communities (HLC) by ADU Design Challenge participants and has not been independently verified by HLC or the Commonwealth of Massachusetts. Please direct questions to the designers.



Building Type: Standard Detached Accessory Dwelling Unit (ADU)
Size: < 900 SF
Configuration: 1 Story | 2 Bedroom
Construction Type: Modular (12' wide factory-built units)
Certification Target: PHIUS Passive Building Standard

This project proposes a **high-performance, factory-built** Accessory Dwelling Unit (ADU) designed to meet PHIUS passive building standards while advancing **attainable, climate-responsive housing** in Massachusetts.

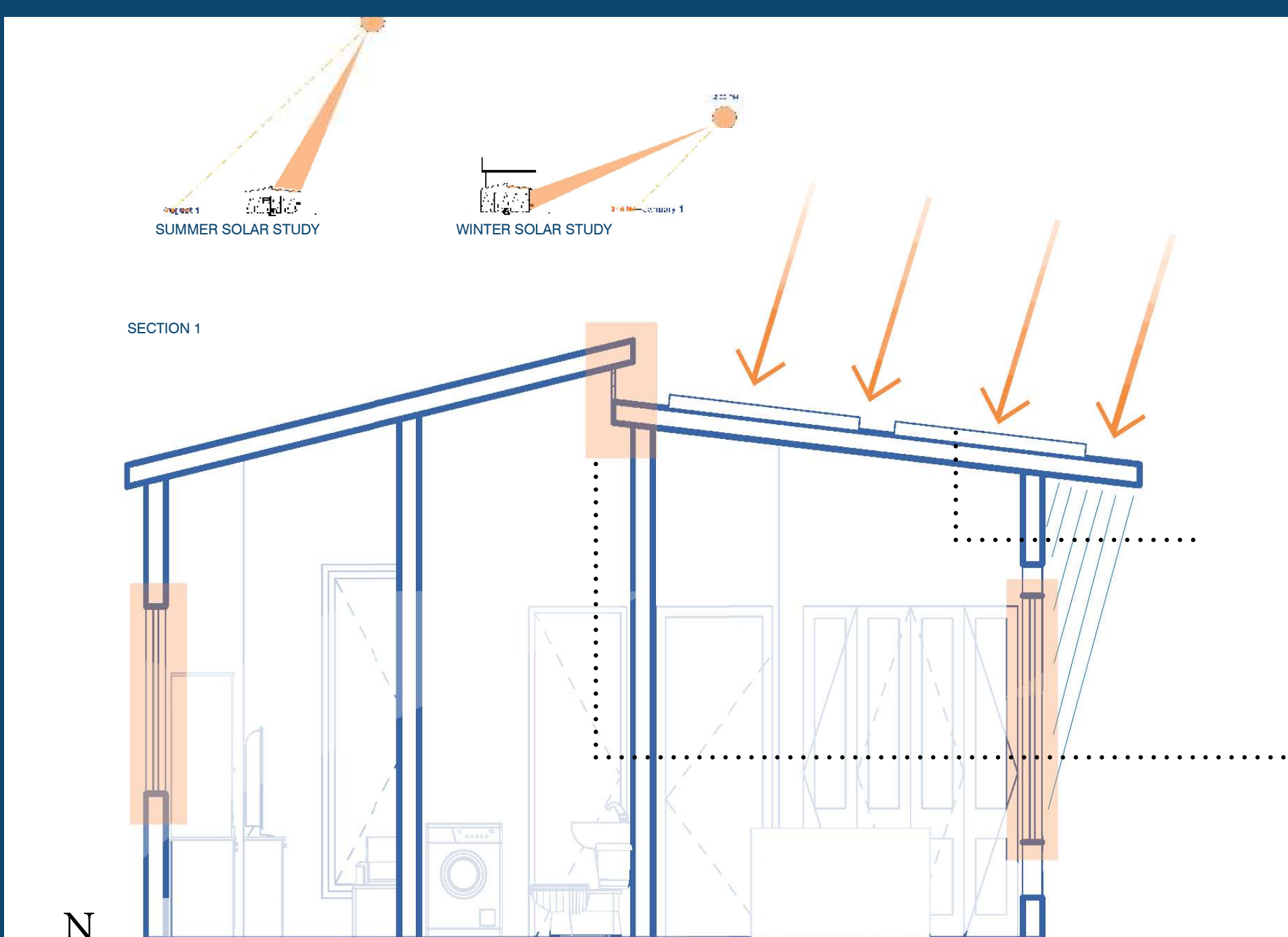
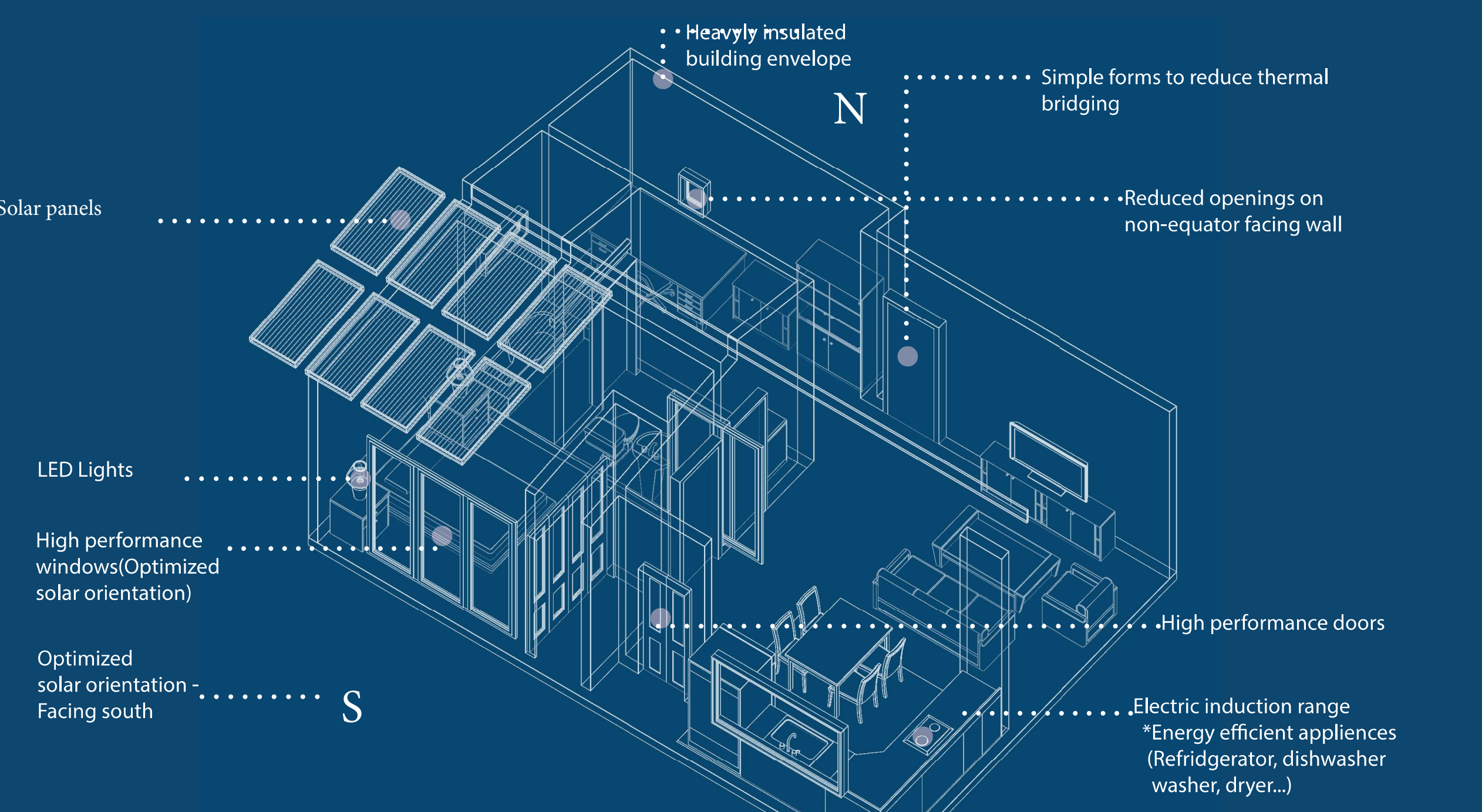
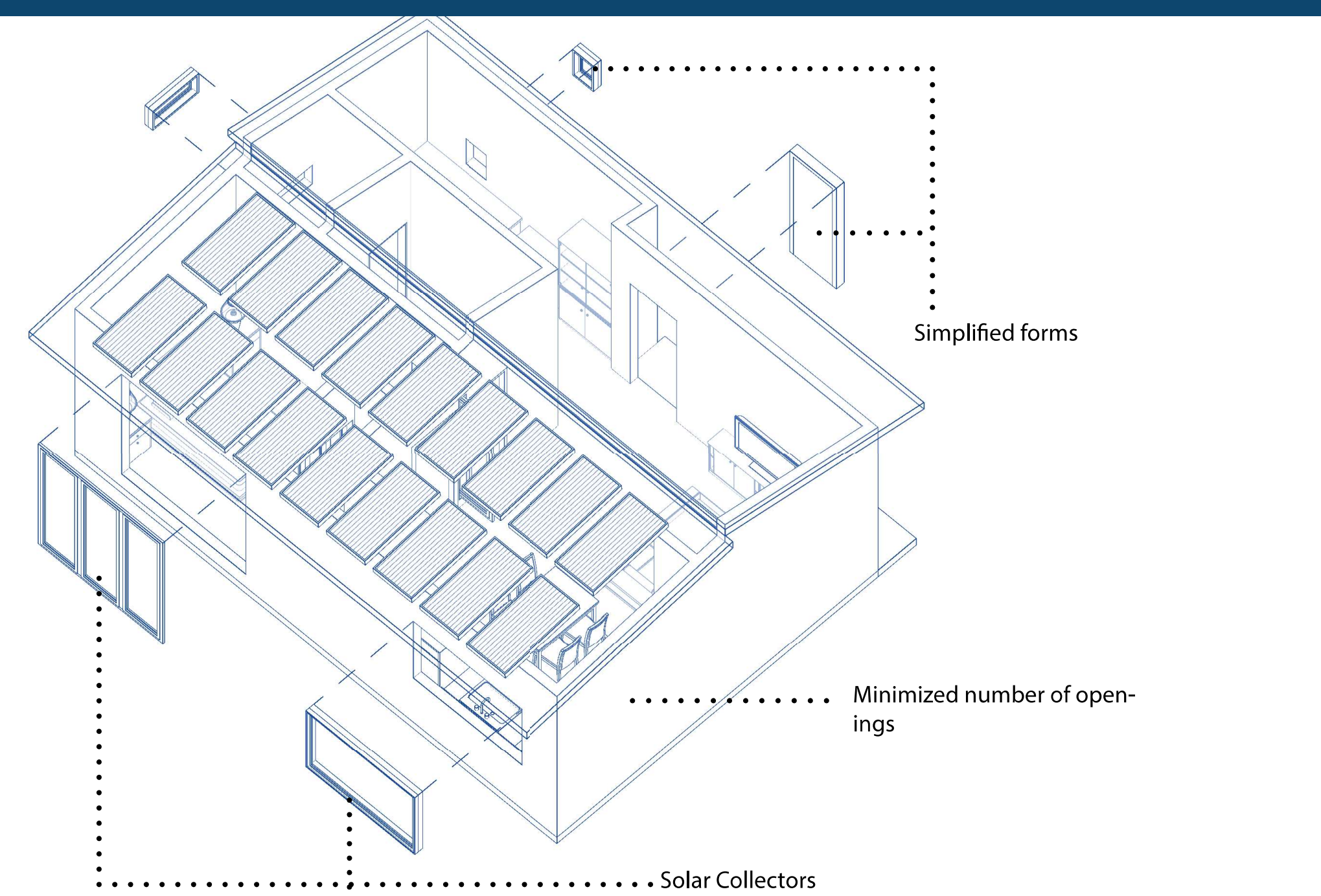
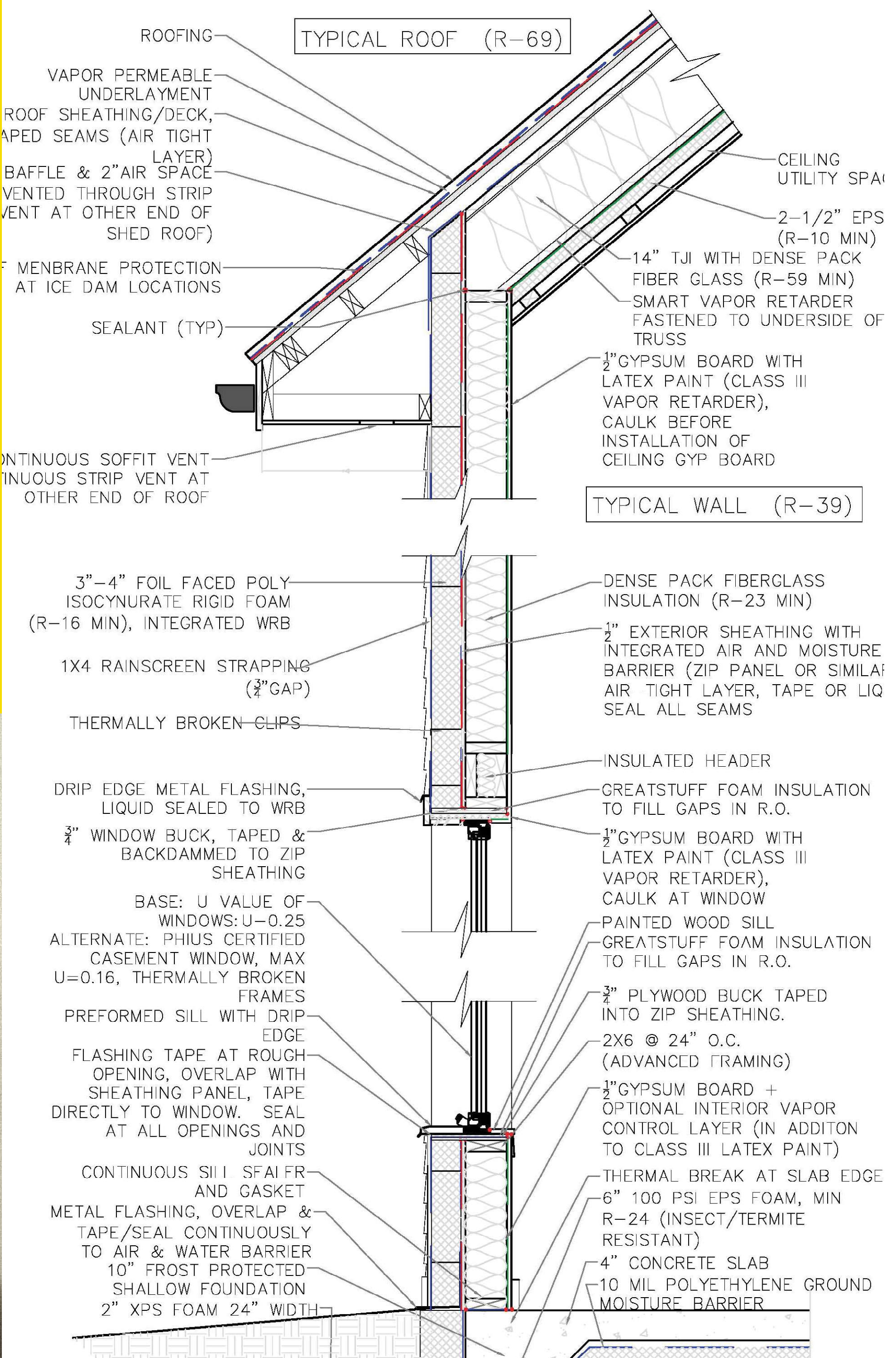
The ADU is composed of **12-foot-wide modules**, fabricated in a controlled factory environment to ensure precision, quality control, and reduced construction waste. The compact, **one-story, two-bedroom** layout is **under 900 square feet** and designed for long-term adaptability, energy efficiency, and **neighborhood compatibility**.

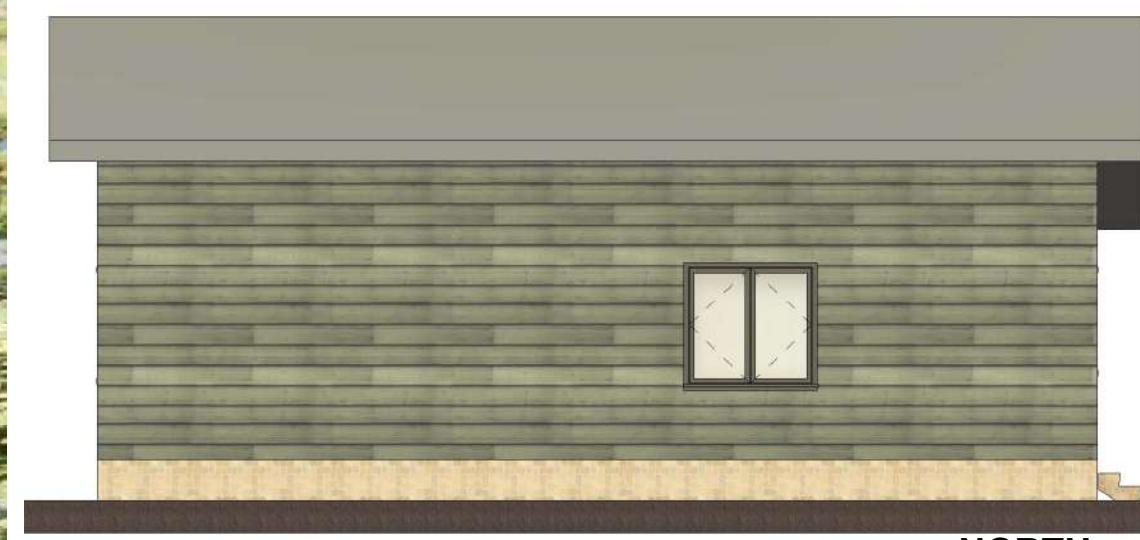
Modular construction allows for **improved airtightness, reduced material waste, and shortened on-site construction time** while maintaining a high-performance building envelope aligned with PHIUS certification goals.

The ADU includes two bedrooms, an open living-dining-kitchen space, and a single bathroom designed to meet **Group 2A Adaptable standards**. The adaptable bathroom supports aging in place and future accessibility modifications, including reinforcement for grab bars and clear maneuvering space. Single-story living further enhances long-term usability and reduces physical barriers. The compact layout maximizes **daylight, cross-ventilation potential**, and spatial efficiency while maintaining comfortable proportions and functional storage.

The project is designed as an **all-electric building** aligned with PHIUS modeling assumptions. The high-performance envelope reduces space conditioning loads, allowing for efficient **heat pump systems** and balanced ventilation with integrated heat recovery (ERV/HRV), located in the attic space above the bathrooms. The south-facing roof plane accommodates photovoltaic panels sized to offset operational energy use over time. The low-load design supports **resilience during extreme weather events** and enhances passive survivability during grid interruptions.

This modular ADU demonstrates how compact infill housing can achieve passive-level performance through a replicable construction model. The combination of factory precision, reduced embodied carbon through FPSF and minimized concrete use, continuous exterior insulation, and airtight detailing results in a durable, climate-forward dwelling.





NORTH



WEST



SOUTH



EAST

CONSTRUCTION STRATEGY

Modular Assembly

The building is delivered as factory-built modules that include structural framing, windows, rough mechanical systems, and interior partitions. Fabrication in a climate-controlled environment enhances **dimensional accuracy and enclosure quality**.

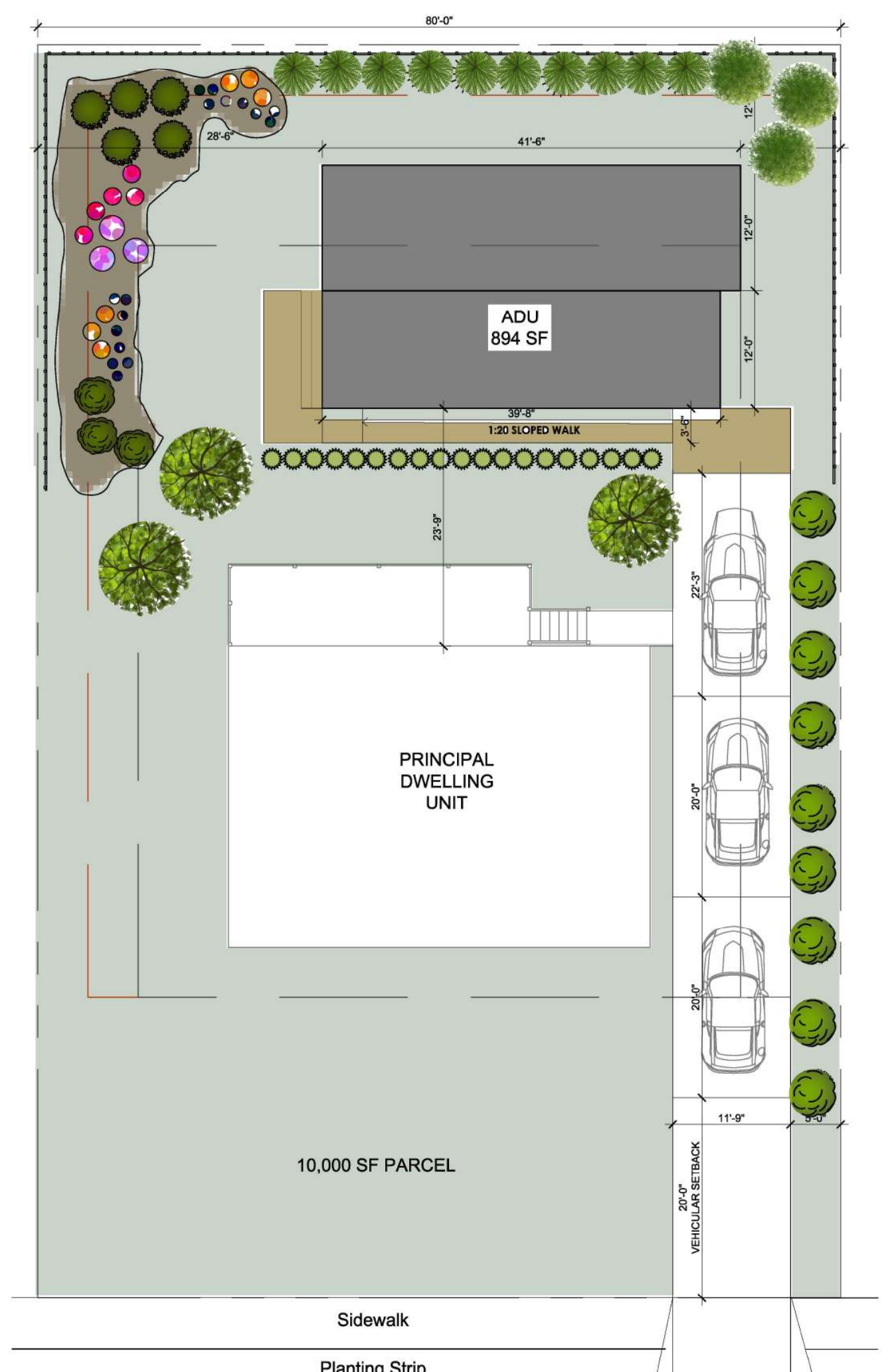
Site Preparation

Pre-site work includes utility coordination, site grading, and installation of a **Frost Protected Shallow Foundation (FPSF)**, where soil conditions allow. The FPSF reduces excavation and concrete use while maintaining thermal stability and durability in Massachusetts' climate.

Following foundation completion, **modules are craned into place**, set on the prepared slab, and mechanically connected. This process significantly reduces site disruption and construction duration.

High-Performance Enclosure

After module installation, the final enclosure layer is applied on site to ensure continuity across module seams. This includes **continuous exterior insulation**, an **integrated air barrier** system, and comprehensive flashing strategies to maintain thermal and moisture control continuity. The enclosure is designed to minimize thermal bridging and achieve airtightness levels consistent with PHIUS performance targets. The **superinsulated envelope** significantly reduces heating and cooling demand, enabling **smaller, more efficient mechanical systems**. **Clerestory windows** are incorporated in the kitchen and primary bedroom to enhance daylight penetration while preserving privacy and maintaining optimized wall insulation performance.

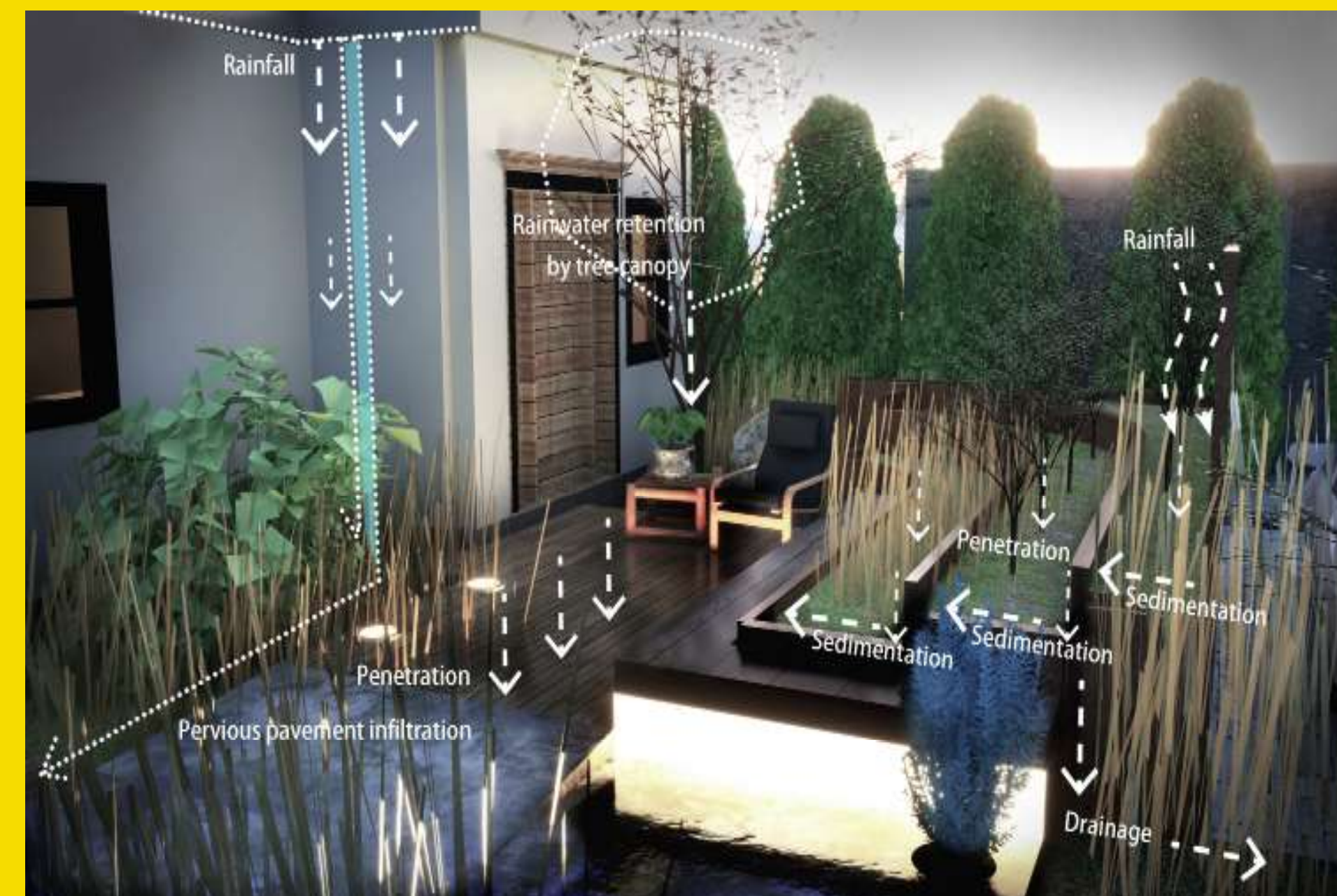


SITE + ORIENTATION

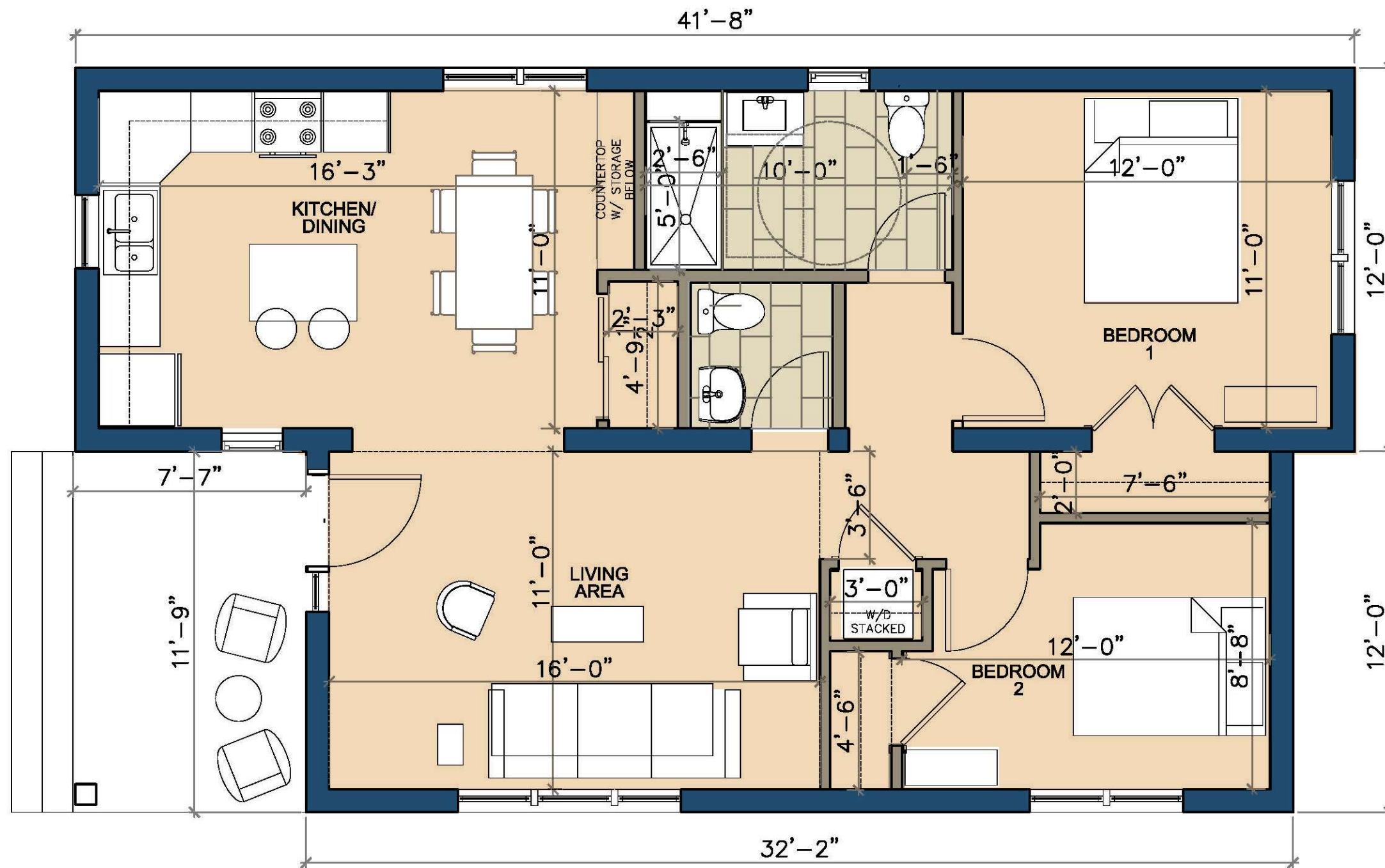
The ADU is carefully positioned to balance **privacy, solar performance, stormwater management, and shared open space**. The siting strategy allows the primary residence and ADU to share a central yard, extending usable outdoor space for both households while maintaining a defined private outdoor area for ADU occupants.

The building is oriented to **optimize southern exposure** for rooftop **photovoltaic** panels, supporting long-term **net-zero** readiness. A larger landscaped area to the north is preserved to support stormwater **infiltration** and reduce site runoff.

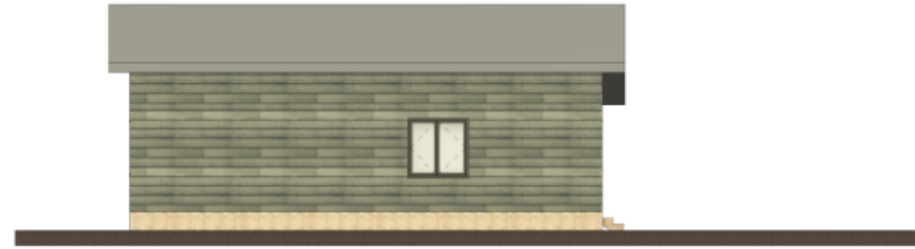
Accessibility is achieved through strategic site grading and a **gently sloped walk** that provides step-free entry without the need for ramps, maintaining residential scale and seamless integration



MODULAR PASSIVE ADU FOR MA



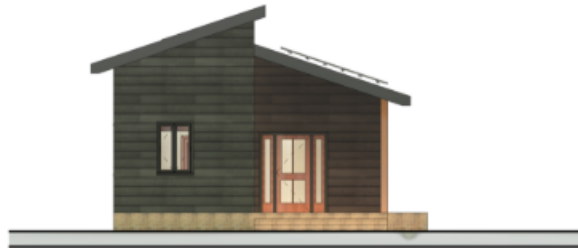
FLOOR PLAN
 SCALE: 1/4"=1'-0"



② North
1/8" = 1'-0"



① East
1/8" = 1'-0"



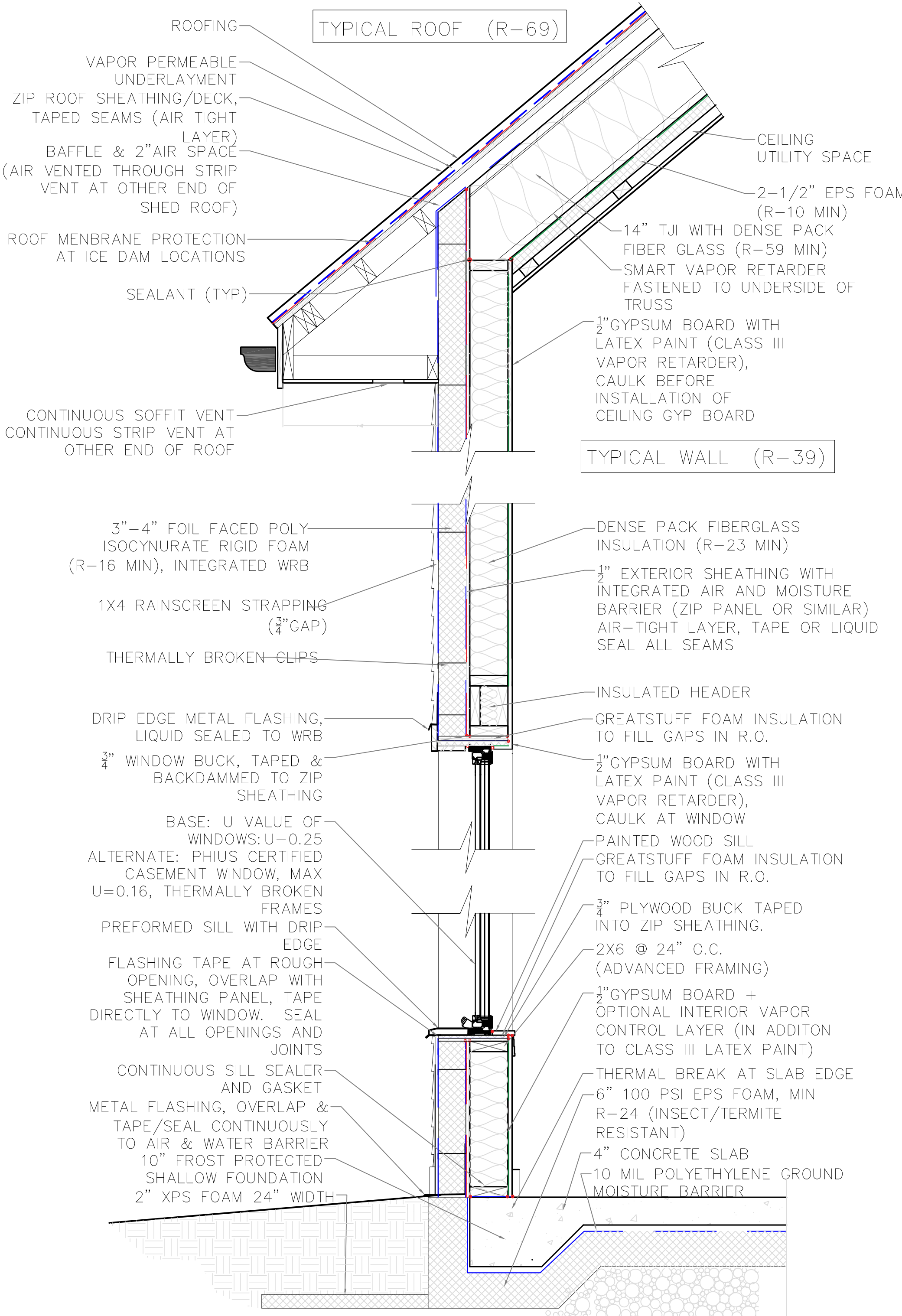
④ West
1/8" = 1'-0"



③ South
1/8" = 1'-0"

EXTERIOR ELEVATIONS

SCALE: 1/8"=1'-0"



TYPICAL ROOF (R-69)

- ROOFING
- VAPOR PERMEABLE UNDERLAYMENT
- ZIP ROOF SHEATHING/DECK, TAPED SEAMS (AIR TIGHT LAYER)
- BAFFLE & 2" AIR SPACE (AIR VENTED THROUGH STRIP VENT AT OTHER END OF SHED ROOF)
- ROOF MEMBRANE PROTECTION AT ICE DAM LOCATIONS
- SEALANT (TYP)
- CONTINUOUS SOFFIT VENT
- CONTINUOUS STRIP VENT AT OTHER END OF ROOF

- CEILING UTILITY SPACE
- 2-1/2" EPS FOAM (R-10 MIN)
- 14" TJI WITH DENSE PACK FIBER GLASS (R-59 MIN)
- SMART VAPOR RETARDER FASTENED TO UNDERSIDE OF TRUSS
- 1/2" GYPSUM BOARD WITH LATEX PAINT (CLASS III VAPOR RETARDER), CAULK BEFORE INSTALLATION OF CEILING GYP BOARD

TYPICAL WALL (R-39)

- 3"-4" FOIL FACED POLY-ISOCYANURATE RIGID FOAM (R-16 MIN), INTEGRATED WRB
- 1X4 RAINSCREEN STRAPPING (3/4" GAP)
- THERMALLY BROKEN CLIPS
- DRIP EDGE METAL FLASHING, LIQUID SEALED TO WRB
- 3/4" WINDOW BUCK, TAPED & BACKDAMMED TO ZIP SHEATHING
- BASE: U VALUE OF WINDOWS: U-0.25
ALTERNATE: PHIUS CERTIFIED CASEMENT WINDOW, MAX U=0.16, THERMALLY BROKEN FRAMES
- PREFORMED SILL WITH DRIP EDGE
- FLASHING TAPE AT ROUGH OPENING, OVERLAP WITH SHEATHING PANEL, TAPE DIRECTLY TO WINDOW. SEAL AT ALL OPENINGS AND JOINTS
- CONTINUOUS SILL SEALER AND GASKET
- METAL FLASHING, OVERLAP & TAPE/SEAL CONTINUOUSLY TO AIR & WATER BARRIER
- 10" FROST PROTECTED SHALLOW FOUNDATION
- 2" XPS FOAM 24" WIDTH

- DENSE PACK FIBERGLASS INSULATION (R-23 MIN)
- 1/2" EXTERIOR SHEATHING WITH INTEGRATED AIR AND MOISTURE BARRIER (ZIP PANEL OR SIMILAR) AIR-TIGHT LAYER, TAPE OR LIQUID SEAL ALL SEAMS
- INSULATED HEADER
- GREATSTUFF FOAM INSULATION TO FILL GAPS IN R.O.
- 1/2" GYPSUM BOARD WITH LATEX PAINT (CLASS III VAPOR RETARDER), CAULK AT WINDOW
- PAINTED WOOD SILL
- GREATSTUFF FOAM INSULATION TO FILL GAPS IN R.O.
- 3/4" PLYWOOD BUCK TAPED INTO ZIP SHEATHING.
- 2X6 @ 24" O.C. (ADVANCED FRAMING)
- 1/2" GYPSUM BOARD + OPTIONAL INTERIOR VAPOR CONTROL LAYER (IN ADDITON TO CLASS III LATEX PAINT)
- THERMAL BREAK AT SLAB EDGE
- 6" 100 PSI EPS FOAM, MIN R-24 (INSECT/TERMITE RESISTANT)
- 4" CONCRETE SLAB
- 10 MIL POLYETHYLENE GROUND MOISTURE BARRIER



PASSIVE HOUSE

WHAT it means

A passive house optimizes your gains and losses based on climate.

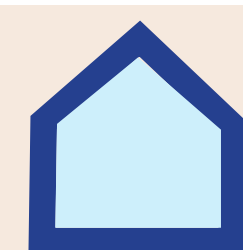
WHAT it means To YOU

Significantly reduces heating and cooling costs without compromising your quality of air and comfort.

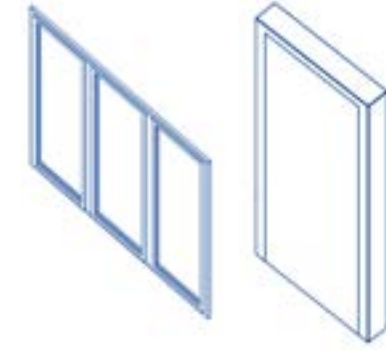
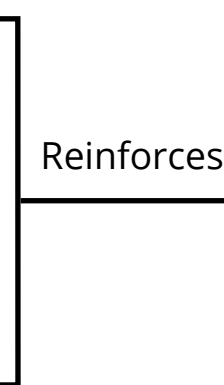
THE MECHANISM



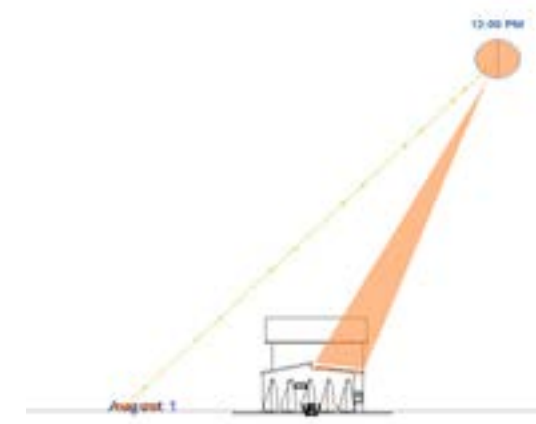
A continuous insulation throughout a building envelope without any thermal bridging.



Extremely airtight building prevents infiltration of outside air and loss of conditioned air.



High-performance windows and doors



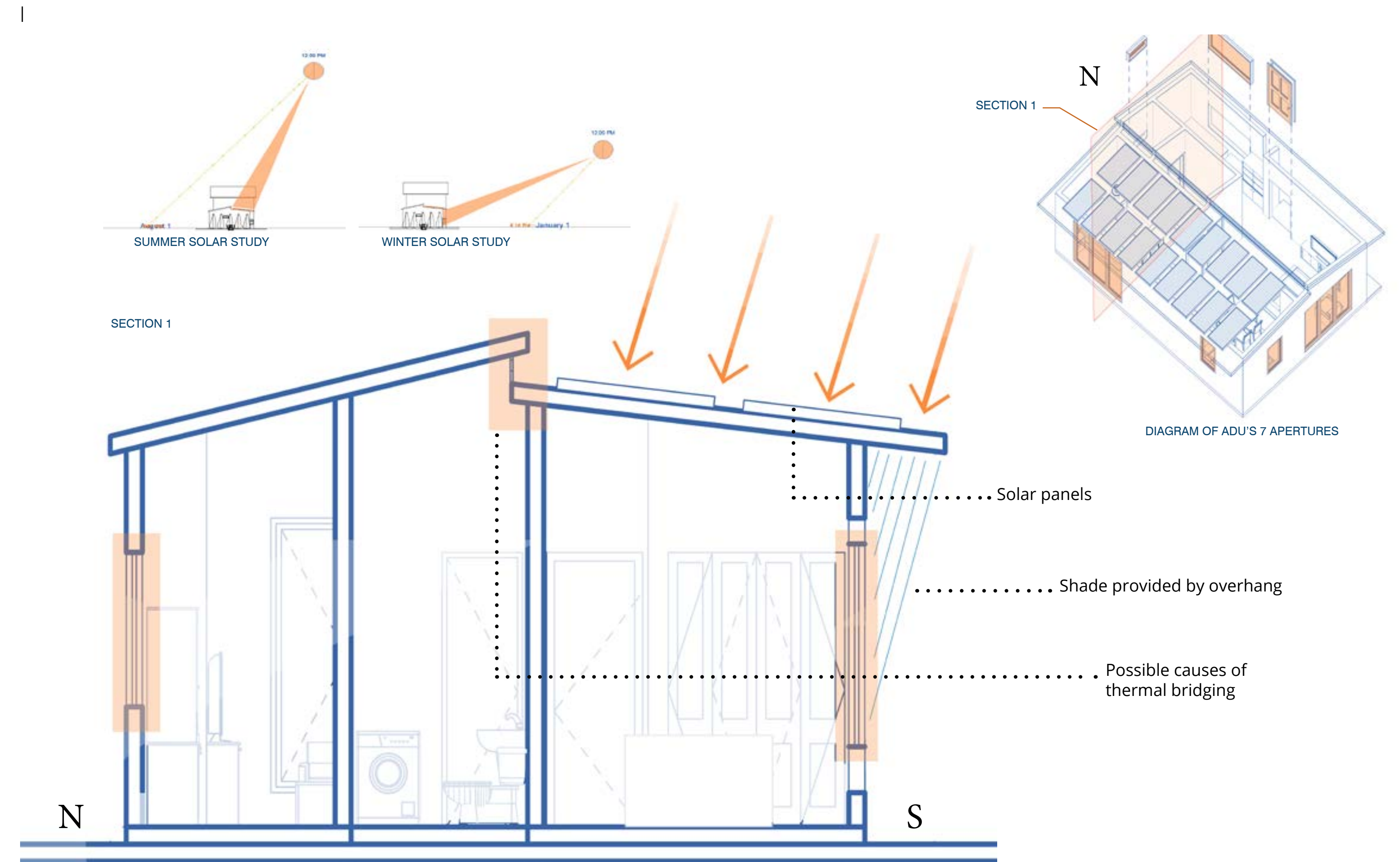
Exploit the sun's energy for heating during winter and minimizes over-heating during summer.

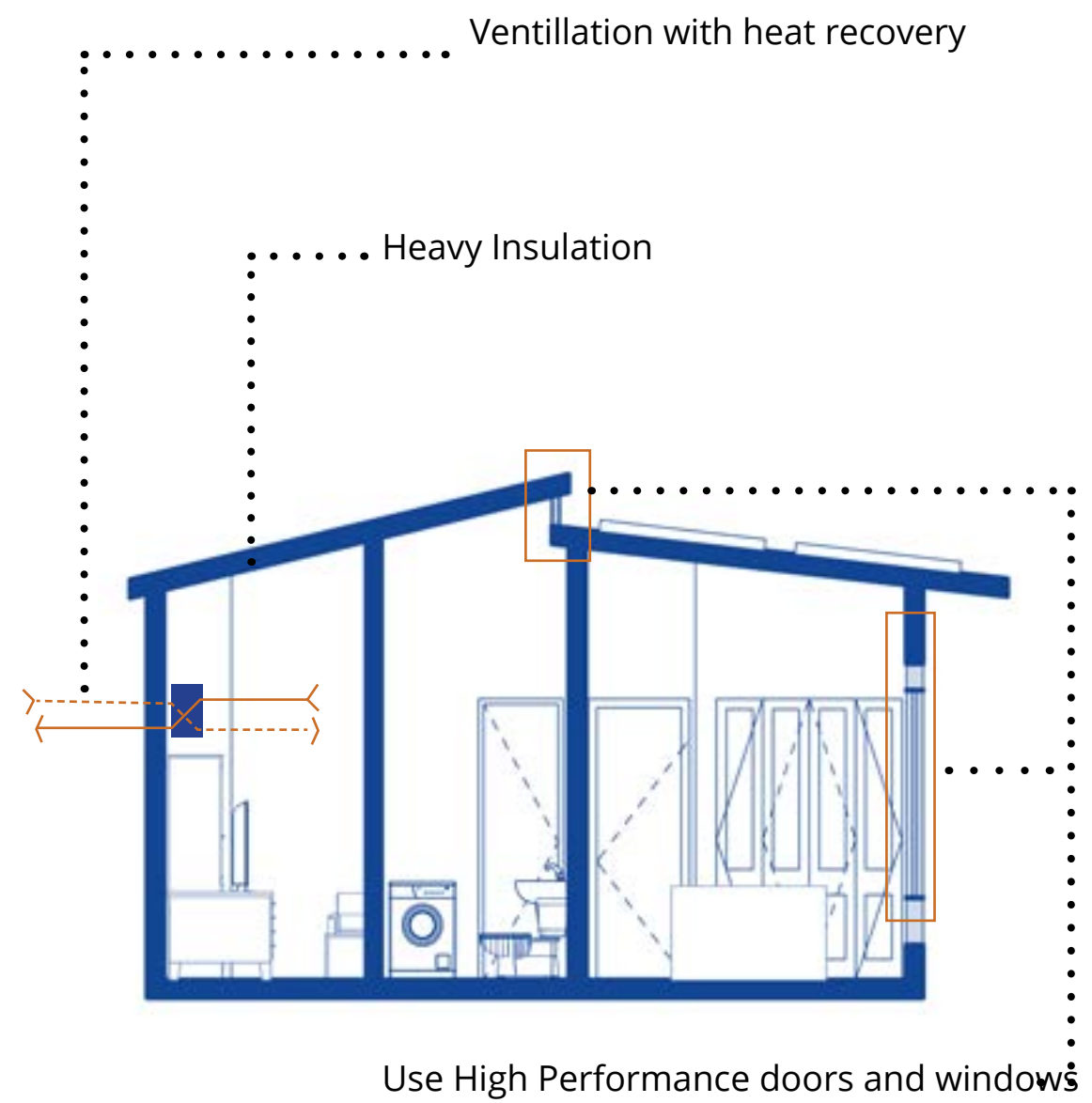
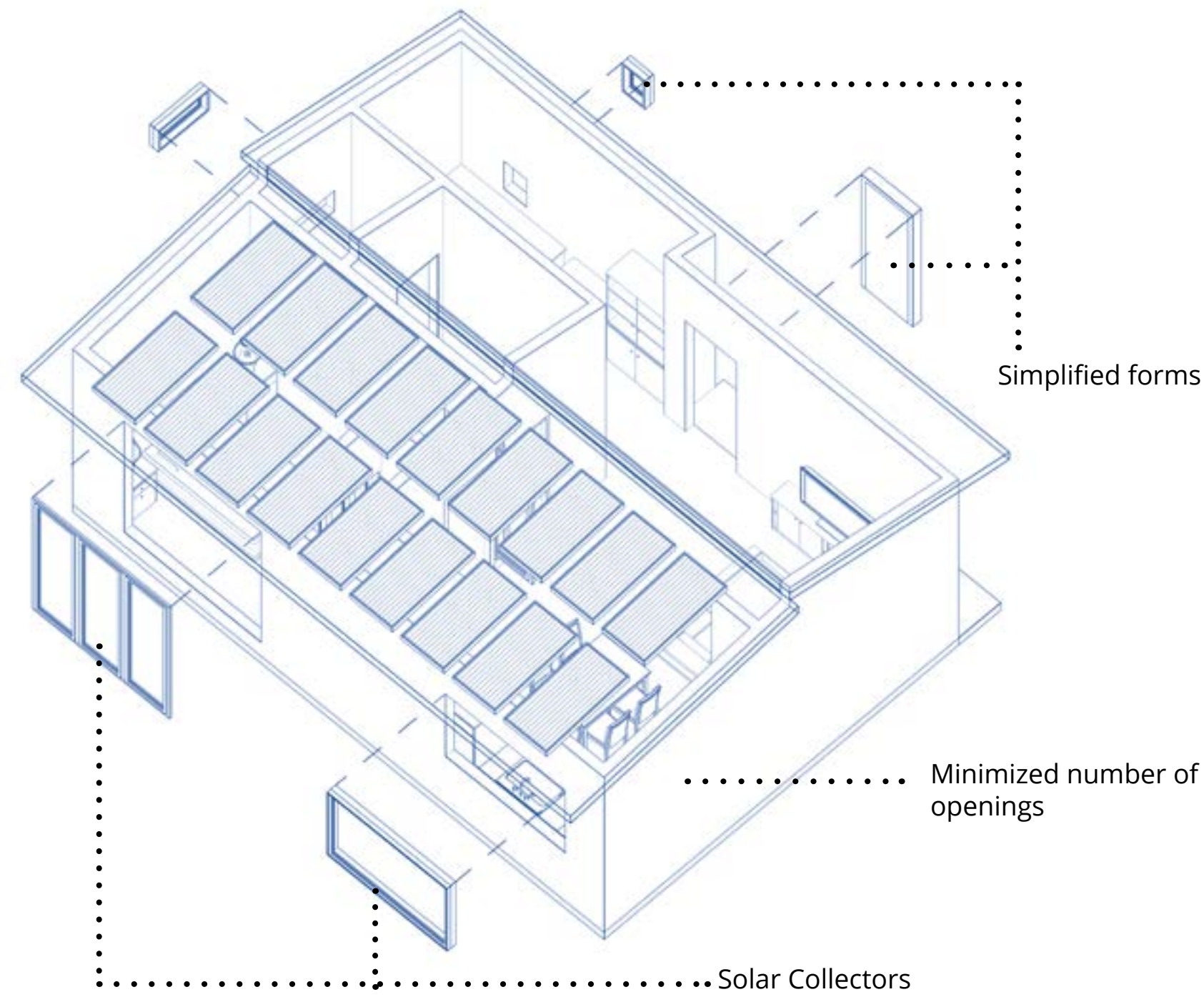


Uses some form of balanced heat and moisture- recovery system

THE RESULT

Energy is sourced from solar panels, allowing the ADU to be off the energy grid.





PASSIVE HOUSE FEATURES

