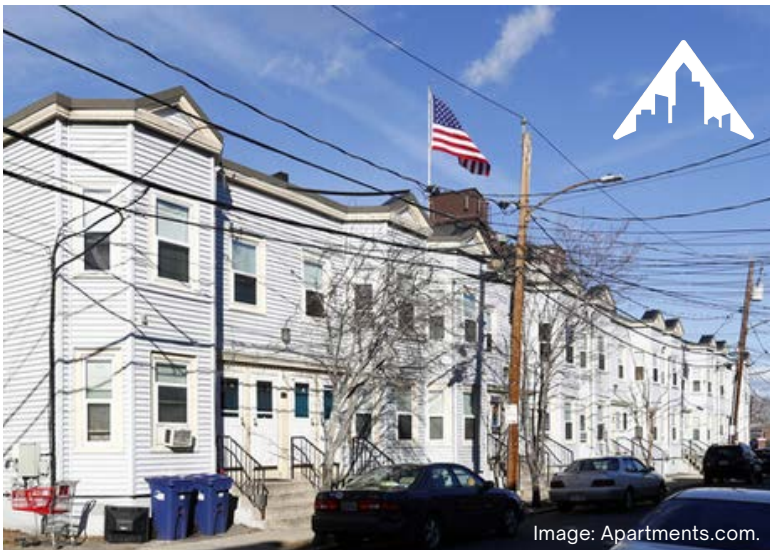
Hano Homes

Boston, MA

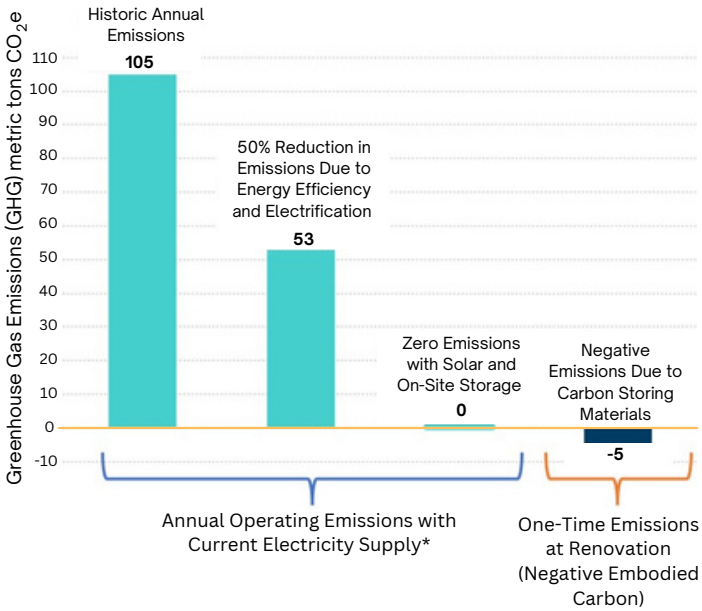
Hano Homes in Boston is a zero-carbon deep energy retrofit scheduled for renovation in 2023–2024. This affordable, low-income property of 20 apartments will achieve passive house (Phius) certification and cut its energy usage by 69 percent through energy efficiency and electrification.



Hano Homes, Boston, prior to renovations.

The building will be wrapped in a new superinsulated exterior shell and outfitted with all-electric mechanical systems. With rooftop solar, the building will meet all its energy needs with renewables, eliminate fossil fuels altogether, and make Hano Homes net-zero energy in operations. To eliminate embodied carbon emissions from the building materials used in the renovation, the team has specified a carbon-storing, bio-based exterior insulation system. Through this deep energy retrofit, the building will be transformed from a carbon emitter to a building that stores carbon!

Deep Energy Retrofit Analysis



*Annual operating emissions are calculated using state-specific long-run marginal emission rates (LRMER) for electricity instead of average historical emissions rates. This method is justifiable when projecting emissions savings over longer periods of time, because LRMER more accurately reflect the current and future electric grid supply.

Without Solar

Anticipated energy reduction from energy efficiency and electrification	69 percent
Energy use intensity (EUI) before retrofit	75.2 kBtu/sf
Modeled EUI after retrofit	23.2 kBtu/sf
Anticipated greenhouse gas (GHG) emissions reduction with current electricity supply	50 percent

With Solar

Total load served by renewables	100 percent
Solar PV system	100-110 kW
Anticipated energy reduction with solar	100 percent
Modeled EUI with solar	0 kBtu/sf
Anticipated GHG emissions reduction with solar with current electricity supply	100 percent*

*Assumes the Renewable Energy Credits (RECs) from on-site solar remain with the property and are not sold to a third party.

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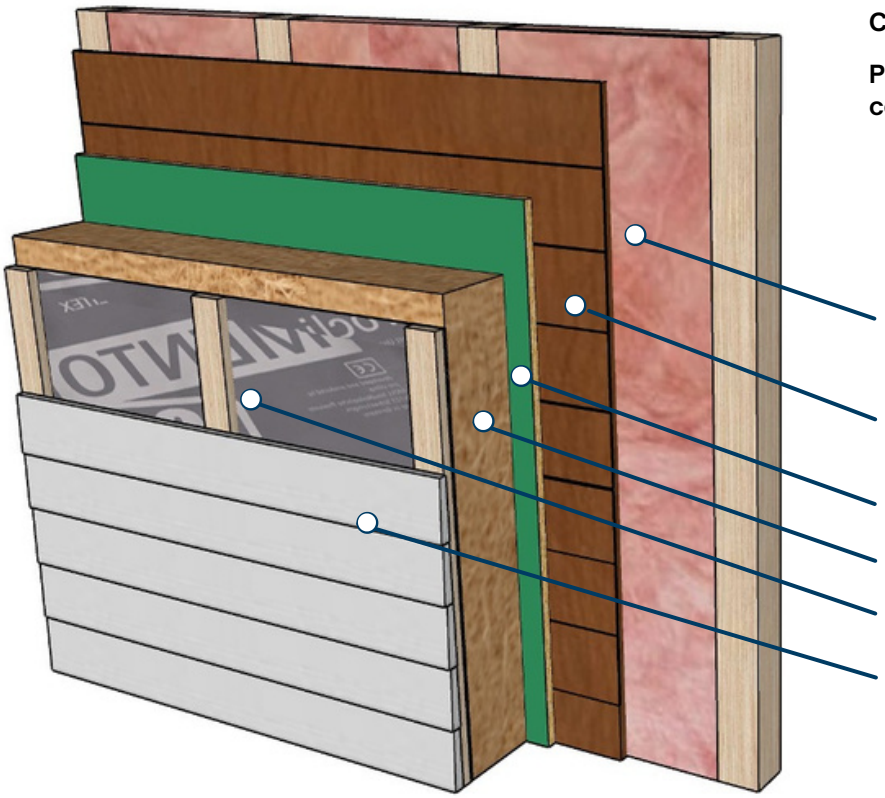
Building Envelope Strategy

As with many cold-climate deep energy retrofits, the existing buildings will be wrapped in a new superinsulated skin to increase the thermal resistance of the walls to R-36.8 and the roof to R-59.1. After stripping the existing siding down to the original sheathing, new 7/16 inch ZIP System Wall Sheathing will be attached to the original leaky wood plank sheathing to act as an air barrier and provide structural reinforcement. Eight inches of carbon-storing wood fiber insulation will be installed. A weather-resistant barrier and strapping will be attached to the wood fiber insulation and will be finished with James Hardie fiber cement siding.

New Insulated Building Envelope (R-36.8)



Building Overview

Project name	Hano Homes
Building type	Multifamily residential
Location	Boston, MA
Year built	1888
Status of renovation	In design; planned for 2023-2024
Number of stories	2
Number of apartments	20
Floor area	24,083 square feet
Certifications	Phius anticipated

Building Team

Building owner	Allston Brighton CDC
Architect	Onion Flats Architecture
MEP engineer	TBD
Building scientist	Onion Flats Architecture
Construction manager	Placetailor
Passive house consultant	Onion Flats Architecture

Exterior Insulation Wall System

Wall Insulation	
R-value before	R-10
R-value after	R-36.8
Roof	
R-value before	R-20
R-value after	R-59.1
Windows	
U-value before	U-0.39
U-value after	U-0.16
Solar heat gain coefficient (SHGC) before	Unknown
SHGC after	0.31
Target Airtightness	1.79 ACH; 0.06 CFM50

One of the most challenging elements of this exterior retrofit is the unique, irregular building footprint. Construction is further complicated by site-specific physical constraints, such as limited street access and overhead wires, which prompted the team to adopt a site-built strategy for exterior insulation rather than utilizing prefabricated panels. With a complicated building facade and existing site challenges, Hano Homes must adopt multiple approaches to address the building envelope efficiently.

Image: Onion Flats Architecture.

Image: Apartments.com.

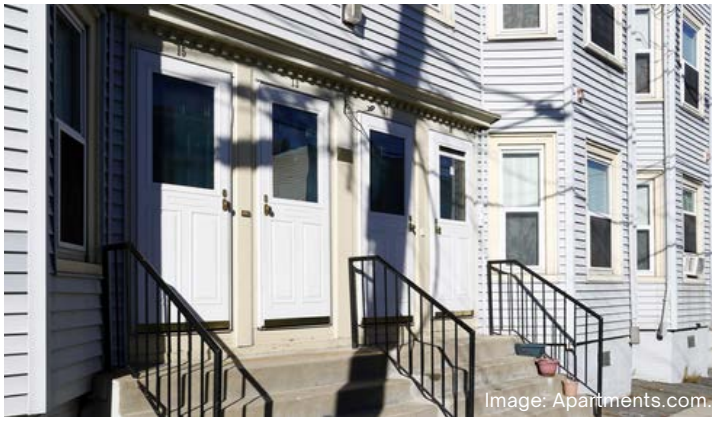


Image: Apartments.com.

Scope of Work

Exterior Insulation (Walls)

- 7/16 inch ZIP System Wall Sheathing (air barrier)
- 8 inches wood fiber insulation (R-28.8)
- New furring strips and James Hardie siding

Exterior Insulation (Roof)

- Blown-in dense-packed cellulose in existing roof frame (R-3.7/inch)
- 6 inches wood fiber insulation (R-21.6)
- EPDM membrane

Mechanicals

- Heating, cooling, and ventilation: All-electric Minotair combined ERV and air-source heat pump units
- Domestic hot water: All-electric heat pump hot water heaters

Solar PV

- Rooftop 100–110 kW solar PV system

HVAC Strategy

Built in 1888, the apartments are currently served by central gas boilers and gas water heaters with no cooling or ventilation. They will be replaced by a decentralized system with compact air treatment units from Minotair in the existing basements of each apartment to supply ventilation, heating, and cooling. The Minotair Pentacare V12 is a multifunctional electric unit with a self-contained heat pump, air exchanger, dehumidifier, and high-efficiency particulate air filtration. Heat pump water heaters will replace gas water heaters, eliminate all on-site gas consumption, and make the building fully electric. Each apartment will be served by its own Minotair unit, individually ducted from the basement and run within the new building envelope. The ductwork remains minimal and cost-effective because of the short runs. New exhaust ductwork will tie into existing direct vented exhaust lines from the kitchen and bathrooms.

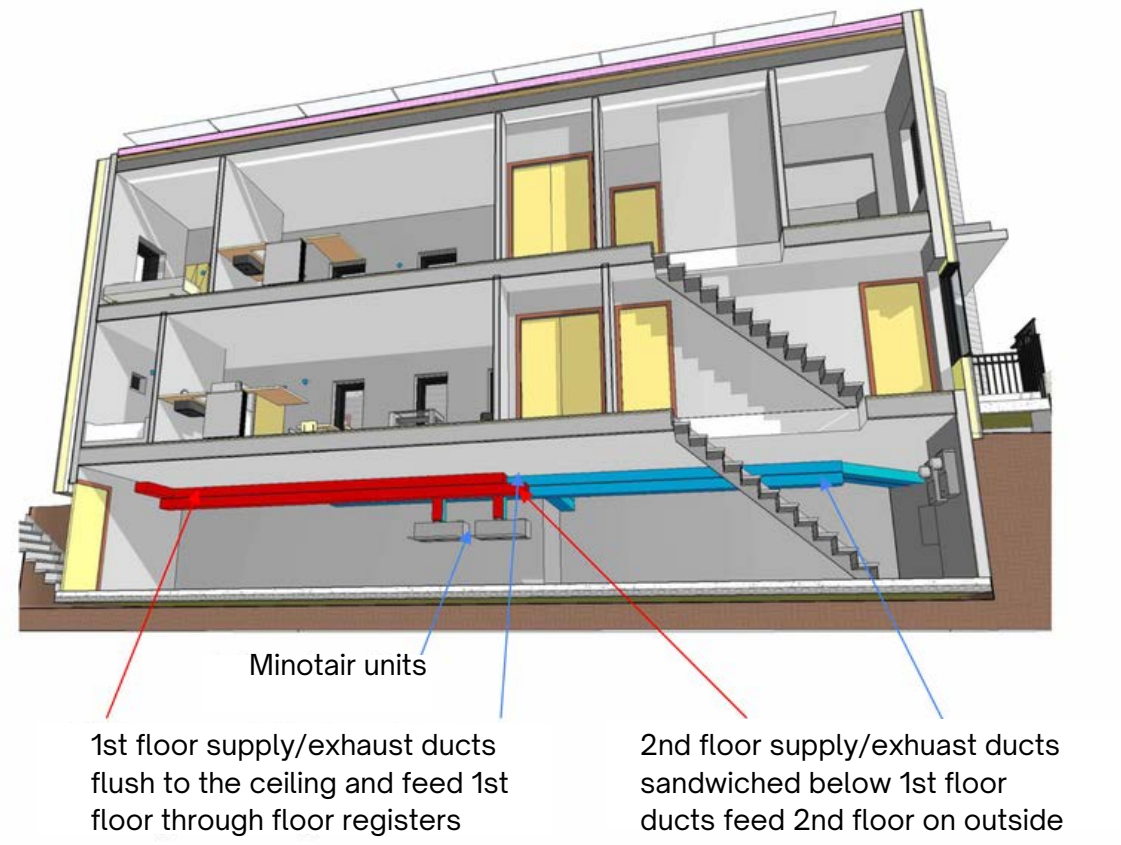
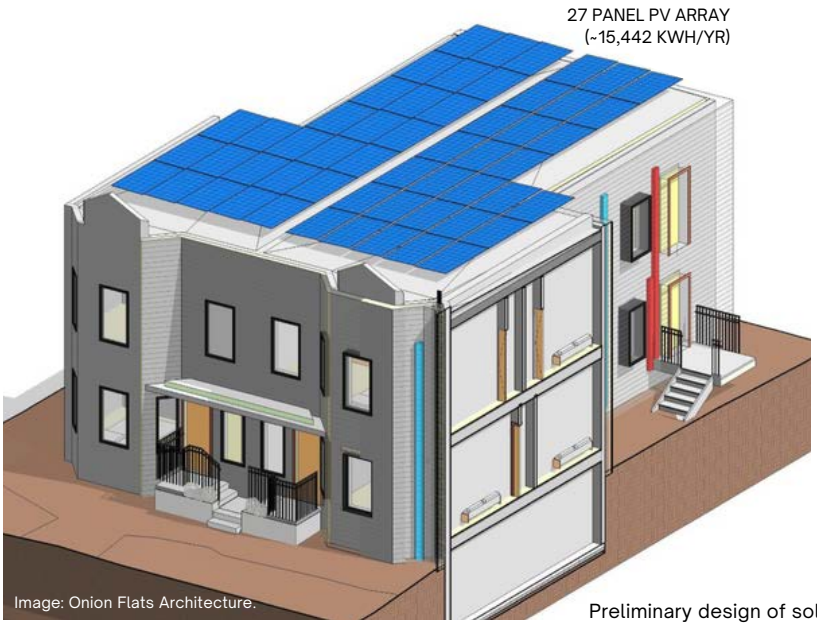


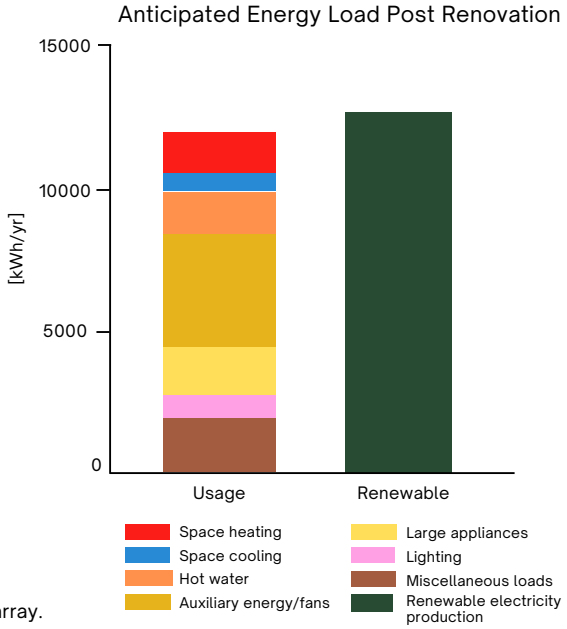
Image: Onion Flats Architecture.

Renewables

With ample roof space for a solar array that will power the entire building complex, Hano Homes is on track to be a net-zero energy building with increased indoor air quality and thermal comfort for residents. It will also achieve Phius certification. The flat roof will allow for a solar PV system estimated at 100–110 kW. With a new, highly efficient building envelope and electrified mechanical systems, the building can achieve 69 percent energy savings, bringing down the existing EUI from 75.2 kBtu/sf to 23 kBtu/sf. After reaching these energy efficiency goals, the solar array is intended to supply 100 percent of energy demands, saving Hano Homes $43,566 in annual utility costs.



Preliminary design of solar PV array.



Cost Breakdown

Anticipated hard construction cost of deep energy retrofit	$3,039,995
Cost per square foot of floor area	$122
Cost per apartment	$152,000
Total cost of exterior insulated envelope assembly (wall and roof)	$1,757,855
Installed exterior envelope assembly cost per square foot of exterior wall surface area	$178
Installed exterior envelope assembly cost per apartment	$87,893

Image: Allston Brighton.

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