Treehouse Communities

Easthampton, MA

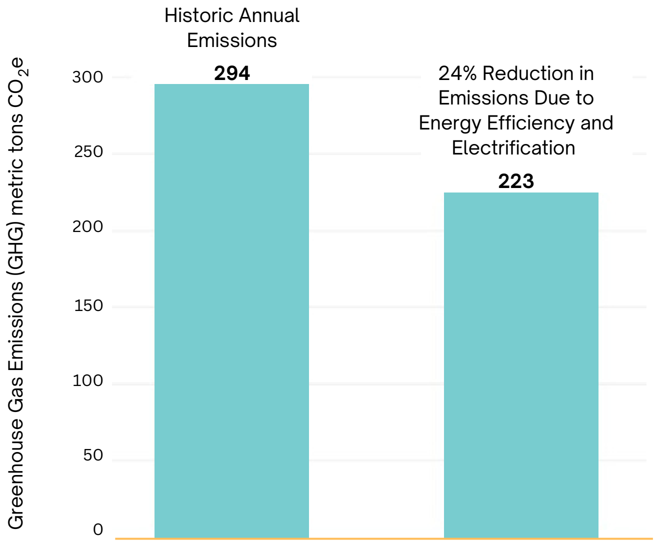

Image: Treehouse at Easthampton Meadows.

Treehouse at Easthampton Meadows, prior to renovations.

Treehouse at Easthampton Meadows, built in 2006, is a 60-apartment affordable housing community scheduled to undergo a deep energy retrofit. Across its 23 buildings, energy usage will be cut by 50 percent. The property was built with energy efficiency in mind, but not to the standard that is possible today.

The community is using a refinancing event as an opportunity to implement a deep energy retrofit that will efficiently insulate and air seal the building envelope from the outside and electrify building mechanicals. Since the property is relatively new, some of the existing siding will be reused to reduce construction costs and embodied carbon emissions associated with the renovation.

Deep Energy Retrofit Analysis



Annual Operating Emissions with Current Electricity Supply*

*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	50 percent
Energy use intensity (EUI) before retrofit	71 kBtu/sf
Modeled EUI after retrofit	35.6 kBtu/sf
Anticipated greenhouse gas (GHG) emissions reduction with current electricity supply	24 percent*

*As with the indirect greenhouse gas footprint continuing to fall to zero as the regional electric grid becomes greener.


Image: Treehouse at Easthampton Meadows.

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Building Envelope Strategy

The existing buildings will be wrapped in a new insulated skin to increase the thermal resistance of the walls to R-22.5 and the roof to R-40. After stripping the existing siding down to the original sheathing, a self-adhesive air and weather barrier will be attached to the sheathing. Then two inches of mineral wool insulation will be installed, increasing the R-value by R-8. The team had originally planned on using XPS rigid insulation but was able to substitute for mineral wool to lower embodied carbon emissions. Because the building is relatively new, the team hopes to reuse 50 percent of the vinyl siding that has not been damaged by wind or sun. Closed-cell spray foam will be used in the attic to reduce air infiltration and increase the thermal performance of the overall conditioned envelope.

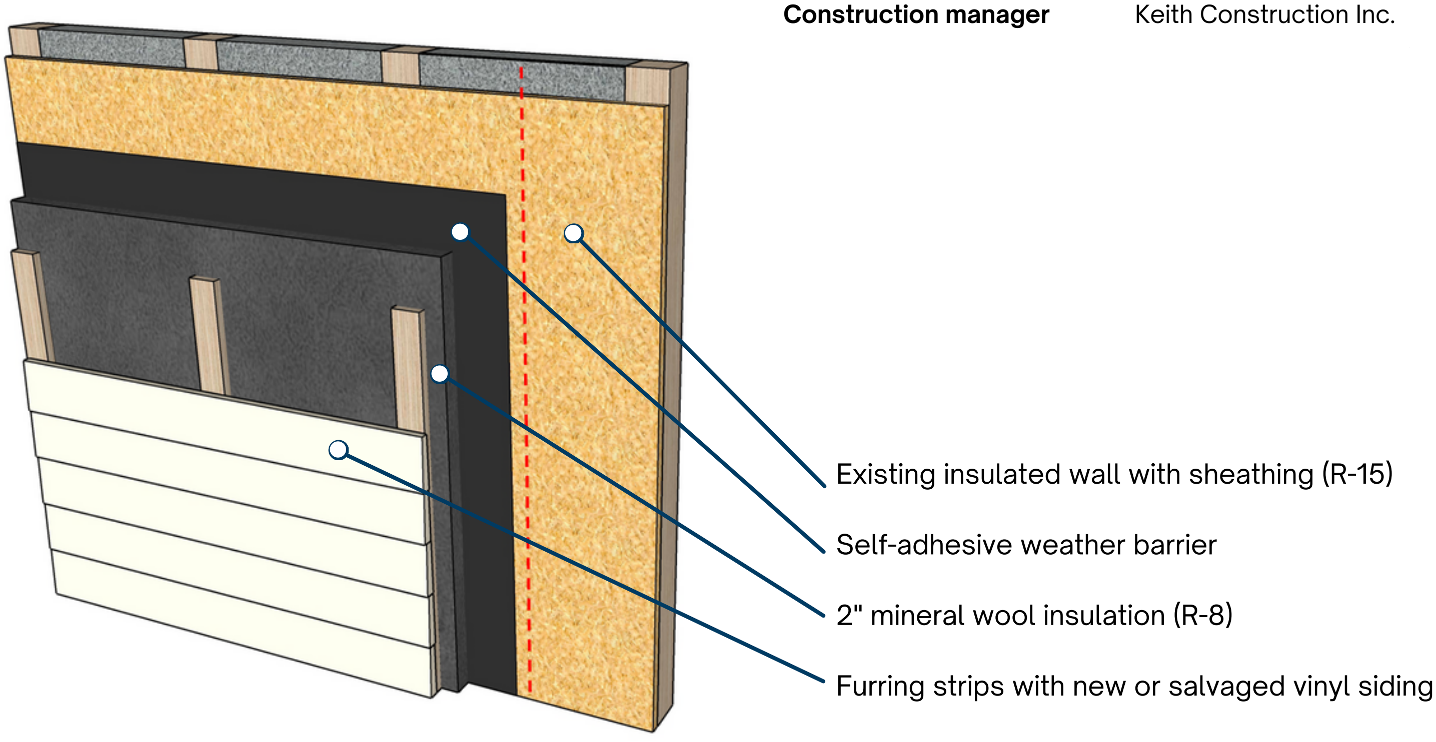
Building Overview

Project name	Treehouse at Easthampton Meadows
Building type	Multifamily residential
Location	Easthampton, MA
Year built	2006
Status of renovation	In design; 2024 start date
Number of stories	Mix of 1 and 2 stories
Number of apartments	60
Floor area	62,000 square feet

Building Team

Building owner	Beacon Communities
Owner's representative	Waypoint KLA
Architect	Davis Square Architects
MEP engineer	Petersen Engineering
Building scientist	New Ecology Inc.
Construction manager	Keith Construction Inc.

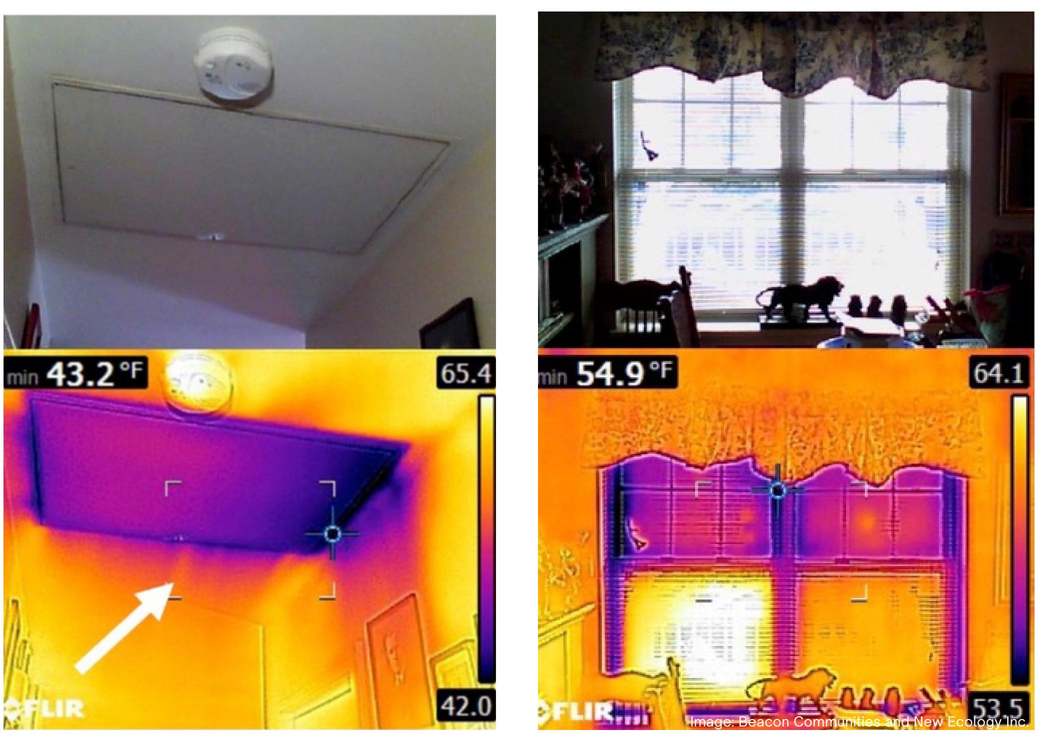
New Insulated Building Envelope (R-23)



Exterior Insulation Wall System

Wall Insulation	
R-value before	R-15
R-value after	R-23
Roof	
R-value before	R-22
R-value after	R-40
Windows	
U-value before	U-0.40
U-value after	U-0.25
Solar heat gain coefficient (SHGC) before	0.50
SHGC after	0.30
Target Airtightness	2.0 ACH; 0.10/0.14 CFM50

Many materials and assemblies, including the roofs and some of the windows, have not reached the end of their service lives. Replacement would improve energy efficiency but would result in unnecessary embodied carbon emissions. To guide decision-making, the building team conducted an analysis that considered embodied carbon and utility savings. With this data in hand, they decided to replace the old, inefficient windows with new windows that meet or exceed a U-0.25 thermal performance. Roofs will be replaced in the future at the same time a solar photovoltaic (PV) system is installed.



Thermal bridging and air leakage shown at attic hatch without gasket (left) and areas around windows (right).

Scope of Work

Exterior Insulation (Walls)

- Self-adhesive weather barrier on existing sheathing
- 2 inches mineral wool insulation (R-8)
- New or reused vinyl siding

Exterior Insulation (Roof)

- New closed-cell spray foam insulation in attic (R-40 minimum)

Mechanicals

- Heating and cooling: Unitized air source heat pump
- Ventilation: ERV system
- Domestic hot water: Electric resistance water heater

Solar PV

- To be determined

HVAC Strategy

Building electrification is a priority at Treehouse. Air conditioning and kitchen appliances within the apartments are currently electric, but heating and hot water are provided by gas-fired individual systems. The heating system will be replaced by individual air-source heat pumps in each apartment for heating and cooling and by ERV systems for ventilation. The exact mechanical systems have yet to be selected at this early planning stage. However, the building team estimates the ERVs will operate at 88 percent efficiency and the air-source heat pumps will have a coefficient of performance (COP) of 3 and a seasonal energy efficiency ratio (SEER) of 18. The ERV system is intended to use existing ductwork. If reused, the ductwork will be cleaned, sealed, and reinsulated. The team decided to install electric resistance water heaters instead of air-source water heaters due to the up-front and life-cycle cost differences.

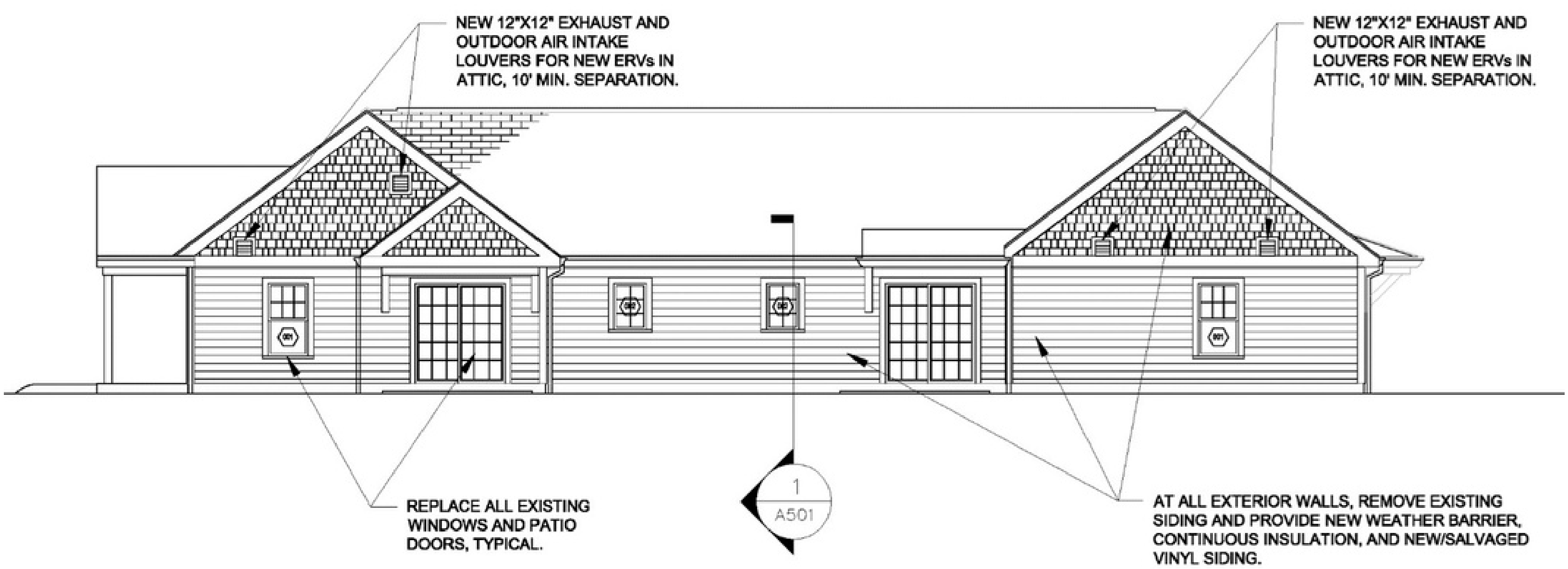


Image: Beacon Communities and New Ecology Inc.

Renewables

Multiple sites across the property are being considered for solar PV, including the community building, parking canopies, and some residential buildings. Many buildings with south-facing roofs are obscured by trees, which the owner and residents wish to keep. Installing solar at this point would also require an unnecessary cost to replace the roofs before the end of their service lives.

Potential solar PV sites by New Ecology Inc. mapped out across the property's 23 buildings.

Cost Breakdown*

Total hard construction cost of deep energy retrofit scope (envelope improvements and mechanical)	$14,220,000
Cost per square foot of floor area	$230
Cost per apartment	$237,000
Total cost of installed exterior envelope assembly (walls, windows, and roofs)	$8,820,000
Cost of installed exterior envelope assembly per apartment	$147,000

*Based on preliminary construction cost estimates from July 2023. Estimates subject to escalation and scope of work revisions.

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