# Eva White Apartments

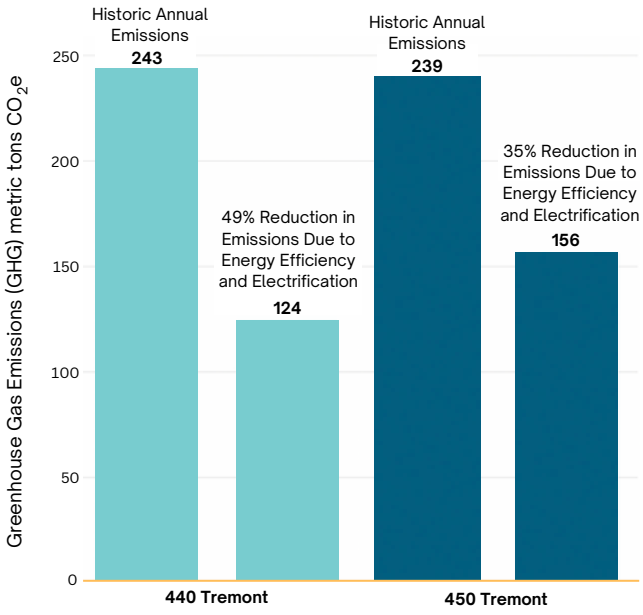
## Boston, MA

Built in 1966, Eva White Apartments includes two identical seven-story buildings (440 and 450 Tremont), with a combined 102 apartments, undergoing a deep energy retrofit in 2023. The project is anticipated to achieve an estimated 49 and 67 percent energy savings at the two buildings, respectively.


Eva White Apartments (440 Tremont), prior to renovations.

Both buildings are being renovated by Castle Square Tenant Organization and Winn Development as part of a Rental Assistance Demonstration (RAD) conversion with low-income housing tax credits. The property will receive super-insulated envelope improvements, including a new roof and prefabricated exterior overclad panels with high-performance windows to drive down energy loads, plus new electric mechanical systems to reduce direct on-site emissions. The variation in projected energy savings between the two buildings is primarily due to the different strategies for providing domestic hot water. The development team decided to electrify the domestic hot water system at 440 Tremont with a highly efficient centralized heat pump water heater system. At 450 Tremont, the recently upgraded gas water heater system will remain in use until it reaches the end of its service life, with plans for future conversion and electrification.

## 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.

### 440 Tremont

| | |
|---|---|
| **Anticipated energy reduction from envelope improvements and electrification** | 67 percent |
| **Energy use intensity (EUI) before retrofit** | 96.4 kBtu/sf |
| **Modeled EUI after retrofit** | 32.2 kBtu/sf |
| **Anticipated greenhouse gas (GHG) emissions reduction with current electricity supply** | 49 percent* |

### 450 Tremont

| | |
|---|---|
| **Anticipated energy reduction from energy efficiency and electrification** | 49 percent |
| **Energy use intensity (EUI) before retrofit** | 96.7 kBtu/sf |
| **Modeled EUI after retrofit** | 48.9 kBtu/sf |
| **Anticipated greenhouse gas (GHG) emissions reduction with current electricity supply** | 35 percent* |

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

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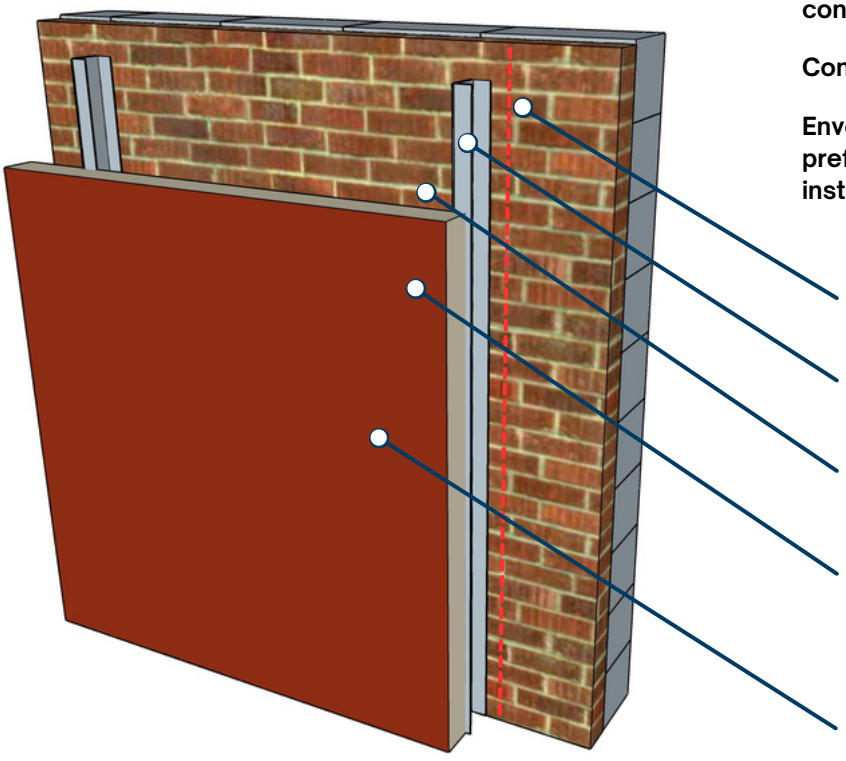
## Building Envelope Strategy

The buildings' existing concrete block and brick face walls are currently uninsulated. The retrofit assembly includes a new self-supporting aluminum frame directly fastened to the existing exterior wall, a fully engineered cladding solution comprised of insulated metal panels (R-29) by Kingspan, and triple-glazed windows (U-0.21) by Peerless. The prefabricated panels include an all-in-one water, air, vapor, and thermal control system, four inches of continuous polyisocyanurate insulation, and a durable metal exterior finish. The panels arrive at the site as a complete assembly and are installed on the new exterior metal framing with a crane. The existing roof will be completely removed and replaced with new built-up insulation and roofing membrane. Refrigerant lines and ductwork will run within the air gap between the existing building face and the new exterior panels from rooftop equipment to each apartment. This will minimize construction disturbance within the occupied apartments.

New Insulated Building Envelope (R-29)




## Building Overview

| | |
|---|---|
| **Project name** | Eva White Apartments |
| **Building type** | Multifamily residential |
| **Location** | Boston, MA |
| **Year built** | 1966 |
| **Status of renovation** | In design; 2024 start date |
| **Number of stories** | 7 |
| **Number of apartments (combined)** | 102 |
| **Floor area (combined)** | 76,684 square feet |

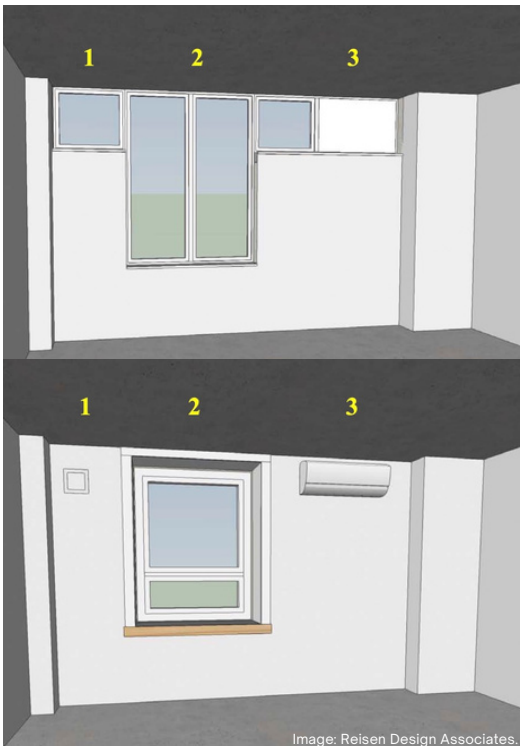
## Building Team

| | |
|---|---|
| **Building owners** | Winn Development |
| | Castle Square Tenants Organization |
| **Architect** | Reisen Design Associates |
| **MEP engineer** | Petersen Engineering |
| **Structural engineer** | Odeh Engineers |
| **Building envelope consultant** | Building Enclosure Associates |
| **Contractor** | Keith Construction Inc. |
| **Envelope prefabrication & installation** | Sunrise Erectors |

## Exterior Insulation Wall System

| | |
|---|---|
| **Wall Insulation** | |
| R-value before | Null |
| R-value after | R-29 |
| **Roof** | |
| R-value before | R-9 |
| R-value after | R-40 |
| **Windows** | |
| U-value before | U-1.02 |
| U-value after | U-0.21 |
| Solar heat gain coefficient (SHGC) before | 0.82 |
| SHGC after | 0.40 |
| **Target Airtightness** | 0.013 ACH; 0.80 CFM50 |

In addition to adding insulation, the envelope will include triple-glazed casement windows that meet U-0.21 thermal performance, replacing the original single-pane windows. To simplify the panel design and to reduce heat loss, the new façade design eliminates two small, inoperable windows on either side of the main window in each apartment. The existing tenant-supplied window air conditioners (ACs) previously occupied one of these window spaces in many apartments, which will now be repurposed to bring new mechanical distribution into apartments. While this approach sacrifices a small amount of overall window area per apartment, the quality of the new windows will be much higher, and the fresh air supply and thermal comfort will improve dramatically while reducing energy loads. Residents have been informed on all of the changes taking place and are very supportive.




Existing window configuration before renovations (top) and new window design post renovations (bottom).

Rendering of Eva White Apartments by Reisen Design Associates.

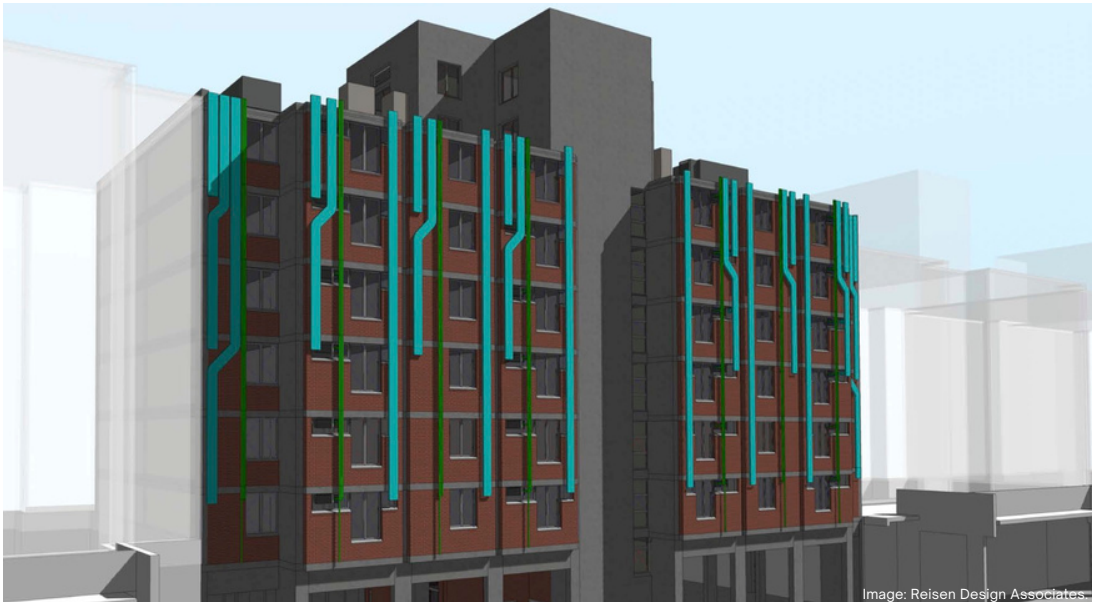
## Scope of Work

| Exterior Insulation (Walls) | Exterior Insulation (Roof) | Mechanicals | Solar PV |
|---|---|---|---|
| • Fully engineered cladding solution comprised of Kingspan insulated metal panels (R-29) and Peerless triple-glazed windows (U-0.21) | • R-40 minimum polyisocyanurate insulation and new roofing membrane | • Heating and Cooling: Central Mitsubishi Y-Series Variable Refrigerant Flow (VRF)<br>• Ventilation: Central Annexair ERV system<br>• Domestic Hot Water: Central Mitsubishi QAHV CO2-based air-to-water heat pump (440 Tremont only) | • None planned due to site restrictions |

## HVAC Strategy

The current heating system includes a central natural gas boiler with hydronic baseboard radiators. However, an energy audit revealed that the heating system was being supplemented extensively by electric space heating. To ensure consistent and efficient thermal comfort and bring cooling to those units that did not have window ACs previously, a central VRF plant coupled with in-unit cassettes will provide heating and cooling, with central energy recovery ventilators (ERVs) for fresh air ventilation. The new mechanical equipment will be housed in existing penthouses and on new steel dunnage on the roof. New refrigerant lines and supply ductwork will run between the existing exterior façade and new exterior panel framing due to structural obstacles and small apartment layouts limiting interior space. The existing exhaust ducts will remain but will be cleaned and sealed using Aeroseal.

The property upgraded its gas domestic hot water system in 2018, installing high-efficiency condensing boilers in both buildings. The systems are relatively new and well within their useful life, so the project will only decommission and electrify the water heaters at 440 Tremont to compare operational performance between the two systems. Electrifying this domestic hot water system will include newly installed central low global warming potential (GWP) CO2-based air-to-water heat pumps and storage tanks. While the existing gas water heaters will remain in use at 450 Tremont, the building owner will upgrade the electrical service to accommodate future electrification when that system reaches the end of its service life. In addition to new highly efficient mechanical and plumbing upgrades, Energy Star appliances, and lighting will be installed to improve overall efficiency and reduce energy consumption.




New refrigerant lines and supply ductwork along façade before panel installation.

## Renewables

Solar energy generation is impractical for the site due to already limited roof space, extensive shading from an existing mechanical bulkhead, and rooftop mechanical equipment. Furthermore, the roofs will be accommodating additional HVAC systems, including new steel dunnage, which will further reduce available area and introduce additional shading, making solar PV infeasible.

Aerial view of Eva White Apartments from Google Maps.

## Cost Breakdown*

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|---|---|
| **Total hard construction cost of deep energy retrofit scope (envelope improvements and mechanical)** | $16,100,000 |
| **Cost per square foot of floor area** | $210 |
| **Cost per apartment** | $157,800 |
| **Total cost of installed exterior envelope assembly (walls, windows, and roofs)** | $9,290,000 |
| **Cost of installed exterior envelope assembly per square foot of exterior wall surface area** | $177 |
| **Cost of installed exterior envelope assembly per apartment** | $91,100 |

*Based on preliminary construction cost estimates from September 2021. Estimates subject to escalation and scope of work revisions.

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