WinnCo Museum Park Apartments

Building Performance Exchange

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This case study is part of the MassCEC Building Electrification and Transformation Accelerator (BETA): Project Planning program, committed to helping a representative selection of commercial building types in Massachusetts reach net zero emissions by 2050. This MassCEC funded resource and more are available via the Building Performance Exchange.

Building type	Senior Housing
Location	Springfield
Year built	1929
Stories	7
Square footage	115,000
Energy use intensity (EUI)*	54 kBtu/sf/yr
Carbon emission intensity (CEI)*	2.8 CO2e kg/sf/yr
Decarbonization goals	Reduce utility usage/cost, GHG compliance, building resiliency

The Museum Park Apartments, located in Springfield, MA, is a114-unit multifamily building that provides senior living apartments to its residents and various services throughout the building. There are community rooms and offices on the first floor with apartments throughout all other floors.

Existing Conditions

Enclosure	Walls	Roof	Windows
	Poor	Good	Good
Heating	Hydronic 2-pipe system from central condensing boiler plant with FCU in each apartment; Basement includes gas unit heaters.		
Cooling	Chiller serves FCU in each apartment		
Ventilation	Bathroom exhaust fan exhausted by gravity turbines		
Hot water	Condensing hot water heater with (2) 200-gallon storage tanks.		
Lighting	Full LED renovation completed in 2016.		
Controls	No centralized controls- Boiler plant on OA reset. 2-pipe system is manually switched between seasons. Boiler pump VFDs do not appear functional.		
Other	Common laundry room includes electric washer and dryers. Residential units have electric kitchen appliances.		
Renewable energy	None		

*EUI represents the annual energy usage of the building divided by the total area. CEI is the amount of greenhouse gas (GHG) emissions divided by the total area.



Key Challenges & Solutions

Electric Switchgear Outdated

Installation and renovation of electric switchgear and apartment breakers.

Limited rooftop space

Air to Water heat pump maximizes available mechanical space and allow available rooftop space for solar PV array.

Inconsistent ventilation and infiltration throughout building

Installation of DOAS system with ERVs to modernize ventilation system

Core Decarbonization Strategy

- Utilize existing distribution system to reduce installation costs.
- New heat pump equipment is staged in phases to align with boiler/chiller system end-of-life.
- Various low-cost fast impact efficiency and load reduction to optimize system sizing.

Retrofit Measures and Energy Impacts

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Measures

Energy Efficiency & Load Reduction

Foundational Efficiency and Load Reduction:

- Retro-commissioning on OA boiler reset
- Retro-commissioning of VFDHW pumps
- DHW piping insulation
- Weatherstripping
- Attic insulation installation
- Seal roof chimney

Advanced Load Reduction:

- Window replacement

System Electrification

Electrification Enablers:

- Electrical switchgear upgrade
- Resize fan coils to lower supply water temp

System Electrification:

- Replace existing gas-fired DHW heater with a heat pump DHW heater
- Grey water heat recovery
- Replace boiler/chiller plant with air-to-water heat pump
- ERV and DOAS installation for ventilation

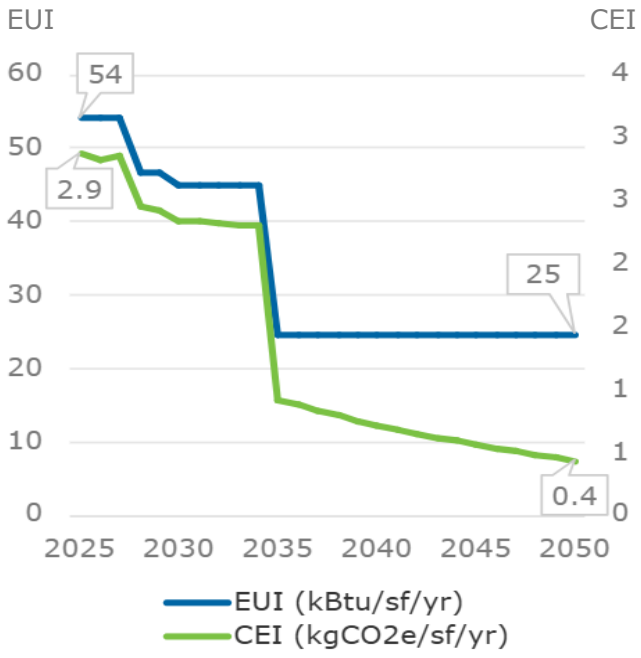
Renewable Energy

Solar:

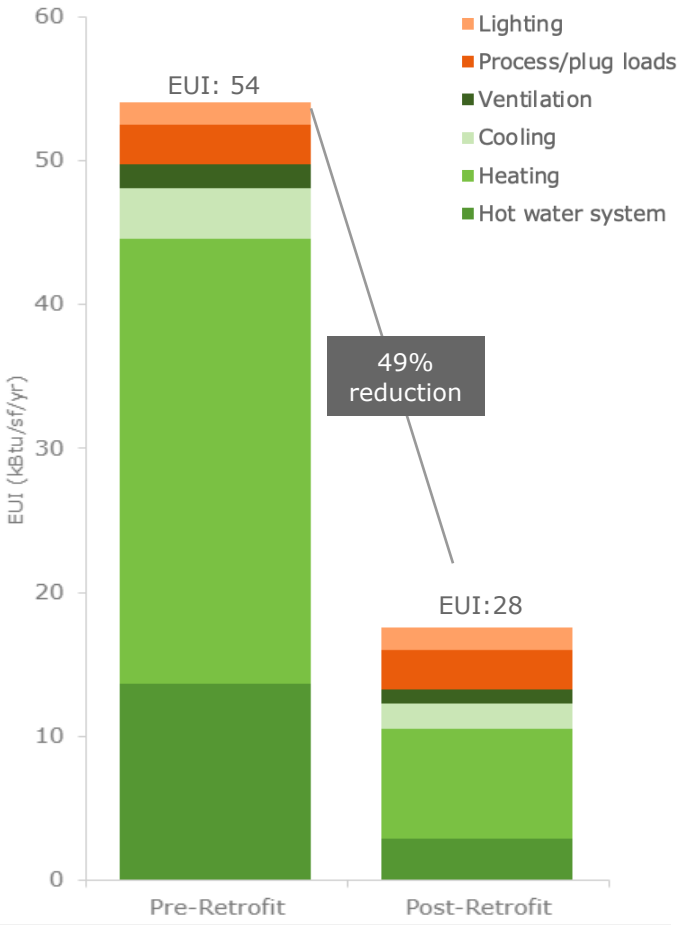
- Install ~82.5 kW solar array on roof

Performance Targets

The decarbonization approach prioritizes immediate energy efficiency measures and heat recovery while looking long term at heat pumps and more efficient all-electric mechanical system replacement at end-of-life. These efforts would yield the following results over time:



Annual Energy Use Impacts*

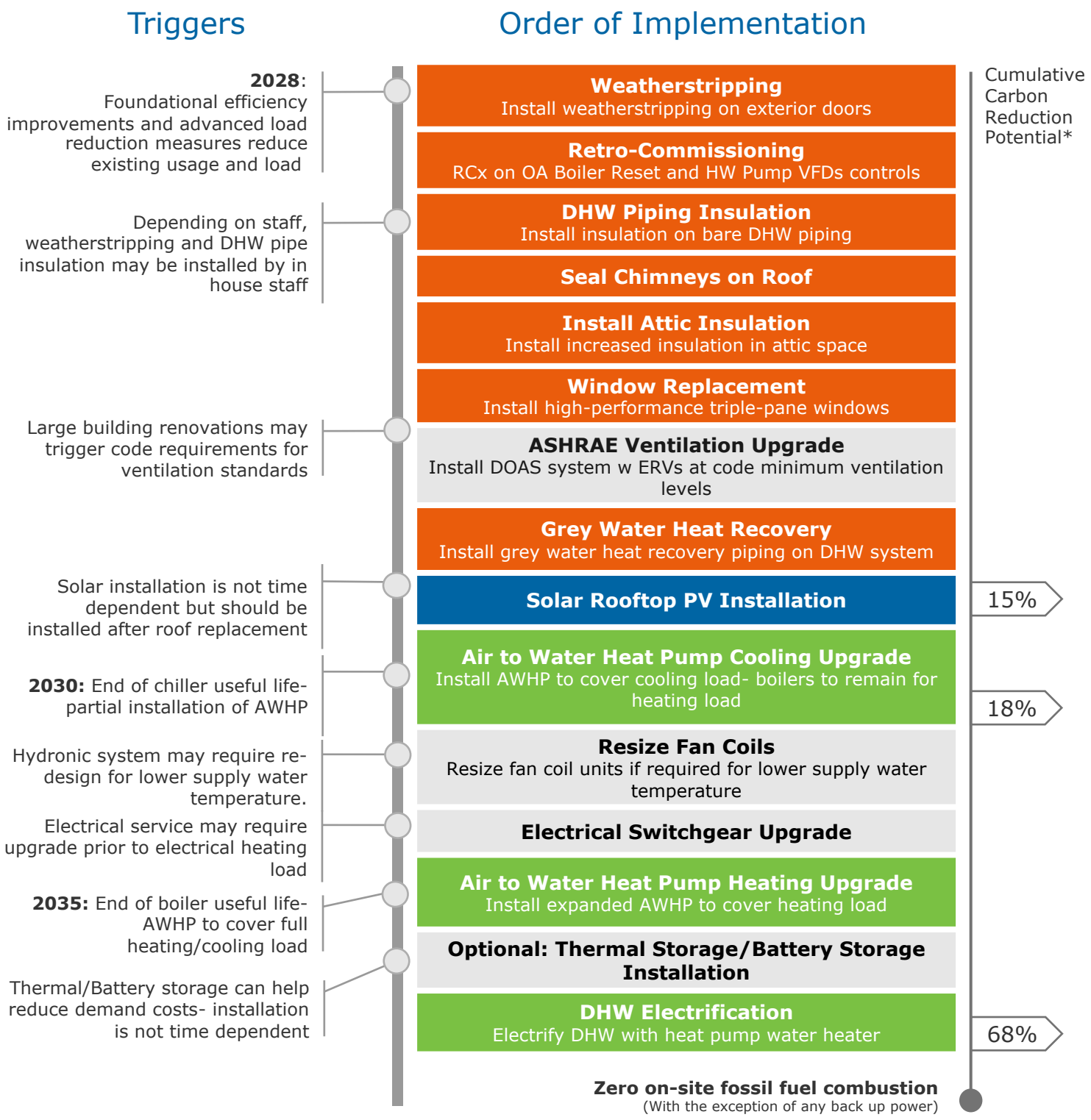


*The annual energy use impacts graphic illustrates an EUI before and after once all recommended measures are implemented, except for any renewable energy. The CEI and EUI shown in the performance targets account for the added benefits of renewable energy.

Project Planning

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The graphic below presents a decarbonization pathway, organizing measures into bundled actions that are best implemented together. The expected cumulative carbon reduction potential from each bundle is noted on the right. The strategy to reach zero GHG emissions by 2050 focuses on maximizing energy efficiency, electrifying on-site combustion systems within a cleaning grid, and cost-effective on-site renewables. Key considerations or triggers are listed along a timeline to support informed decision-making, with bolded dates indicating recommended implementation years.



*GHG calculations are based on BERDO Version 3 emissions factors. Full decarbonization is dependent on statewide renewable energy adoption. GHG calculations include direct onsite combustion (Scope 1) and purchased electricity (Scope 2). For any renewable energy measures included in this plan, it is assumed that the owner will retain the Renewable Energy Credits (RECs) to claim the GHG reduction for reporting.

Cost Analysis

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Annual Utility Impacts

Measure description	Changes in annual utility costs*		
	Electricity	Fossil fuel	Net total changes
Ventilation	$200	$0	$200
Cooling	($10,900)	-	($10,900)
Heating	$117,800	($38,800)	$79,000
Hot water system	$23,500	($18,500)	$5,000
Total from recommended measures	**$130,600**	**($57,300)**	**$73,300**
Renewable energy	($25,000)	-	($25,000)

No changes were noted to end uses of Lighting nor Process/Plug loads
*All utility costs are based on Adjusted Ventilation Baseline used as baseline scenario for usage, utility cost, and emissions

Lifecycle Costs*

Realizing the full value of decarbonization requires a long-term outlook that weighs upfront investments, operating costs, and financial incentives. BETA assessments identify the retrofit pathway that most effectively reduces emissions, maintains comfort, and improves performance relative to upgrades an owner would already make (the business-as-usual (BAU) scenario). This comparison highlights long-term avoided costs and risks, as well as opportunities—such as incentives—that support pursuing the optimized pathway.

Costs	BAU retrofit	Optimized decarbonization pathway	
Base building and envelope costs	$1,256,000	$508,000	Foundational efficiency and load reduction
		$1,663,000	Advanced load reduction
Mechanical costs	$602,000	$554,000	Electrification enablers
		$1,364,000	System electrification
Renewable energy costs	$0	$413,000	Renewable energy
Soft costs	$372,000	$900,000	
Total upfront costs	**$2,230,000**	**$5,402,000**	
Utility incentive opportunities	$0	($443,000)	
25-year total accrued utility costs	$5,983,000	$6,914,000	
25-year accrued total operating costs	$7,910,000	$8,842,000	
25-year LCCA	**$10,140,000**	**$13,801,000**	

BAU scope:
- Double Pane Window Replacement
- Gas-fired DHW heater replacement
- Gas-fired condensing boilers replacement
- Chiller replacement
- HV unit replacement
- Roof Replacement

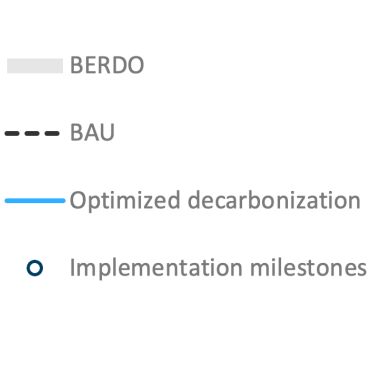
*All cost and incentive values are estimated based on industry data and rounded to the nearest $1,000. All incentives values are based on currently available programs and are subject to change over time. Forecasted operating costs include utility costs, maintenance costs, and noncompliance fees if relevant. Utility and maintenance costs reflect a 3% annual escalation rate. The BAU approach assumes necessary repairs and replacements that meet code compliance. In this case study, BAU represents the conventional gas or code-compliant versions of the decarbonization measures listed.

Decarbonization Benefits

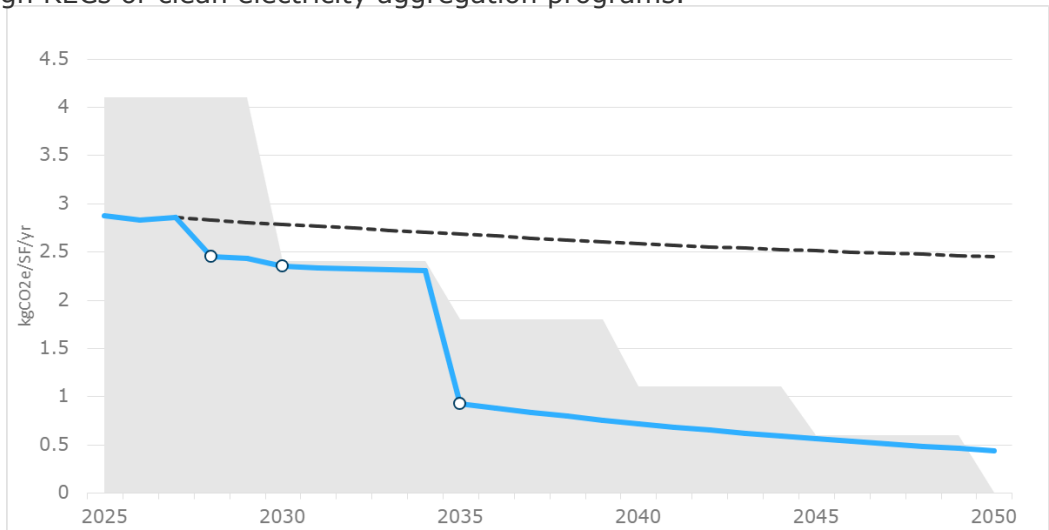
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Emissions Goals and Benchmarking

Boston's Building Emissions Reduction and Disclosure Ordinance (BERDO) applies to large existing buildings in the city and, outside Boston, serves as a useful benchmark for owners to proactively align upgrades with statewide goals. As Massachusetts targets net-zero emissions by 2050, similar policies may be adopted statewide. Achieving "zero" depends on the pace of statewide renewable energy adoption, with any remaining gaps addressed through RECs or clean electricity aggregation programs.



Future grid emission projections are based on BERDO Version 3 emission factors, which the City of Boston reassesses every five years.



Resiliency Considerations

According to localized flood hazard data derived from the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRMs), the property is located within an "Area of Minimal Flood Hazard."
However, the building is located outside but close to the current FEMA flooding zones (Connecticut river area) and nearly areas protected by a levee. Hampden County shows a "relatively high" level of risk for Riverine Flooding, Hurricane, and Ice Storms.



Next Steps and Best Practices

There are many potential strategies to reduce the operational GHG emissions of buildings. As a starting point, owners are encouraged to have a solid understanding of base building information, including current energy use, carbon emissions, and long-term property goals through 2050. The data and scoping developed through this assessment can be used by design teams, including architects and engineers, to begin shaping project plans and construction timelines, while also strengthening financing strategies and incentive applications. To move from assessment to action and ensure a clear, strategic path toward decarbonization, the following next steps are recommended.

- [x] Existing building conditions
- [x] Decarbonization assessment
- [ ] Supplemental assessments
  - Structural roof assessment
  - Hydronic Thermal Stress Test
- [ ] Emergency protocols
- [ ] Assemble project team
- [ ] Structure financing stack