BUILDINGENERGY BOSTON

Planning for Carbon Neutrality: Preparing Affordable Housing for an Equitable Transition

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Northeast Sustainable Energy Association (NESEA)
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Who We Are

As a mission-driven nonprofit, New Ecology works nationally to bring the benefits of sustainable development to the community level, with a concerted emphasis on underserved populations.

We seek to make the built environment more efficient, healthy, durable, and resilient.

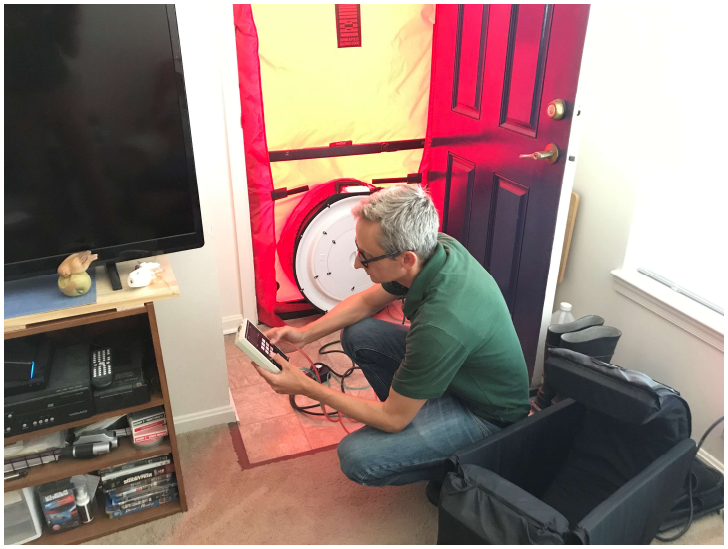
LISC BOSTON

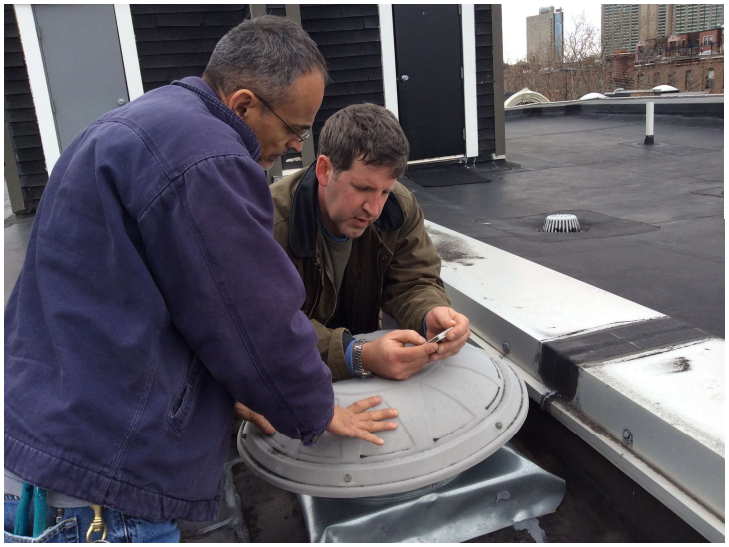
MASSACHUSETTS CLEAN ENERGY CENTER

DOER Massachusetts Department of Energy Resources

Comprehensive Energy Audit Matching Grant Application

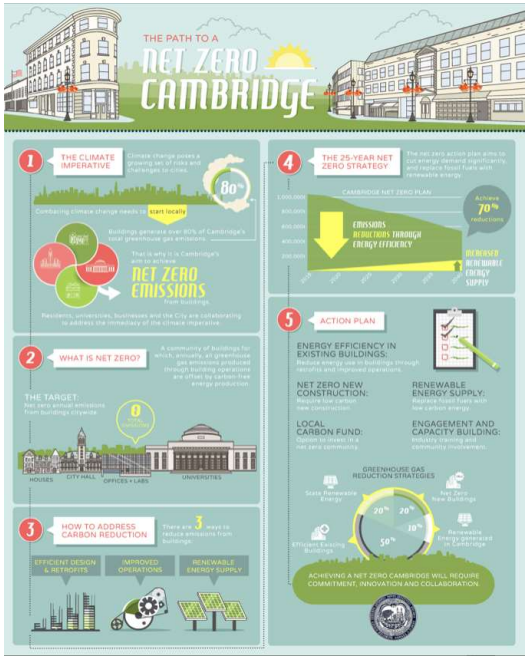
Application Deadline: Rolling (likely available through December 2023)



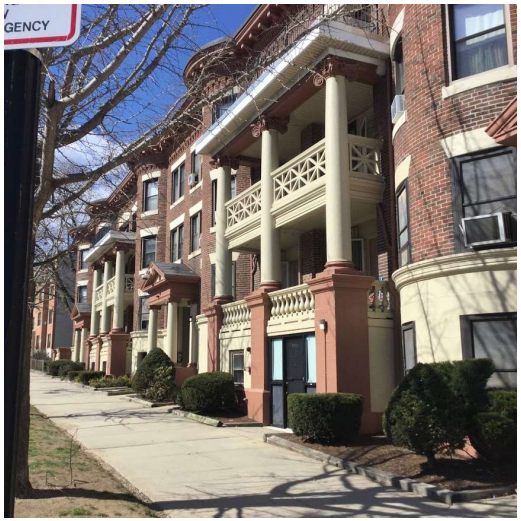


A Rapidly Changing Landscape

Senate Bill 9 - *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy*

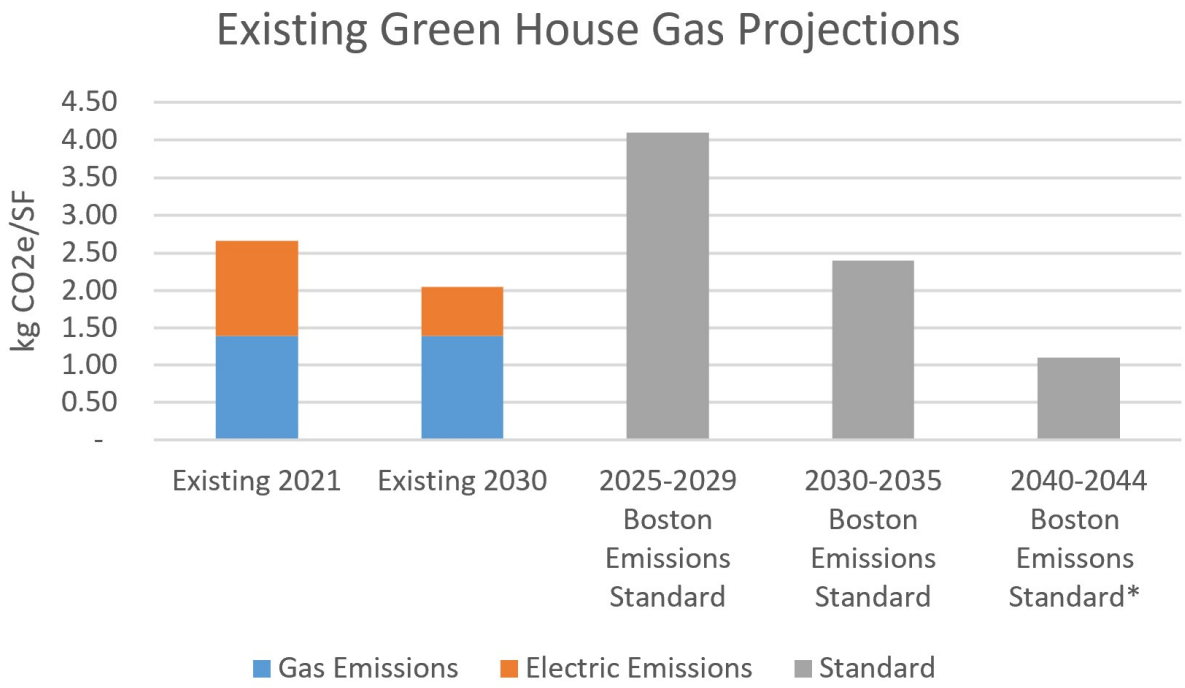


Nonantum Village Place and New Franklin Park



Nonantum Village Place

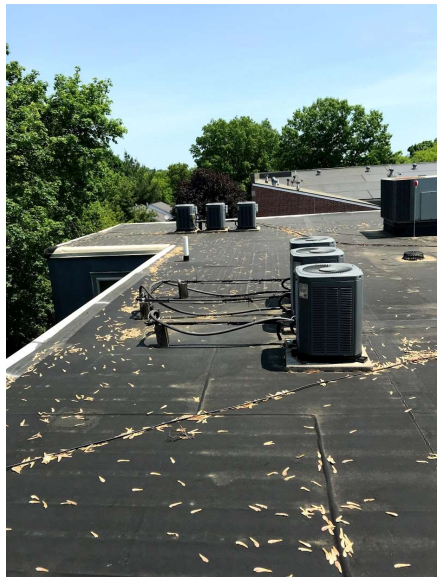
Current Performance Overview



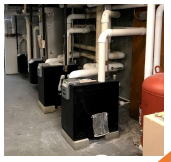
CO2e/kWh based on NREL and Cambrium's energy grid "Standard Scenarios" viewer for electric energy in Massachusetts: https://cambium.nrel.gov/?project=c3fec8d8-6243-4a8a-9bff-66af71889958

Proposed Capital Project

- Replace roof add R-50 insulation
- Replace apartment condensing units/ fan coils with hybrid system:
  - *heat pump/ hot water coil feeding new fan coils*
  - *controlled by 2-stage thermostat*
  - *switches to existing high efficiency gas boilers when temperature drops below 30F (~27% of heating)*
- Replace gas fired RTU's w/ heat pump RTU's



Apartment Heating and Cooling Timeline



2021: Current System

- Central Gas-Fired Condensing Boiler
- Hot Water Coil in Fan Coil Unit
- 80% Efficient Heating, 11 SEER cooling

2022: Hybrid Heat Pump

- Central Gas-Fired Condensing Boiler (Below 30F)
- Apartment Heat Pumps (Above 30F)
- Hot Water Coil and Heat Pump in Fan Coil Unit
- 80% Efficient Gas HW, 3.1 COP Heat Pump, 20 SEER Cooling

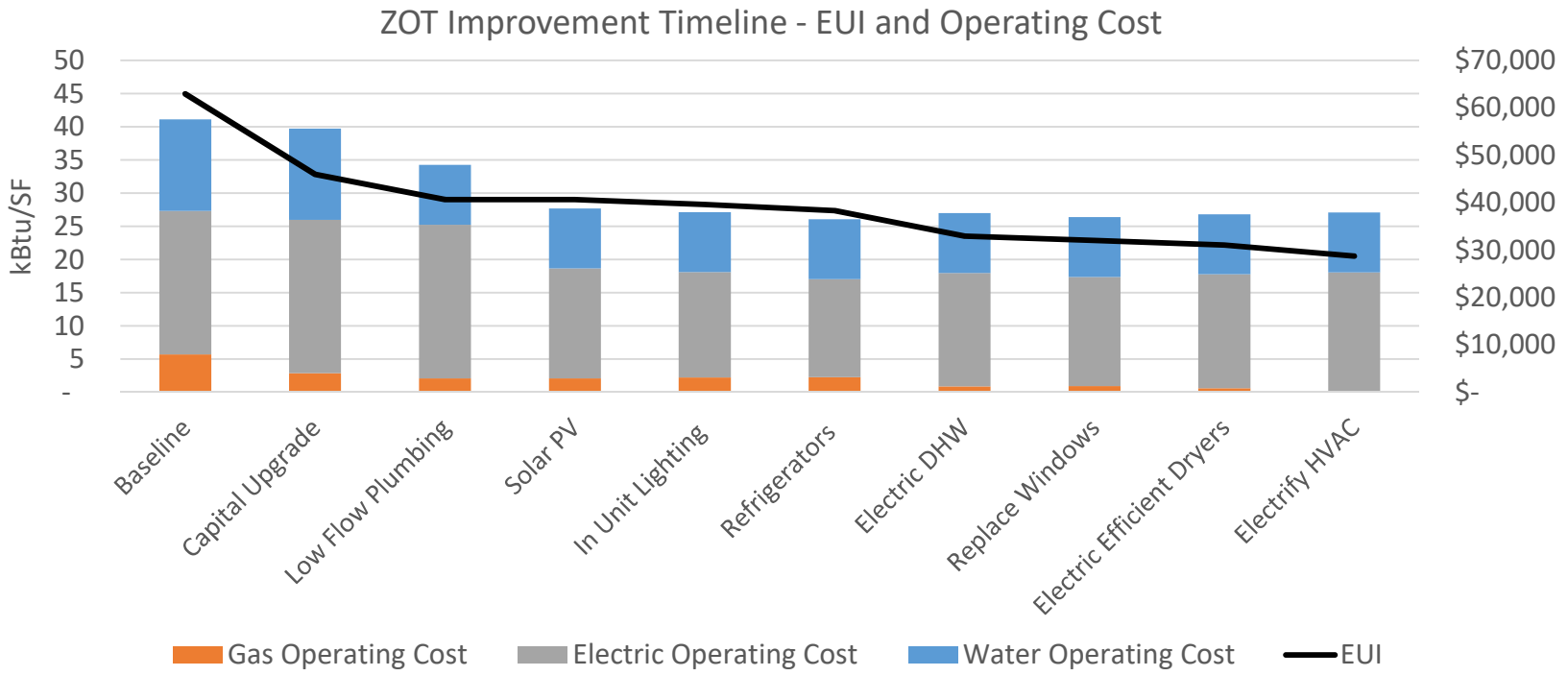
2033: Full Electrification

- Apartment Heat Pumps (All Temperatures)
- Heat Pump in Fan Coil Unit
- Above 30F: 3.1 COP, Below 30F: 2.4 COP, 20 SEER Cooling

Over Time Measures

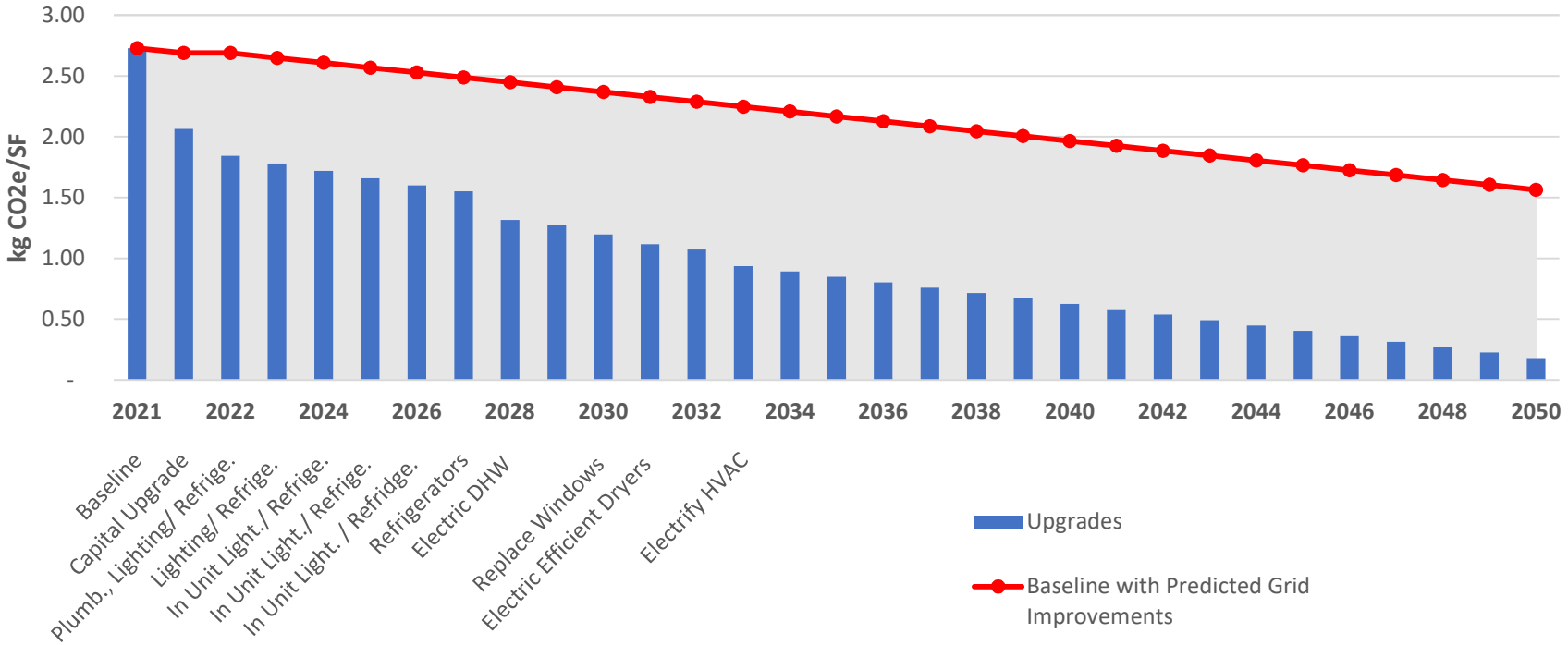
- In-Unit LED Lighting
- Low-Flow Plumbing Fixtures
- Energy Star Refrigerators and Dryers
- Window Replacement
- Solar PV
- Electrify HVAC (remove boilers)
- Heat Pump Domestic Hot Water Heater

Economic and Energy Overview



The graph above shows the cumulative impact on cost and Energy Use Index (EUI) impact with each progressive upgrade.

Carbon Emissions for Baseline Model and Model with Upgrades Over Time



Using NREL's Massachusetts electric grid carbon emissions projections between now and 2050, the graph above shows the passive carbon savings from the greening of the energy grid if no upgrades are performed (red line) and the savings if the upgrades noted are performed in tandem with the greening of the electric grid (blue bars).

New Franklin Park

Type 1 – Large Masonry
building with square footage above 35,000 sf.

Type 2 – Small Masonry
building with square footage below 25,000 sf.

Type 3 – Wood Frame
Wood Frame Building

New Franklin Park

Heating Boilers

Water Heaters

Window AC units

Baths Exhaust fans

Buildings reporting to BERDO

BERDO's emission standards

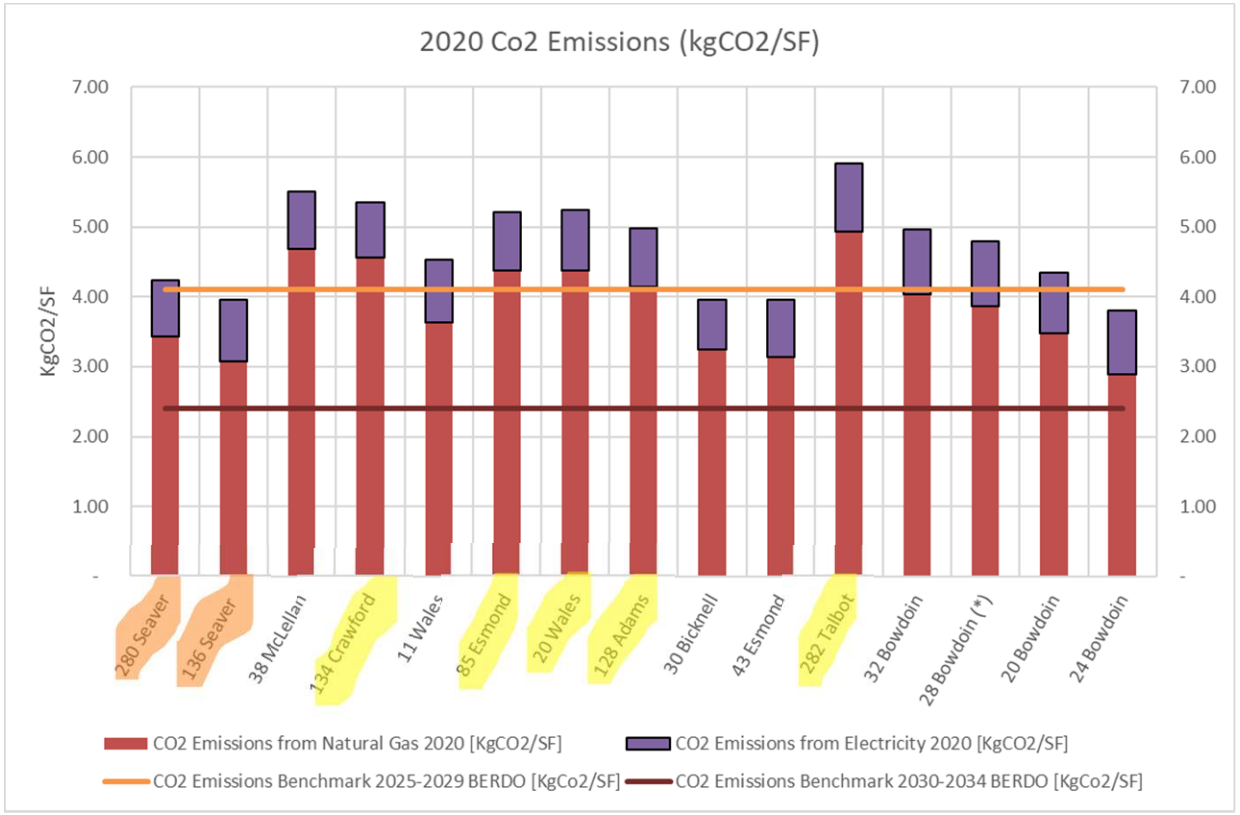
Building use	Emissions standards ($kgCO_2e/SF/yr.$)					
	2025-2029	2030-2034	2035-2039	2040-2044	2045-2049	2050-
Assembly	7.8	4.6	3.3	2.1	1.1	0
College/ University	10.2	5.3	3.8	2.5	1.2	0
Education	3.9	2.4	1.8	1.2	0.6	0
Food Sales & Service	17.4	10.9	8.0	5.4	2.7	0
Healthcare	15.4	10.0	7.4	4.9	2.4	0
Lodging	5.8	3.7	2.7	1.8	0.9	0
Manufacturing/ Industrial	23.9	15.3	10.9	6.7	3.2	0
Multifamily housing	4.1	2.4	1.8	1.1	0.6	0
Office	5.3	3.2	2.4	1.6	0.8	0
Retail	7.1	3.4	2.4	1.5	0.7	0
Services	7.5	4.5	3.3	2.2	1.1	0
Storage	5.4	2.8	1.8	1.0	0.4	0
Technology/Science	19.2	11.1	7.8	5.1	2.5	0

Note: There is an Alternative Compliance Payment ($234 per Metric Ton)

Building Type	Building Address	Gross Square Foot	Units
Type 1 – Large Masonry	280-296 Seaver St	40,618	29
	132-140 Seaver St	47,246	39
Type 2 - Small Masonry	38-40 McLellan St	14,112	10
	134-140 Crawford St	23,384	16
	11-11A Wales Sf	15,656	11
	85 Esmond St	20,172	22
	20 Wales St	20,072	22
	128-136 Adams St	16,068	15
	30-32 Bicknell St	11,742	6
	41-43 Esmond St	13,632	10
	282-292 Talbot Ave	19,992	20
Type 3 - Wood Frame	32 Bowdoin Ave	7,244	5
	28 Bowdoin Ave	7,284	5
	20 Bowdoin Ave	7,256	5
	24 Bowdoin Ave	7,404	5

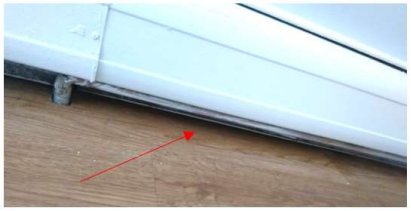
Note: Buildings highlighted have been or will be reporting to BERDO.

CO2 Emissions in the Portfolio

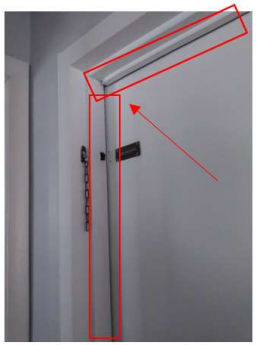


Proposed Capital Project

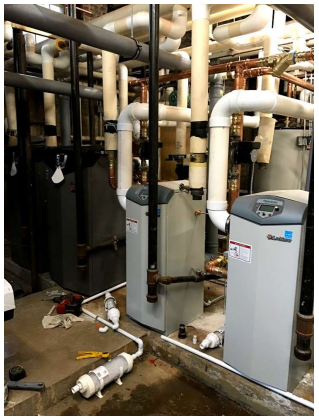
- New weather stripping in exterior doors
- In-Apartment air sealing
- New Exhaust fan in bathrooms with booster mode.
- New windows (in 1 building)
- Roof (in 1 building)
- Gas-fired Condensing boilers and water heaters (Funded by the LEAN program in 5 buildings).
- DHW electrification (in 5 Buildings)



An air gap between the flooring and wall sheetrock behind the Baseboards heaters in unit 20 at 28 Bowdoin Ave



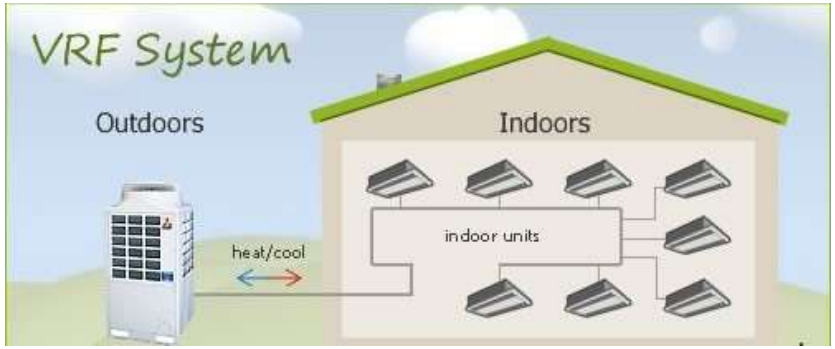
Air leakage in the Entry door of the apartments



Proposed Capital Project– Pilot Projects

Full electrification of 2 buildings.

- Injected Cavity Insulation in Exterior walls
- VRF system (3.0 COP)
- Heat pump water heaters (2.5 COP)
- Solar PV system
- Electric Ranges and Dryers



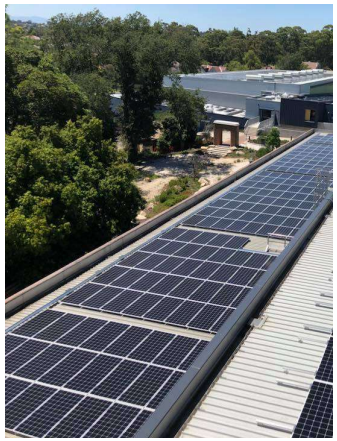
Goals:

* Evaluate the economic and carbon emission impact of implementing all measures at once versus over time.

Over Time Measures

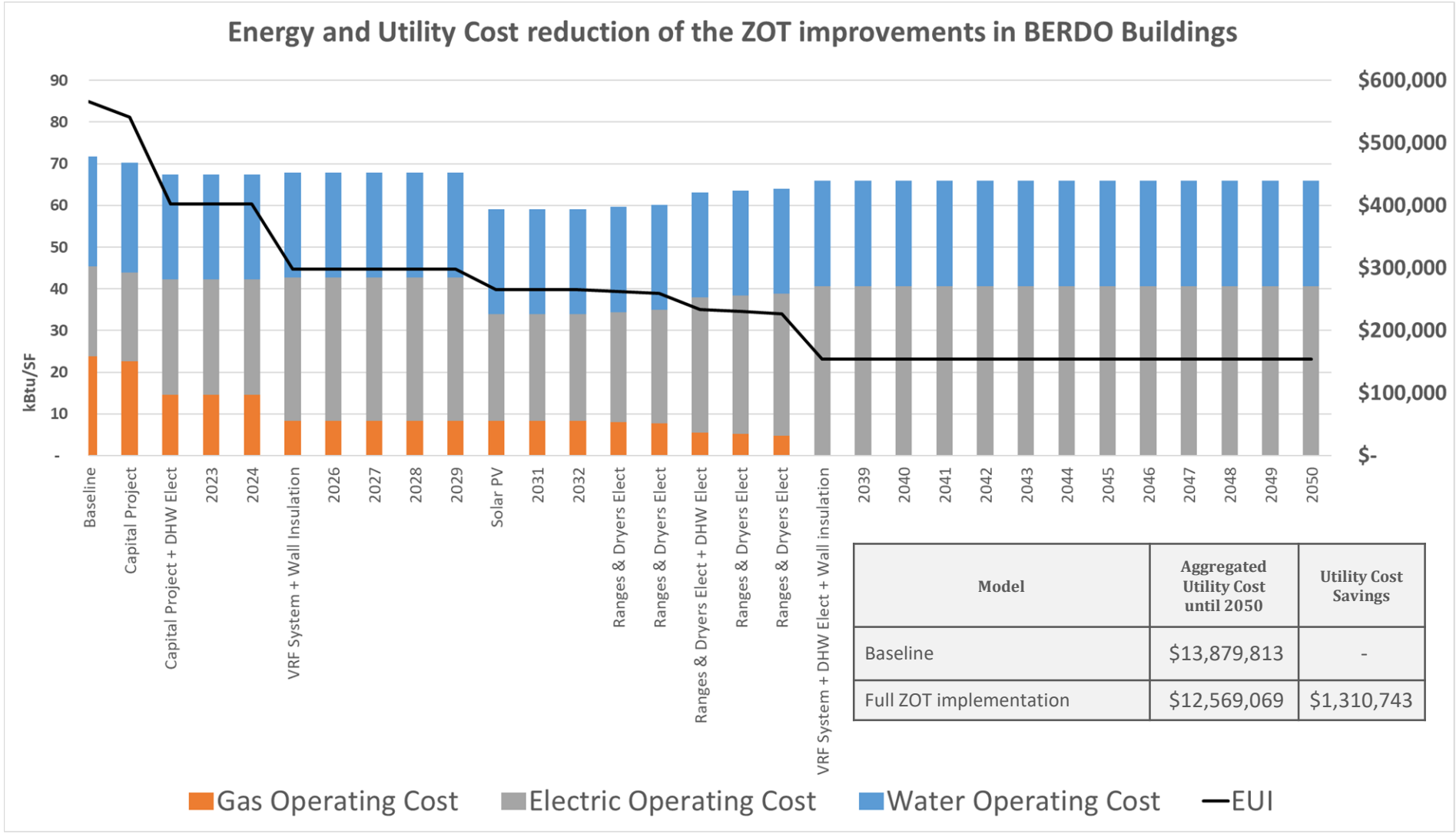
To be completed by 2050

- Injected cavity insulation/Exterior Wall Insulation at all Exterior Walls
- Heat Pump water heaters (2.5 COP average)
- Solar PV System
- VRF System (3.0 COP average)
- Electric Ranges and Dryers

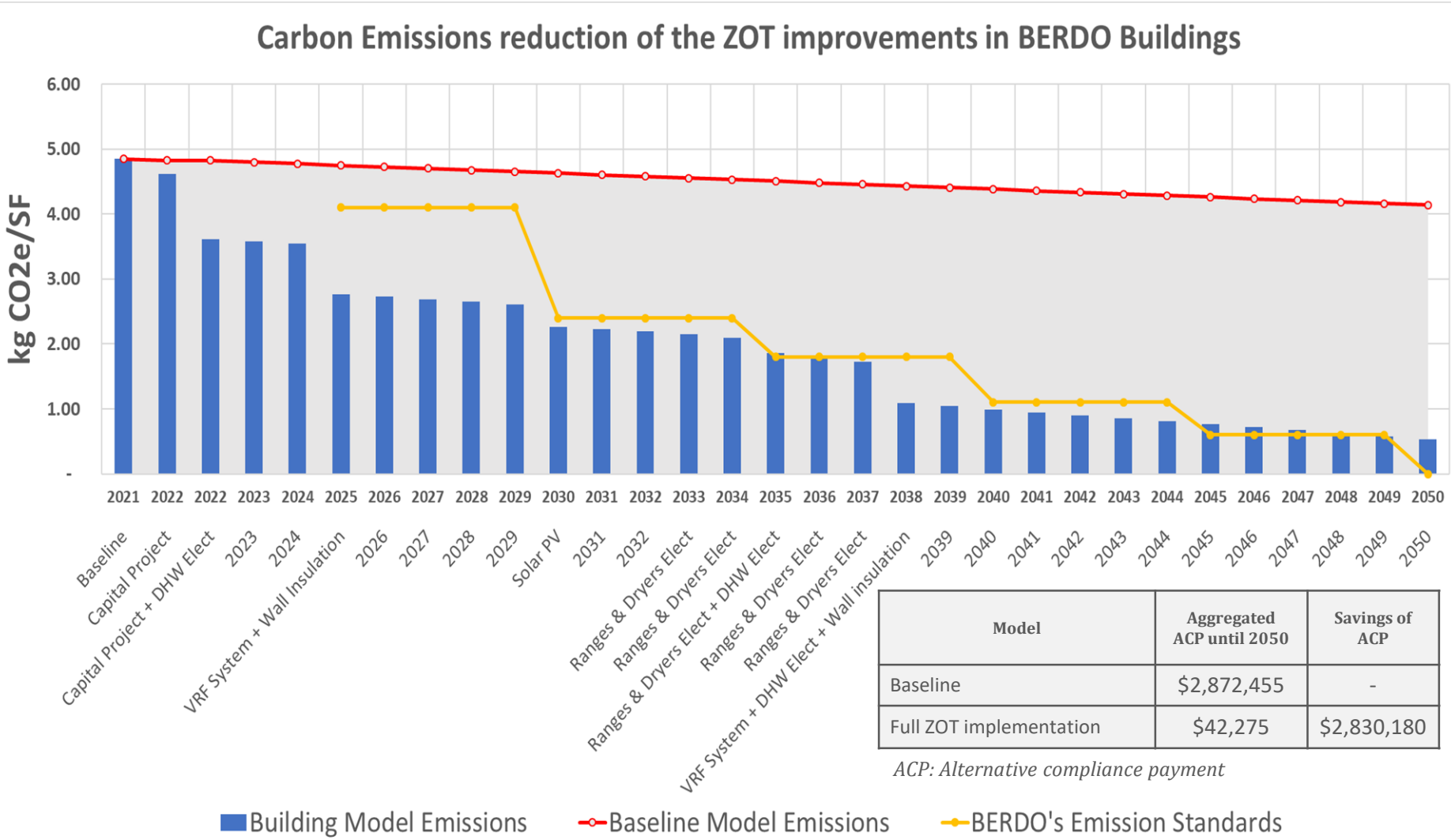


Over Time Measures - Thought Process

1. End of the useful life of equipment (3 groups of buildings with different timeframes)
2. Utility Cost.
3. BERDO - Emission requirements and alternative compliance payment.



Model	Aggregated Utility Cost until 2050	Utility Cost Savings
Baseline	$13,879,813	-
Full ZOT implementation	$12,569,069	$1,310,743



Model	Aggregated ACP until 2050	Savings of ACP
Baseline	$2,872,455	-
Full ZOT implementation	$42,275	$2,830,180

ACP: Alternative compliance payment

Findings/Thoughts

- Financial Reorientation – From cost savings to cost increase mitigation
  - Spark Rate implications
  - Solar integration critical to cost and carbon mitigation
  - Green underwriting programs?

- Electrification – Typically at least 5 years out for projects that are not comprehensive rehabilitations.
  - Different technology and incentives likely at play

- Are the compliance payments enough to drive decarbonization at scale?

- “Living Plans” – Lots of assumptions made that will change, but provides a framework/road map that can be updated

Thank You!

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