Net Zero Carbon Zoning

Planning Department and Environment Department

Planning Department

CITY of BOSTON

Presentation Outline

1. **NZC Zoning proposal**
   a. Proposal overview
   b. How NZC Zoning works with BERDO
2. **NZC Zoning impact projections**
   a. Citywide emissions
   b. Building-level emissions
   c. Embodied carbon
3. **NZC Compliance**
   a. Cost impact
   b. Renewable energy procurement examples
   c. Compliance pathways and options
4. **Recap**

Presentation Outline

1. **NZC Zoning proposal**
   a. Proposal overview
   b. How NZC Zoning works with BERDO

Net-Zero Carbon Zoning proposal

1. Requires **net zero operational emissions**
    a. Phased in for Hospital, General Manufacturing, and Lab uses
        i. New Hospital and General Manufacturing will be net zero in 2045
        ii. New Lab will be net zero in 2035
2. Requires **reporting on embodied carbon** (emissions from materials/construction)
    a. Operational carbon reduces over time whereas embodied carbon does not
3. Continues **LEED certifiable** requirement (no change from current Article 37)
4. Applies to **new buildings with 15+ units or 20,000+ SF and additions of 50,000 SF**.

*Source Architecture 2030

NZC Zoning proposed exemptions

Net Zero Carbon Zoning **does not** apply to:

- ➔ Renovations
- ➔ Additions < 50,000 gsf
- ➔ Change of Use

Compared to constructing a new building of similar size, large-scale adaptive reuse projects combined with energy efficiency upgrades have the potential to significantly reduce carbon emissions.

Image: 259-267 Summer St.
Office to Resi pilot program

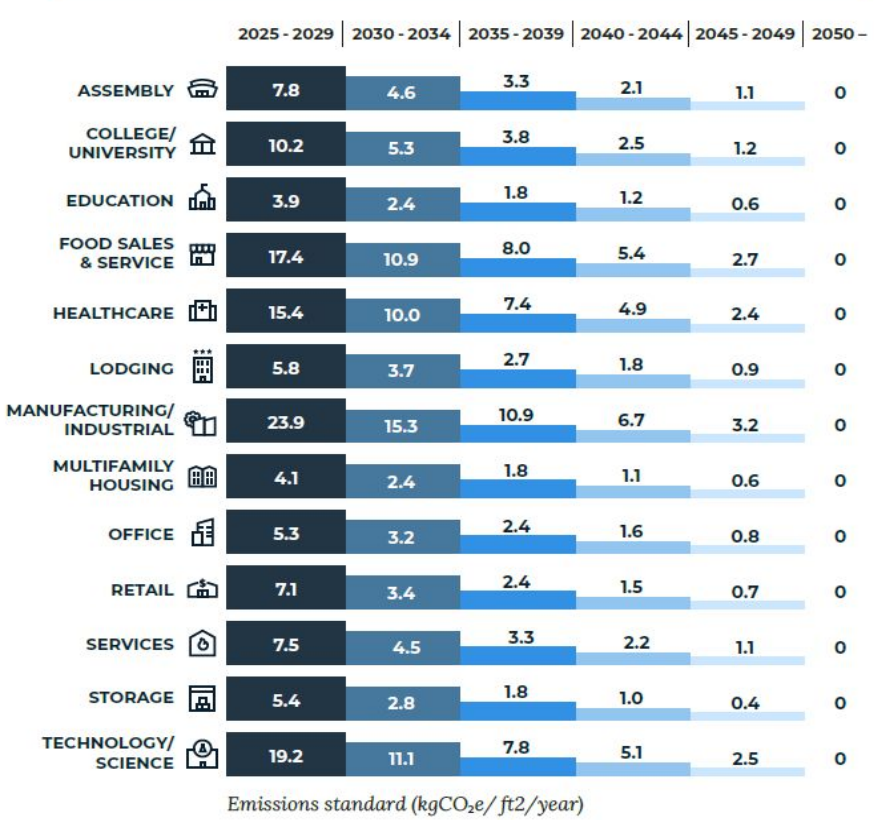
NZC Zoning proposed timing

Starting July 1, 2025: New project filings will be required to meet Net Zero Carbon emissions standard

Once a building is constructed and in operation, compliance with net-zero emissions will be demonstrated through
BERDO compliance mechanisms and annual reporting.

NZC Zoning is based on BERDO

- Background: BERDO requires existing buildings to decrease emissions over time and achieve net zero emissions by 2050.
- **Net Zero Zoning will require new buildings to be Net Zero Ready** or for, high intensity uses, accelerate their emissions reductions in comparison to BERDO.
- Once in **operation** a new building will need to **demonstrate net zero compliance** under BERDO.
- Net Zero Zoning will use **BERDO to track compliance**



NZC Zoning accelerates the BERDO net-zero year for new buildings.

Most building types will open with net zero emissions
(e.g. Multifamily, Office, Assembly, Schools, Retail, University, Lodging)

2025	→	2025
0		0

Emissions standard (kgCO2e/ ft2/year)

Three building types have a longer timeline

Industrial Manufacturing

2025	→	2045
15.3		0

Emissions standard (kgCO2e/ ft2/year)

Healthcare

2025	→	2045
10		0

Emissions standard (kgCO2e/ ft2/year)

Technology Science Labs

2025	→	2035
5.1		0

Emissions standard (kgCO2e/ ft2/year)

Side note: Recent new buildings are already exceeding BERDO targets.

Most filings only need to accelerate emissions reductions by approximately 10 years.

- On average, 2023 filings remain under BERDO emissions limits until 2040.
- The Average emission intensity for all large projects filed in 2023 is 3.9 kgCOe/sf/year.
- Buildings that would be covered by NZC zoning in 2025 and beyond are expected to have an even smaller gap with their BERDO limits.

How can a building be net-zero emissions under BERDO?

Compliance with emissions limits set under NZC zoning will be demonstrated annually through the Building Emissions Reduction and Disclosure Ordinance (BERDO).

Reduce direct building emissions

For a new building, this means designing an energy efficient, low-carbon building.

Install renewable energy systems

Typically, rooftop solar.

Purchase eligible renewable energy

Purchase eligible renewable energy to reduce emissions from electricity only.

Make Alternative Compliance Payments (ACPs)

Payments go into the Equitable Emissions Investment Fund support building decarbonization projects that prioritize benefits to Environmental Justice communities in Boston. ACPs are set at $234/ton of CO_2.

Types of renewable energy (more detail later in presentation)

RENEWABLES

SOLAR, THERMAL AND WIND TURBINE

BCCE

BOSTON COMMUNITY CHOICE ELECTRICITY

PPAS

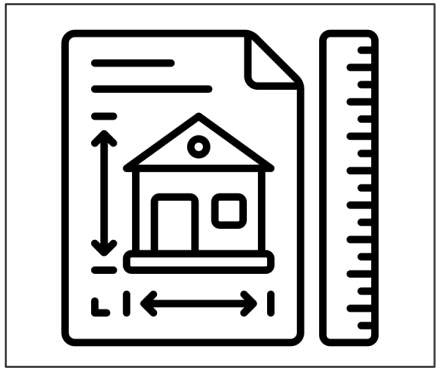
POWER PURCHASE AGREEMENTS

MASS CLASS 1 RECS

RENEWABLE ENERGY CREDITS

Example timeline

Planning



NZC ZONING

On average a project can anticipate 2-4 years from PNF filing to construction completion.

Step 1 - Submit PNF - July 15th, 2025
Includes; Energy model, Climate Resilience Checklist, LEED checklist, preliminary embodied carbon analysis

***Step 2 - Board approval- Q2, 2026**
Includes; Net Zero Carbon Acknowledgement Letter

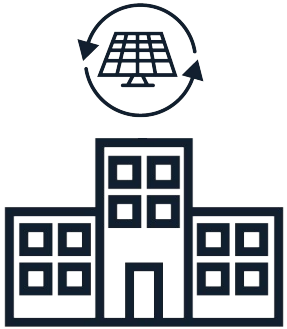
Step 3 - Building Permit- Q4, 2026
Includes; Embodied carbon analysis (Large Projects), updated Energy model, Climate Resilience Checklist, LEED checklist - as needed

Step 4 - Construction Complete- Q1, 2028
Includes; Final Energy model, Climate Resilience Checklist, LEED checklist, BERDO ID number established

**Note: Key project Milestones will align with Article 80 modernization.*

Example timeline

Operation



Net Zero Operations

Step 5 - Certificate of Occupancy - Q1, 2028

Renewable Energy Service Begins

Step 6 - Project Reports Net Zero Compliance via BERDO - May 15, 2030

Annual reporting and compliance through BERDO is required for the first full calendar year of operations (2029 data) following issuance of COO. Third party data verification is also required this year.

Step 7 - Annual BERDO reporting and compliance 2030 onward

Presentation Outline

2 NZC Zoning impact projections

a. Citywide emissions
b. Building-level emissions
c. Embodied carbon

Citywide impact

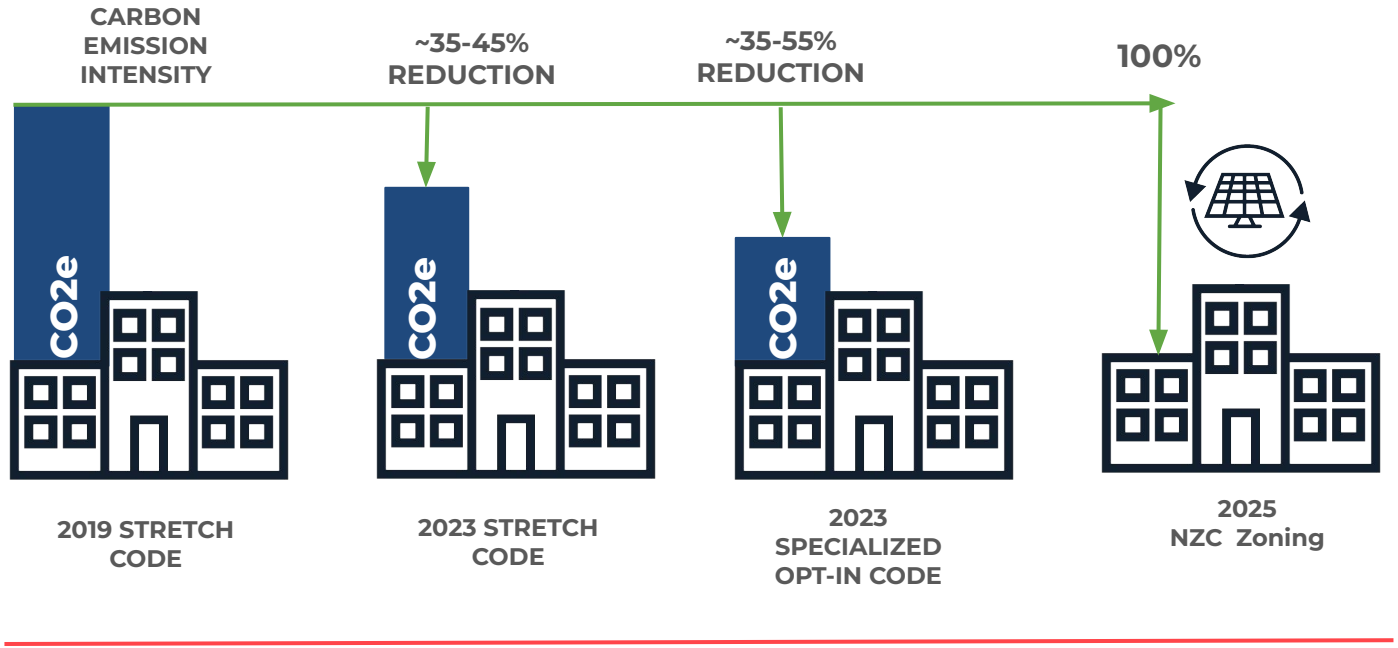
If NZC zoning had been in place in 2023, the equivalent of 0.58% of annual Boston-wide GHG emissions would have been avoided.

- 2023 Article 80 large project filings* totaled an estimated 35,271 annual metric tons CO2e.
- This is approximately the same as all of Boston's GHG emissions from waste.

**Large projects are 50,000 GSF or greater and report modeled annual carbon emissions via Article 37 review*
NOTE: The estimated annual CO2e does not include the Massachusetts Class 1 RPS

Building-level impact

Net Zero Carbon Zoning captures the remaining 45%-65% net-emissions associated with new buildings operations when compared to the 2019 stretch code.



Source: Energy Modeling Analysis Summary ZNC Zoning vs. 2023 Stretch Code, BR+A Engineers

Embodied carbon impact

- Embodied carbon emissions would be tracked and reduced. **We do not have embodied carbon data for Boston**. Currently, embodied carbon is not accounted for in Article 80 review, and is also not accounted for in the City's greenhouse gas inventory.
- What are other cities doing on embodied carbon?
  - Case study from Vancouver (new office building) showed a **45% reduction** with strategies that address embodied carbon: mass timber, building reuse, low carbon concrete.
  - **City of Vancouver** established embodied carbon benchmarking in 2023. Starting in 2025, Vancouver has proposed:
    - **10% embodied carbon reduction target** against baseline
    - 5 % embodied carbon reduction target against baseline with industry leadership credits
  -

Source: https://vancouver.ca/files/cov/proposed-embodied-carbon-requirements-vancouver-building-by-law-2025.pdf

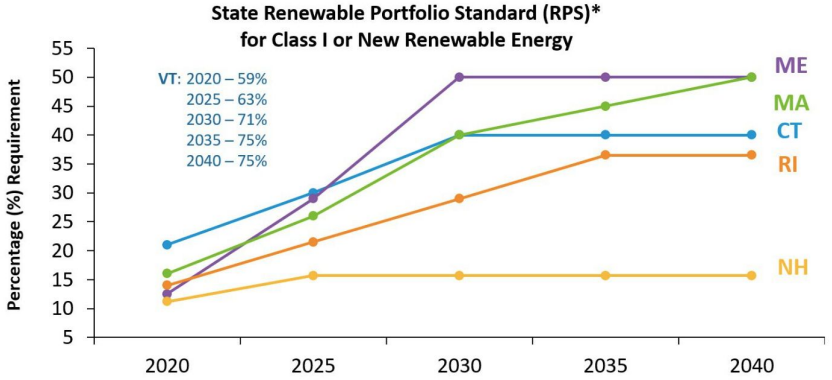
Presentation Outline

3 **NZC Compliance**

a. Cost impact
b. Renewable energy procurement examples
c. Compliance pathways and options

Increased renewable energy in the grid reduces compliance costs.

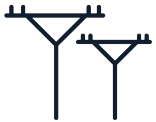
- The Massachusetts Class I Renewable Portfolio Standard (RPS) **increases by 3%** each year between **2025-2029 (27%-39%)** and by **1% each year thereafter.**
- The Massachusetts Renewable Energy Portfolio Standard (RPS) requires retail electricity suppliers to obtain a minimum percentage of their electricity from renewable energy sources.
- **Moving forward projects will benefit from the Massachusetts RPS in their Net Zero compliance reporting under BERDO**



Source: NE-ISO Newswire

ESTIMATED COMPLIANCE COSTS DECREASE OVERTIME

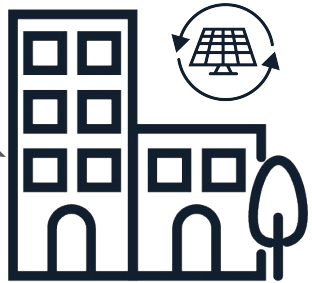
600,000 kWh



(RPS in 2030 = 40%)

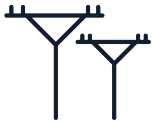
$14,400
Estimated Cost in 2030

2030



First Full Year of Operation
NZC Compliant

20% Reduced Grid Emission per current RPS Requirements



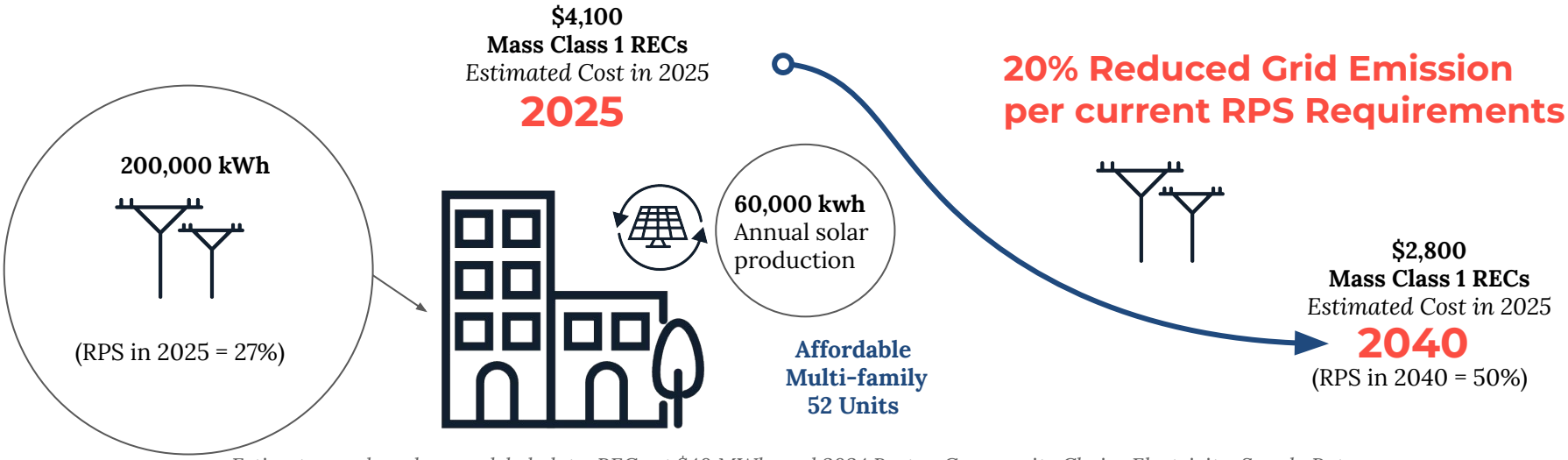
$9,600
Estimated Cost in 2050

2050

(RPS in 2050 = 60%)

Estimates are based on modeled data, RECs at $40 MWh, and 2024 Boston Community Choice Electricity Supply Rates

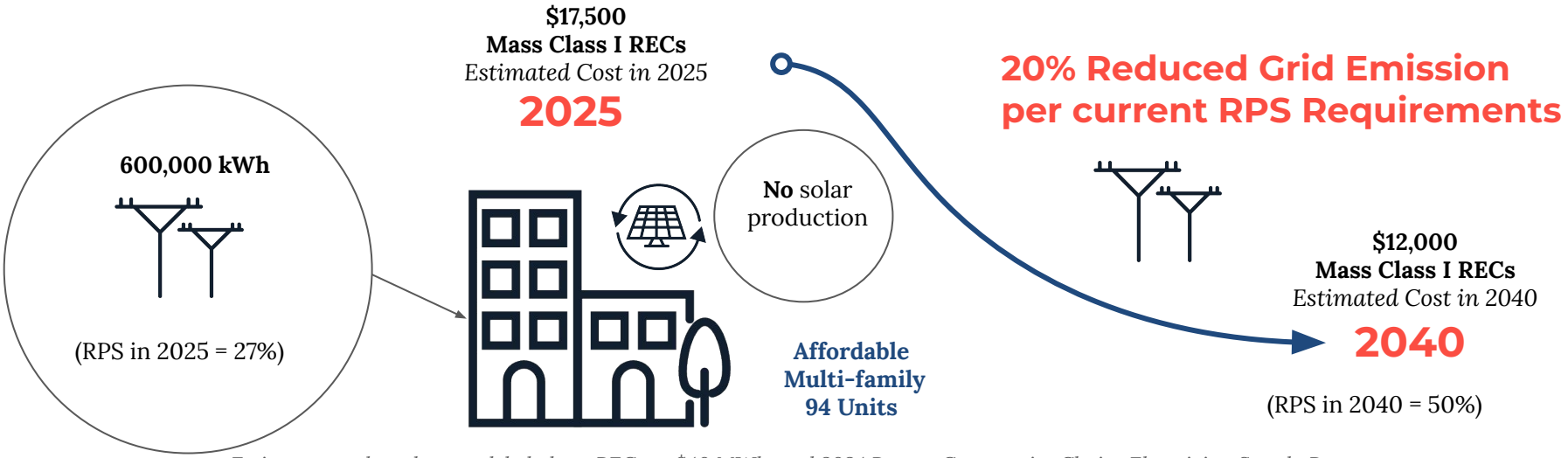
Residential example 1: cost projections



Estimates are based on modeled data, RECs at $40 MWh, and 2024 Boston Community Choice Electricity Supply Rates

Project Example	**Key Features**	**BCCE Green 100 additional compliance cost (w/ PV)** *Average 1st year cost*	**Mass Class I REC compliance cost additional (w/ PV)** *Average 1st year cost*	**Estimated annual electric supply + delivery costs without renewables (No PV)** *Based on BCCE standard rate + Eversource Delivery rate*
Affordable multi-family (50 units), ~48,000 SF	Passive House, PV installed (50kW), Battery Backup, all electric	+ ~$2,500 ($48 per unit)	+~$4,100 ($78 per unit)	~$68,000

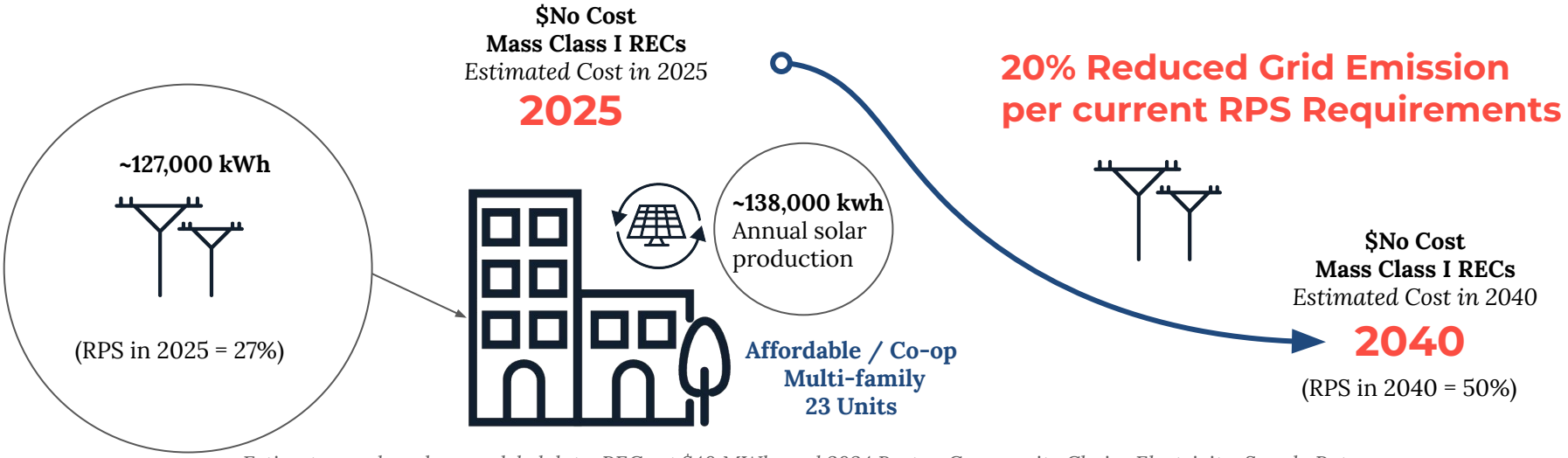
Residential example 2: cost projections



Estimates are based on modeled data, RECs at $40 MWh, and 2024 Boston Community Choice Electricity Supply Rates

Project Example	**Key Features**	**BCCE Green 100 additional compliance cost (No PV)** *Average 1st year cost*	**Mass Class I REC compliance cost additional (No PV)** *Average 1st year cost*	**Estimated annual electric supply + delivery costs without renewables (No PV)** *Based on BCCE standard rate + Eversource Delivery rate*
Affordable multi-family (94 units), ~105,000 SF	Passive House,Mass timber, all electric	+~$14,300 ($152 per unit)	+~$17,500 ($186 per unit)	~$204,000

Residential example 3: cost projections



Estimates are based on modeled data, RECs at $40 MWh, and 2024 Boston Community Choice Electricity Supply Rates

Project Example	Key Features	BCCE Green 100 additional compliance cost (w/ PV) *Average 1st year cost*	Mass Class I REC compliance cost (w/PV) *Average 1st year cost*	Estimated annual electric supply + delivery costs without renewables (No PV) *Based on BCCE standard rate + Eversource Delivery rate*
Affordable multi-family (23 units), ~105,000 SF	Passive House, Energy Positive, all electric	~$0 *Additional Savings calculated via net metering terms*	~$0 *Additional Savings calculated via net metering terms*	~$43,000

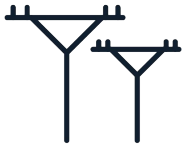
Residential cost recap: Estimated Range of Costs

$0-$220 Per unit
Mass Class I RECs
Estimated Cost in 2025

2025

Affordable Housing

20% Reduced Grid Emission per current RPS Requirements



$0-$170 Per unit
Mass Class I RECs
Estimated Cost in 2040

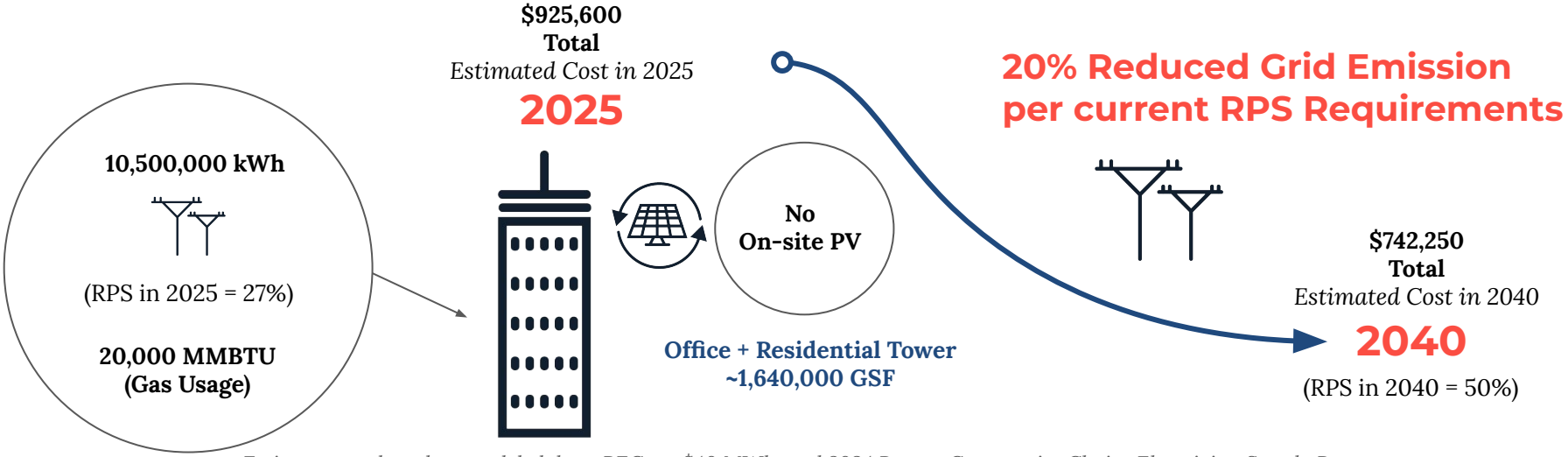
2040

(RPS in 2040 = 50%)

- Electricity cost estimates for supply (BCCE Standard Rate) and delivery (Eversource Delivery Rate) range from $0 to ~$685,000 in 2025 depending on the size and scale of the building (15 units - 300+ units).
- Additional renewable energy increases these costs by 0-8%.

Estimates are based on modeled data, RECs at $40 MWh, and 2024 Boston Community Choice Electricity Supply Rates and Eversource residential delivery rates

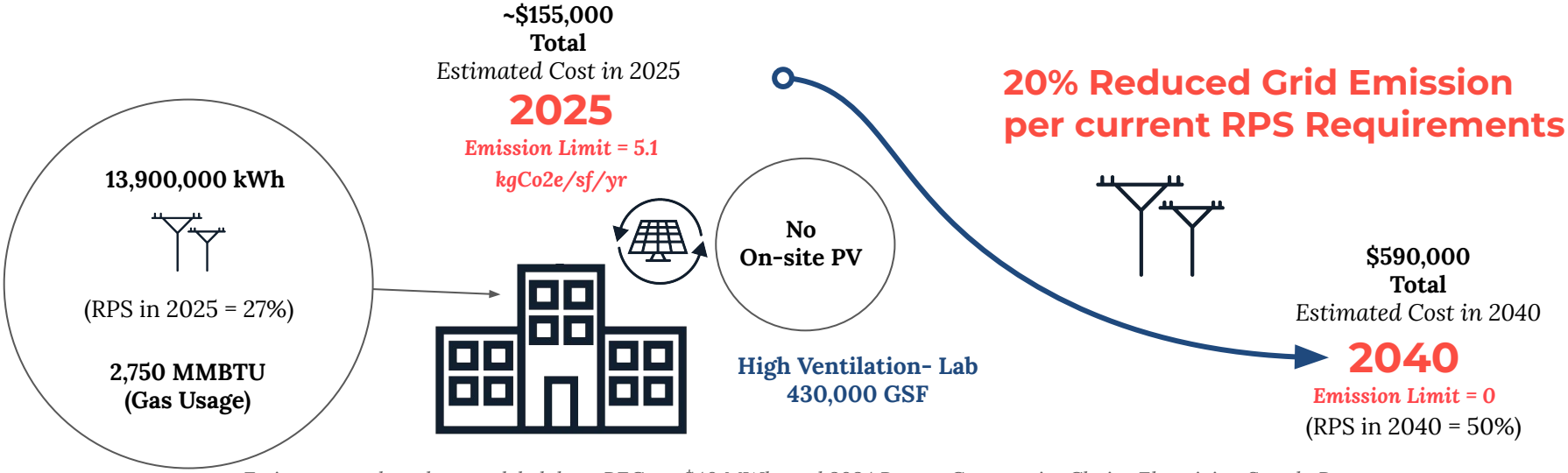
Commercial Example 1: Office / Residential Tower



Estimates are based on modeled data, RECs at $40 MWh, and 2024 Boston Community Choice Electricity Supply Rates

Project Example	**Key Features**	**Mass Class 1 Recs** *Average 1st year cost* *Emission Limit = 0*	**Alternative Compliance Payments** *Average 1st year cost* *Assumes $234 per metric ton of CO2e*	**Estimated annual energy costs** *Before renewables and ACPs*
Residential/ Office Tower	Passive House Electric + Fossil Fuel onsite	~$306,600 ($0.18 /SF)	~$629,000 ($0.38 /SF)	~$2,125,500 ($1.29 /SF)

Commercial Example 2: High Ventilation - Lab



Estimates are based on modeled data, RECs at $40 MWh, and 2024 Boston Community Choice Electricity Supply Rates

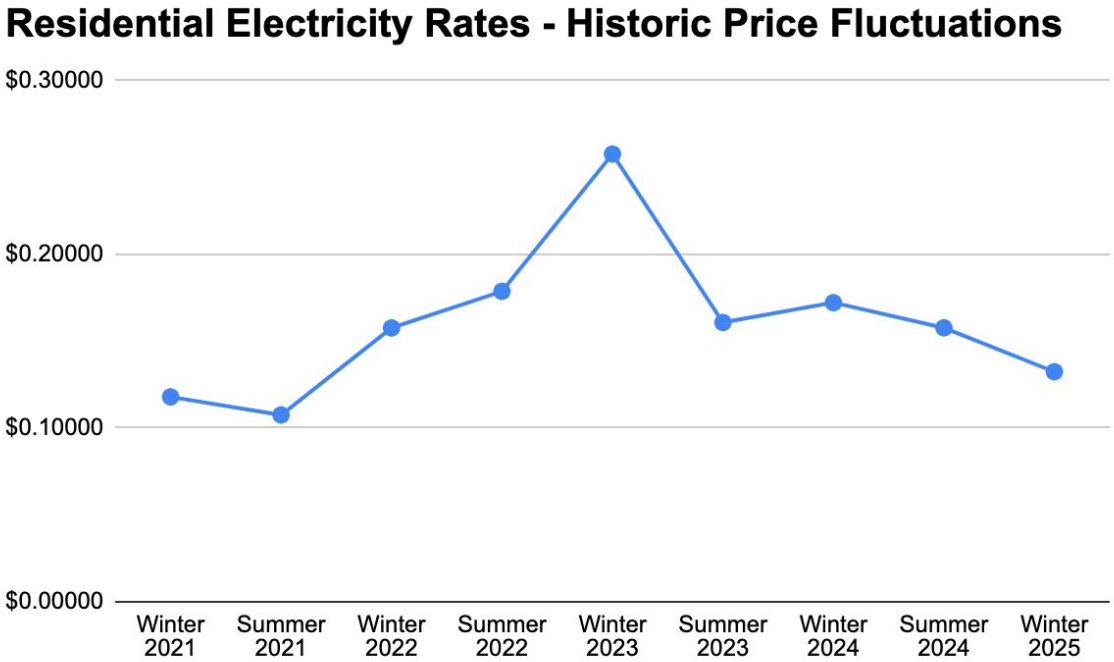
Project Example	**Key Features**	**Mass Class 1 Recs** *Average 1st year cost* *Emission Limit = 5.1*	**Alternative Compliance Payments** *Average 1st year cost* *Assumes $234 per metric ton of CO2e*	**Total (RECs +ACPs)** *Average 1st year cost* *Emission Limit = 5.1*
Lab/ Office	Electric + Fossil Fuel onsite	~$77,080 ($0.18/SF)	~$77.080 ($0.18 /SF)	~$155,000 ($0.36 /SF)

Cost factor: electricity supply volatility

Historic Averages
Winter 2021-Winter 2025

Eversource Basic Supply
Residential Average = $0.16130

- Within the last five years, electricity prices have fluctuated $0.140, or over 100%.



Cost factor: Historical trend of Mass Class 1 REC prices

10 Year trend
Mass Class 1 RPS

Market valuation: *DOER must publish each Compliance Year's adjusted rate for ACPs by January 31st of that Compliance Year.*

The ACP Rate is equal to the previous year's ACP Rate adjusted up or down according to the previous year's Consumer Price Index (CPI).

RPS Alternative Compliance Payment Rates

Compliance Year	CPI	RPS Class I	RPS Class I Solar Carve-Out	RPS Class I Solar Carve-Out II	RPS Class II Renewable Generation	RPS Class II Waste Energy
2024	------	$40.00	$330.00	$257.00	$34.20	$34.20
2023	313.786	$40.00	$330.00	$271.00	$33.06	$33.06
2022	303.320	$50.00	$347.00	$285.00	$30.91	$30.91
2021	283.557	$60.00	$365.00	$300.00	$29.75	$29.75
2020	272.908	$71.57	$384.00	$316.00	$29.37	$11.75
2019	269.392	$70.44	$404.00	$333.00	$28.91	$11.56
2018	265.139	$68.95	$426.00	$350.00	$28.30	$11.32
2017	259.538	$67.70	$448.00	$350.00	$27.79	$11.12
2016	254.850	$66.99	$472.00	$350.00	$27.50	$11.00
2015	252.185	$67.07	$496.00	$375.00	$27.53	$11.01
2014	252.463	$66.16	$523.00	$375.00	$27.16	$10.86

Source: DOER - https://www.mass.gov/info-details/annual-compliance-information-for-retail-electric-suppliers

Cost factor: impact on opex, capex, and underwriting

- Mayor's Office of Housing will take into account the additional operating costs due to the Zero Net Carbon Zoning requirements when staff underwrite new affordable housing projects
- For commercial properties, additional operating costs of renewable energy are not expected to affect underwriting.

Side Note: Comparison to existing buildings

- **Existing buildings of this size are already being asked to reduce their emissions under BERDO.**
  - **In 2025, approximately 15%** of buildings will need to purchase renewable energy for compliance* and by **2030, approximately 70%** of buildings will need to purchase renewable energy and/or pursue other compliance options under BERDO.
  - We estimate the following average costs for renewable energy purchases under BERDO in 2030:
    - Multifamily housing: $10,000
    - Office: $37,500
    - College/University: $100,000

*Or pursue other compliance options under BERDO

Estimates are based on reported data and $40/REC

This City will help with renewable energy procurement

- Existing Resources
  - Renewable Energy Request for Information - Includes vendors who offer renewable energy products and services to make it easier to find a vendor.
  - BERDO Renewable Energy Quick Guide
  - BERDO webinars on renewable energy
- Resources and support under development
  - Improvements to reporting of BCCE in BERDO
  - Evaluate raising BCCE supply cap to include larger accounts (1.5M kWh/year)
  - Exploration of bulk procurement for renewable energy (RECs, PPA, etc.)
  - Additional technical assistance and engagement on renewable energy market and procurement

Boston Community Choice Electricity

BCCE

BOSTON COMMUNITY CHOICE ELECTRICITY

- For buildings with small businesses and residential tenants Boston Community Choice Electricity provides an **affordable and easy way to procure renewable energy**

- In the past 4 years, Boston Community Choice Electricity **Green 100** average rate has **equaled the default Eversource** rate for residential service.

    - BCCE Green 100 = 100% renewable energy
    - BCCE Standard (default) = 42% renewable energy
    - BCCE Basic = 27% renewable energy
        - *(meets current MA requirements)*
    - Eversource Basic Service = 27% renewable energy
        - *(meets current MA requirements)*

PROCUREMENT STRATEGIES

PPAS

POWER PURCHASE AGREEMENTS

- **Longer-term agreements** to develop new renewable energy outside of New England allow for **potentially lower rates**
- The **additionality requirement** ensures new clean energy projects will come online in regions that need it the most
- Typically suitable for larger energy buyers, under BERDO, **smaller projects will be able to-opt into pre-existing PPAs** with the same terms and conditions

MASS CLASS 1 RECS

RENEWABLE ENERGY CREDITS

- Renewable energy is produced within the New England and **meet rigorous standards**

PROCUREMENT STRATEGIES

RENEWABLES

SOLAR, THERMAL AND WIND TURBINE

- The **return on investment for on-site PV** can take as little as 4-6 years.
- On-site renewables help drive down overall compliance costs and in some cases **lead to lower operational costs** (especially for smaller projects) or can be cash positive in year one depending upon programs and financing.
- Advancements in geothermal and solar thermal technologies offer **efficient solutions for heat, cooling and domestic hot water production**.

Alternative Compliance Payments (ACP)

ACPS

ALTERNATIVE COMPLIANCE PAYMENTS

- Alternative Compliance Payments in BERDO are set at **$234/metric ton of CO2e**
- Alternative Compliance Payments in **BERDO can serve as a backstop estimate** of compliance costs to help with financial planning
- Alternative Compliance Payments contribute to the Boston's **Equitable Emissions Investment Fund**

Side Note: How is the City complying with its own buildings?

- Fossil fuel free new buildings Executive Order signed in 2023 goes beyond specialized stretch code.
- Installing first geothermal for City project with intention for additional deployment
- 2.3 MW of solar installed on City property
- Actively pursuing renewable energy supply contracts with target for 100% renewable electricity by 2030.

Presentation Outline

4 Recap

Feedback from continued engagement

1. Renewable energy procurement new and complex for some building owners, particularly affordable housing. Technical assistance and procurement support from the City is needed.
2. Cost estimates for affordable housing are small, but all costs are critical.
3. Understanding of how NZC zoning fits into BERDO (which includes hardship pathways) is important to planning.
4. We have heard support for the embodied carbon reporting component of NZC zoning.

Questions