

# **BUILDINGENERGY BOSTON**

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## **Go All-Electric: Decarbonizing Public Housing in Boston**

**Pallavi Mantha (Arup)  
Joel Wool (Boston Housing Authority)**

**Curated by Emily Dillon (Elevated Design)**

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**Northeast Sustainable Energy Association (NESEA) | March 19, 2024**



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BOSTON HOUSING AUTHORITY

# Decarbonizing Public Housing in Boston



**Joel Wool**

Deputy Administrator for Sustainability and Capital Transformation  
Boston Housing Authority



**Pallavi Mantha**

Americas East Climate and Sustainability Service Lead  
Arup

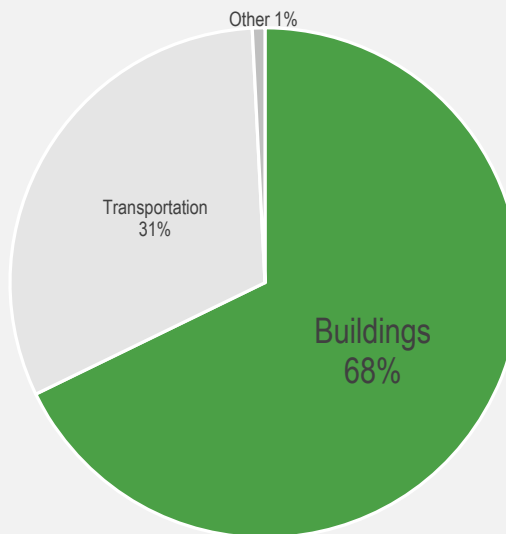
# Why decarbonize?

The building sector represents the largest source of emissions in the City of Boston and the second largest source of emissions in the Commonwealth

BHA is one of the largest property owners in the state with over 500 buildings throughout the City of Boston

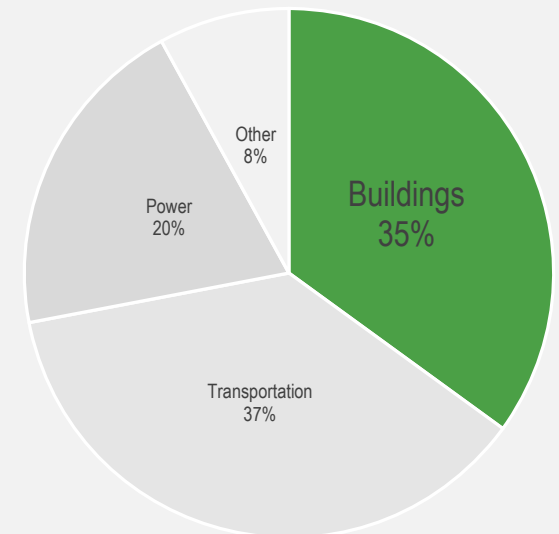
In January 2023, the Mayor of Boston, Michelle Wu, directed BHA to go Fossil Free.

68% of Citywide Emissions



2021 Boston Community-Wide Emissions

35% of Statewide Emissions



2020 Mass DEP Inventory Data

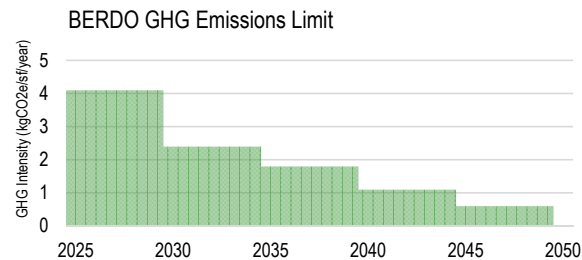
# Why decarbonize?

To meet BHA's fossil-fuel free mandate, BHA is seeking to electrify by 2030 or the earliest feasible year.

Reducing local emissions and improving efficiency in public housing has health and economic benefits.

## Regulatory drivers of change

- Fossil Fuel Free Public Housing target
- Building Energy Reporting and Disclosure Ordinance (BERDO 2.0)



## Resident health and wellbeing

- Indoor Air Quality and Health Equity
- Thermal Comfort

## Other drivers of change

- The energy system is undergoing rapid transformation
- Additional drivers:



Climate-driven impacts and other hazards (heat, floods, cyber, etc.)



Moving energy generation away from fossil fuels towards renewable sources



Building and transportation electrification



Aging infrastructure seeing increasing energy demands



Sociodemographic, economic, and political forces like population growth, migration, and war can impact energy demand, availability and cost



# BHA's building stock

## Portfolio snapshot



# BHA's building stock

## Portfolio snapshot

### Developments

**59** in scope developments

### Buildings

**519** in scope buildings

### Units

**9,476** in scope units

Over **50%** of all units in **Walk-Up** buildings

**75% of all BHA buildings are 60 years old or older.**

**16%** of the total BHA population is age 5 or less;

**9%** of all BHA households contain at least one child under the age of 5.

**34%** of the total BHA population is aged 65 and older, while

**45%** of all BHA households contain at least one resident aged 65 and up.

# BHA's building stock

## Portfolio snapshot

All buildings were grouped into 4 archetypes for this study, representing 100% of the BHA building stock by floor area.



**WALK-UP**



**HIGH-RISE**



**GARDEN STYLE**



**OFFICE**



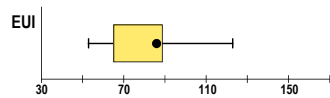
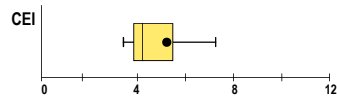
# A portfolio represented by 4 archetypes



60% of total area  
57% of total emissions

## WALK-UP

|                 |            |
|-----------------|------------|
| Typical Floors  | 3          |
| Typical Systems |            |
| Space Heat      | Gas Boiler |
| DHW             | Gas Boiler |
| Cooling         | Tenant A/C |
| Cooking         | Gas Stove  |



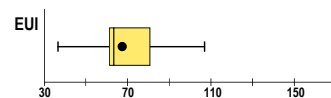
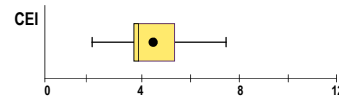
EUI in kBtu/sf/yr  
CEI in kgCO<sub>2</sub>e/yr



30% of total area  
25% of total emissions

## HIGH-RISE

|                 |            |
|-----------------|------------|
| Typical Floors  | 6-20       |
| Typical Systems |            |
| Space Heat      | Gas Boiler |
| DHW             | Gas Boiler |
| Cooling         | Tenant A/C |
| Cooking         | Gas Stove  |



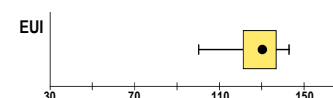
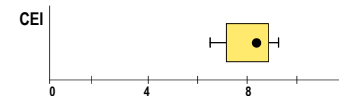
EUI in kBtu/sf/yr  
CEI in kgCO<sub>2</sub>e/yr



10% of total area  
17% of total emissions

## GARDEN STYLE

|                 |            |
|-----------------|------------|
| Typical Floors  | 2          |
| Typical Systems |            |
| Space Heat      | Gas Boiler |
| DHW             | Gas Boiler |
| Cooling         | Tenant A/C |
| Cooking         | Gas Stove  |



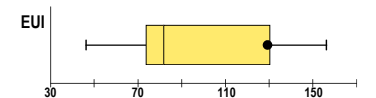
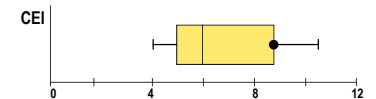
EUI in kBtu/sf/yr  
CEI in kgCO<sub>2</sub>e/yr



<1% of total area  
1% of total emissions

## OFFICE

|                 |             |
|-----------------|-------------|
| Typical Floors  | 1           |
| Typical Systems |             |
| Space Heat      | Gas Boiler  |
| DHW             | Gas Boiler  |
| Cooling         | Window Unit |
| Cooking         | NA          |







EUI in kBtu/sf/yr  
CEI in kgCO<sub>2</sub>e/yr

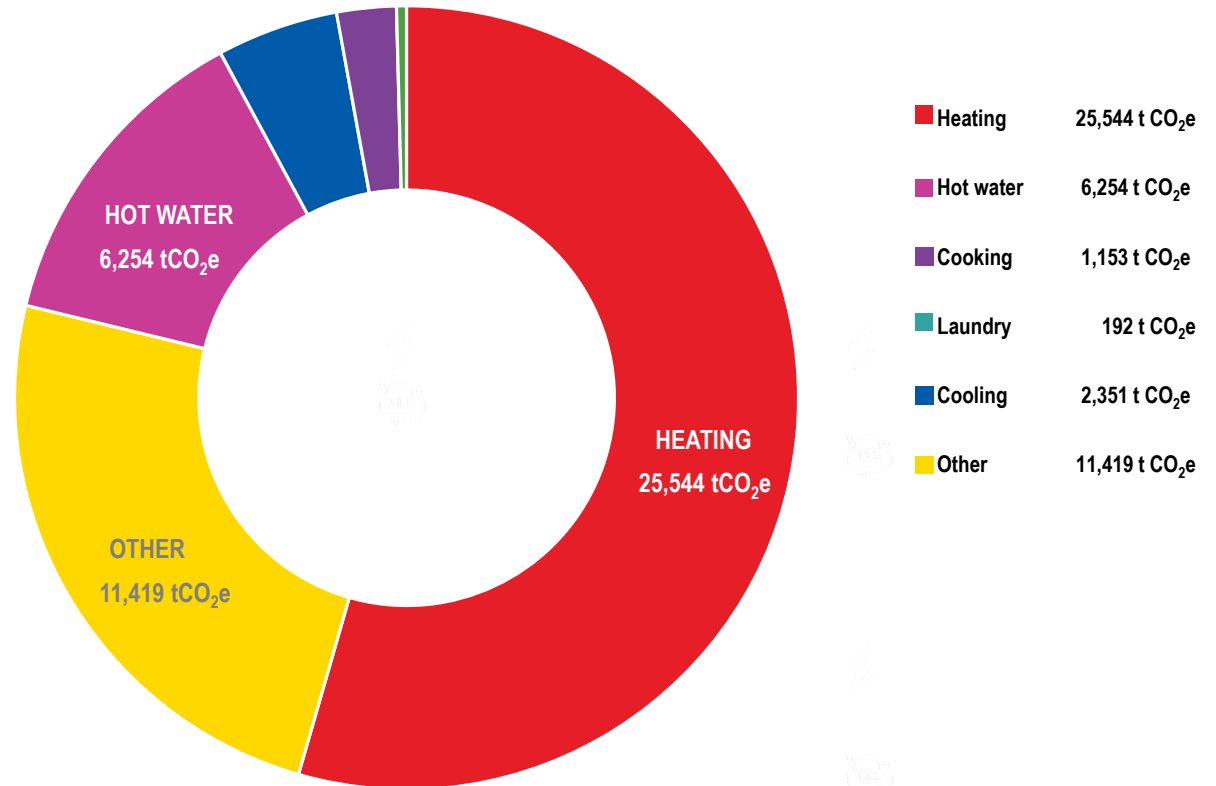
# BHA's building stock

## Portfolio emissions by end use

### Key Stats

Over half of all portfolio emissions are associated with providing space heating.

|  |  |
|--|--|
|  Space heating | 54% of total portfolio emissions<br>93% of which are Scope 1 |
|  Hot water     | 13% of total portfolio emissions<br>93% of which are Scope 1 |
|  Cooking       | 3% of total portfolio emissions<br>59% of which are Scope 1  |
|  Laundry       | <1% of total portfolio emissions<br>10% of which are Scope 1 |
| Cooling  | 5% of total portfolio emissions<br>0% of which are Scope 1   |
| Other  | 24% of total portfolio emissions<br>0% of which are Scope 1  |



# Electrification is essential to operate fossil fuel-free

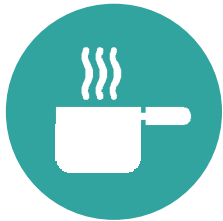
## End uses to be electrified



Space heating



Domestic hot water



Cooking

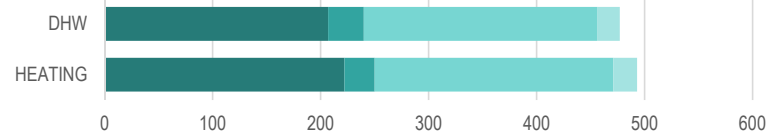


Clothes washing & drying

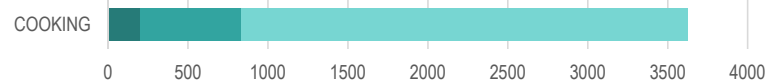
### Building End Uses to be Electrified

■ Garden Style ■ High-Rise ■ Walk-Up ■ Office

Number of Buildings which require Heating and DHW electrification



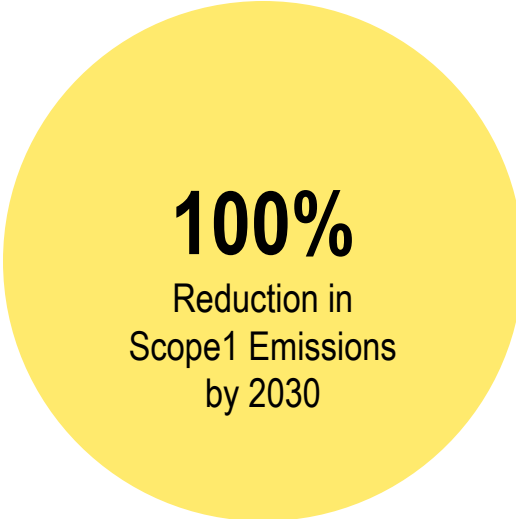
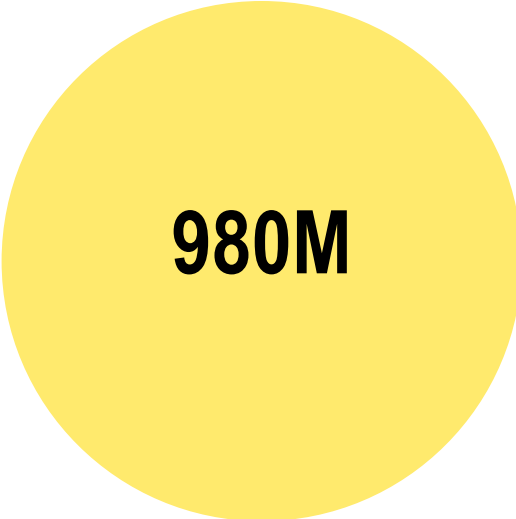
Number of Dwelling Units which require cooking electrification



Number of Dryers that require electrification

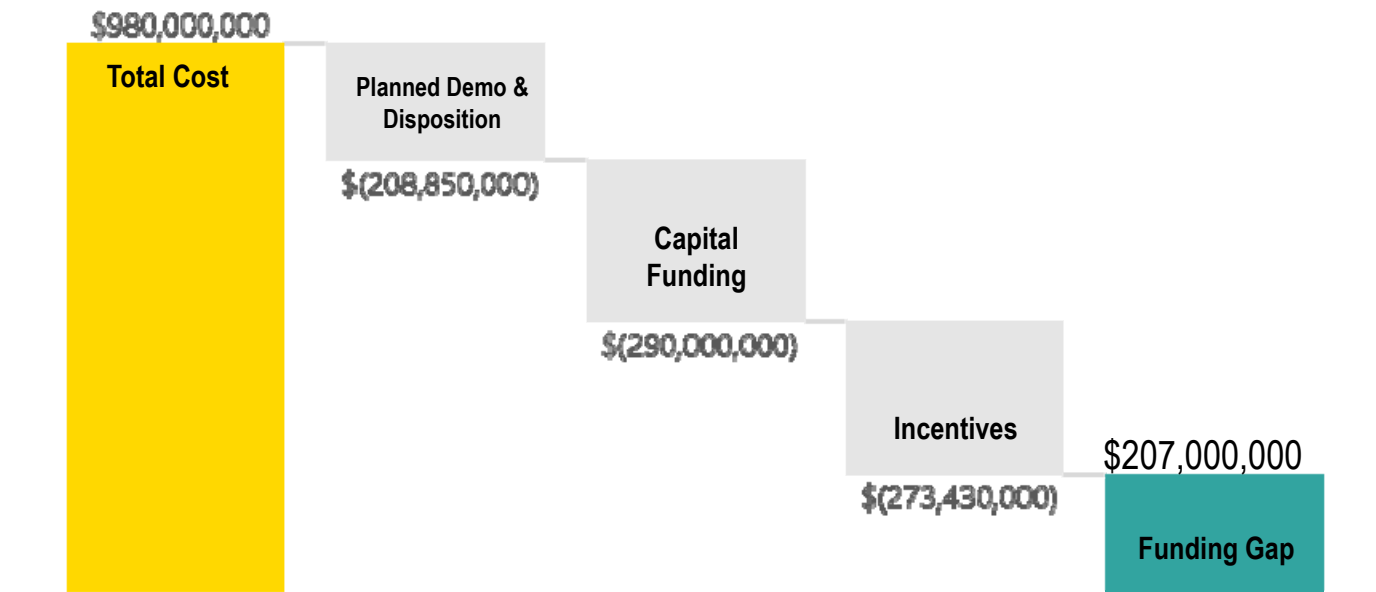


# A Roadmap to 2030



# A Roadmap to 2030

A funding gap of ~20% or ~207M has been identified.





# A Roadmap to 2030

\$980M to decarbonize 9,476 in scope dwelling units over seven years

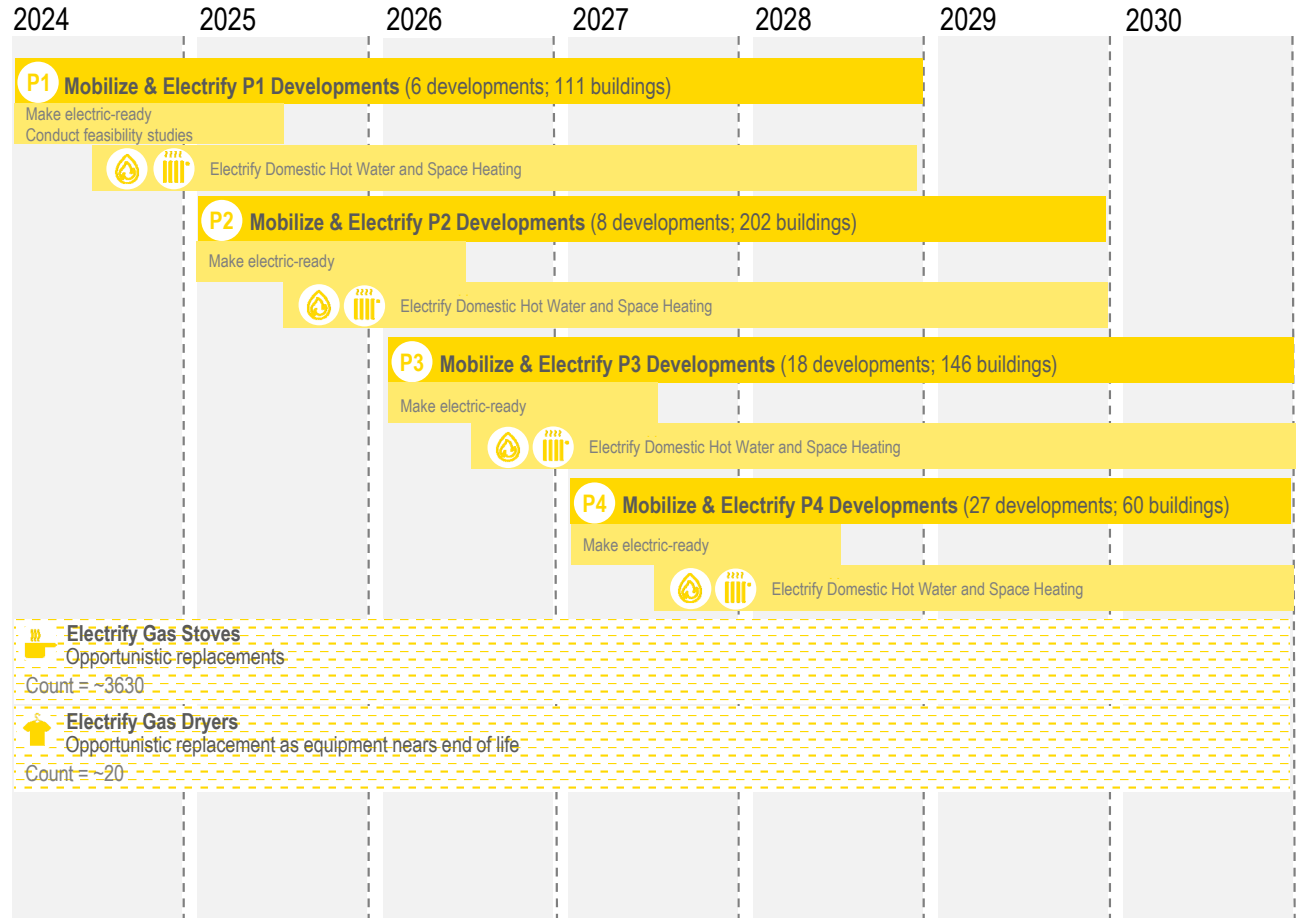
Average cost \$105.5k per unit to decarbonize

100% reduction in scope 1 carbon emissions by 2030

44% reduction in total carbon emissions (Scope 1 + 2) by 2030 with 2023 carbon emissions factor

49% reduction in total carbon emissions (Scope 1 + 2) by 2030 with 2030 carbon emissions factor

53% reduction in energy use across the portfolio by 2030



# A Roadmap to 2030

\$980M to decarbonize 9,476 in scope dwelling units over seven years

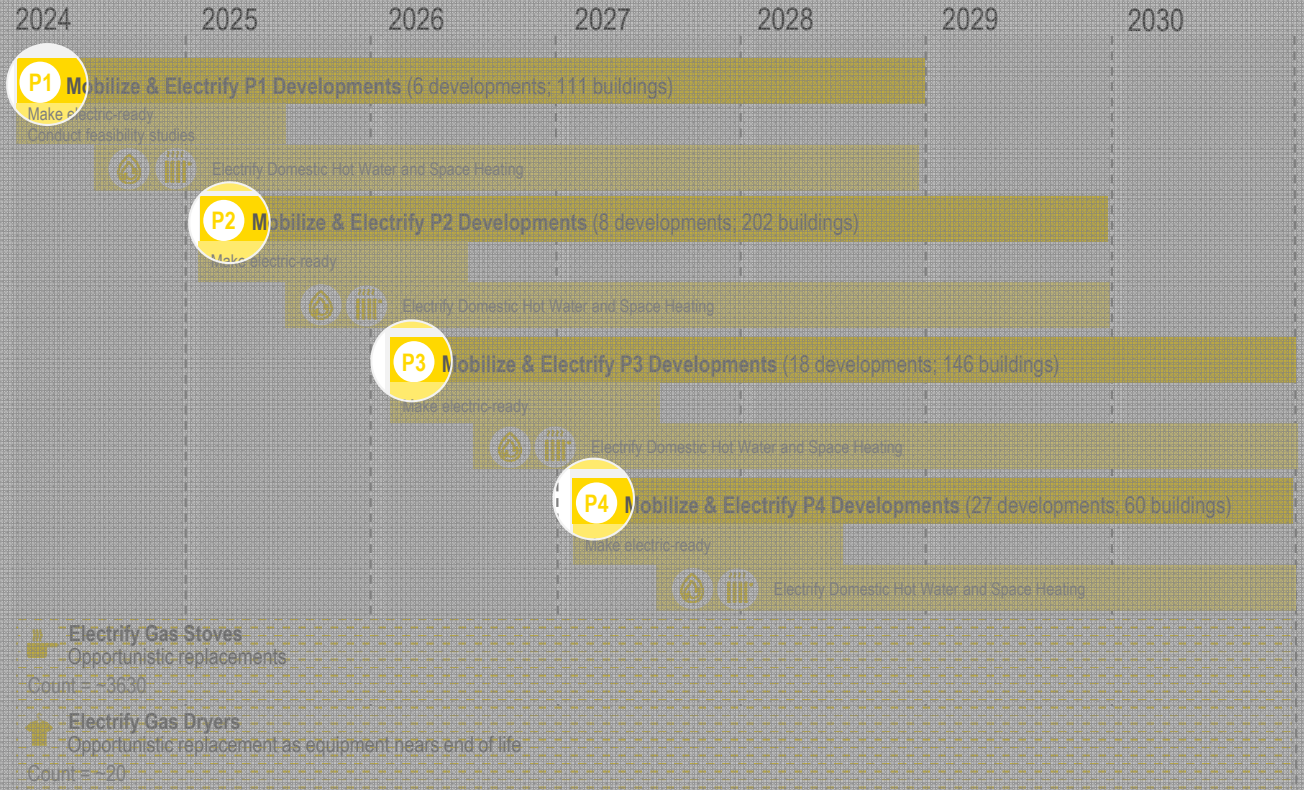
Average cost \$105.5k per unit to decarbonize

100% reduction in scope 1 carbon emissions by 2030

44% reduction in total carbon emissions (Scope 1 + 2) by 2030 with 2023 carbon emissions factor

49% reduction in total carbon emissions (Scope 1 + 2) by 2030 with 2030 carbon emissions factor

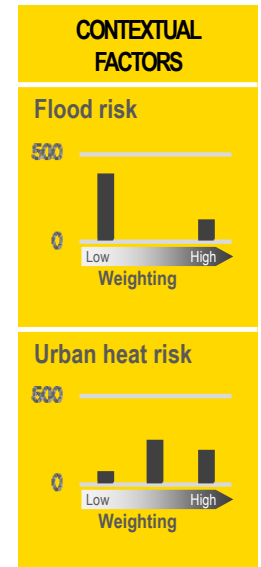
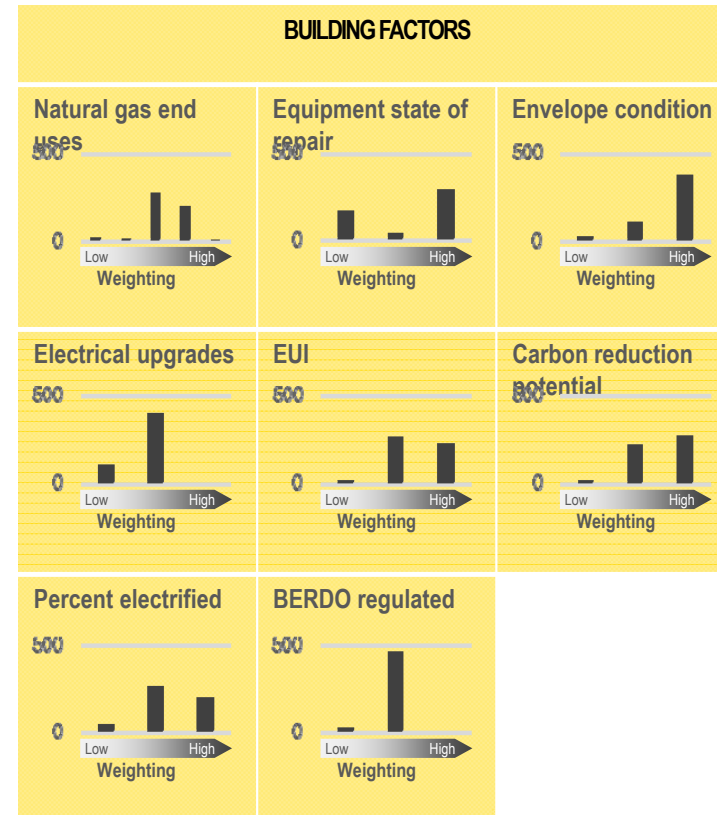
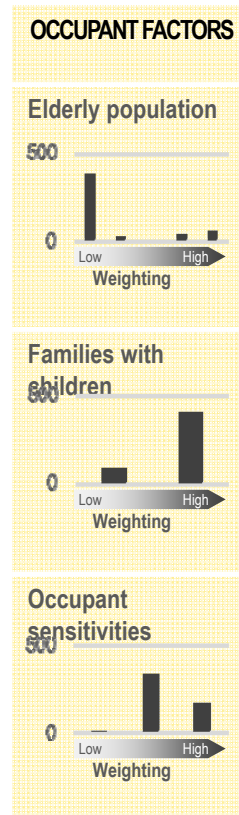
53% reduction in energy use across the portfolio by 2030



# Prioritization criteria

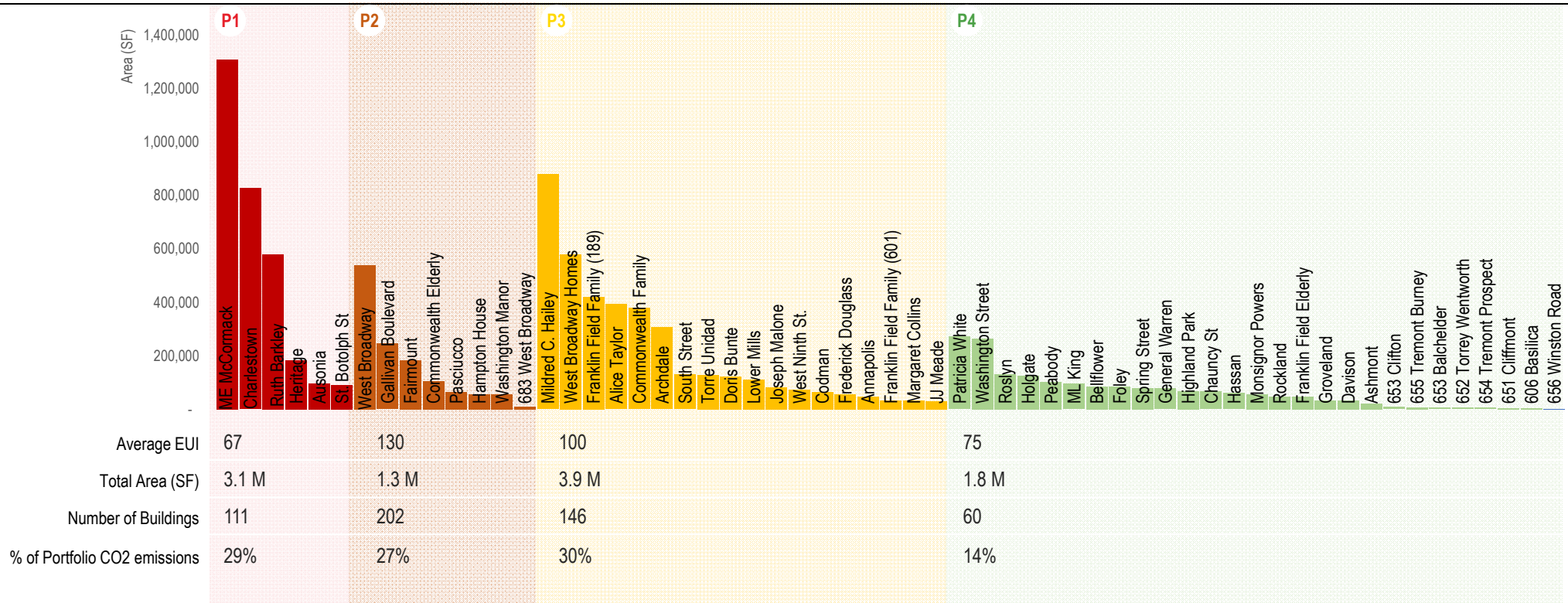
A range of prioritization criteria were used to categorize the BHA buildings into priority groups. The analysis of the prioritization weighting sensitivity revealed the following prioritization criteria **as the most influential** due to their combined overall weighting and quantile characteristics:

- Natural gas end uses
- EUI
- Carbon reduction potential
- Percent electrified



# Prioritizing BHA developments

Each development was individually scored against a set of priority criteria and then grouped into four priority buckets.

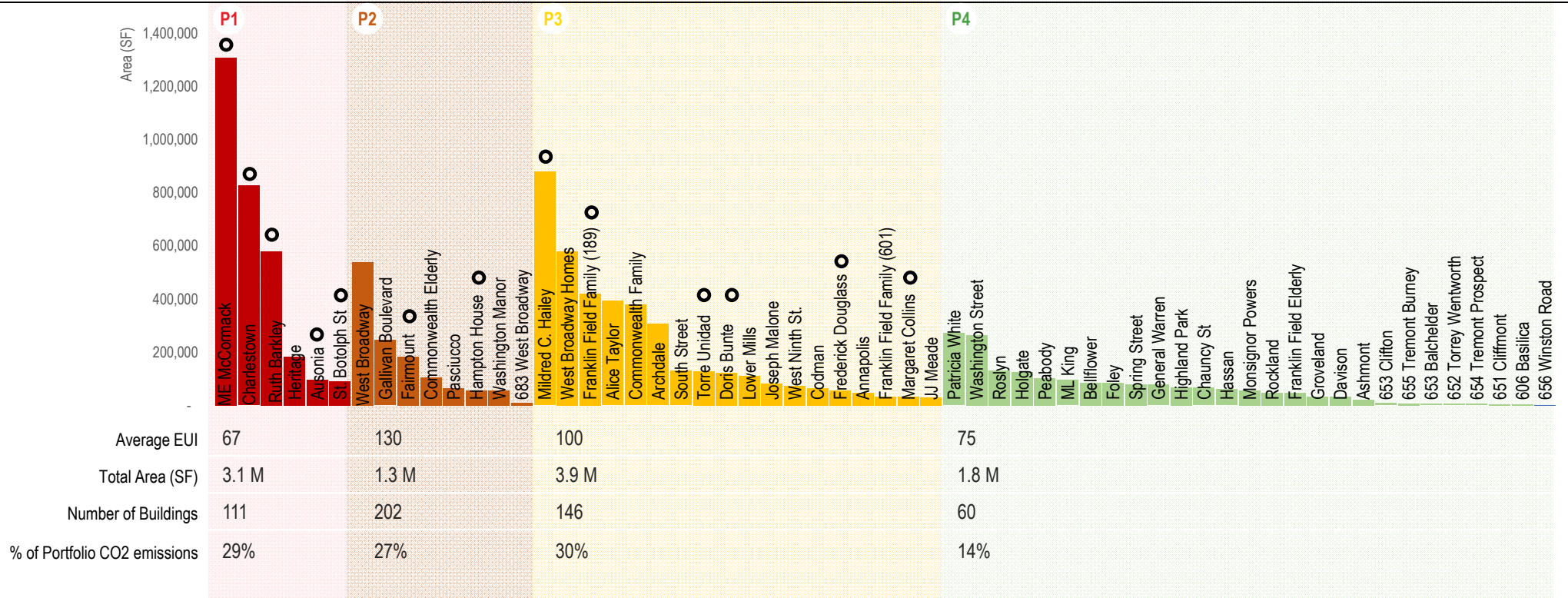




# Prioritizing BHA developments

Each development was individually scored against a set of priority criteria and then grouped into four priority buckets.

○ Planning + implementation In-progress









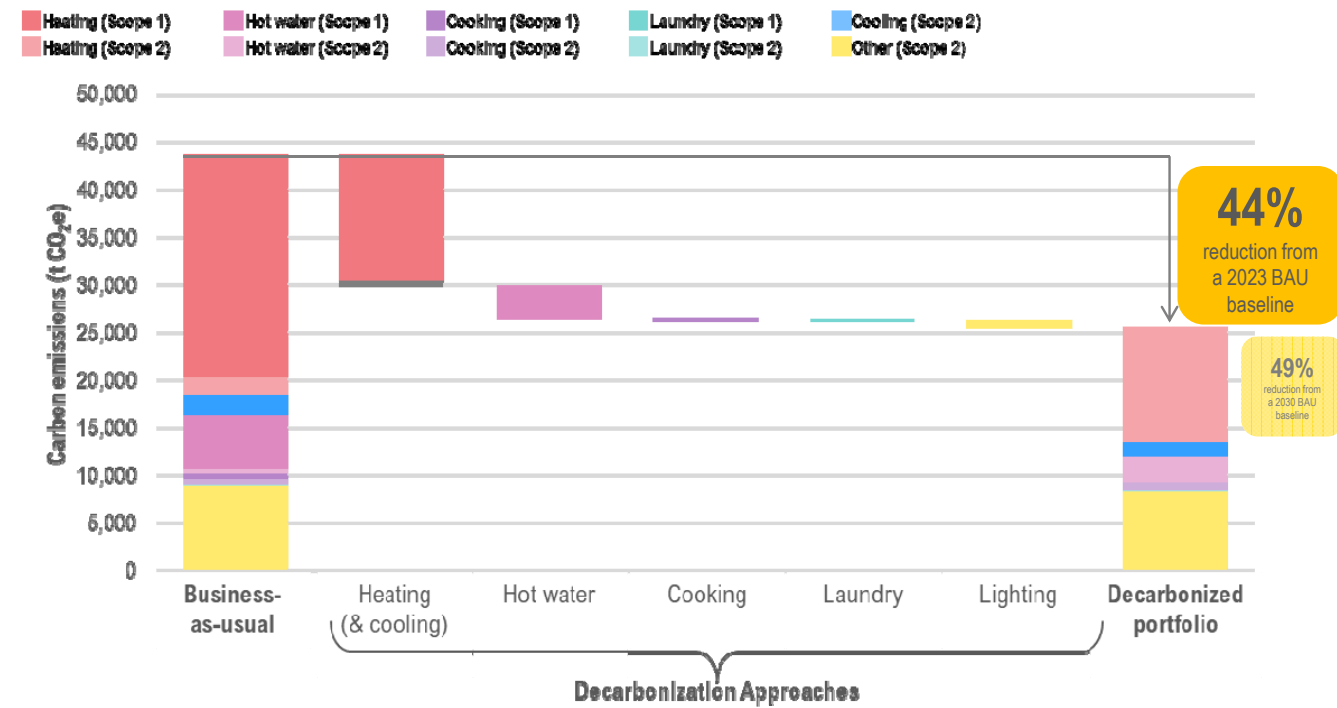
# A roadmap to 2030

## Carbon emissions reductions

### Key Stats

|  |   |
|--|---|
|  Space heating | 100% reduction in Scope 1 emissions<br>41% reduction in Scope 1+2 emissions |
|  Hot water     | 100% reduction in Scope 1 emissions<br>49% reduction in Scope 1+2 emissions |
|  Cooking       | 100% reduction in Scope 1 emissions<br>22% reduction in Scope 1+2 emissions |
|  Laundry       | 100% reduction in Scope 1 emissions<br>6% reduction in Scope 1+2 emissions  |
| Cooling  | 0% reduction in Scope 1 emissions<br>25% reduction in Scope 1+2 emissions   |
| Other  | 0% reduction in Scope 1 emissions<br>7% reduction in Scope 1+2 emissions    |
| Portfolio  | 100% reduction in Scope 1 emissions<br>44% reduction in Scope 1+2 emissions |

### Portfolio End-Use Decarbonization Impacts





# South Boston Elderly Housing Retrofit

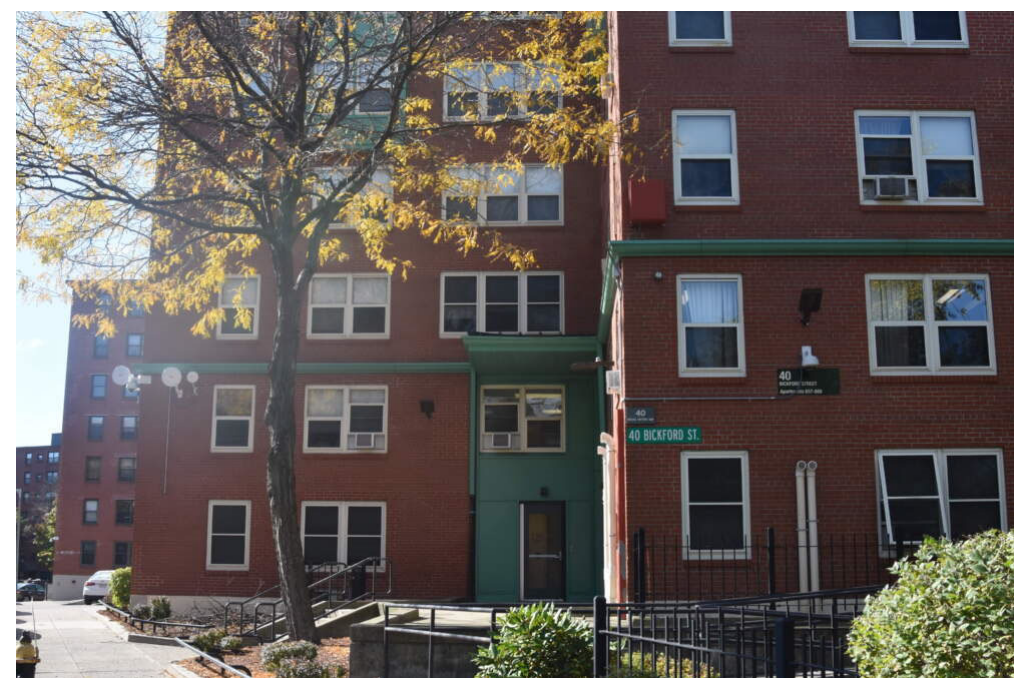
Monsignor Powers Apartments





# Projects Underway

Mildred C. Hailey Electrification / Deep Energy Retrofit



# Projects Underway

Franklin Field



## Boston Housing Authority, National Grid team up on geothermal project in Dorchester

The project could be a test case for other sites in Boston, and elsewhere in the state

By [Jon Chesto](#) Globe Staff. Updated January 25, 2024, 11:01 a.m.

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# Decarbonization Challenges

Decarbonizing Boston Public Housing is challenging but necessary

Three-quarters (75%) of all BHA buildings are 60 years old or older.

Ensuring a reliable supply of materials and contractors

Coordinating various decarbonization packages and ensuring they are effectively implemented.

Cost of electrifying older buildings, especially where extensive upgrades to the electrical infrastructure is required.

Securing funding, incentives and grants for decarbonization initiatives

Tenant relocation and disruption from temporary loss of power, construction activities, and restricted access

Administrative and project management staffing needs



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