



# Planning for Net-Zero:

# The Retrofit Playbook for Large Buildings and New Empire Building Challenge Winners Launch Event

31 Chambers Street

June 11, 2024

9:00am to 12:00pm

### speaker

**Michael Reed, Acting Head of Large Buildings, NYSERDA**

**Joe Chavez, Deputy Director, Resilient & Efficient Buildings, NYC MOCEJ**

**Brett Bridgeland, Principal, Carbon Free Buildings, RMI**

### moderator

**Jennifer Leone, Chief Sustainability Officer, NYC HPD**

**Joe Chavez, Deputy Director, Resilient & Efficient Buildings, NYC MOCEJ**

**Samantha Pearce, Vice President of Sustainability, NYS HCR**



building energy exchange



NYSERDA



Urban Land Institute

1.5 AIA LU | HSW



Retrofit Playbook for Large Buildings

[retrofitplaybook.org](http://retrofitplaybook.org)

be  
ex

building  
energy  
exchange



NEW  
YORK  
STATE

NYSERDA



Urban Land  
Institute



case study

**Empire State Building**  
**New York City icon reaches for carbon neutrality**

Empire State Realty Trust

Multi-use building Office Retail



case study

**345 Hudson**  
**Nordic design principles applied to New York real estate**

Hudson Square Properties

Office



case study

**Whitney Young Manor**  
**Recapitalization to achieve carbon neutral affordable housing**

Paths Development LLC

Affordable multifamily

Mixed income multifamily



case study

**The Heritage**  
**Fully occupied mixed-income property pursues facade retrofit**

L+M

Affordable multifamily

Mixed income multifamily



case study

**The Victory**  
**Energy conservation analysis at midtown tower**

Empire State Realty Trust

Mixed income multifamily

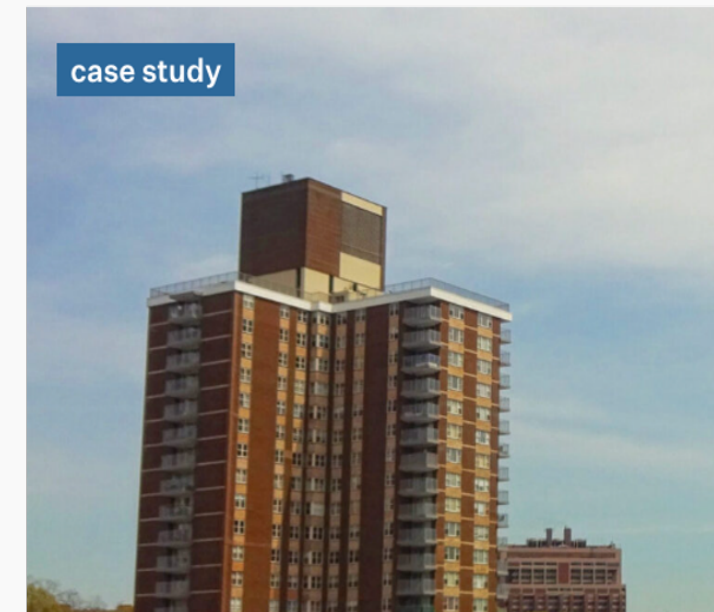


case study

**PENN 1**  
**Innovative heat recovery project for carbon emissions reduction**

Vornado

Multi-use building Office Retail



case study

**The Towers**  
**Oldest US multifamily co-op transforms wastewater into clean energy**

Amalgamated Housing Corporation

Affordable multifamily



case study

**59-17 Junction Boulevard**  
**Updating end-of-life equipment to enhance resilience and decarbonize**

Lefrak

Office



case study

**660 Fifth Avenue**  
**High-rise implements heat pumps and outdoor air systems for decarbonization**

Brookfield Properties

Office



case study

**601 Lexington Avenue**  
**Iconic midtown tower modernizes by recycling heat**

Boston Properties

Multi-use building Office Retail



# Planning for a zero emissions future.

Follow the 3-step strategic planning approach to generate an action plan for your building.

## Step 1:

**Examine Current Conditions**

## Step 2:

**Design Resource Efficient Solutions**

## Step 3:

**Build the Business Case**



# Step 1: Examine Current Conditions

Building System Conditions



Asset Conditions



Market Conditions





# Step 1: Examine Current Conditions

## Building System Conditions



- Equipment nearing end of life
- New heat source potential
- Shifting tenant loads
- Poor indoor air quality
- Façade maintenance
- Resilience upgrades

## Asset Conditions



- Repositioning
- Recapitalization
- Capital event cycles
- Tenant turnover/vacancy
- Carbon emission limits
- Tenant and investor sustainability demands

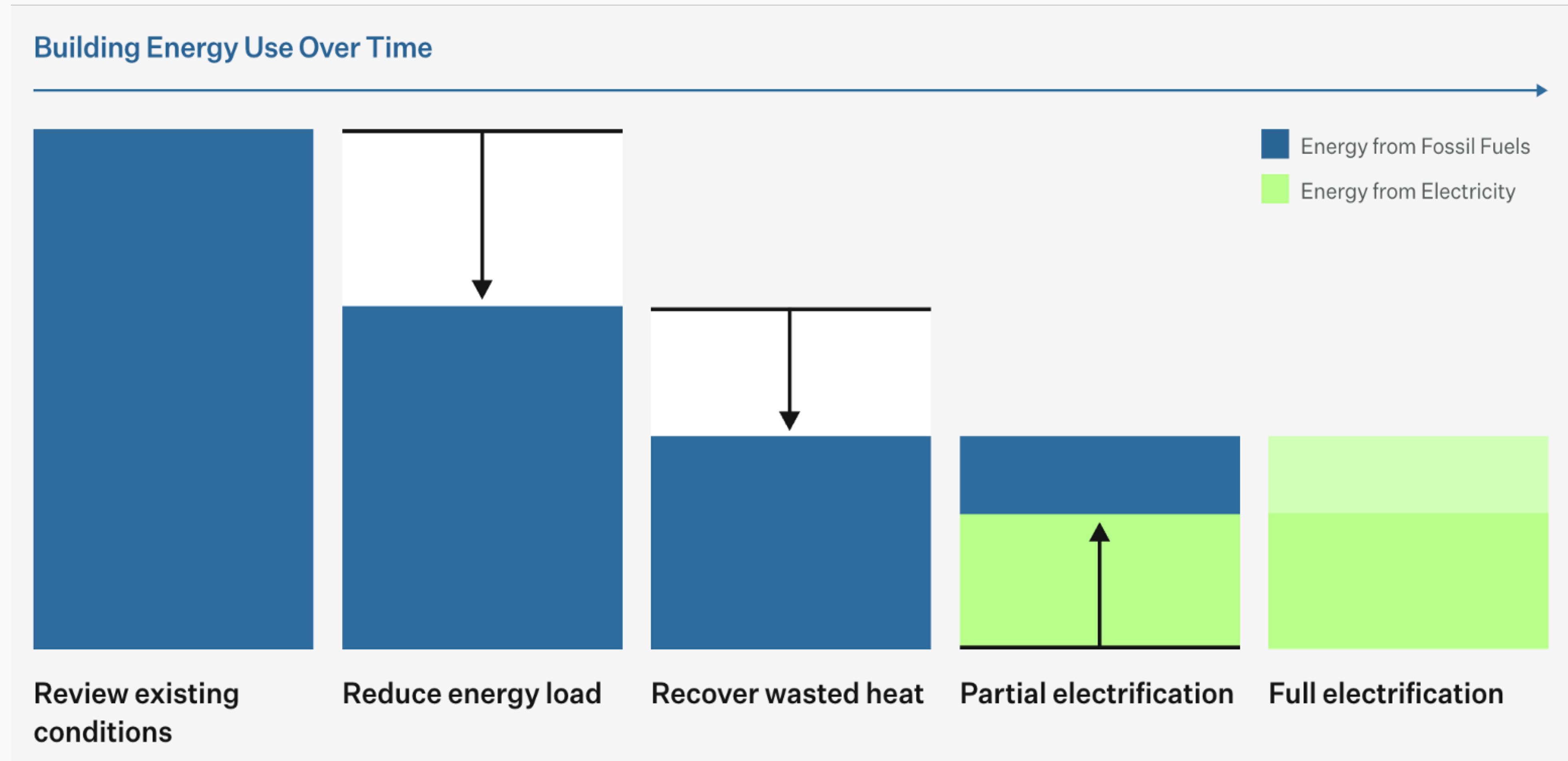
## Market Conditions



- Technology improves
- Market supply and demand changes
- Policy advances
- Utility prices fluctuate
- Infrastructure transitions
- Fuels phase out
- Assets are stranded



# Step 2: Design Resource Efficient Solutions





# Step 3: Build the Business Case



Retrofit Costs



Avoided Cost



Avoided Risks



Added Value



Net Present Value





# Step 3: Build the Business Case



## Retrofit Costs

- Reduce loads
- Reconfigure systems
- Recover heat
- Partial electrification
- Full electrification



## Avoided Cost

- Routine maintenance
- Equipment replacement
- Fit-outs
- Refreshes
- Repositioning
- Cooling and ventilation improvements



## Avoided Risks

- Tenant retention
- Energy prices
- Fines
- Regulations
- Valuation
- Reputation
- Obsolescence
- Stranded assets



## Added Value

- Incentives
- Valuation
- Exit yield
- Sustainability
- Green leases
- Insurance access
- Debt capital access

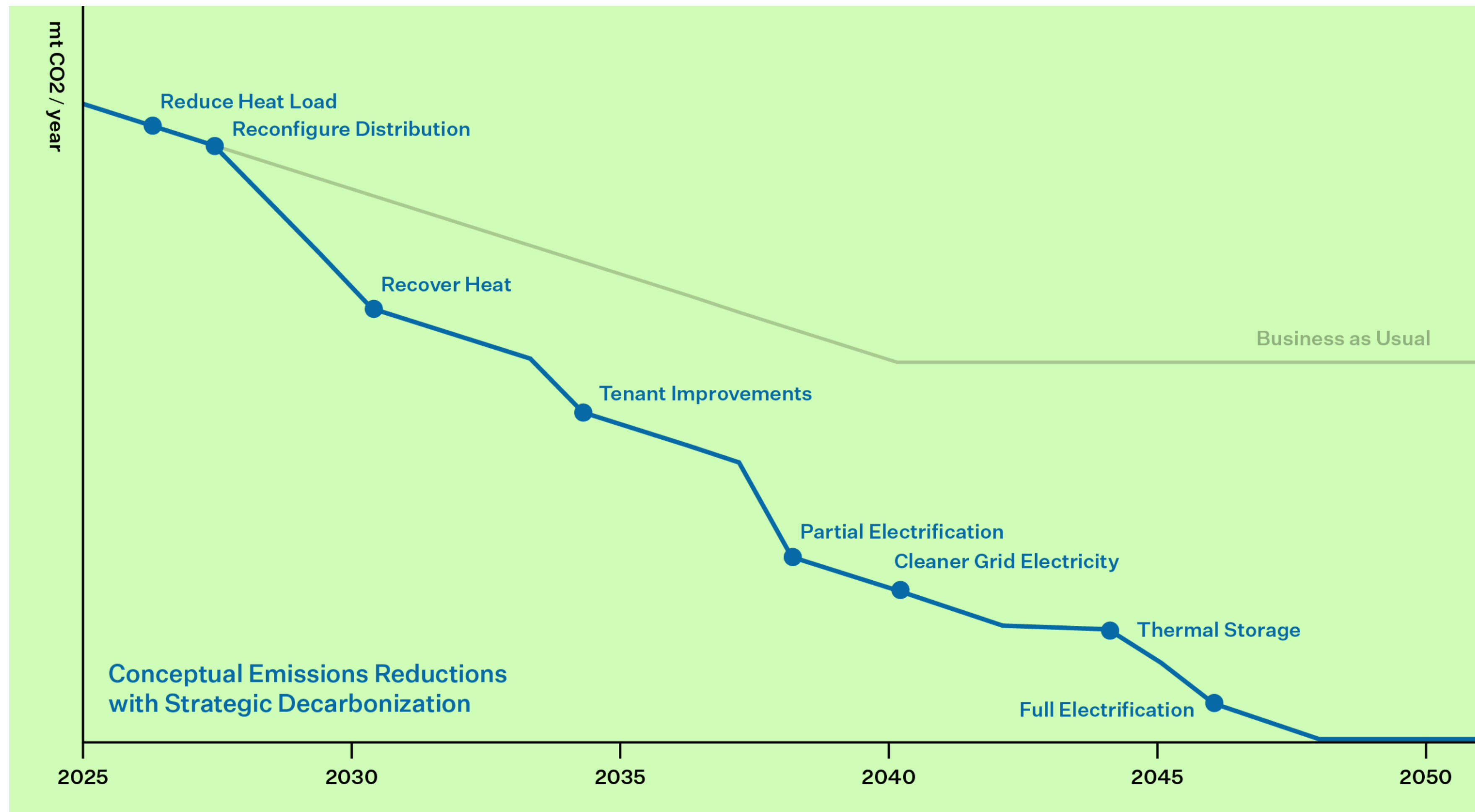


## Net Present Value

- Resilience
- Thermal comfort
- Cooling
- Ventilation
- Occupant health
- Reputation



# Output: Strategic Decarbonization Action Plan





# Case Study: The Towers

The Bronx, Amalgamated Housing Cooperative (AHC)

- Two 20-story buildings
- 316 affordable apartments
- 425,000 square feet
- Established 1927
- Oldest limited equity multifamily co-op in the country





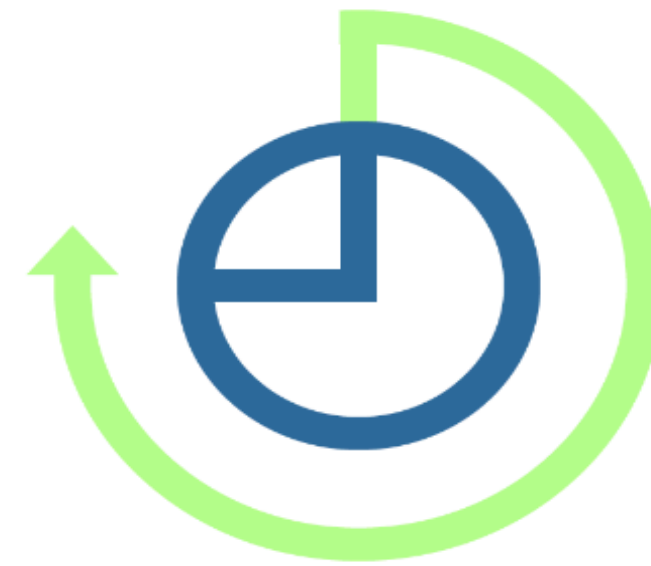
# Step 1: Examine Current Conditions

## Building System Conditions



- System Failure
- Equipment nearing end-of-life
- New heat source potential
- Comfort improvements
- Indoor air quality improvements
- Facade maintenance
- Resilience upgrades
- Efficiency improvements

## Asset Conditions



- Recapitalization
- Capital event cycles
- Carbon emissions limits
- Investor sustainability demands
- Owner sustainability goals

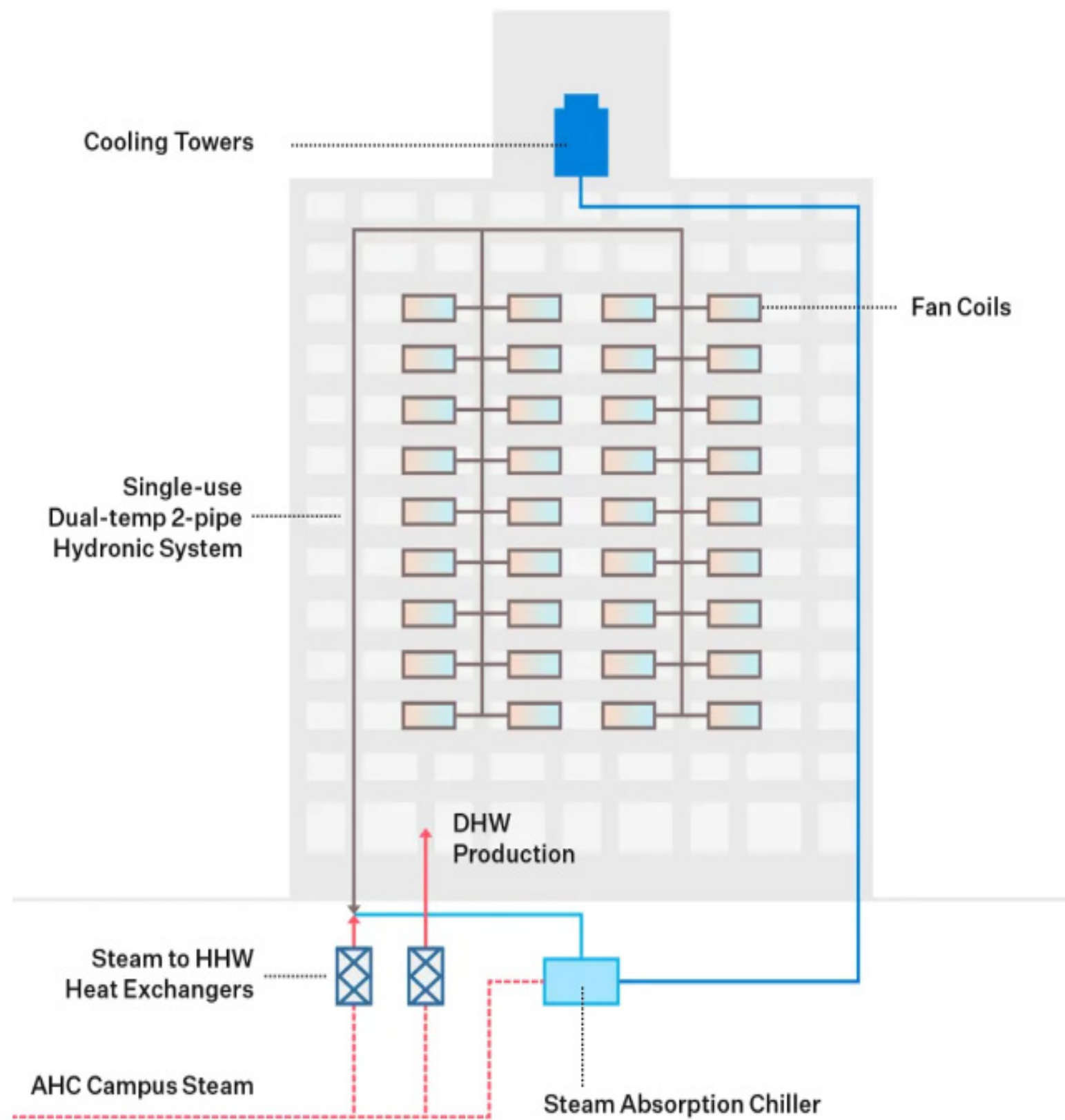
## Market Conditions



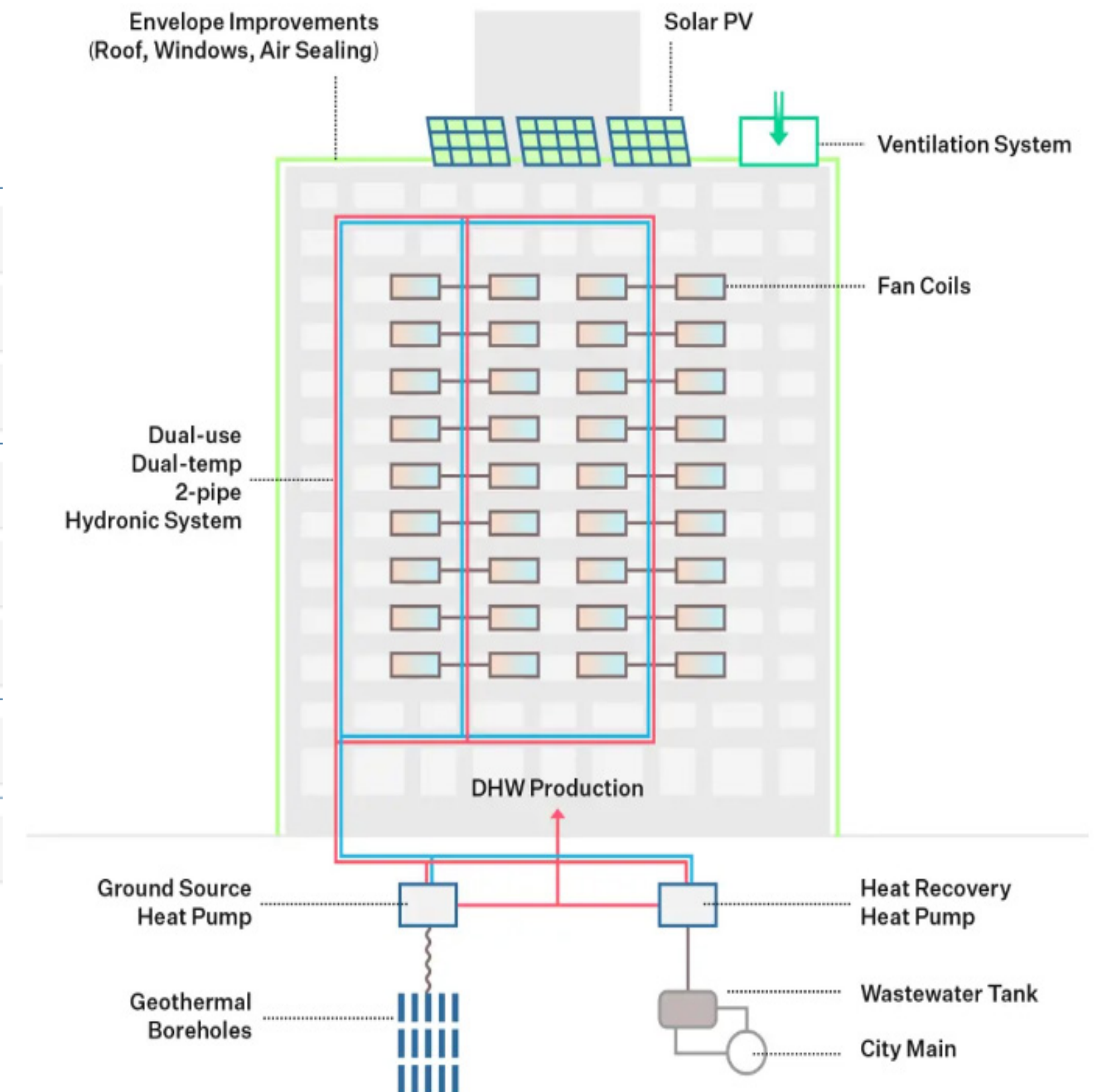
- Technology improves
- Policy changes
- Infrastructure transitions
- Fuels phase out



# Step 2: Design Resource Efficient Solutions



2024	<ul style="list-style-type: none"> <li>Retrofit Dual-Temp Hydronic System</li> <li>Wastewater Energy Transfer (WET) System</li> <li>Ventilation System Maintenance</li> </ul>
2026	<ul style="list-style-type: none"> <li>Envelope Improvements</li> <li>Geothermal System</li> <li>Submetering and Controls Upgrades</li> </ul>
2028	<ul style="list-style-type: none"> <li>Solar PV</li> </ul>
2030	<ul style="list-style-type: none"> <li>Laundry and Cooking Appliance Electrification</li> </ul>





# Step 3: Build the Business Case



**Retrofit Costs**

**\$33M**

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Capital costs of decarbonization.



**Avoided Cost**

**\$29.5M + \$35k / YR**

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BAU cost of system replacement.

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Repairs & maintenance.



**Avoided Risks**

**N/A**

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LL97 fines do not apply at this property.



**Added Value**

**\$6.7M**

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Incentives.



**Net Present Value**

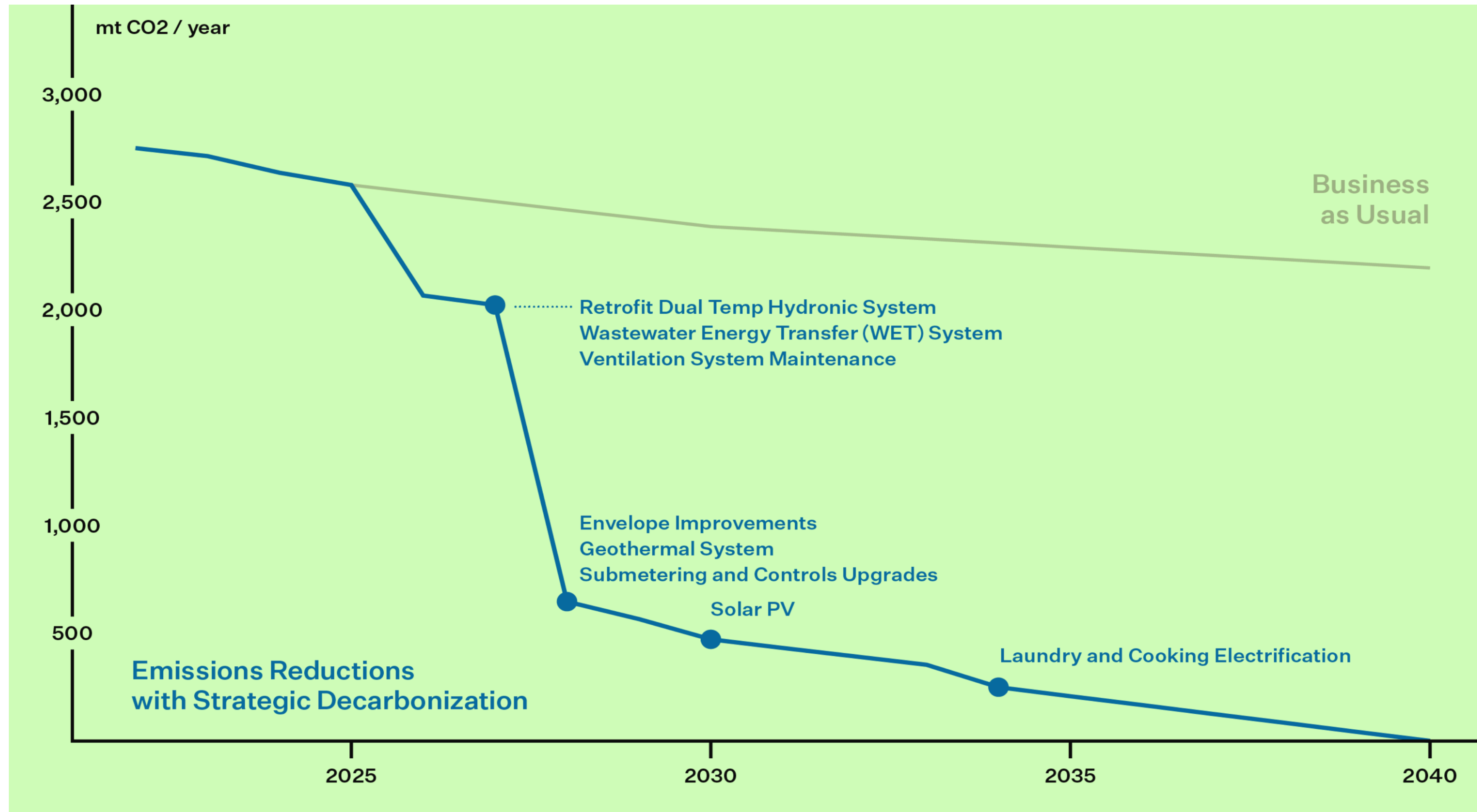
**\$1.97M**

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Versus -\$1.36M for BAU with difference of \$3.33M.



# Output: Strategic Decarbonization Action Plan





[Sign Up for Updates](#)

[Submit a Case Study](#)

[Suggest a Resource](#)

[Explore the Resource Library](#)





# Request a Design Charette

Want to review your decarbonization plan with our team of experts? Request a design charrette.

Complete the form below.

## 1 → Contact Information\*

First name \*

Jane

Last name \*

Smith

Email \*



# Planning for a zero emissions future.

A design charrette is an intensive, multi-disciplinary workshop aimed at finding and refining solutions to complex problems.

## Step 1:

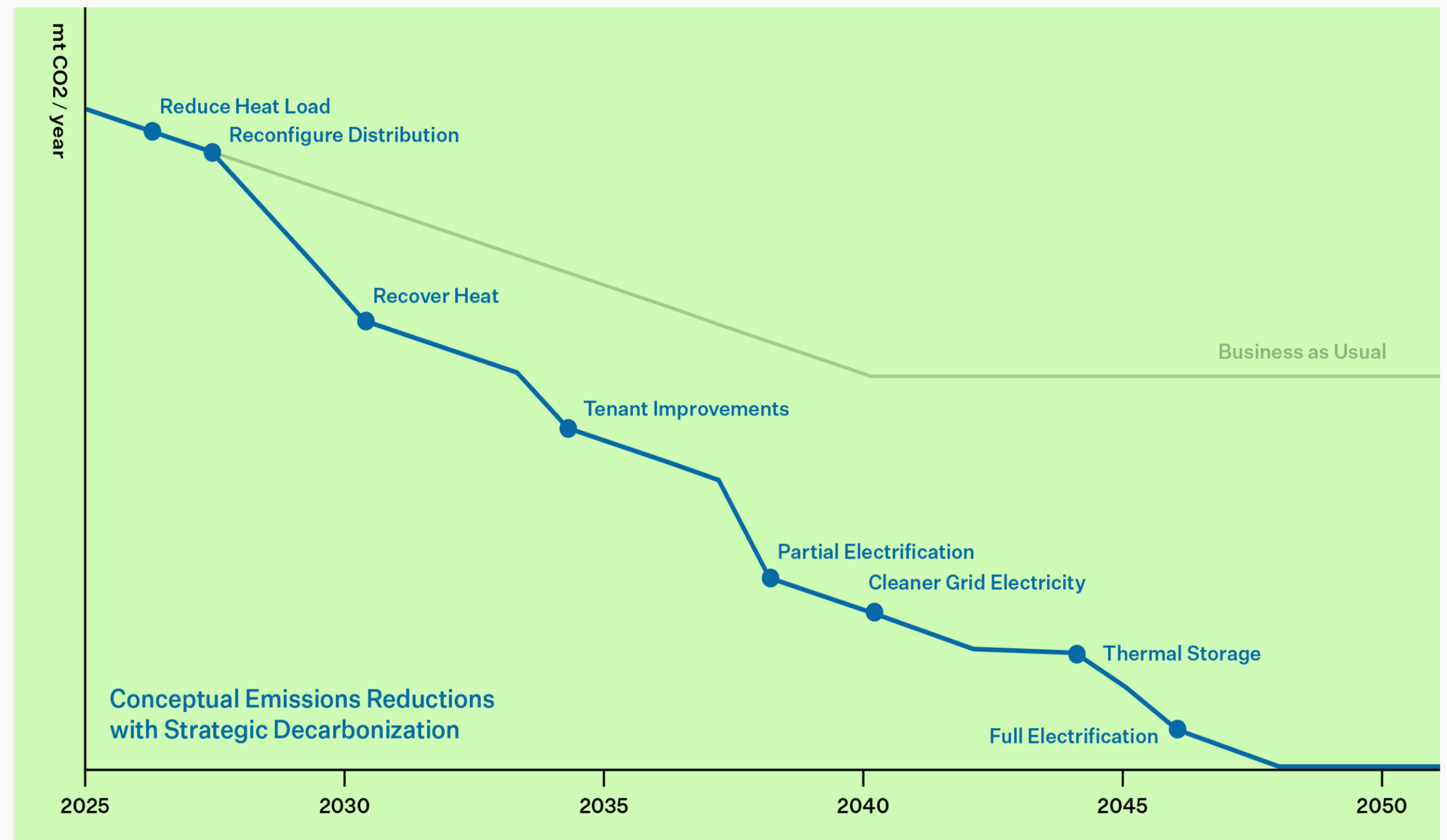
Examine Current Conditions

## Step 2:

Design Resource Efficient Solutions

## Step 3:

Build the Business Case





# EBC Charette Breakthrough Examples

## Market-Rate Multi-Family

Halted a major gas-fired infrastructure overhaul that was recognized as a future stranded asset. Now developing a thermal network transition over time.

## Office

Reimagined a planned traditional chiller investment to instead focus on heat recovery, solving cooling needs while also being the first phase of a heating transition.

## Office

Originally exploring a 1:1 replacement of heating capacity with central air-to-water heat pumps. Reimagined to a phased heating transition, including envelope, heat recovery, partial electrification. Driven by repositioning, ESG and regulatory triggers.

## Affordable Multi-Family

Originally exploring unitized ASHPs as part of recapitalization. Overhauled plans to envelope overclad and a hydronic/fancoil system with central heat pumps for heating, cooling and DHW, including heat recovery. Driven by O+M simplification and resident well-being.

On average, committed to targeting fossil fuel reductions of 97%, with the majority planning to completely eliminate fossil fuel use at the proposed buildings.

# Empire Building Challenge

## Round 3: New multifamily partners

# Empire Building Challenge

These partners collectively own **more than 1.7 million square feet** of real estate and 133,500 residential units throughout New York State, including more than 18,700 affordable housing units.

Almost all the partners are **targeting fossil fuel reductions of 96% or more**, with the majority looking to eliminate fossil fuel use completely.

- 11 partners | 9 LMI | 2 Market Rate
- Projects in all 5 boroughs | 2 upstate
- 3 senior housing



# BUILDING INFORMATION

	58 E 132	53 E 131	421 E 116
Year	2008		1997
Area	77,812	37,320	62,336
Units	61	28	63
Space heat	Natural gas hot water boilers with hydronic baseboard distribution		
Space cool	Through-Wall Sleeve AC		
DHW	DHW provided by the boilers via a heat exchanger		
Envelope	Concrete block and precast concrete plank construction, with brick veneer, and fiberglass wall insulation. Wood roof deck roof with ~R-11 cavity insulation + varying deck insulation up to R-10.		
Ventilation	Rooftop exhaust fans from baths and kitchens		
EUI Total (kbtu/sf)	54.3		67.3



58 E 132nd - ALL SAINTS



53 E 131st - ALL SAINTS



421 E 116th - MT PLEASANT



# SOLUTIONS UNDER INVESTIGATION



58 E 132nd - ALL SAINTS  
53 E 131st - ALL SAINTS



421 E 116th - MT PLEASANT

Over cladding	Windows	Space conditioning plant	Distribution	Terminal units	DHW	Ventilation
EIFS, except 2 lot-line walls (panels under consideration)	Replace	Central air-water heat pump (GSHP not feasible)	Existing heating loop	New water-water heat pumps	Water-water HP in cooling season + ASHP (WWHR not feasible)	Heat recovery for common space
EIFS, except 1 lot-line wall (panels under consideration)	Replace	GSHP	Existing heating loop + add new cooling loop	New fan coils	Waste-water heat recovery	Heat recovery for common space

# CHARTERED PROPERTIES WITH LABELLA ENGINEERING & SUNAMP TECHNOLOGIES

- Nearly 100 Brooklyn occupants residing in seven 100-year old brick buildings located in predominantly economically disadvantaged areas
- 78 Herkimer St – 4 stories, 29 units
- 226 Shafer St – 3 stories, 6 units
- 586 Wilson Ave – 3 stories, 6 units
- 1336-40 Bergen St - 4 stories, 24 units
- 1342 Bergen St - 4 stories, 16 units
- 55 Arlington St - 3 stories, 6 units
- 462 Nostrand Ave - 4 stories, 8 units



1336-40 Bergen



462 Nostrand



1342 Bergen



78 Herkimer



55 Arlington



586 Wilson

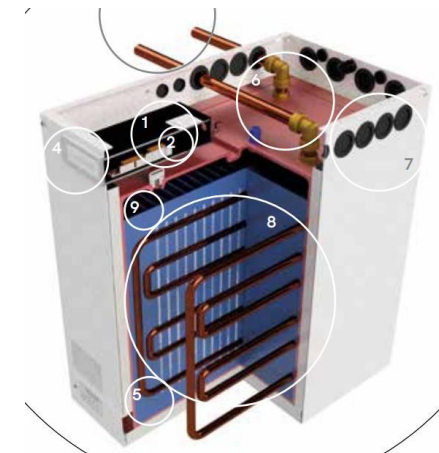
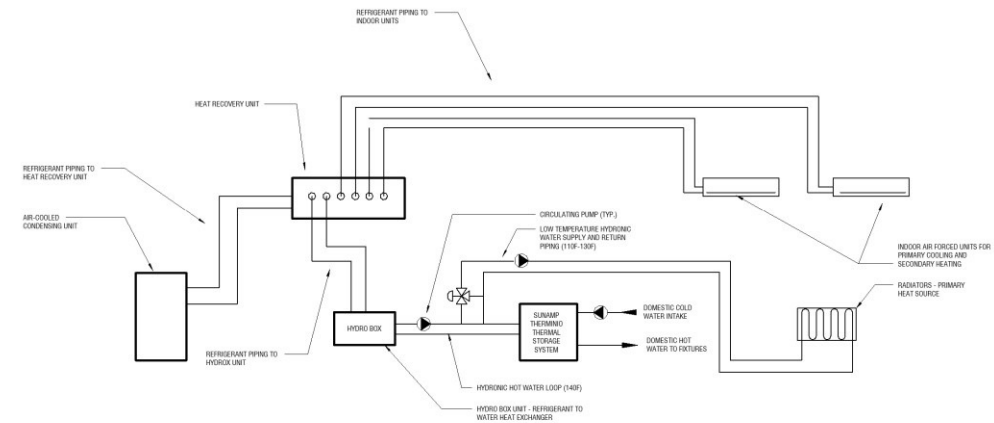


226 Schaeffer



# APPROACH TO CARBON NEUTRALITY

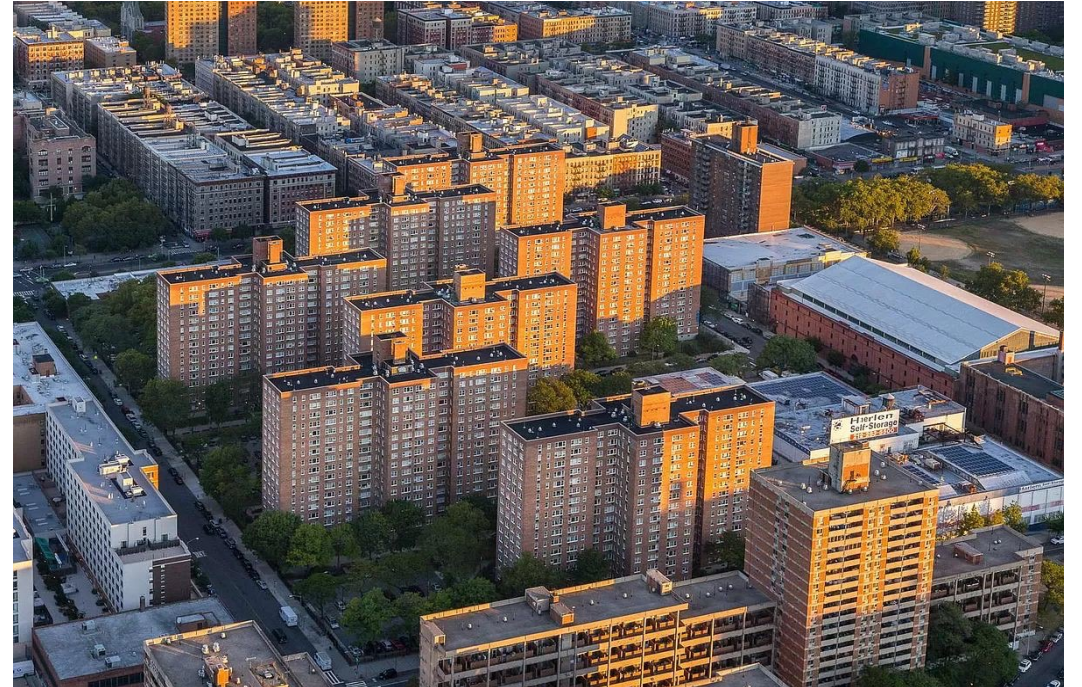
- Carbon neutrality is the effort to reduce or offset the output of carbon emissions by any source in order to provide a net neutral impact on the environment.
- NYSERDA brings together economic stakeholders with engineering experts into a guided collaboration that challenges participants to produce groundbreaking mechanical designs that deliver leading-edge decarbonization solutions for New York buildings.
- Chartered Properties aims to replace obsolete gas-fired steam heating systems throughout all seven committed buildings with high efficiency heat pump systems in conjunction with heat recovery and thermal storage systems that leverage off-peak electric use for space and water heating, energized at an 85% discount. The heat pump's rejected heat charges in-apartment thermal storage that in turn provides space and water heating, further reducing energy cost and power consumption in a manner far cleaner than carbon alternatives. Solar power integration is a long-term objective as well.



# Savoy Park

Savoy Park is a seven-building, 1,790-unit, 1,034,818 Square foot, campus-style rental property in Central Harlem. Over half of the apartments at Savoy Park are income-restricted, and every unit is rent-regulated, ensuring that the community remains affordable long-term.

Originally constructed in 1959, each 17-story elevator building features a two-pipe steam heating system supplying convector radiators which are recessed into wall cavities, and cooling is provided with through-wall air conditioners.



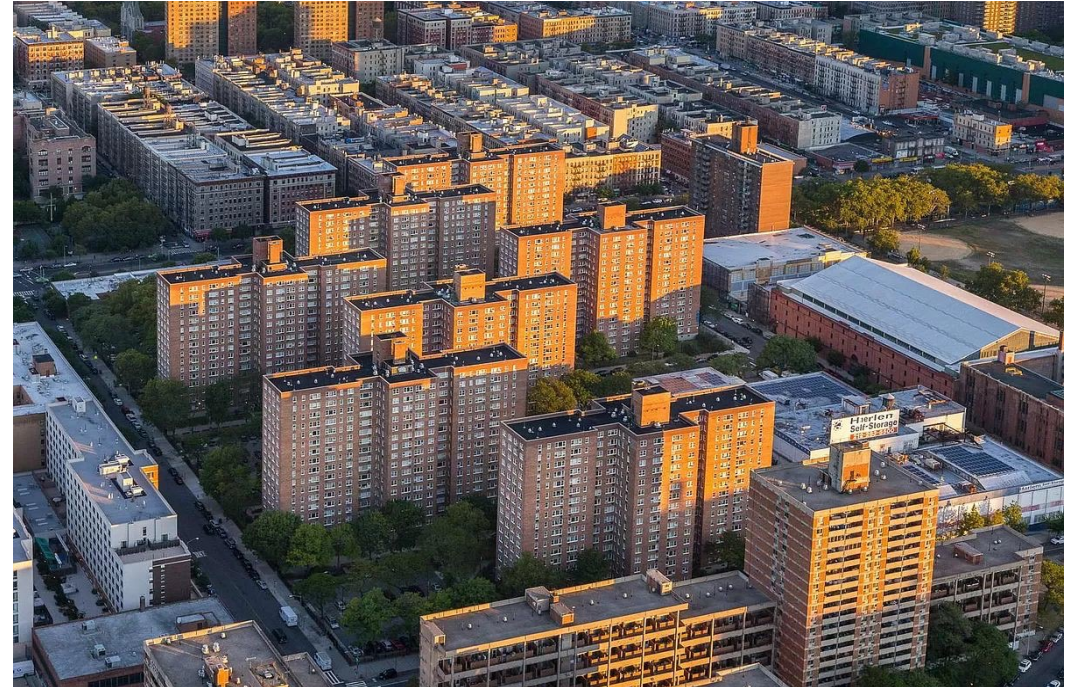
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# Savoy Park

The campus EUI is currently 105.3 with an ENERGY STAR score of 35 and relies on fossil fuels.

The project will develop a roadmap for reducing the site EUI to ~21 through a mix of measures including implementing Kelvin's Cozy Thermostatic Radiator Covers, installing heat pumps, thermal batteries, and dedicated ASHP DHW heaters.

If the roadmap identifies a financially and operationally viable path, the team aspires to implement the strategy in at least one of the buildings by 2035.



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# Lincoln Square Condominium

111 West 67th Street

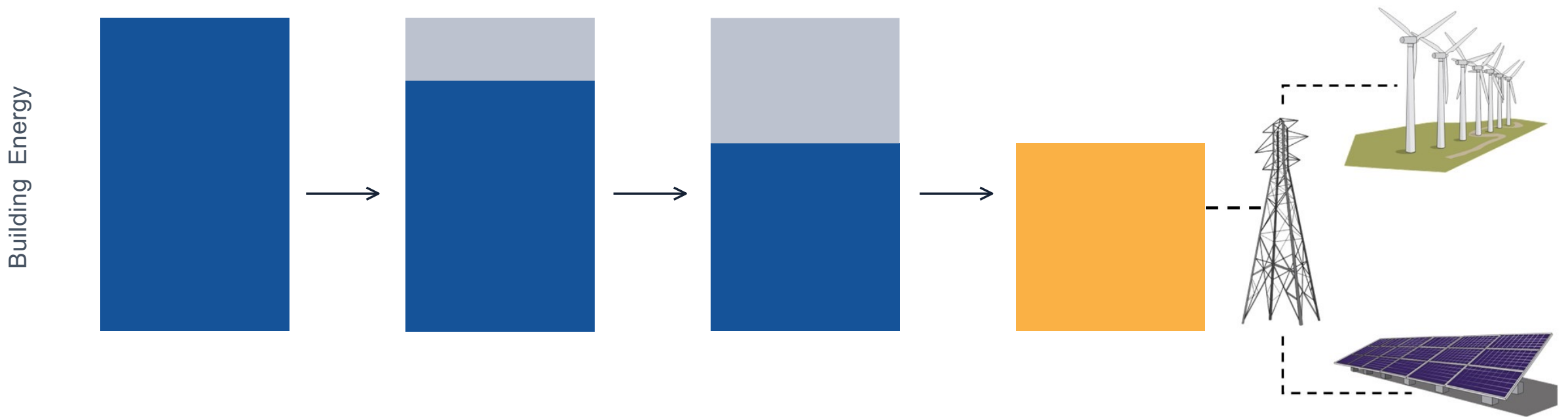
## Building Information

- Constructed in 1992
- 47 stories above-grade, 2 below-grade
- ~750K sqft
- 2 - pipe steam PTACs with gas boiler
- Mixed-use (50:50 split in area)
  - Multifamily: 284 units
  - Commercial tenants:
    - Multiplex cinema, fitness center, mailing center
    - Retail and bank branch
- Mixed ownership structure



# How do we decrease carbon and energy by 25%?

*Building Decarbonization Strategy: Reduce, Recover, Electrify*



# GEORGE T. DOURIS TOWER

- 27-40 Hoyt Avenue South, Astoria, NY 11102
- Completed in 2009
- 15 stories tall
- 184 100% affordable senior units
- Heating Plant: boiler plant with five gas-fired, non-condensing hydronic boilers
- Cooling Plant: through wall air conditioners for apartments; direct expansion rooftop unit for common spaces
- Façade: Cinder block wall with Brick and Masonry
- Current EUI: 102.7 kBtu/SF



# EMPIRE BUILDING CHALLENGE

## CHALLENGES

- Senior, tenant in-place retrofit
- Repurpose existing infrastructure
- Finding space for new equipment
- Avoid shifting heating costs to residents
- Minimize capital and operating expenses
- Achieve carbon neutrality
- Providing heating system resiliency

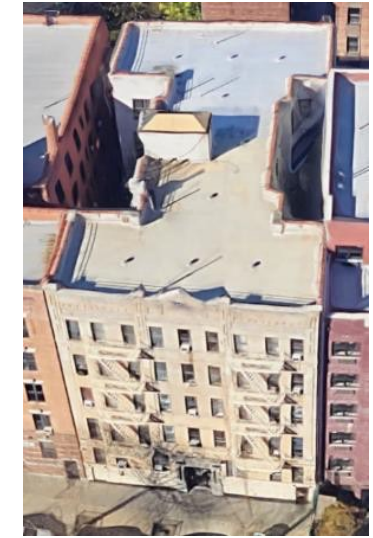
## SOLUTIONS

- Geothermal for heating, DHW, and cooling
- Heat recovery from commercial kitchen, other service spaces, and wastewater
- Ventilation energy recovery
- Window and envelope improvements
- Cooking and laundry electrification
- Solar PV



# Building Information

	439 W 125	1203 Fulton Ave	575 E 168	865 E 167
Year	1997	1911	1910	1928
Area	23,004	20,825	9,856	40,800
Units	21	29	9	55
Space Heat	Natural gas hot water boiler	Fuel oil boiler - 1-pipe steam distribution		
Space Cool	Through wall AC	Window AC		
DHW	Natural gas heater + tanks	DHW provided by boilers		
Envelope	Masonry walls, concrete floors/roof	Masonry walls with wood-frame floors and roof		
Ventilation	Central exhaust fans	Windows		





# Solutions Under Investigation



439 W 125

- EIFS Over-cladding
- New Windows
- Through-wall heat pumps
- CO2 HPWH



1203 Fulton Ave

- EIFS Over-cladding
- New Windows
- VRF or window saddle-type heat pumps
- Split HPWH



575 E 168

- New Windows
- Mini-split heat pumps
- Hybrid tank HPWH

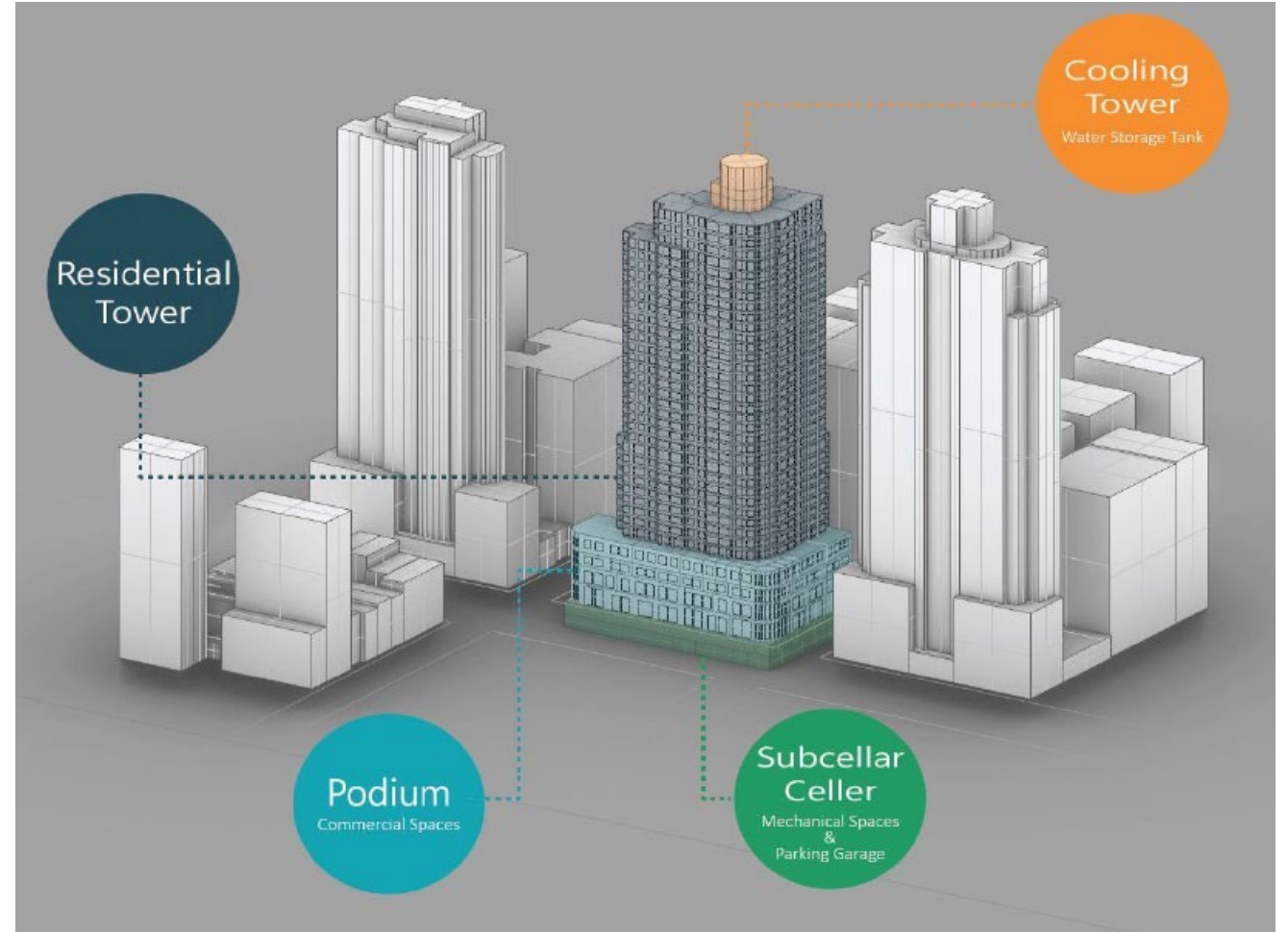


865 E 167

- EIFS Over-cladding
- New Windows
- VRF heat pumps
- Waste Water Heat Recovery + Resistance backup

# The Capitol - Chelsea Multifamily

- Built in 2001
- 39 stories
- 474,606 SF
- 387 units (5<sup>th</sup>-36<sup>th</sup> floors)
- Retail and commercial tenants and building amenities are located floors 1-4 (Podium).
- Mechanical rooms are in the subcellar and a section of the 4<sup>th</sup> floor.
- A two-level parking garage spans roughly half of the subcellar and cellar levels



# The Capitol - Decarbonization Concepts

Chelsea New York Realty Company LLC is targeting to eliminate fossil fuels on-site by 2035 or sooner.



Resource Efficient  
Electrification



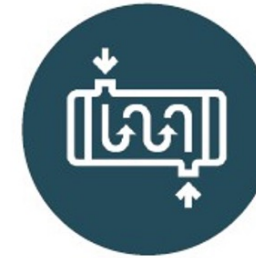
Steam to Low  
Temperature Hot  
Water



Geothermal



Fuel Switching



Energy Recovery



Energy  
Efficiency



Battery Energy  
Storage



Building Envelope  
Improvements



On-Site  
Renewables



Thermal Storage



# RiseBoro

COMMUNITY PARTNERSHIP

Empire Building Challenge

# BUILDING INFORMATION



<b>Building</b>	Noll Street Apts.	Melrose Apts.
<b>Address</b>	43 Central Ave Brooklyn, NY	63 Central Ave Brooklyn, NY
<b>Year Built</b>	2004	2007
<b># of Units</b>	60	38
<b># of Stories</b>	6	
<b>Heating</b>	Central gas-fired boilers; Hydronic baseboard	
<b>Cooling</b>	Through-wall window ACs	
<b>Façade</b>	4" Face Brick and 8" CMU w/R-13 Batt Foil Faced Insulation	
<b>Current EUI</b>	76 kBTU/ft <sup>2</sup> /yr	60 kBTU/ft <sup>2</sup> /yr

# CHALLENGES & SOLUTIONS

## Challenges

- Minimize capital costs and operating cost increases
- Tenant in-place retrofit
- Avoid shifting cost-burden to affordable housing residents
- Keep retrofits simple for building operators
- Provide heating system resiliency

## Solutions

- Heating & DHW geothermal shared between the buildings
- Common laundry and sanitary waste heat recovery
- Grid-interactive building controls
- Ventilation energy recovery
- Window & envelope upgrades
- Cooking range & gas dryer electrification

# Decarbonizing James Geddes – Building Information

- Location: Syracuse, New York
- Use: Multifamily
- Age: 70 Years
- # of stories: 7 + basement
- # of dwelling units: 54
- Heating Plant: Natural gas fired boilers
- Cooling Plant: Window AC units
- Distribution systems: Steam system
- Façade description: Concrete block with exterior brick face and interior drywall. Estimated R-Value: R-8. Aluminum-frame windows with thermal breaks and double-glazing.
- Current EUI: 91 kBtu/sq. ft./year
- Current emissions: 1,314 tons of CO<sub>2</sub> equivalent per year



*Committed buildings: Existing condition*

# Problem Statement

The deep energy retrofit project aims to achieve site energy use intensity (EUI) reductions of 50% from 2010 baseline (84.4 EUI) to target 42.4 EUI, with full building electrification by target year 2030. The scope of the project includes the deployment of an integrated system that includes insulated overcladding panels, windows, and a heating, cooling and ventilation system, all installed from the exterior of the building without displacing building residents. The proposed system will replace the existing fossil fuel fired heating, ventilation, and DHW systems.

The team, Syracuse Housing Authority, Cycle Retrotech, Hydronic Shell Technologies, and Taitem Engineering, will also explore the possibility of a neighborhood scale decarbonization and thermal energy network for all of the buildings within the James Geddes development which consists of four mid-rise buildings and multi-family row houses for a total of 477 affordable public housing units.



*Committed buildings: Artist's Rendering*



# St. Elizabeth's Manor EBC Team



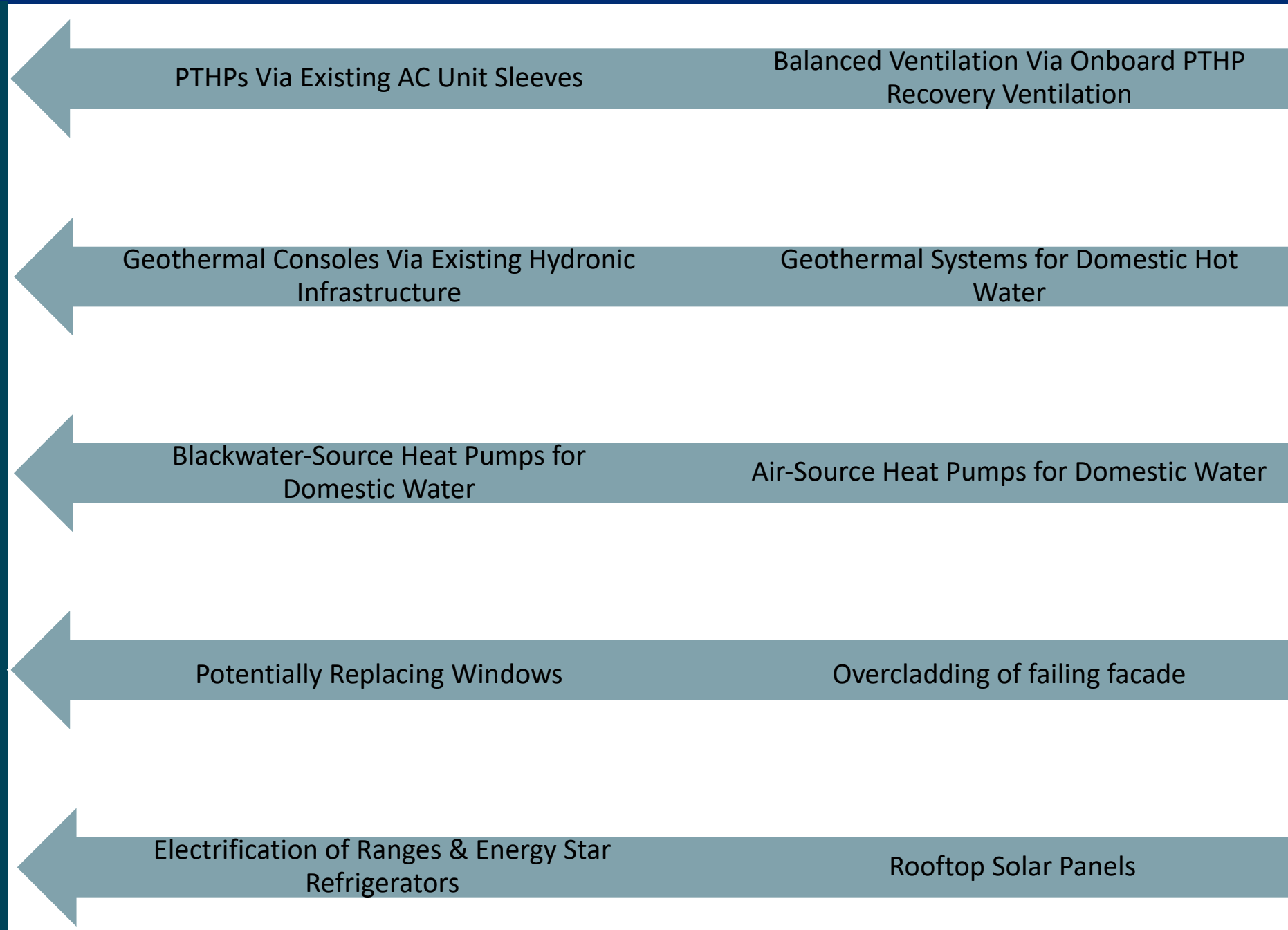
# Building Overview: Saint Elizabeth Manor (150 Brielle Avenue)

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- Located on the North Shore of Staten Island in the Manor Heights neighborhood
- 4 stories
- Built 1994
- 80 – units Multifamily senior-housing – all 1 bedroom units – all permanently affordable,
- No renovations since 1994
- Utilizes natural gas for space heating and DHW, everything else is electric.
- Heat provided via hydronic baseboards and radiators with central gas boiler, cooling is via window mounted a/c units.



# How to mindfully electrify building systems with senior tenants-in-place?



# EBC Pilot Project: Stovroff Towers

- Senior living facility located in Amherst, NY
- 120 studio apartments, ~20% occupied
- Four-story LGM framed building
- Heating/Cooling: In-Unit
  - Natural Gas, Forced air furnaces with gas-fired heat
  - Distribution: Heating and cooling is unitized, with every 2 apartments sharing 1 gas furnace
- Common area heat: Gas-fired hot water & hydronic baseboard
- DHW: Two gas-fired hot water boilers and two 119-gallon
- Exterior Façade:
  - Concrete block and aluminum-framed curtain wall systems, with 1" insulated glass.



# Decarbonization Challenges & Solutions

- **Façade Improvements**

- Limited to no existing insulation
- High air infiltration
- Thermal bridging
- Relatively good structural condition and aesthetics
- **EBC Solutions:** *continuous insulation and triple pane windows, targeting R-20 thermal performance and reduced air infiltration*

- **Efficient Electrification**

- Convert gas heat and DHW to efficient heat pumps
- Re-use central ventilation ductwork where possible
- **EBC Solutions:** Packaged Heat Pump vs. Geothermal, considering energy recovery and cost optimization

- **Other Considerations**

- Solar PV and/or Solar thermal for ground loop re-charge
- Wastewater heat recovery



# Questions?



# Discussion Breakout Groups

## Group 1

**Moderator:**  
**Samantha Pearce (HCR)**

- RiseBoro
- HANAC
- Syracuse Housing Authority
- WinnDevelopment

## Group 2

**Moderator:**  
**Jen Leone (HPD)**

- JOE NYC
- Ascendant
- Sisters of Charity
- Chartered

## Group 3

**Moderator:**  
**Joe Chavez (NYC MOCEJ)**

- FirstResidential
- The Capitol/Chelsea
- Fairstead

