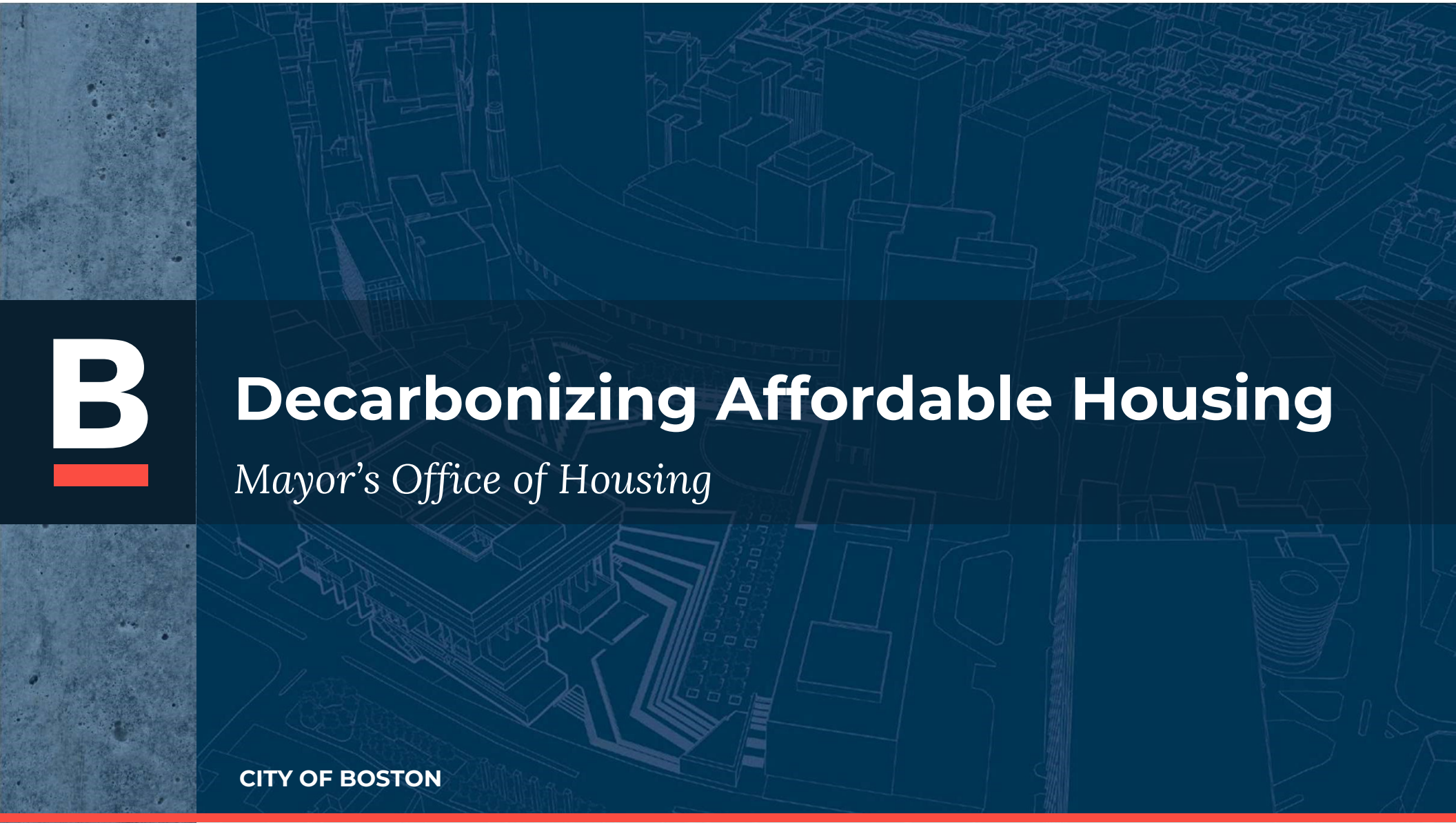
BUILDINGENERGY BOSTON

Building Momentum: Lessons from the Field of Decarbonization Retrofits in Boston

Kristen Simmons, City of Boston Mayor's Office of Housing
Caitlin Robillard, Allston Brighton Community Development Corporation
Joel Wool, Boston Housing Authority
Christina McPike, Winn Companies
Moderator: Brooks Winner, City of Boston

Curated by Lauren Baumann

Northeast Sustainable Energy Association (NESEA) | March 20, 2025



Decarbonizing Affordable Housing

Mayor's Office of Housing

CITY OF BOSTON

Mayor's Office of Housing: Decarbonizing Affordable Housing

Some responsibilities:

- Housing the homeless
- Developing and preserving affordable housing
- And helping Boston residents buy, improve, and keep their homes

Decarbonization initiatives:

- 2020: Zero Emissions Buildings Guidebook
- 2023: Energy Retrofit Pilot Programs (ARPA funded)
  - Carbon and energy savings
  - Healthier housing
  - Developing replicable and scalable decarbonization models

MOH's Energy Retrofit Pilot Programs

Comprehensive Energy Assessment Grants

- Up to $10,000/grant
- +15 units, income-restricted
- Awarded 80 buildings, + 2,200 units

Energy Retrofit Funding

- Up to $50,000/unit
- +15 units, income-restricted
- 50% energy reduction
- Awarded 43 buildings, +300 units

Healthy & Green Retrofit Pilot

- Up to $50,000/unit
- 2-3 unit NOAH
- Tenant protections
- Awarded 31 homeowners, +72 units

Assessment and Planning Phase Trends

Status:

- 19 completed energy assessments

Observations:

- Varied decarbonization plan formats
- No "One-Size-Fits-All": Decarbonization strategies vary based on building specifics and priorities.
- Project phasing: single large phase (40-50% energy/carbon reduction), or multiple incremental upgrades, over 10-15 years.
- "Perfect is the enemy of good": Flexibility is key to taking action.

It's challenging for building owners to translate decarbonization reports into tangible projects.

Design and Development Trends: From Plans to Action

Status:

- 4 retrofit projects in design

Observations

- Single large phase projects often require complex and competitive financing
- More buildings will decarbonize overtime, in multiple, incremental phases
- Project teams typically include an architect and/or MEP, and a GC for pre-construction services
    - Tenant relocation planning
- Many new and different technologies are being explored
- Utility cost considerations

Construction Trends

Status

- 2 projects in construction
- 2 projects expected to start construction in 6 months

Observations:

- Unique considerations for occupied buildings:
  - Tenant management
  - Tenant protections
- Impacts of construction sequencing
- Tenant education, including operational guidance
- Community engagement

Key Lessons Learned and Next Steps

Key Lessons Learned

- Building owners need clearer, simpler guides on how to decarbonize their buildings.
- Owner vision and timelines are crucial, but funding determines what happens.
- Funders of affordable housing want to make sure tenants aren't burdened with higher utility bills.
- Building owners and residents need easier-to-understand instructions on how to run and maintain new systems.

Next Steps

- Conduct in-depth analysis of project outcomes and best practices.
- Create specific decarbonization plans for different types of buildings.

Retrofitting & Rebuilding Public Housing

NESEA

March 20, 2025

BOSTON HOUSING AUTHORITY

BHA's Building Stock





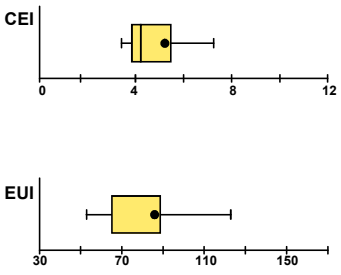



Four(+) Primary Archetypes

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

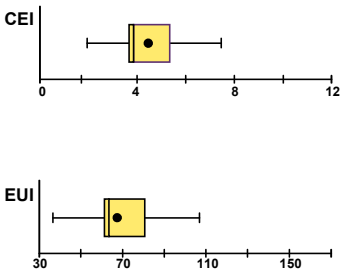


EUI in kBtu/sf/yr
CEI in $kgCo_2e/yr$

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

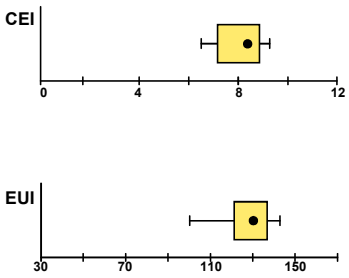


EUI in kBtu/sf/yr
CEI in $kgCo_2e/yr$

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

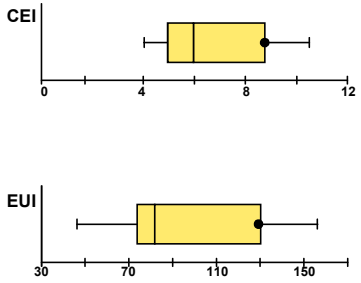


EUI in kBtu/sf/yr
CEI in $kgCo_2e/yr$

<1% of total area
1% of total emissions

OFFICE

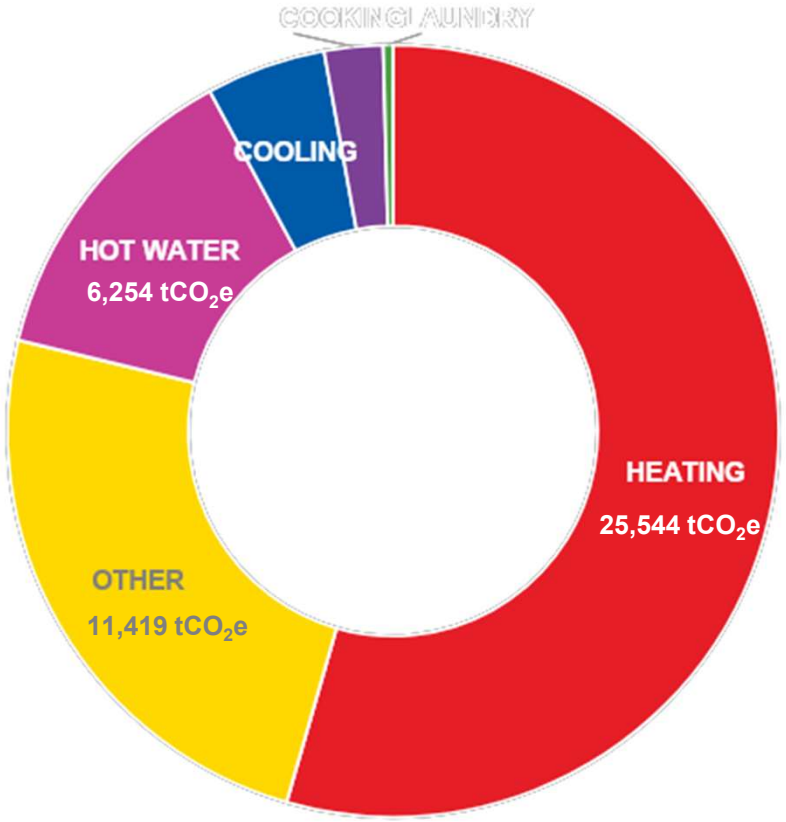
Typical Floors	1
Typical Systems	
Space Heat	Gas Boiler
DHW	Gas Boiler
Cooling	Window Unit
Cooking	NA



EUI in kBtu/sf/yr
CEI in $kgCo_2e/yr$

Emissions By End Use

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



- **Heating** 25,544 t CO_2e
- **Hot water** 6,254 t CO_2e
- **Cooking** 1,153 t CO_2e
- **Laundry** 192 t CO_2e
- **Cooling** 2,351 t CO_2e
- **Other** 11,419 t CO_2e

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

Capital Projects: Public Housing

Site	Type of Site	Type of Project	Status
Msgr Powers	Elderly	Deep Energy Retrofit	Complete
Hailey Modernization	Family	Deep Energy Retrofit	Under Construction
Multiple Sites	Family/Elderly	Window Replacement (925 units)	Under Construction
Pond Street	Elderly	Deep Energy Retrofit	In Design
Franklin Field	Family	Networked Geothermal	In Design
Ashmont	Elderly	Heat Pumps	In Design
St. Botolph	Elderly	Comprehensive Modernization	In Progress
Doris Bunte	Elderly	Comprehensive Modernization	In Design
Ausonia	Elderly	Comprehensive Modernization	In Design
Patricia White	Elderly	Modernization + New Construction	In Design
General Warren	Elderly	Comprehensive Modernization	Designer Procurement
Portfolio wide	All	Electrification Study	Complete
Multiple Sites	All	Induction Stoves	Designer Procurement

MassSave + State Partnerships

Site	Type of Site	Type of Project	Status
Pond Street	Elderly	MassSave: Insulation	In review
Franklin Field (State)	Family	MassSave: Insulation and Thermostat	Approved
Ashmont	Elderly	DHW Pipe Insulation	Completed
Bellflower	Elderly	MassSave: Weatherization, Thermostat	Approved
Peabody	Elderly	MassSave: Weatherization, Thermostat	Approved
Alice Taylor	Family	MassSave: Insulation; Decarb Study	In review; Project Kickoff
General Warren	Elderly	MassSave: Insulation	In review
Maryland St Condos	Family	MassSave + MassCEC electrification	In design
Hassan	Elderly	Window Heat Pump	Pilot/Scoping
Heritage	Elderly	Decarbonization Study	Project Kickoff
Lower Mills	Elderly	Decarbonization Study	Project Kickoff
Ruth Barkley	Family	Decarbonization Study	Project Kickoff
Charlestown	Family	Decarbonization Study	Project Kickoff

A Sample of (Re)Development

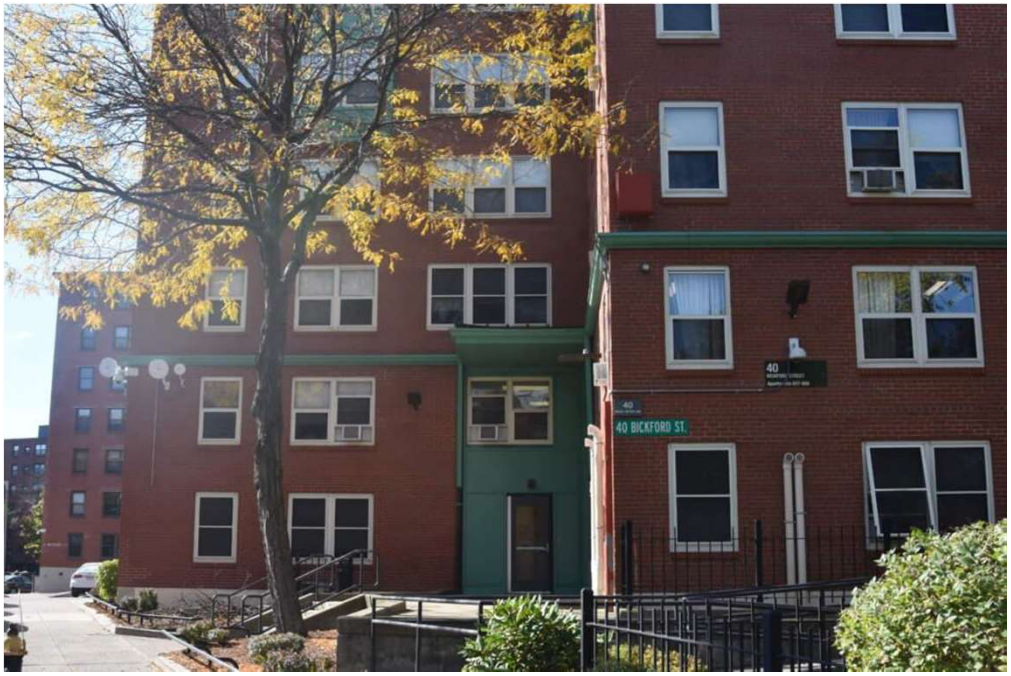
Site	Type of Site	Type of Project	Status
Mary Ellen McCormack	Family	Public/Private Redevelopment	Ongoing
Charlestown	Family	Public/Private Redevelopment	Ongoing
Faneuil Gardens	Elderly	Public/Private Redevelopment	In Design
Eva White	Elderly	Public/Private Redevelopment	Just Closed!
290 North Beacon	Mixed Use	New Development / Music Rehearsal	Conceptual
1492 Tremont	DDS	Retrofit + New Construction	In Design
78 Torrey Street	DDS	Retrofit + New Construction	In Design

- Over next decades, BHA will work with private partners to **redevelop** thousands of units, BUT
- Some redevelopments are so long, buildings must be retrofit now, AND
- To address housing crisis, BHA is also seeking to **build** thousands of new units!

bha BOSTON HOUSING AUTHORITY

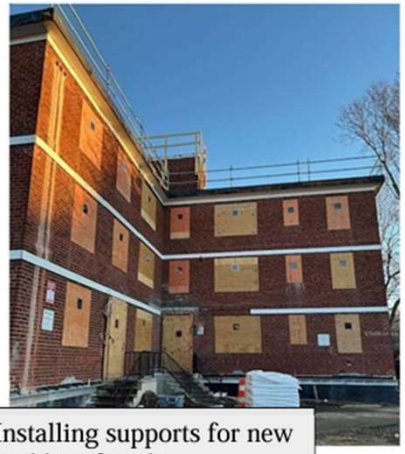
M.C. Hailey Deep Energy Retrofit

Comprehensive Modernization



BOSTON HOUSING AUTHORITY

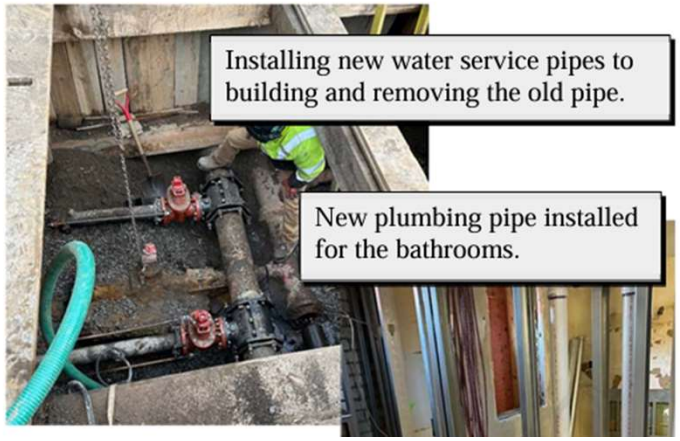
M.C. Hailey Deep Energy Retrofit



Installing supports for new building facade

Framing for new walls in units

Removing old roof and installing new roof



Installing new water service pipes to building and removing the old pipe.

New plumbing pipe installed for the bathrooms.

BOSTON HOUSING AUTHORITY

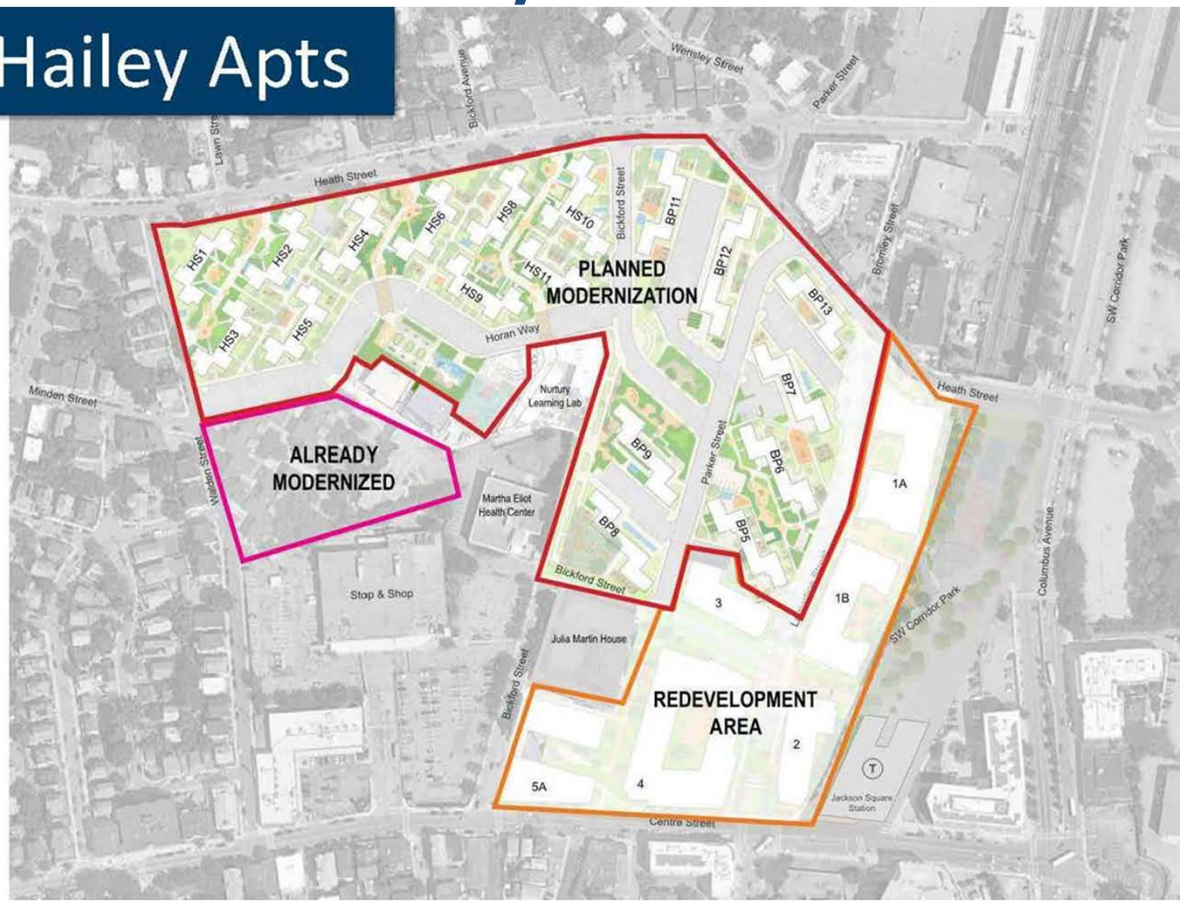
A home for every story

Side By Side: Retrofit, Demo/Rebuild

Mildred C. Hailey Apts

Original Apartments	
Redevelopment Footprint	253
Previously Modernized	60
Modernization Underway	456
Total Apartments	769

Master Plan	
New Construction	
Replacement Units	253
Net-New Units	421
Modernization	516
Master Plan Total	1190



BOSTON HOUSING AUTHORITY

Franklin Field

Networked Geothermal Pilot

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.

BOSTON HOUSING AUTHORITY

Pond Street

- “Garden-style” elderly
- 5 Buildings, 44 units
- 32,330 GSF
- Existing heat + DHW: Gas
- Design evolution:
  - Gas replacement
    -> ASHP -> GSHP
- Project includes roof, windows, heat, hot water
- Solar PV to follow

BOSTON HOUSING AUTHORITY

A home for every story

You Never Know Until You Dig...

More water than anticipated!

Drill depth:
300’ instead of 600’

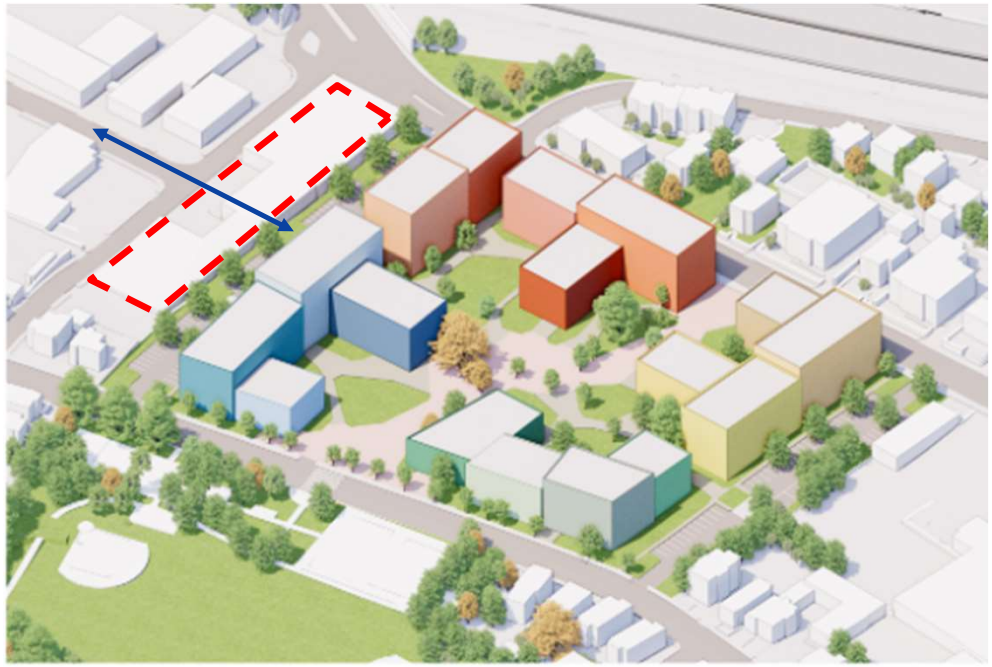
HP DHW likely to be separate split system, geothermal covering the space heating

BOSTON HOUSING AUTHORITY

A home for every story

Redevelopment: Faneuil Gardens

Existing Faneuil Gardens site



Future Planned Development

BOSTON HOUSING AUTHORITY

Thank you!

Joel Wool
Joel.Wool@bostonhousing.org
https://www.linkedin.com/in/joelwool/

BOSTON HOUSING AUTHORITY
A home for every story

Affordable Housing

Deep Energy Retrofit

Hano Homes | Allston, MA

March 20, 2025

Allston Brighton
COMMUNITY DEVELOPMENT CORPORATION

Decarbonization Plan:

- **GOAL:** Fossil fuel free by 2040
- **WHY:**
  - Climate crisis
  - Resident health & comfort
  - Time to refinance and renovate
  - Normalize DERs
- **HOW:**
  - Data, e.g. ASHRAE
  - Strong partners
  - Green funding, e.g. Climate Ready Housing
  - Building technology advancements
  - Public Policy and Regulations, e.g. BERDO

Allston Brighton COMMUNITY DEVELOPMENT CORPORATION

Introduction to Hano Homes:

Building Typology:

- 10 adjoining townhomes; built 1888
- Gas heat + gas DHW
- 20 units: 75% income-restricted

Unit Breakdown:

	30% AMI	50% AMI	60% AMI	Market Rate	TOTAL
2-BD	1	3	5	1	**10**
3-BD	1	3	2	4	**10**
TOTAL	**2**	**6**	**7**	**5**	**20**

Project Goals:

1) Electrify; Passive House certification
2) Minimize disruption to tenants
3) Finance without LIHTC

Allston Brighton COMMUNITY DEVELOPMENT CORPORATION

Hano Homes DER Team:

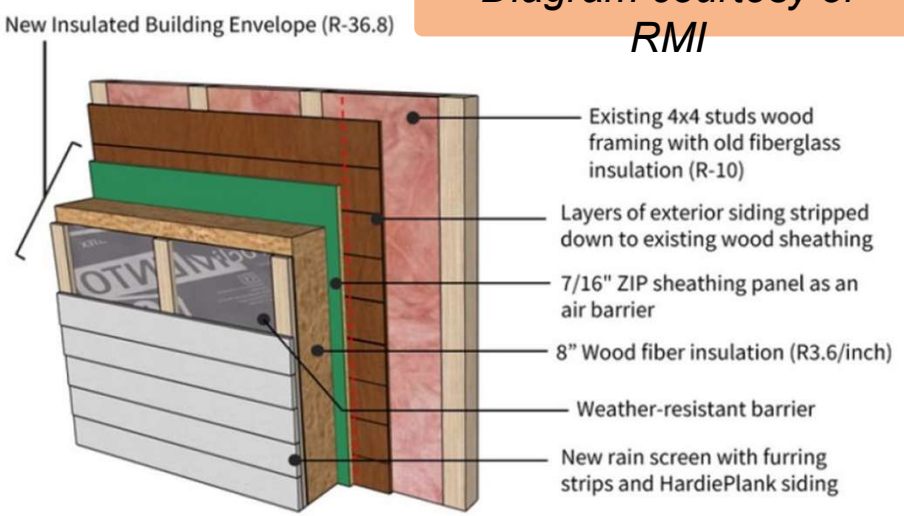
Maloney
PROPERTIES

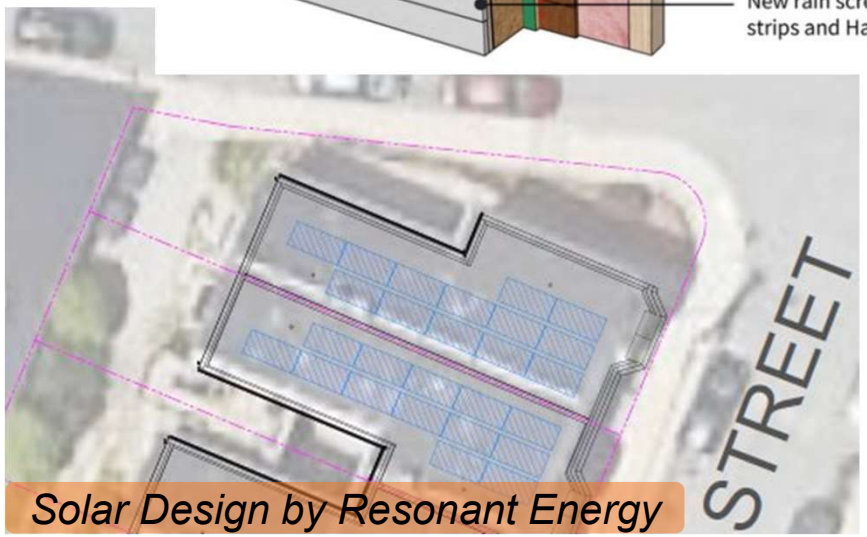
TIERNEY DEVELOPMENT SERVICES LLC

Goal #1: Electrify & PH

- Super insulated envelope
  - (carbon storing wood fiber insulation!)
- Heat pumps (HVAC + DHW)
- Fresh air ventilation
- Rooftop solar PV panels

Diagram courtesy of RMI





Solar Design by Resonant Energy

phius

Allston Brighton COMMUNITY DEVELOPMENT CORPORATION

Goal #2: Minimize Disruption to Tenants

- 10-month occupied rehab
- 2-week turn-around for interior work

Goal #3: Finance without LIHTC

Project Budget

		TOTAL	PER UNIT
USES	Acquisition	-	-
	Hard Costs	4,934,222	246,711
	Soft Costs	1,578,514	78,926
	Capitalized Reserves	331,458	16,573
	Developer Fee + Overhead	840,000	42,000
	TOTAL USES:	**7,684,194**	384,210
SOURCES	Permanent Loan	2,750,000	137,500
	Existing Reserves	131,458	6,573
	Misc. Green Grants	412,000	20,600
	Solar Tax Credits	151,000	7,550
	IRA Electrification Rebate*	400,000	20,000
	LEAN Utility Incentives	326,000	16,300
	DOER Decarbonization Program	800,000	40,000
	City of Boston Funding	1,000,000	50,000
	Climate Ready Housing	1,350,000	67,500
	Deferred Developer Fee	363,736	18,187
	TOTAL SOURCES:	**7,684,194**	384,210

EUI Reduction: 73%!

Utility Costs

	HANO HOMES *	
	Pre-DER	Post-DER
Oil	-	-
Gas	22,478	-
Electric	33,224	38,251
Water & Sewer	28,782	19,157
SUBTOTAL:	84,484	57,408
Rooftop Solar Savings:	-	(17,743)
TOTAL Annual Utility Costs:	84,484	39,665
Total Annual Savings from DER:		44,819

Lessons Learned

- Initial Decarbonization Audit
- Persistence
- Funding
- Storytelling
- Project Team
- Resident Communication

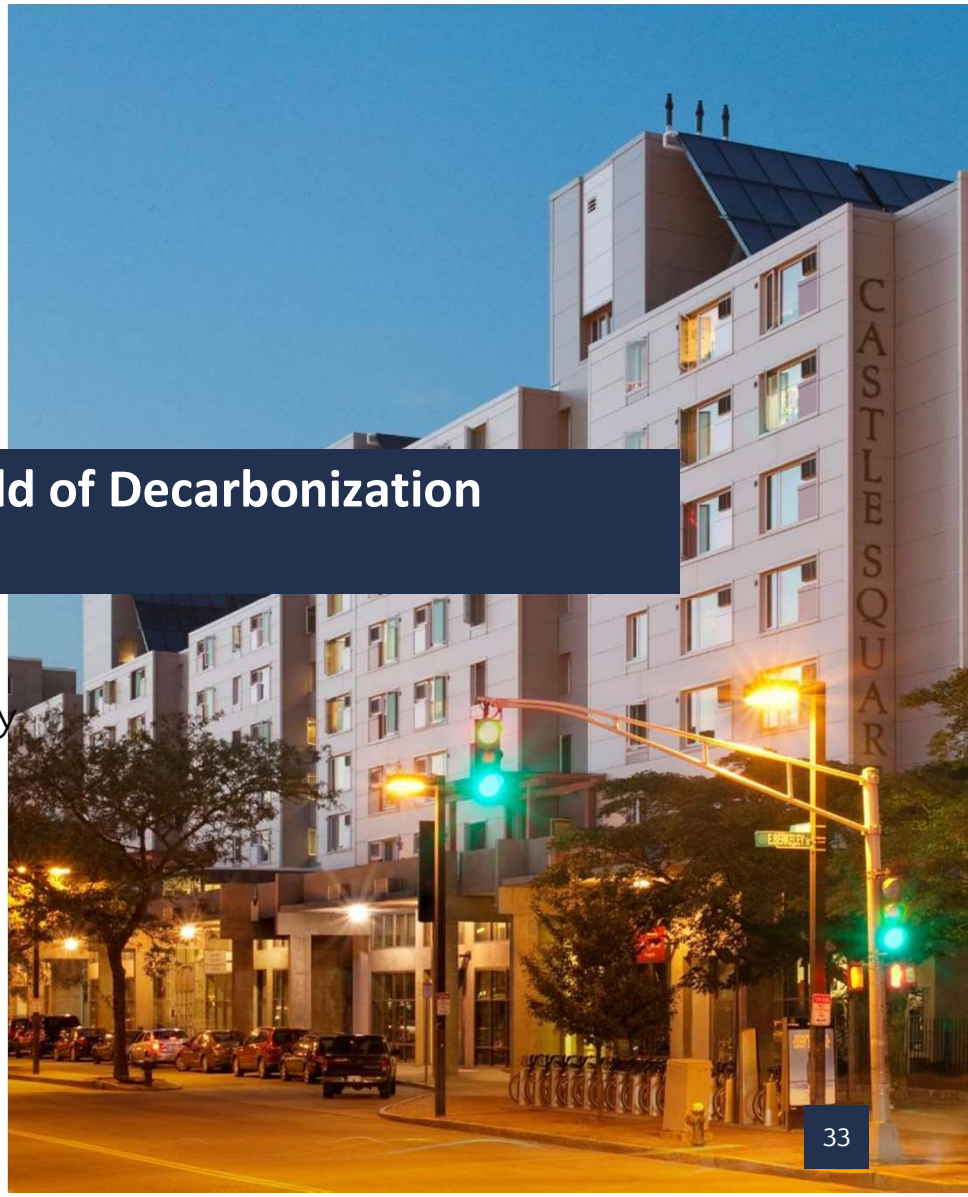
Allston Brighton
COMMUNITY DEVELOPMENT CORPORATION

THANK YOU!

WinnCompanies

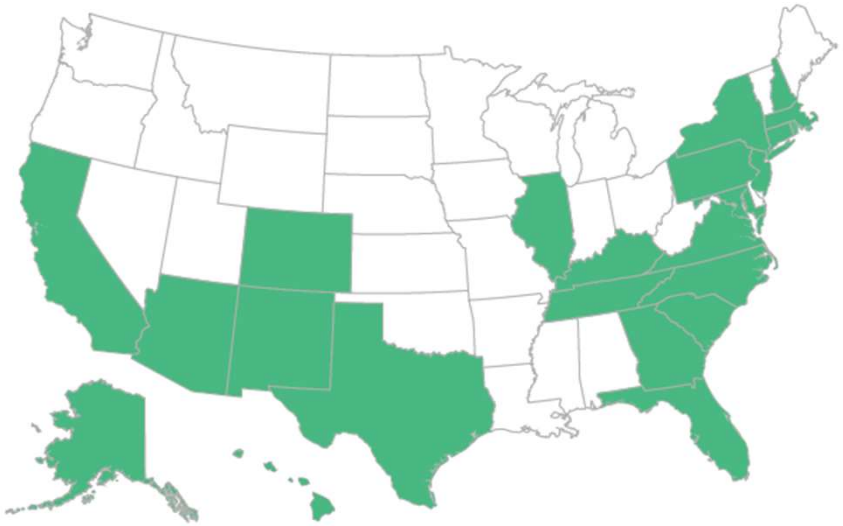
Building Momentum: Lessons from the Field of Decarbonization Retrofits in Boston

Christina McPike, Vice President of Energy & Sustainability



WinnCcompanies by the Numbers

- WinnCcompanies is a long term-owner stakeholder, which has owned many properties for **30+ years**.
- Employs more than **3,500** hard-working and capable team members, including **318 veterans** of the United States Military, with more than 60% of employees identifying as minorities.
- Manages **121 Million** square feet, including housing, condos, commercial, retail, parking facilities;
- Provides homes to **330,000** residents;
- Has transformed 36 historic properties into **more than 3,600 units of mixed-income housing** in mixed-use communities.



WinnCompanies
Development | Residential | Military

Eva White Apartments

PROJECT PARTNERS

- Castle Square Tenant Organization
- Boston Housing Authority
- Reisen Design Associates (Architect)
- Petersen Engineering (MEP)
- Keith Construction, Inc. (GC)

Existing Conditions

WinnCompanies
Development | Residential | Military

Eva White Apartments DER Scope

- Occupied with daily IAQ testing
  - Residents use “day-space units”
  - Targeting 3 units/day
- Kitchen & Bathroom Reno
- Continuous Insulation: 4” Kingspan Quadcore Panels, R-32
- R-40 Roof Insulation
- Peerless G-500 Casement, U-0.26
- HVAC Overhaul with Electrification
- **68% Modeled Energy Savings**

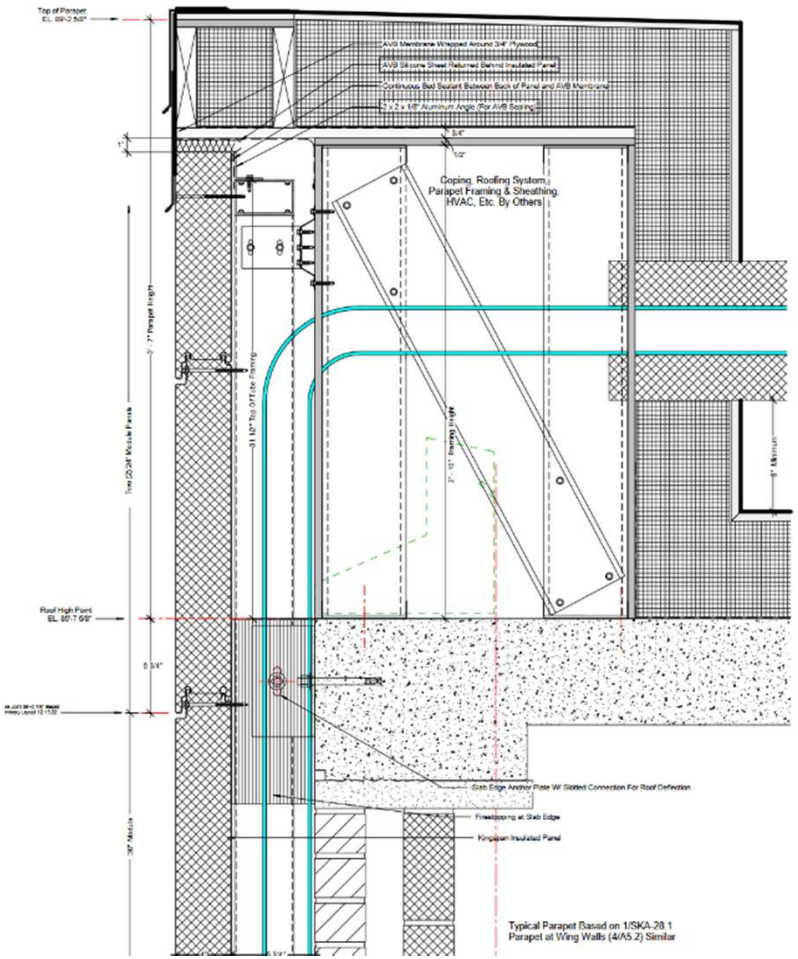
WinnCompanies
Development | Residential | Military

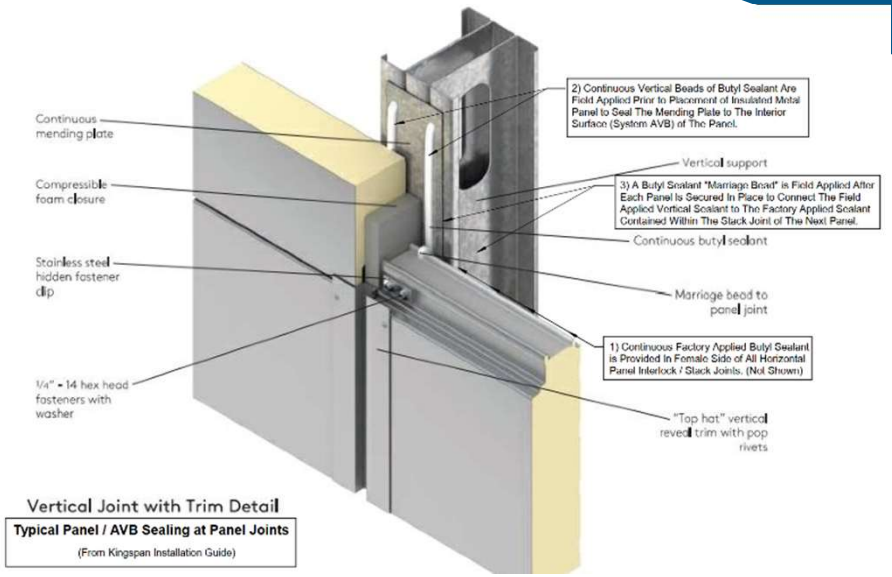
N

Relsen Design Associates
ARCHITECTURE

Petersen Engineering

Façade System





Vertical Joint with Trim Detail

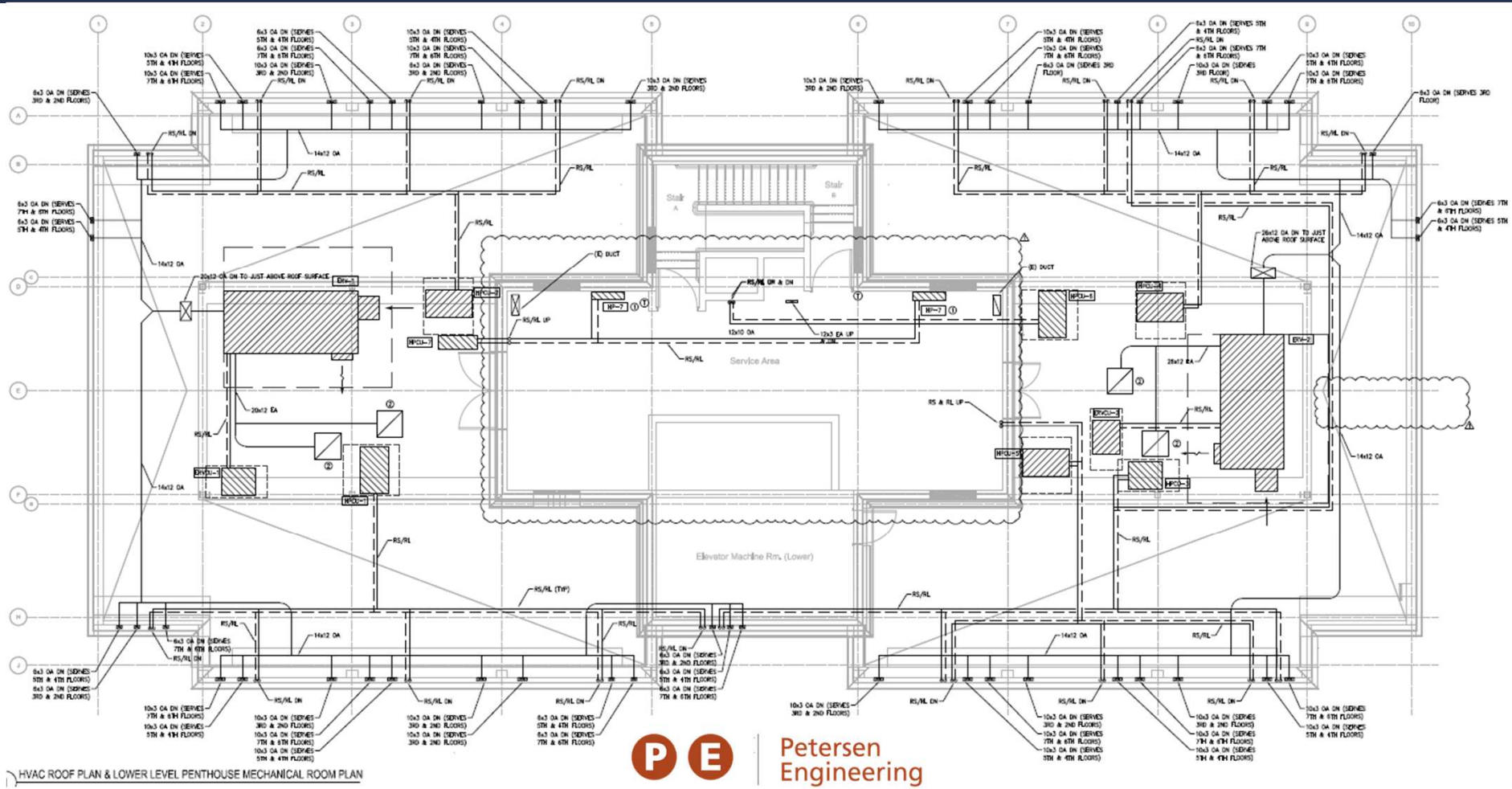
Typical Panel / AVB Sealing at Panel Joints

(From Kingspan Installation Guide)

SUNRISE ERECTORS

Relsen Design Associates
ARCHITECTURE

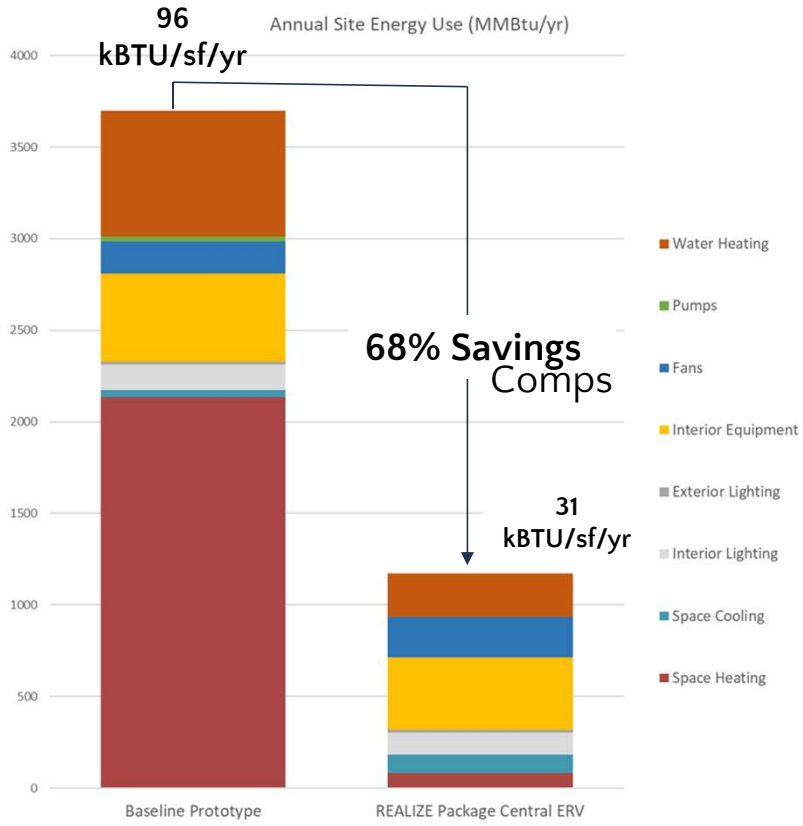
HVAC Design



HVAC ROOF PLAN & LOWER LEVEL PENTHOUSE MECHANICAL ROOM PLAN

Petersen Engineering

Energy Modeling



Utility Costs	Existing	Proposed (1)	Proposed (2)	% Savings
Gas	$86,900	$4,560	$8,800	90%-95%
Electricity	$125,000	$130,000	$154,400	(4%-24%)
Total	$211,900	$134,560	$163,200	**23-36%**

WinnCcompanies
Development | Residential | Military

RMI
ENERGY TRANSFORMED.

Eva White Financing

Summary of Sources		
	Construction	Permanent
Source of Funds	Amount	Amount
Federal LIHTC Syndication Proceeds	10,035,697	25,089,243
Construction Loan	33,500,000	
1st Mortgage	-	18,850,000
Deferred Developer Fee & Overhead	3,900,000	1,294,656
MHFA CMF	-	600,000
AHT	2,275,000	2,275,000
HSF	2,272,500	2,525,000
NFIT	900,000	1,000,000
Seller Note	5,333,049	5,333,049
CSTO Loan	2,500,000	2,500,000
Mass Save	360,000	1,560,000
FHLB AHP	650,000	650,000
NOI During Construction	318,132	318,132
TOTAL SOURCES	$62,044,378	$61,995,080

Summary of Uses (for reference only)				
Source of Funds		Total		$/Unit
Acquisition	$	6,000,000		58,824
Design		1,891,965		18,549
Construction (including Contingency)		40,119,145		393,325
Total Developer Fee & Overhead		3,900,000		38,235
Other Soft Costs (including Contingency)		10,083,969		98,862
TOTAL USES	$	61,995,080	$	607,795

WinnCcompanies
Development | Residential | Military

Lessons Learned & Anticipated

- Contractor feedback and product familiarity is valuable (but needs to change)
- Window Limiters & Egress
- Taller panels = fewer horizontal breaks
- Ductwork connecting 2 floors
- Cavity detailing & connectivity
- BIM Coordination
- Peer Reviews
- Modeled energy savings vs. Actual energy savings vs. Utility cost savings

WinnCompanies
Development | Residential | Military

Phillips Brooks Apartments

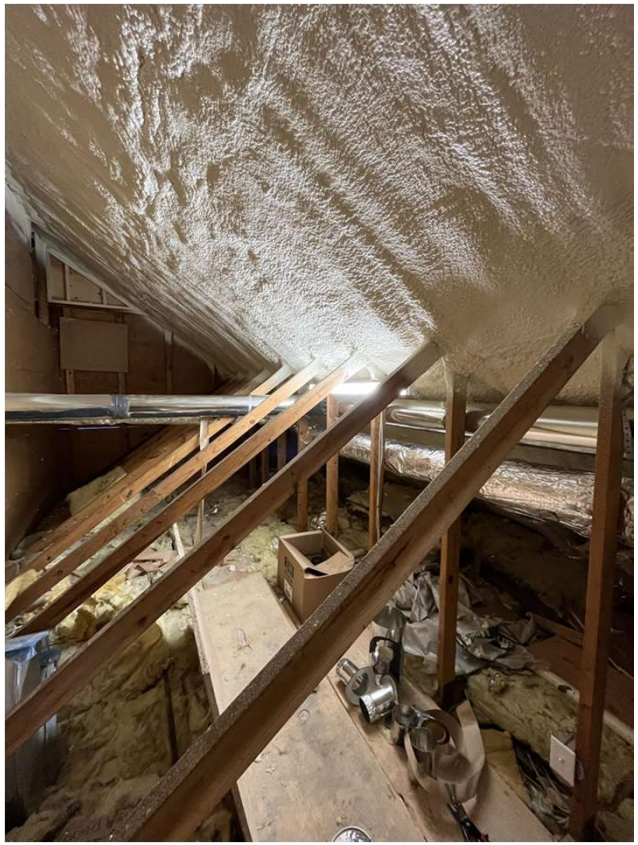
WinnCcompanies
Development | Residential | Military

Phillips Brooks DER Scope

- DER at 27 units in nine triplex buildings (Moderate Reno at historic school)
- 3" continuous insulation, R-12.6
- Intus Triple Pane Windows, U-0.19
- New AVB (Blueskin)
- R-40 roof insulation (6" CCSF at Roofs)
- Full Electrification
  - ASHPs – Daikin
  - AWHPs – Sanco
  - ERVs – Zehnder ComfoAir
- **57% Modeled Energy Savings**

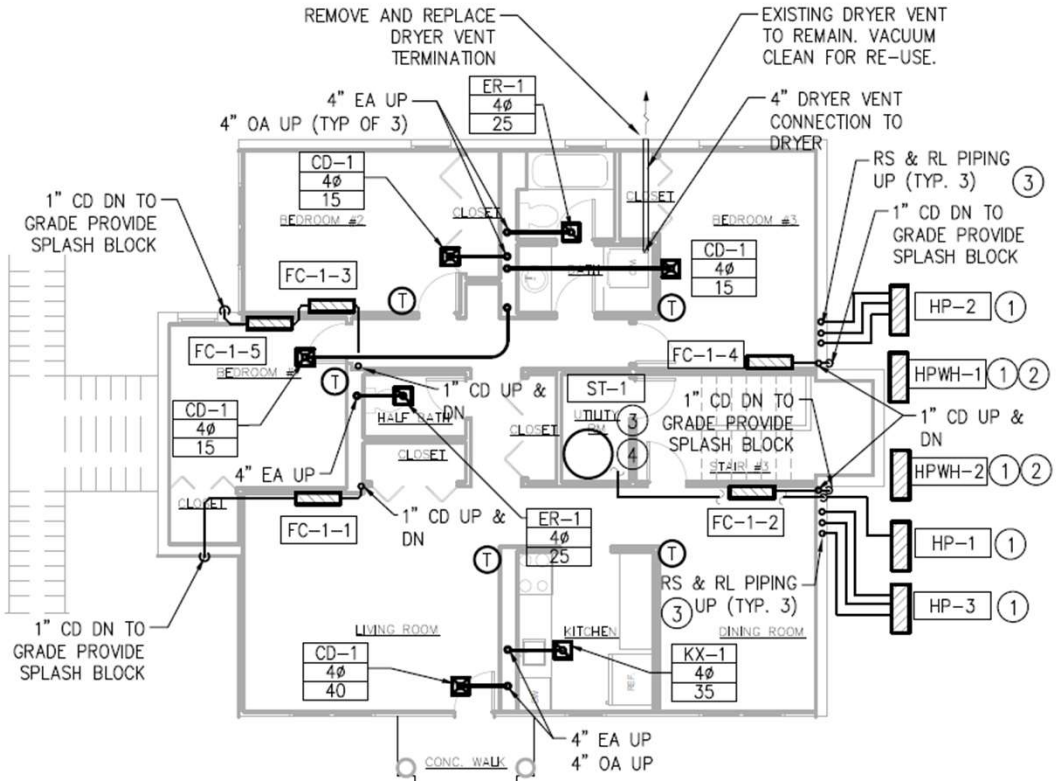
WinnCompanies
Development | Residential | Military

Phillips Brooks School

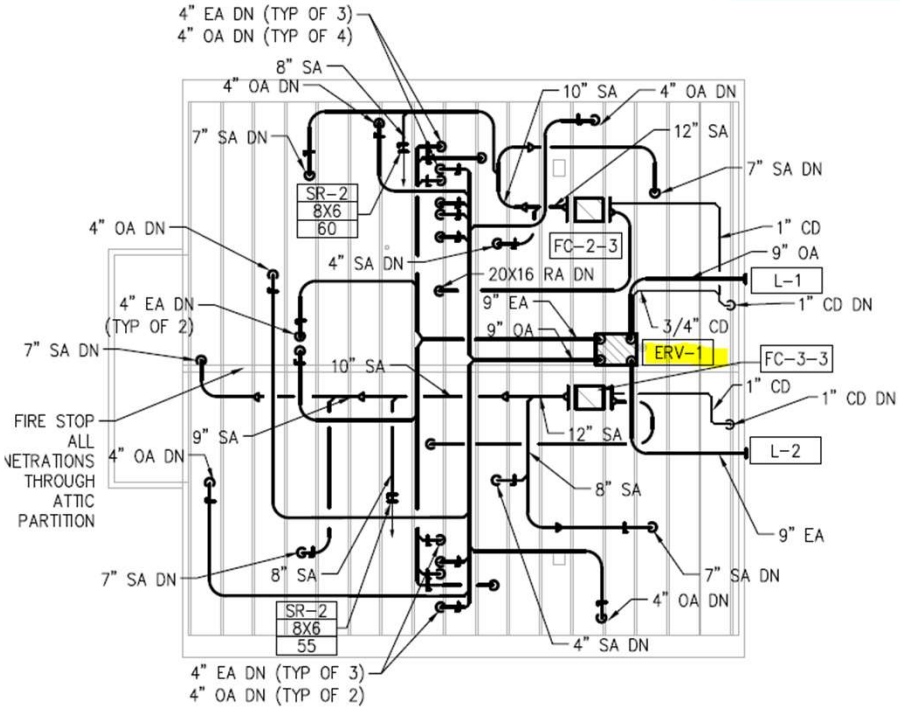


WinnCompanies
Development | Residential | Military

Phillips Brooks School



First Floor



Attic

WinnCompanies
Development | Residential | Military

Petersen Engineering

Phillips Brooks Financing

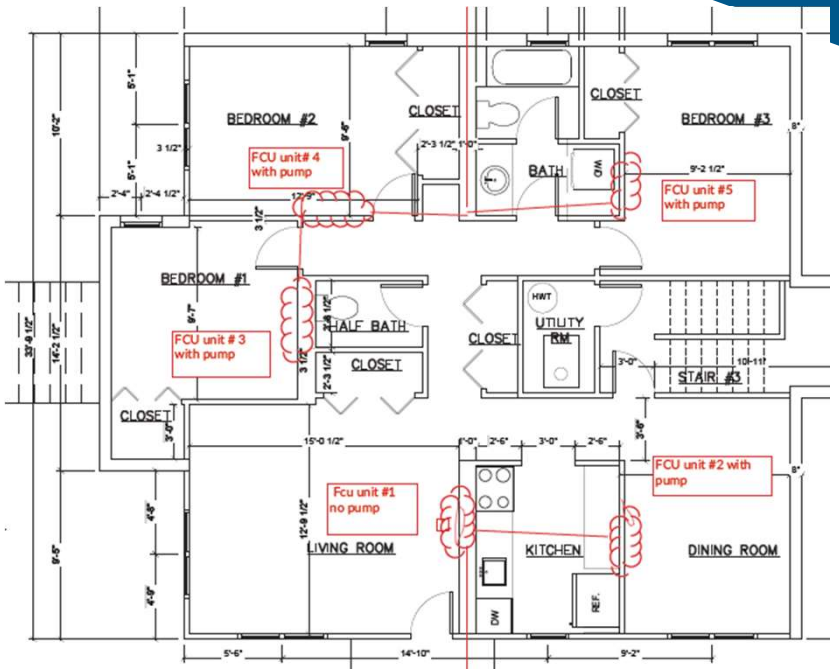
Sources	
Consolidated MassHousing First	$ 5,532,720
NEW Capital Needs Loan	$ 11,308,434
SHARP	$ 2,423,483
CEDAC	$ 533,147
City of Boston	$ 1,246,000
City of Boston	$ 182,000
NEW City of Boston ARPA	$ 1,350,000
NEW MassSave Grant	$ 567,022
NEW Climate Ready Housing	$ 1,350,000
Existing Replacement Reserves (adj. 6/5 balance)	$ 391,004
Total Sources	**$24,883,810**

Uses		
Resubordinated Debt		
Consolidated MassHousing First		$ 5,532,720
SHARP		$ 2,423,483
CEDAC		$ 533,147
City of Boston		$ 1,246,000
City of Boston		$ 182,000
	Subtotal Resubordinated Debt	$ 9,917,350
KCI Construction Costs		$ 11,754,760
Other Construction Costs		$ 531,135
Construction Contingency		$ 587,738
Initial Deposit to Replacement Reserves		$ 1,150,000
Other Transaction Costs		$ 942,827
	Subtotal	$ 14,966,460
Total Uses		**$ 24,883,810**

WinnCcompanies
Development | Residential | Military

Phillips Brooks School: Lessons Learned

- Line set locations in plan vs. field
- Utility Company Coordination
- Early Release – long lead time items impact sequencing
- Space Conflicts – garbage vs. heat pump
- Site Security
- Condensate Pumps & Maintenance
- System Changeover
- Utility Allowance Updates



WinnCompanies
Development | Residential | Military

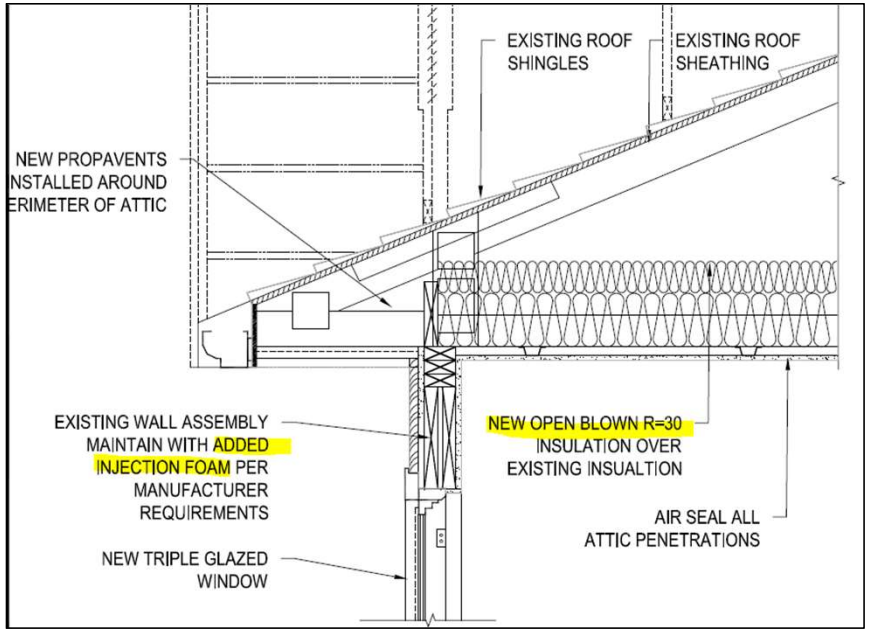
Mission Main Apartments DER Pilot

- $60m rehab at 535 units
  - Grants + Project Savings → 2 DER Buildings "Change Order" project
  - Building 10 & 22: 17 units (12 are < 60% AMI)
- Tenants in place
- Building envelope strategies
  - Bldg. 10: 3" polyiso c.i.
  - Bldg. 22: Injection foam
  - Amberline uPVC triple pane windows
- + ASHPs + Ventilation upgrades
- New, upsized electrical service – meters, secondaries, load centers
- No change to DHW
- Future Solar PV (not current scope)

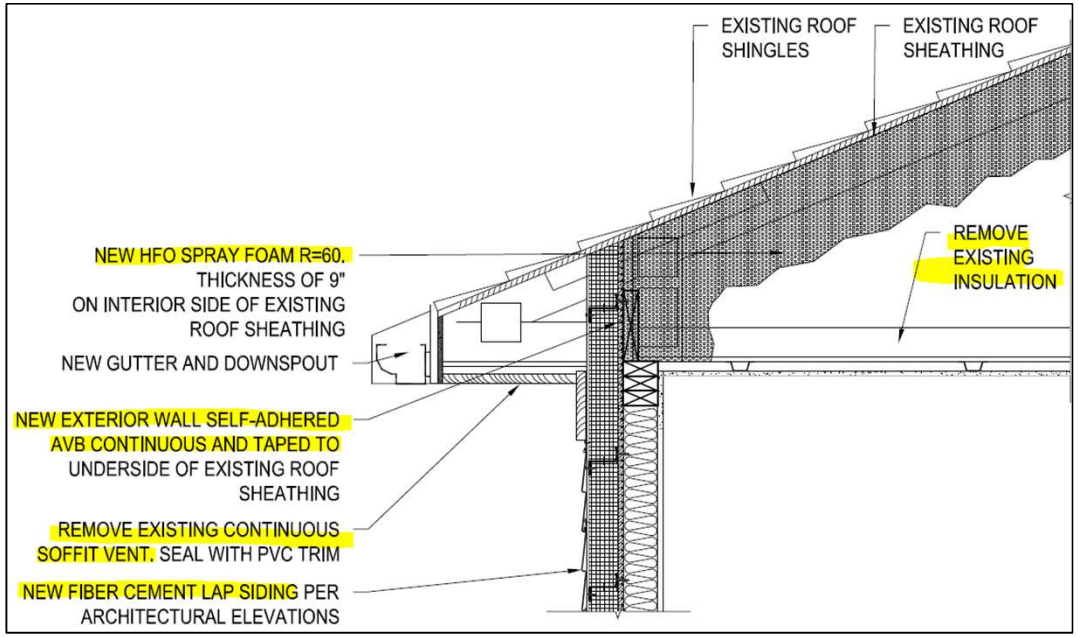
WinnCcompanies
Development | Residential | Military

Mission Main DER

Building 10:



Building 22:



WinnCompanies
Development | Residential | Military

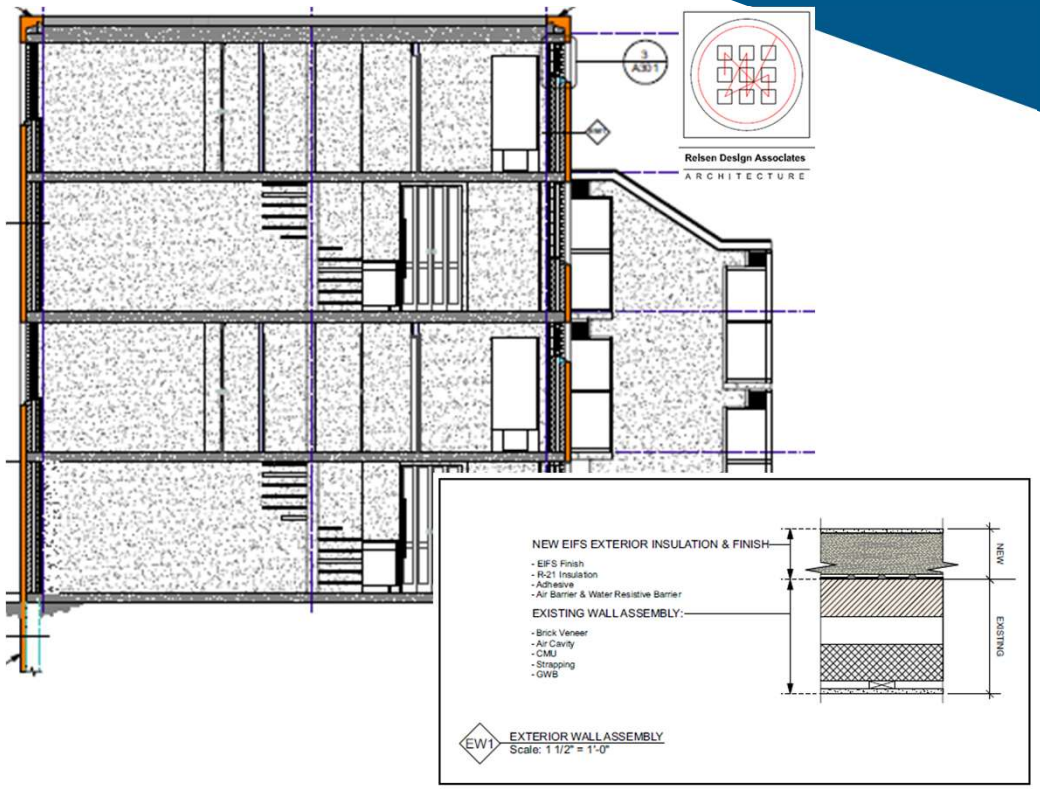
tat

Mission Main Apartments

- Building 10: $1,752,947
- Building 22: $1,172,970
- Total Construction Cost: $2,925,917
- Challenging to approach as a change order with existing subcontractors
- Injection foam and simplified ventilation reduces costs (~ $600k)
- **45% site energy use savings** = ~ 1.5 kgCO2e/sf/yr

PERMANENT FINANCING	Total
Permanent Loan (Lender)	$5,850,000
Developer Equity	$1,485,000
Deferred Developer Fee	$150,000
MOH - ARPA DER Grant	$600,000
Net Operating Income	$250,000
Reserves	$149,605
LEAN DER Incentives	$228,443
DOER - Retrofit Fund	$680,000
Total Permanent Financing	**$9,393,048**

Next Up (in Boston): Castle Square Low-Rise Pilot



WinnCompanies
Development | Residential | Military

Scaling Deep Energy Retrofits

- How can we deep energy retrofits or 'zero over time' retrofits the new norm?
  - They cost more…They're much harder to do…Energy cost savings are not enough…
- Strategy & Solutions
  - Capacity Building
  - Leverage Capital Needs – especially with ZOT approach
  - Leverage "other" financing – LIHTC, RAD, Refinancing
  - Try to Simplify – modeling, design, construction, legal
  - "Sticks" will continue being essential driver to decarb:
    - Energy Codes
    - Carbon emissions mandates/Building Performance Standards
  - "Carrots" are just as important
    - Robust incentive & grant programs – such as MOH, DOER, and MHP/MHFA/LISC's – deliver demonstration projects

WinnCompanies
Development | Residential | Military

Thank you

Christina McPike

Vice President of Energy & Sustainability

cmcpike@winnco.com | 617-640-9879