

BUILDINGENERGY NYC

Deep Energy Retrofits: Innovative Building Envelope and MEP Approaches

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Curated by Griffin Teed & Karina Gaft-Azcue

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Deep Energy Retrofits

Innovative Building Envelope and MEP Approaches

Curtis +
Ginsberg
Architects



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Ginsberg
Architects



BRIGHT
POWER

paths

LORING
CONSULTING ENGINEERS

Presenters



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Executive Director of
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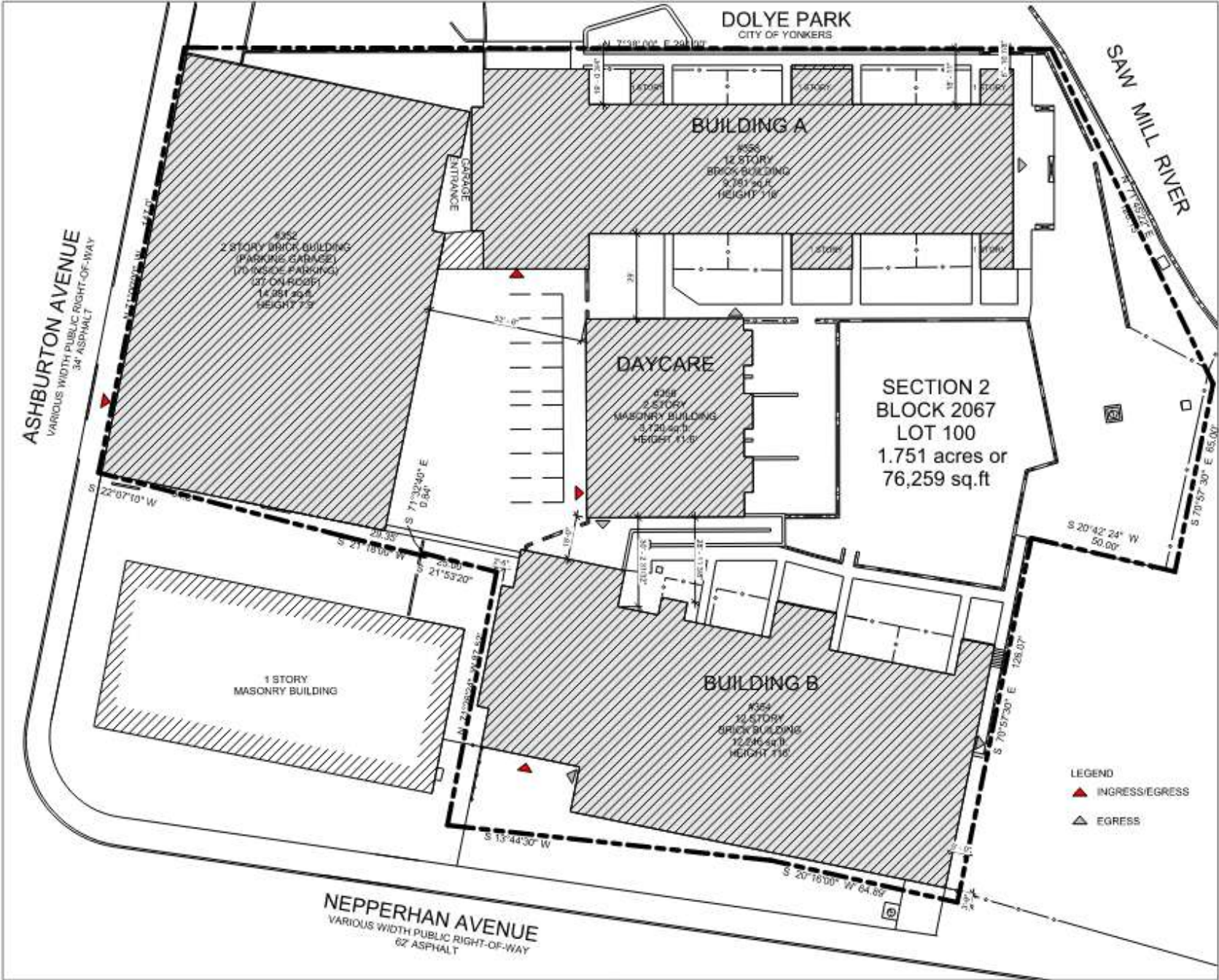


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Whitney Young Manor



Year Built	1974
# of Apartment	195
Occupancy Type	Affordable Housing, Daycare, Retail
Gross Floor Area	247,105 sq ft (Residential)
Stories	12 Stories (2)

Existing Systems

System	Pre-retrofit condition	Why it mattered
Heating	Electric-resistance baseboards (500–1,250 W per room), in-unit thermostats	Most expensive heat on a master-metered account; residents supplementing with gas stoves
Cooling	Tenant-owned through-wall ACs in wall sleeves	Open sleeves in every room – air leakage and thermal bridging
Ventilation	21 rooftop exhaust fans; corridor make-up air units on each roof	Unbalanced – sampled apartments ranged from no flow to 107 CFM
Domestic hot water	Two gas plants of six modular boilers with heat exchangers; 24/7 recirculation	The main gas end use on site
Envelope	Brick on CMU, uninsulated ($\approx R-8$); 2006 aluminum double-hung windows ($U=0.43$); balcony slabs not thermally broken	Drafts, stack effect and cold balconies drive heating load
Controls	No central system; unitized cooling, apartment thermostats	No visibility into how the building runs



Apartment: electric baseboard below a through-wall AC sleeve



Rooftop exhaust fans



Gas DHW plant (modular boilers)

Project Goals



Tenants

Equitable for tenants

- Improve thermal comfort by improving heating controls plus, for the first time, central cooling through in-unit fan coils
- Improve air quality and balanced fresh air – exhaust overhaul and corridor DOAS with energy recovery
- Provide Uninterrupted heat and hot water – backup boilers for resiliency



Owner

Financially feasible for owners

- Rehabilitate the property's aging systems during the LIHTC resyndication
- Cut operating cost by moving off electric-resistance heat
- Simplify / centralized maintenance, ~\$5M of apartment electrical work avoided
- Use Stack NYSERDA EBC funding with utility incentives to close the gap and demonstrate a replicable state-of-the-art solution

How the business case was framed

Use the capital event
The resyndication was the trigger – decarbonize during the recapitalization, not at equipment failure.

Judge by lifecycle value
20-year NPV (NYSERDA SDA tool), not simple payback. Every option was NPV-negative; gas was least negative, EBC funding closed the gap to gas.

Keep options open
Reduce loads first and build a central loop that can take heat recovery, storage or geothermal as the grid decarbonizes.

NYSERDA – Empire Building Challenge Goals

Demonstrate a state-of-the-art heat pump / decarbonization solution that can be replicated across large multifamily buildings in New York State.

What EBC (PON 4809) asked of the project

- Pair a portfolio owner with engineers/consultants, architects and manufacturers on a tall, occupied building
- Prioritize Load reduction first, then right-sized electrified heating, cooling and DHW
- Demonstrate a carbon-neutrality roadmap, tenant engagement plan and Strategic Decarbonization Assessment (SDA) alongside the near-term scope
- Measured, transparent performance data shared back to the market (M&V)



Yonkers sits outside NYC's Local Law 97 caps – the carbon and EUI targets here are voluntary owner commitments, which is part of what made the project a useful test case for the state.

Carbon neutral by 2035

Public commitment for Whitney Young Manor

EUI 96 → ≤ 50

kBtu/SF/yr site energy target (2019 baseline → 2035)

47 properties · ~13,000 units

Portfolio where the approach can be repeated

~11.6M SF built 1920–1990;
electric-resistance, hydronic and steam buildings

Strategy – Reduce Load, Recover Heat, Electrify



1 Reduce load

- 4" EPS EIFS overclad, new uPVC windows, new roof (R-23 → R-31.5)
- Seal every through-wall AC sleeve
- Exhaust overhaul: sealed shafts, variable-speed fans, constant-airflow regulators
- Low flow water fixtures

~38%

smaller heat pump plant once loads came down



2 Recover heat

- SHARC wastewater energy transfer – heat recovered from building wastewater through a heat exchanger and heat pump
- Energy recovery on the corridor DOAS
- DHW heat pumps draw from the loop – heat sharing with cooling season

450 kBtu/h

SHARC heat exchanger on an 18,000-gal wastewater tank



3 Electrify

- Rooftop air-to-water heat pump plant per tower (~200 tons, 10°F design)
- Water-to-water heat pumps make DHW at 160°F
- Low-temperature 2-pipe fan coils; gas condensing boilers kept for backup only

–77% gas

modeled; electricity also falls ~15% as baseboards go away

Maps to NYSERDA's Resource Efficient Decarbonization (RED) framework – *phased, technology-agnostic, load reduction first*

Reduce
Envelope and
ventilation



Reconfigure
New dual-temp
hydronic loop
replaces baseboards



Reuse
Wastewater and
exhaust-air heat



Replace
Heat pumps now; gas
kept as backup until
grid and technology
allow

Key Decisions

1

Envelope upgrades

Options weighed

EIFS vs. prefabricated panels
vs. enclosing the balconies

What we chose

4" EPS EIFS, new uPVC
windows, new roof; balconies
left open

Deciding factors

Lowest cost per SF (~65%
below panels), tenants keep
their balconies, and the load
reduction shrank the heat
pump plant ~38%.

2

Central vs. decentralized system

Options weighed

Mini-splits / PTHPs in each
apartment vs. two rooftop
plants

What we chose

Central air-to-water heat
pump plant per tower

Deciding factors

One riser per tower instead
of 195 apartment electrical
upgrades (~\$5M avoided),
centralized maintenance,
backup boilers for
resiliency.

3

Refrigerant vs. Hydronic distribution

Options weighed

VRF refrigerant piping vs. a
dual-temperature water loop

What we chose

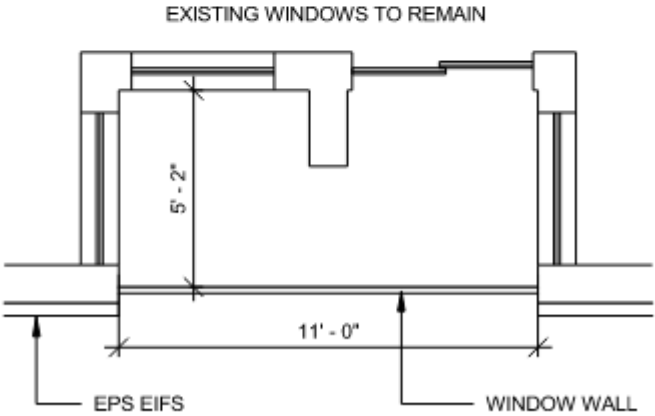
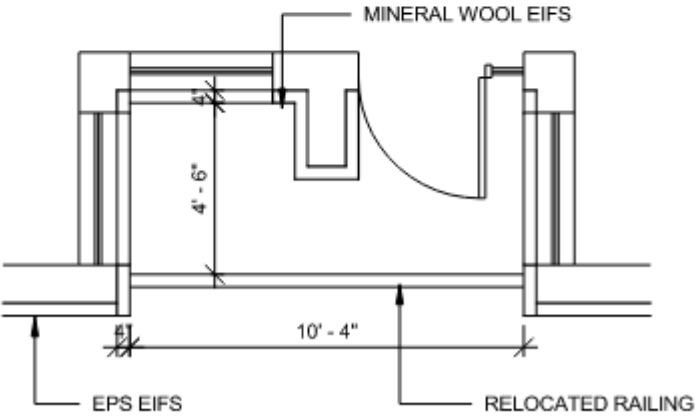
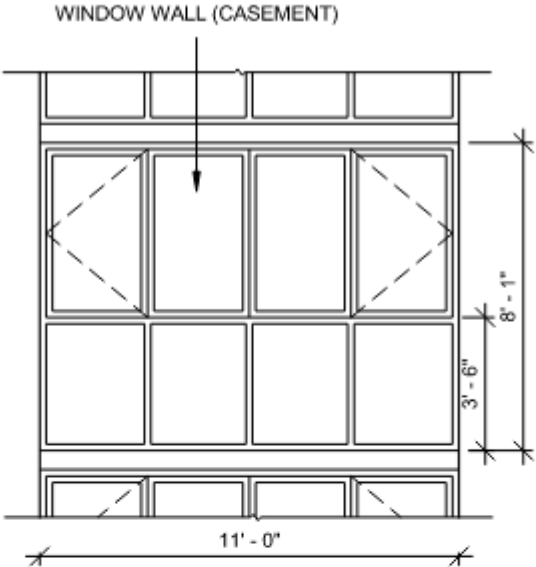
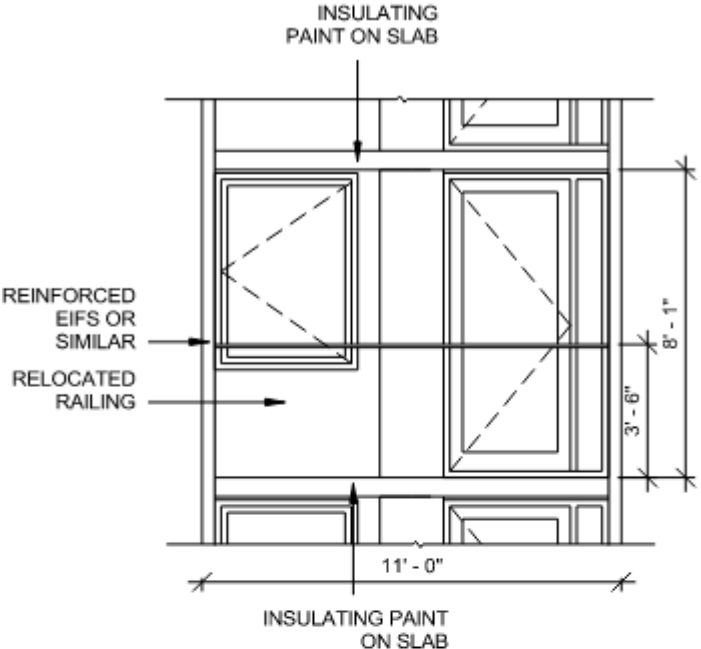
2-pipe hydronic loop feeding
fan coils, DHW heat pumps and
wastewater heat recovery

Deciding factors

One loop serves heating,
cooling, DHW, backup and heat
recovery; no refrigerant in
apartments; open to storage
or geothermal later.

Each decision was made in the 2021 design charrette with NYSERDA, Omni's construction team, Loring and Curtis + Ginsberg – before the Phase II proposal was written.

Decision 1 – Overcladding



1

2



Decision 1 – Overcladding Alternatives

Envelope option (C+G study, Aug 2021)	Insulation / system	Total est.	Annual energy savings	tCO2e / yr	Carbon cut
A. EIFS + mineral-wool EIFS & insulating paint at balconies	4" EPS EIFS, MW at balconies	\$6.19M	\$65,380	162	11.2%
B. EIFS + enclose balconies with window wall	4" EPS EIFS + operable window wall	\$4.85M	\$71,242	177	12.2%
C. EIFS everywhere except balconies	4" EPS EIFS, reinforced at ground floor	\$4.80M	\$57,089	142	9.8%
D. Prefabricated panels (Dextall)	Mineral wool, R-22 assembly, windows integrated	\$10.65M	Not modeled		
E. Prefabricated panels + window wall	As D with balcony enclosure	\$9.47M	Not modeled		

Costs are June 2021 open-shop estimates excluding scaffolding, demolition and railing replacement; see next slides for the as-built envelope.

Decision 1 – Overcladding Alternatives

Why the envelope came first

Load reduction let the heat pump plant be sized ~38% smaller than for the bare building – fewer modules, less electrical distribution, lower demand charges.

Modeled envelope package alone: ~\$57K/yr savings, 142 tCO₂e/yr (9.8%) – small on its own, essential to everything else.

Inside the EIFS decision

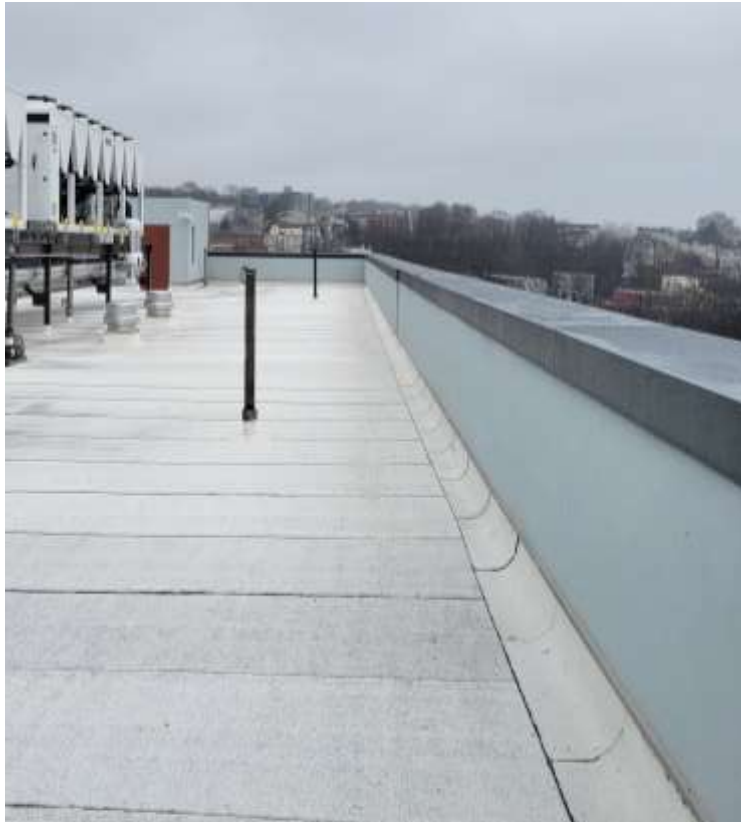
- EPS over XPS: nearly the same R/inch at a fraction of the embodied carbon (XPS is several times EPS per R-20)
- uPVC casement/hopper windows (Rehau) – ~25% cheaper than aluminum, U-0.29 vs U-0.43 existing double-hung
- Seal every through-wall AC sleeve – a hole in every living room and bedroom, filled with Densglass and framing

Costs are June 2021 open-shop estimates excluding scaffolding, demolition and railing replacement; see next slides for the as-built envelope

• Roof: 41.5" polyiso, R-23 → R-31.5, new membrane over existing

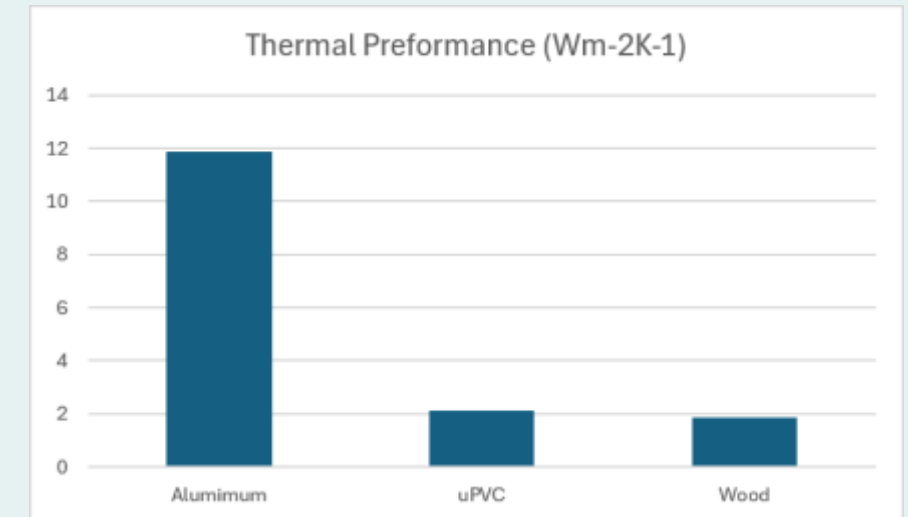


Overcladding



Address thermal bridged

- Overcladded at slab edge
- Install new roof insulation and insulated parapet
- Upvc window less conductive than aluminum.



Improved Air Sealing and Thermal loss

- Closed up through wall AC sleeve
- Tilt turn windows with multi locking are more air tight then existing sliders.

Revitalized Exterior and improved envelope

Key Decisions

1

Envelope upgrades

Options weighed

EIFS vs. prefabricated panels
vs. enclosing the balconies

What we chose

4" EPS EIFS, new uPVC
windows, new roof; balconies
left open

Deciding factors

Lowest cost per SF (~65%
below panels), tenants keep
their balconies, and the load
reduction shrank the heat
pump plant ~38%.

2

Central vs. decentralized system

Options weighed

Mini-splits / PTHPs in each
apartment vs. two rooftop
plants

What we chose

Central air-to-water heat
pump plant per tower

Deciding factors

One riser per tower instead
of 195 apartment electrical
upgrades (~\$5M avoided),
centralized maintenance,
backup boilers for
resiliency.

3

Refrigerant vs. Hydronic distribution

Options weighed

VRF refrigerant piping vs. a
dual-temperature water loop

What we chose

2-pipe hydronic loop feeding
fan coils, DHW heat pumps and
wastewater heat recovery

Deciding factors

One loop serves heating,
cooling, DHW, backup and heat
recovery; no refrigerant in
apartments; open to storage
or geothermal later.

Each decision was made in the 2021 design charrette with NYSERDA, Omni's construction team, Loring and Curtis + Ginsberg – before the Phase II proposal was written.

Decision 2 – Central Plant vs. Decentralized Heat Pumps

	Mini-splits / PTHPs in each apartment (Phase I concept)	Central air-to-water plant per tower (selected)
Electrical	New feeders and panel upgrades in 195 apartments; risers through occupied units	One new riser to each rooftop plant; existing service kept – ~\$5M avoided
Maintenance	195+ outdoor units, refrigerant service inside apartments, staggered replacement	Two modular rooftop plants; centralized service and spares
Tenants & facade	Condensers on balconies or in sleeves; EIFS penetrations	Balconies untouched; sleeves sealed; in-unit work limited to fan coils and PEX
Resiliency	No backup; each unit fails alone	Modular heat pumps + backup condensing boilers per tower
Future-	Locked to refrigerant	Dual-temp loop accepts



Aermec NYK modular air-to-water heat pump – basis of design, 9 modules (~200 tons) per tower

Also evaluated and set aside

Geothermal (Alt. 2): best carbon case (495 tCO2e/yr) but \$7.4M and a longer schedule than the resyndication allowed. PTHPs in existing sleeves: ruled out with NYSERDA for the same maintenance and electrical reasons as mini-splits. Master-metered building: the owner pays every kWh, so central plant efficiency and demand control mattered more than tenant metering.

Key Decisions

1

Envelope upgrades

Options weighed

EIFS vs. prefabricated panels
vs. enclosing the balconies

What we chose

4" EPS EIFS, new uPVC
windows, new roof; balconies
left open

Deciding factors

Lowest cost per SF (~65%
below panels), tenants keep
their balconies, and the load
reduction shrank the heat
pump plant ~38%.

2

Central vs. decentralized system

Options weighed

Mini-splits / PTHPs in each
apartment vs. two rooftop
plants

What we chose

Central air-to-water heat
pump plant per tower

Deciding factors

One riser per tower instead
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upgrades (~\$5M avoided),
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Refrigerant vs. Hydronic distribution

Options weighed

VRF refrigerant piping vs. a
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What we chose

2-pipe hydronic loop feeding
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Deciding factors

One loop serves heating,
cooling, DHW, backup and heat
recovery; no refrigerant in
apartments; open to storage
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Each decision was made in the 2021 design charrette with NYSERDA, Omni's construction team, Loring and Curtis + Ginsberg – before the Phase II proposal was written.

Decision 3 – Refrigerant vs. Hydronic Distribution

Refrigerant (VRF / multi-split)

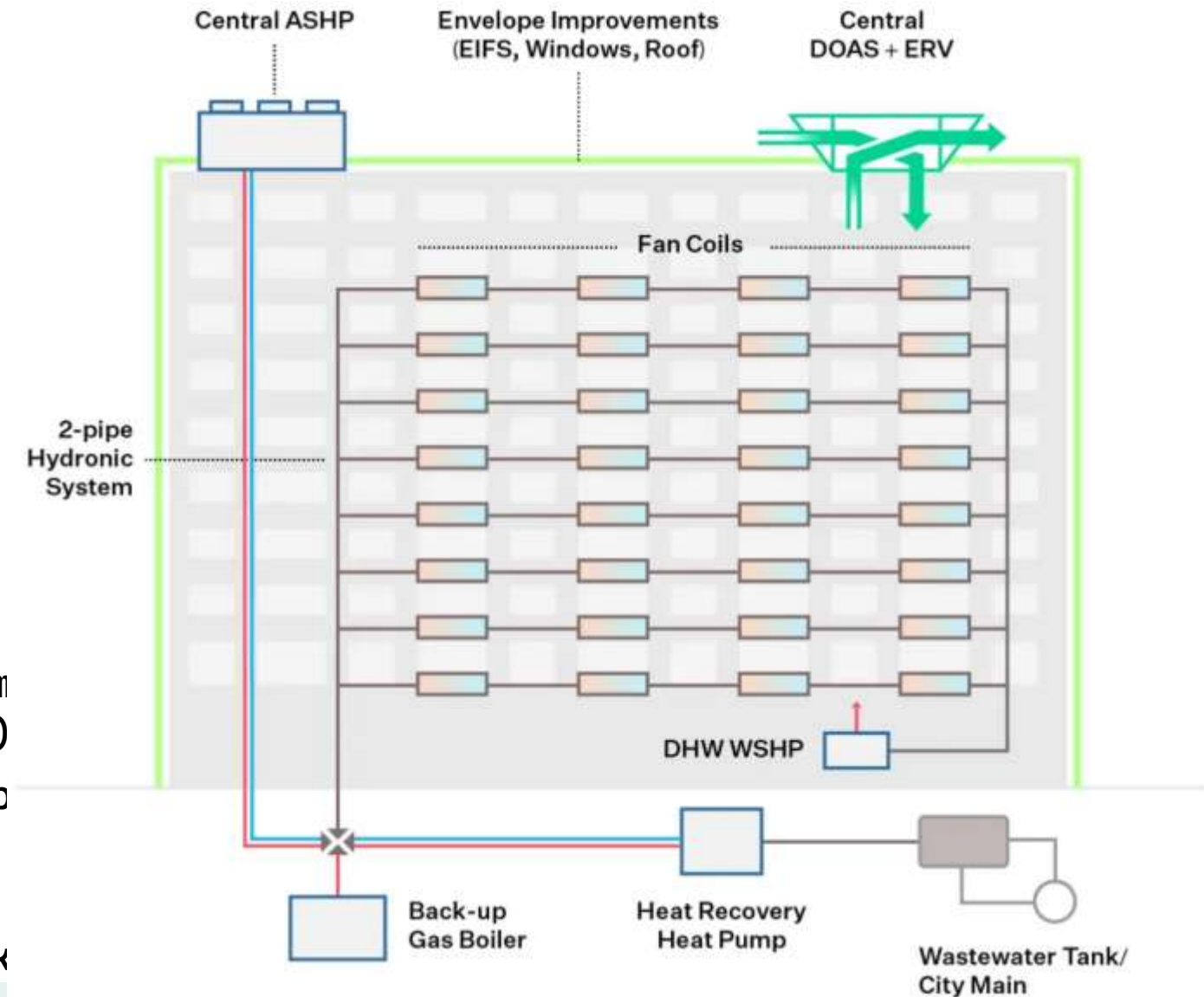
- Long refrigerant runs through 12 stories of occupied apartments
- Leak detection and charge limits in sleeping rooms; A2L transition risk
- No simple way to add thermal storage, heat recovery or a backup system
- DHW would need its own separate system

Hydronic dual-temperature loop (selected)

- 2-pipe loop, 30% glycol, isolated from the plant by plate-and-frame heat exchangers
- Low-temperature 2-pipe fan coils in every living room and bedroom; PEX in-unit (1/2-1/3 the cost of copper)
- Water-to-water heat pumps make DHW from the same loop – warm return water in winter, free pre-cooling in summer
- SHARC wastewater heat recovery and an 18,000-gal tank

Why it mattered later

The loop is what let the team add wastewater heat recovery after the proposal, keep gas backup for resiliency, and leaves a path to thermal storage or geothermal without touching an apartment again.



Source: Retrofit Playbook for Large Buildings – Whitney Young Manor case study

Heating System

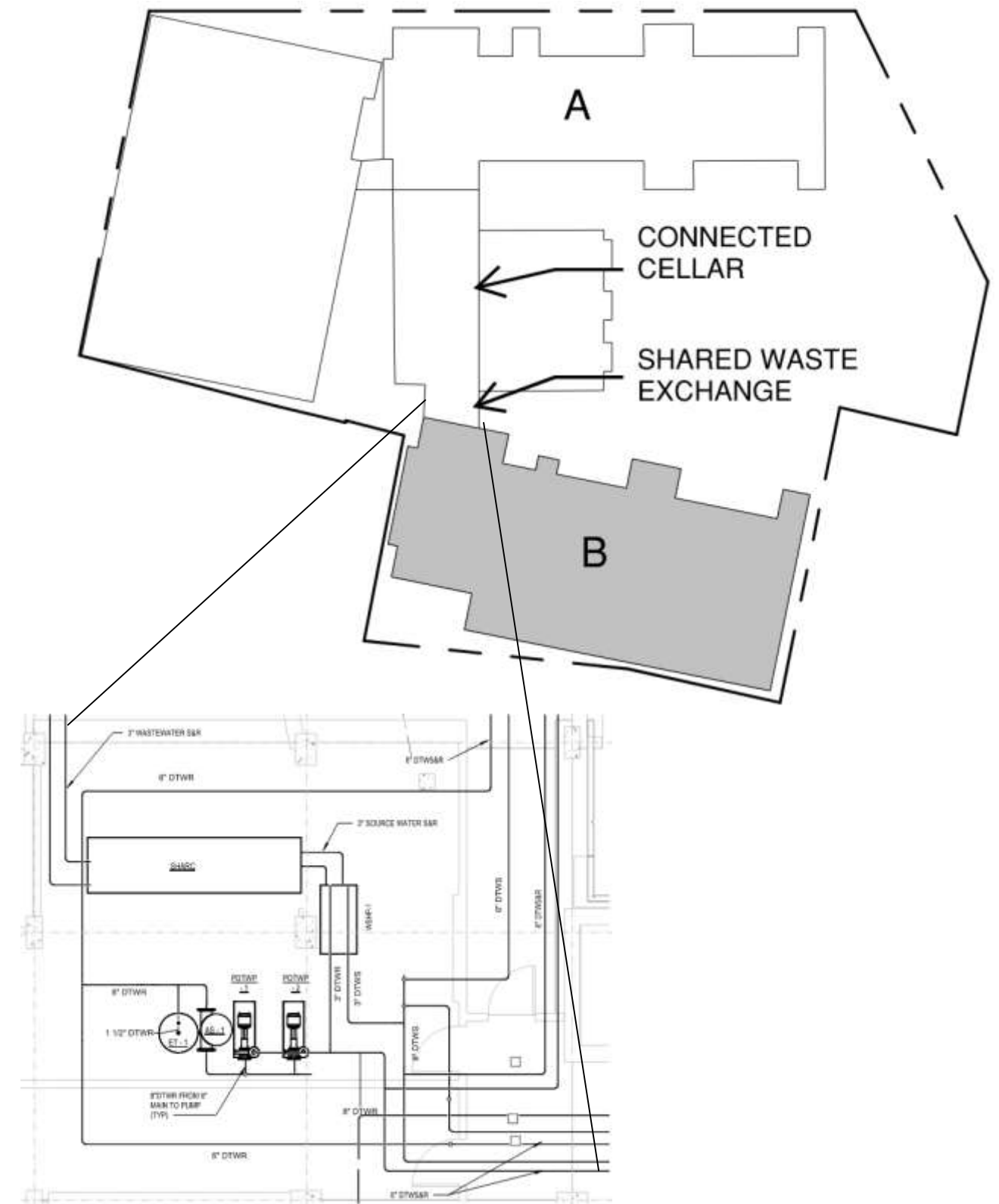


Terminal unit at entry



Rooftop Heat pump

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Funding & Incentive Strategy

\$5.0M

NYSERDA Empire Building Challenge
Phase II implementation award (PON 4809), Nov
2021 proposal

~\$800K

Con Edison Clean Heat
Heat pump heating/cooling + DHW

\$136.5K

NYSERDA Low Carbon Pathways
Multifamily program, \$700/unit

What the EBC dollars bought (2021 estimate)

EBC-funded measure	Est. cost	EBC share	Owner
4" EPS EIFS overclad, new windows, new roof	\$5.07M	\$2.31M	\$1.78M
Central air-to-water heat pump plants + DHW	\$5.50M	\$2.50M	\$1.28M
Ventilation overhaul + ASHP ERV DOAS	\$0.42M	\$0.19M	\$0.08M
Total EBC-funded measures	\$10.98M	\$5.00M	\$3.14M*

*after estimated utility incentives. Total development cost of the full LIHTC resyndication: \$84.7M (2024). Electrical distribution to the rooftop plants (~\$850K) sat outside the EBC scope.

Tariff lesson: on a master-metered EL12 account the economics are driven by demand charges (~\$19/kW heating season, ~\$31/kW cooling season in 2021), so kW was modeled separately from kWh and the plant was sized after the envelope, not before.

Project Challenges



Schedule

The 2021 plan had construction in 2023 and completion by mid-2024. The backup boiler fired Sept 2024, heat pumps started up Apr-May 2025 and commissioning closes Sept 2026; winter 2024-25 ran on a temporary boiler sequence. In an occupied building, the sequencing must take into account heating/cooling seasons.



Occupied building / Structural Considerations

Tenant-in-place work across 195 apartments: baseboards stayed live until fan coils were ready, and every in-unit test or fix needs access – the first fan coil test covered 12 units in 7 apartments.

Apartment ERV did not proceed due to space and cost for additional shafts.



Electrical & power quality

No utility service upgrade was needed, but ~\$850K of conduit, wiring and transformers carried power to the rooftop plants. Heat pumps alarmed on incoming voltage and a primary pump was locked out for reverse-rotation risk.

Project Challenges



System complexity

The combined heating/DHW system and the range of equipment serving the loop created significant challenges for overall system balancing and continuing operations.



Controls & BMS

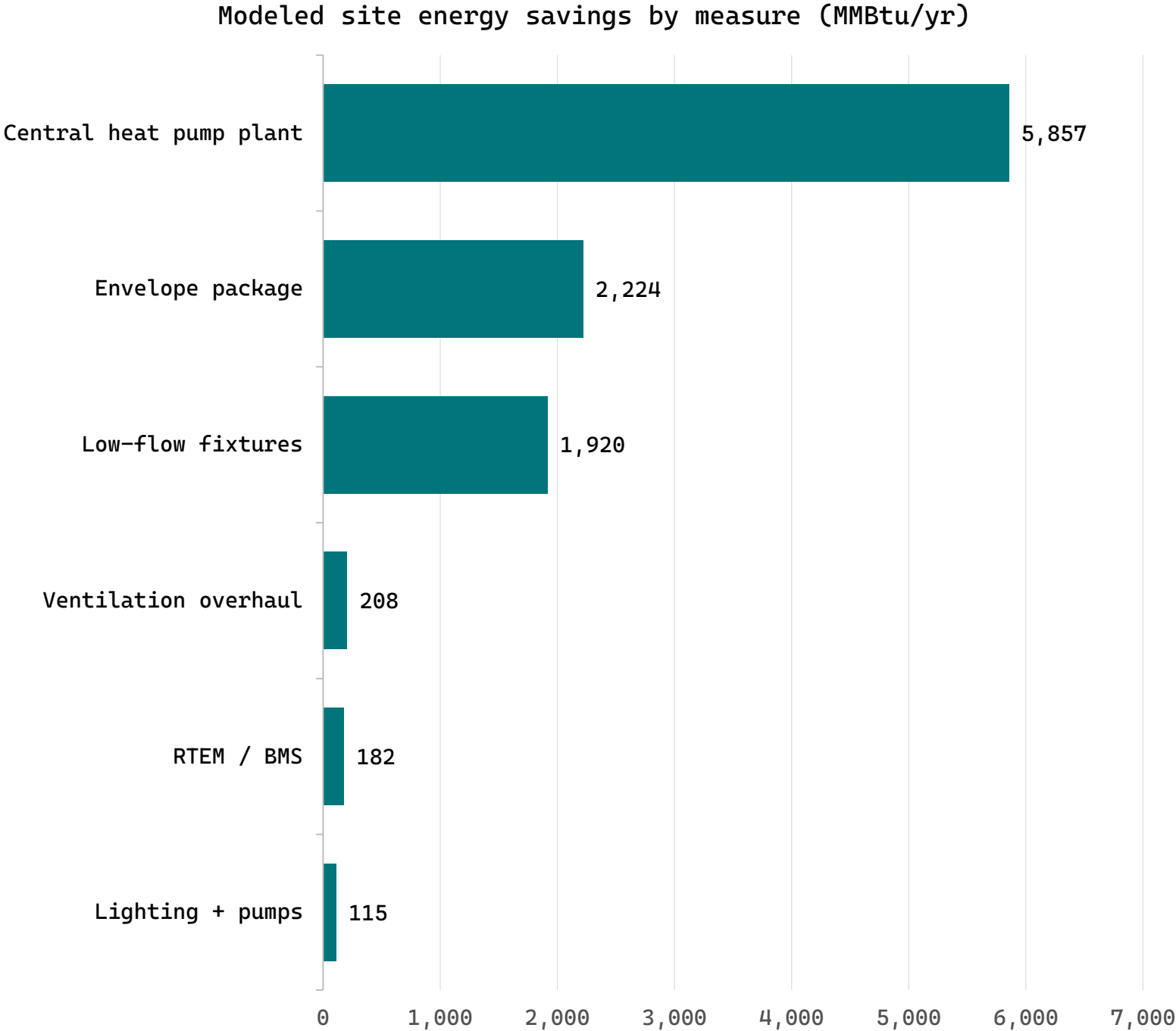
The EMS scope became a BMS that is still coming online. Pumps ran in HAND through most of 2025, the controls contractor missed a key test visit, and heat pump alarms weren't visible to operators.



Heat Recovery Storage

Installing a heat recovery system in a retrofit context can be exceptionally challenging. Adapting the existing sanitary system to the SHARC was great on paper, but its execution in an existing building was hampered by other issues associated with the building's structure and more mundane issues like permitting and entitlements.

Model Results – Whole Property



Carbon trajectory

- At today’s grid the retrofit alone cuts roughly half (46.5%)
- The rest comes as New York’s grid decarbonizes: 1,456 tCO2e/yr (2019) → 273 tCO2e/yr expected by 2035 (–81%)
- fuel mix 54% gas / 46% electric → 25% / 75%.

Model: bin-based spreadsheet, TMY3 weather, 229,278 SF existing / 236,715 SF proposed (100% CDs). Central plant savings exclude stove-heating displacement. Water savings not shown.

Model Results – Whole Property

Metric	Baseline (2019, weather-normalized)	Modeled post-retrofit	Change
Site EUI (kBtu/SF/yr)	93.4	46.1	-51%
Site energy (MMBtu/yr)	21,424	10,918	-49%
Natural gas (therms/yr)	117,461	26,961	-77%
Electricity (kWh/yr)	2,836,336	2,409,636	-15%
Utility spend (\$/yr, 2024 rates)	\$737K	\$515K	-30% ≈ \$222K/yr

Electricity falls 15% even though heating stays electric: heat pumps deliver two to three units of heat per kWh versus one for the old baseboards, behind a tighter envelope.”

Early Actual Results – First 10 Months (Pre-Commissioning)

–41%

Whole-building site energy
vs. weather-adjusted baseline

74 → 44

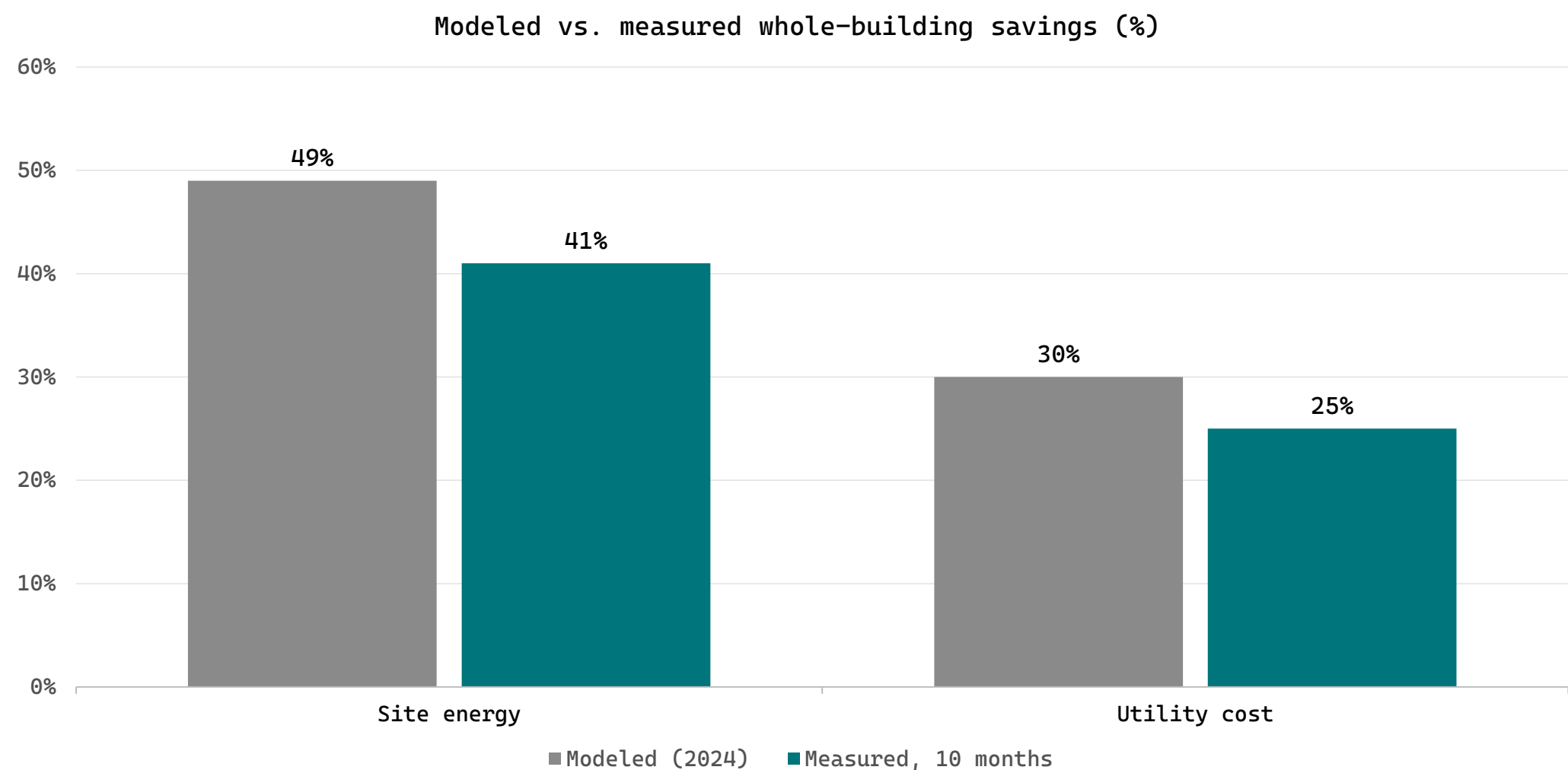
Site EUI, kBtu/SF (10-month)
adjusted baseline → measured

–25%

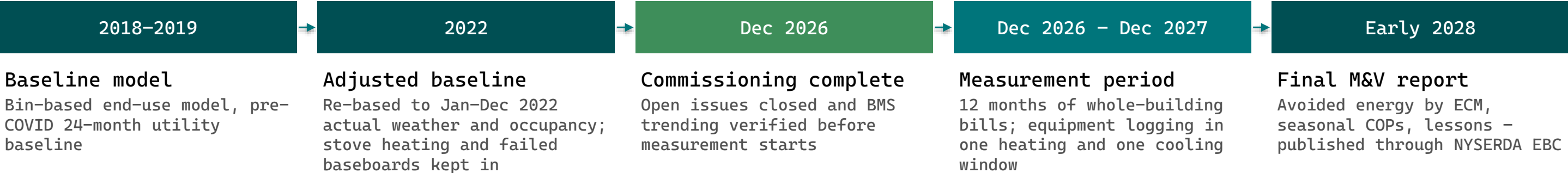
Utility cost
\$2.92 → \$2.19 per SF

–43%

GHG emissions
NYC LL97 factors, for comparison only



System-Level Measurement & Verification



IPMVP Option C – whole building

- Monthly gas and electric bills, kWh and kW, Dec 2026 – Dec 2027 – demand tracked as closely as consumption
- Regression on actual weather (dry bulb, wet bulb, enthalpy – not just HDD/CDD) and occupancy
- "Avoided energy" not "savings": baseline included stove heating and under-performing baseboards; new comfort and ventilation are real loads
- Non-EBC measures (lighting, fixtures, pumps) measured separately so credit is not double-counted

IPMVP Option B – equipment level

- 5-minute logging, two weeks heating + two weeks cooling: heat pump kW/kWh, loop GPM, entering/leaving water temps, pump kW
- Same for the water-to-water DHW heat pumps and the SHARC loop, plus wastewater inlet/outlet temperature curves
- Instantaneous COP = $(\text{GPM} \times 500 \times \Delta T) \div \text{kW}$; weighted seasonal COP; binned COP vs. load ratio and outdoor temperature
- BMS trends and utility meters used where they exist; temporary loggers and flow meters fill the gaps

Team: Bright Power (M&V lead, data collection), Loring (MEP), Reliant Realty (BMS operator), Renewal Construction (site access), Paths (owner). Framework: IPMVP 2022 and ASHRAE Guideline 14-2023, per the NYSERDA EBC Task 5 M&V plan.

Questions?

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Please fill out an evaluation for this session



or: [*nesea.org/eval*](https://nesea.org/eval)

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