NEW YORK STATE OF OPPORTUNITY. | RetrofitNY

RetrofitNY

Revolutionizing building renovations in New York State

Create a large scale, self-sustaining market for high performance retrofit solutions

Industry-designed, cost-effective, long-lasting retrofit solutions for tenanted buildings reaching or approaching net zero energy.

Implement solutions on a large scale to drive industrialization, reduce cost, and standardize and guarantee long-term performance.

Revolutionizing the way multifamily buildings are renovated in NYS

- Keeping residents in their homes
- Minimizing tenant disruption

Adapting the successful Energiesprong model for New York State

- 2,500 rehabs
- 2,500 new construction
- 20,000 in pipeline

Energie Sprong

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Transfer of Knowledge from Energiesprong

- Workshops in NYC or webinars led by Energiesprong program officials and/or industry professionals.
- Case studies and reports
- Energiesprong team mock design on NYC building (Bronx)
- Netherlands field trip (week of August 27)

Energie Sprong

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Field Trip to the Netherlands

Itinerary

1. Amsterdam
2. Soesterberg
3. Utrecht: BAM-Rennovates Conference
4. Groningen
5. Assen
6. Lemelerveld: RC Panels Factory
7. Utrecht: Mitros Housing Association
8. Tiel: Factory Zero
9. Amsterdam
10. Zoetermeer
11. Amsterdam

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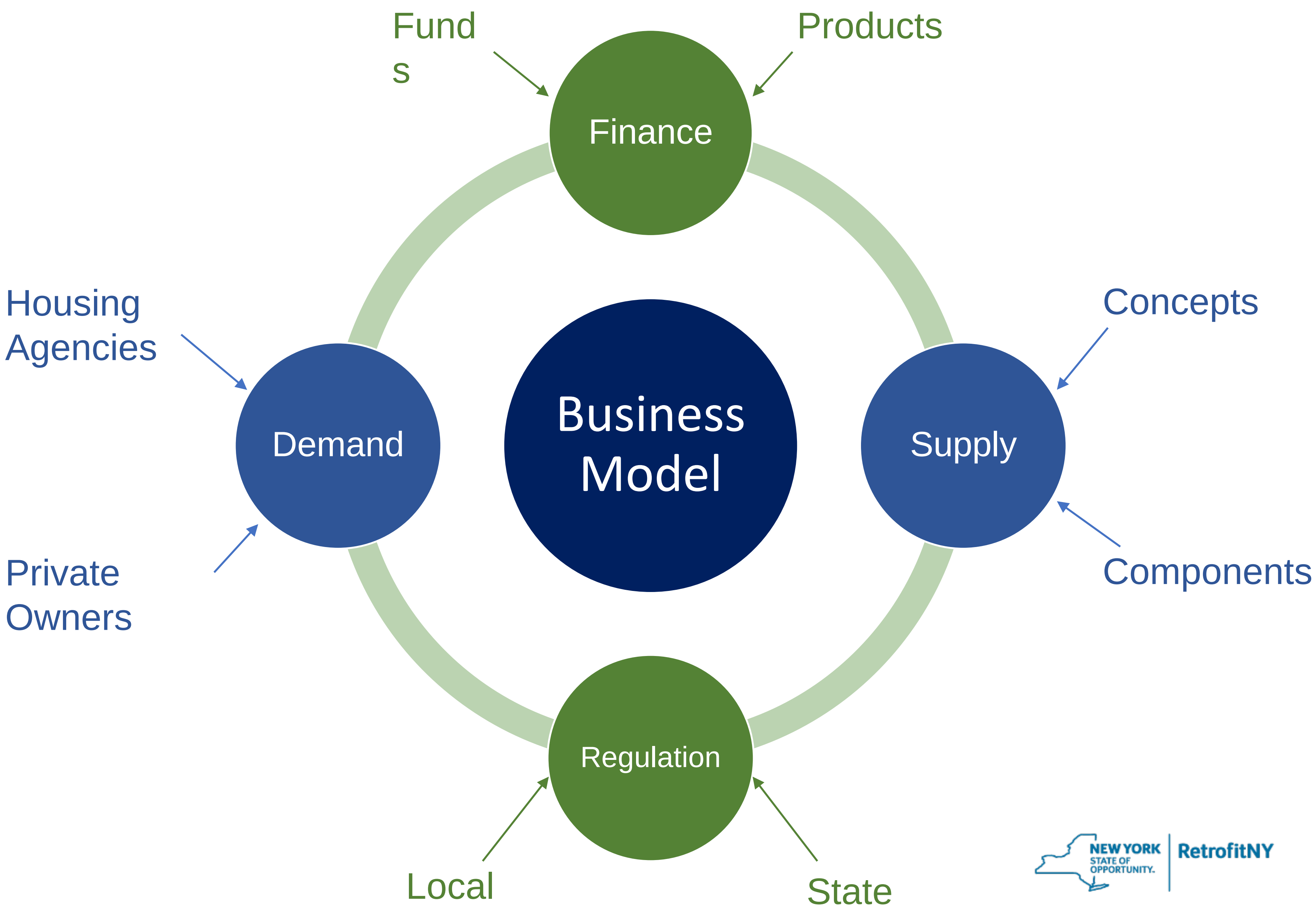
Field Trip to the Netherlands

- **Garden style apartments- Soesterberg**

Energie Sprong

Developing new business models in the multifamily sector to tackle climate challenges of today.



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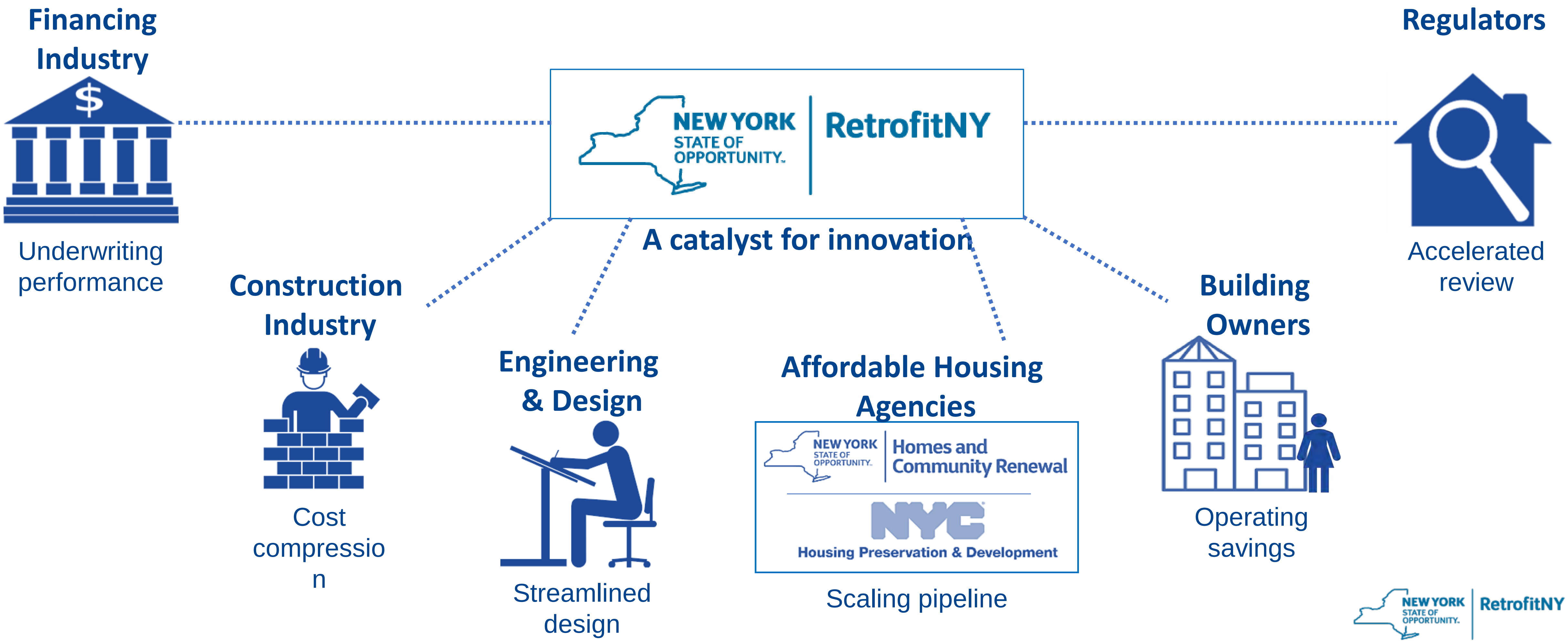
RetrofitNY’s Role

Market Transformation & Aligning the Market



Midway into the Pilot Phase

Preparation → Pilot Projects → First Market → Market Growth → Volume Market for "Net Zero" Retrofits

Design RFP: First projects start June 2018
First of a series

Unlocking Additional Markets
NYC Housing Authority (178,000 apartments)
State University of New York (400 buildings, 70,000 beds)

Affordable Housing Buildings

- 1-2 story garden style
- 3-7 story building
- Simple architecture

Match

6 months design period

- Designs that can be approved and executed
- Trust and understanding of the financial models
- Clarity on what regulations may need adjustment
- Solutions adaptable to other buildings

Qualified Industry Teams

- Can design and install the solution
- $75,000 stipend for design
- Open source design

6 months design period

Deal Closing
+
Construction

Gap Funding Available

Supporting the Teams

- Transfer of knowledge from Energiesprong
- Coaches
- $75,000 stipend
- IPNA for Buildings

Making the Deal

- Regular touch base
- HPD, HCR and HUD
- Financing partners
- Permitting agencies

Encourage collaboration between teams and open communication with owners and agencies

Milestones Summary

1. Start Up
   - Conducting IPNAs in selected Buildings as required by HPD & HCR and to support Teams
   - Assigning each Team a coach
2. **Conceptual Design – end of Month 3**
   - Demonstrate the strategy for implementing the proposed retrofit
   - First estimate of the solutions costs and performance
   - Start identifying hurdles to building the retrofit
3. Schematic Design – end of Month 6
   - Set of documents needed to start closing the transaction and move to construction

Key Elements of a Net-Zero Building

Air sealed & high performance building envelope

- Panelized construction
- Site applied façade
- High performance windows & doors

Efficient mechanical & ventilation systems

- Electrified buildings
- Heat pump technology
- Energy recovery ventilation

On-site energy generation

- Solar PV

Costs Premium Today

100% Electrified solution

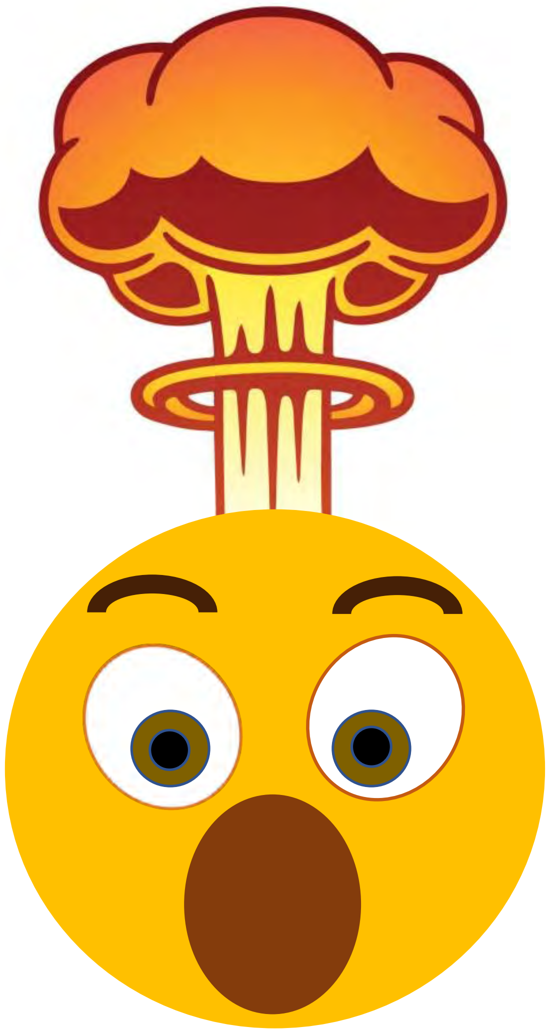
- Average incremental costs across pilot projects at conceptual design: $60K/DU

Understanding main cost drivers

- Domestic hot water delivery
- Panels

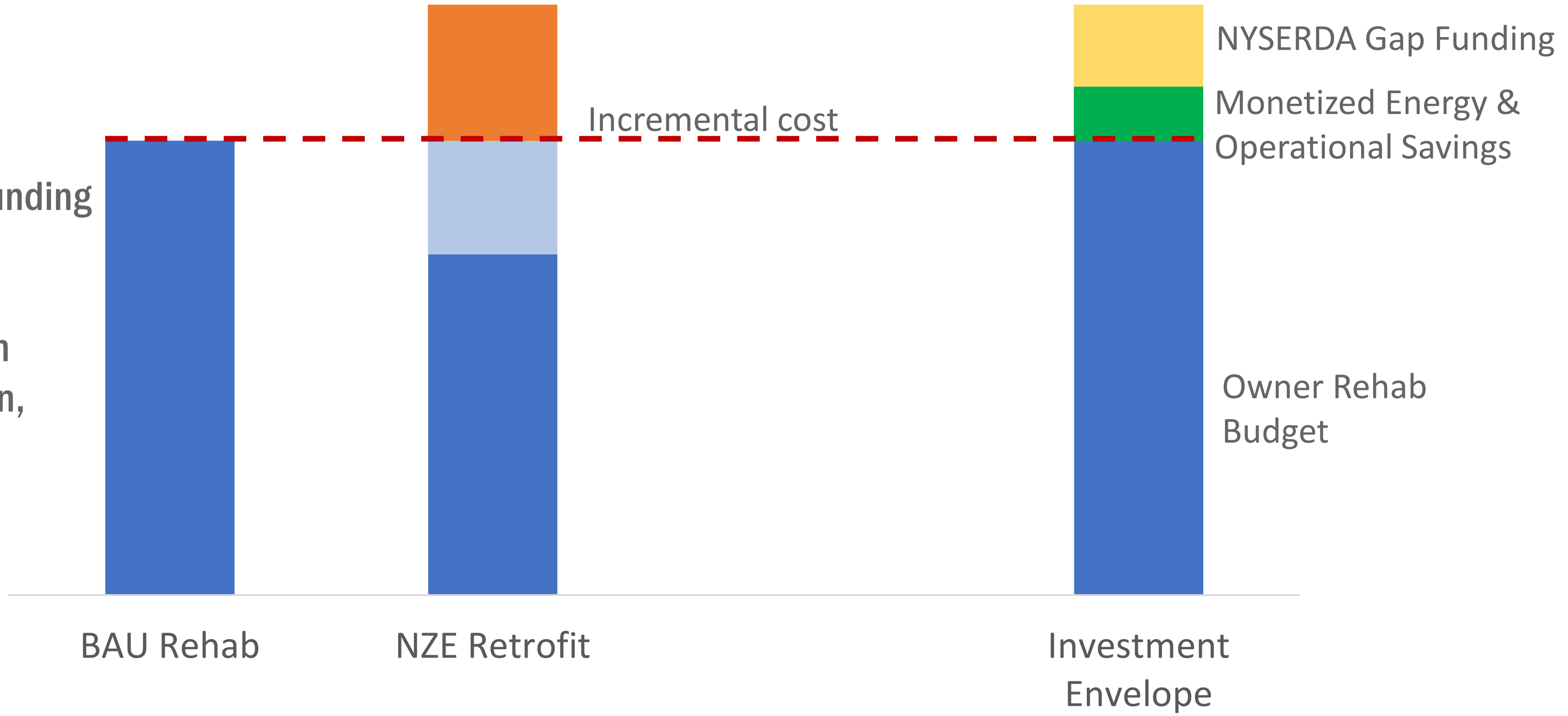
Getting projects to construction

- Design flexibility
- NYSERDA gap funding
- Underwriting performance



Opportunity In Scope Overlap + Our Commitment to Getting Projects Built

- Incremental cost of NZE retrofit vs. BAU
- Monetized operational savings + NYSERDA funding to bridge the gap
- NZE Retrofits will be more cost-effective in coming years via cost compression, innovation, standardization, and scale



RetrofitNY Financing Working Group

Launched September 13, 2018

cpc

NYCEEC BUILDING FINANCIAL SOLUTIONS

citi

CHASE

WELLS FARGO

M&T Bank

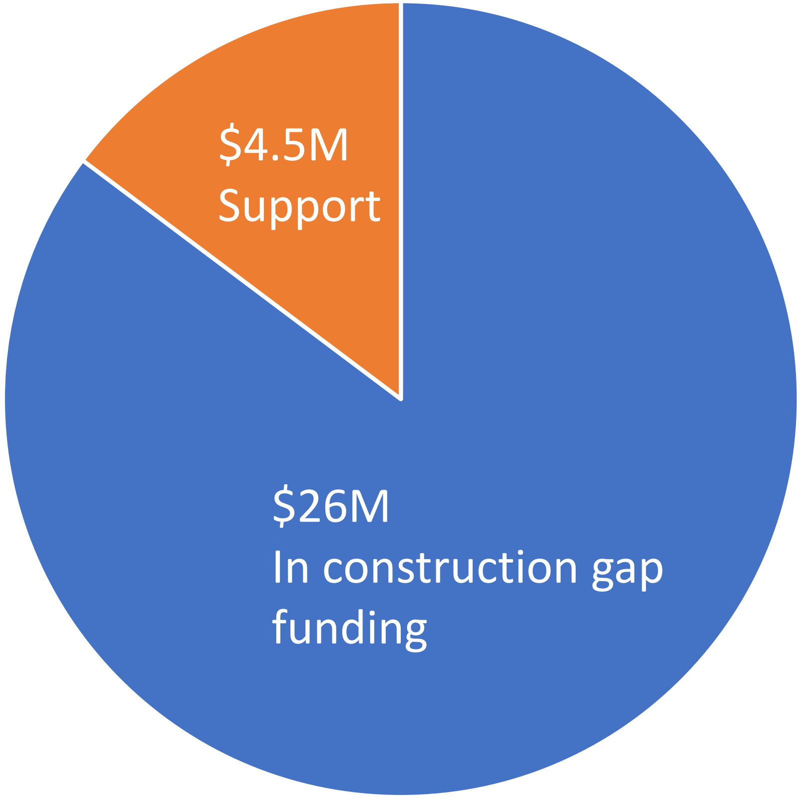
NYC Department of Housing Preservation & Development

NYC HDC NEW YORK CITY HOUSING DEVELOPMENT CORPORATION

NEW YORK STATE OF OPPORTUNITY. | Homes and Community Renewal

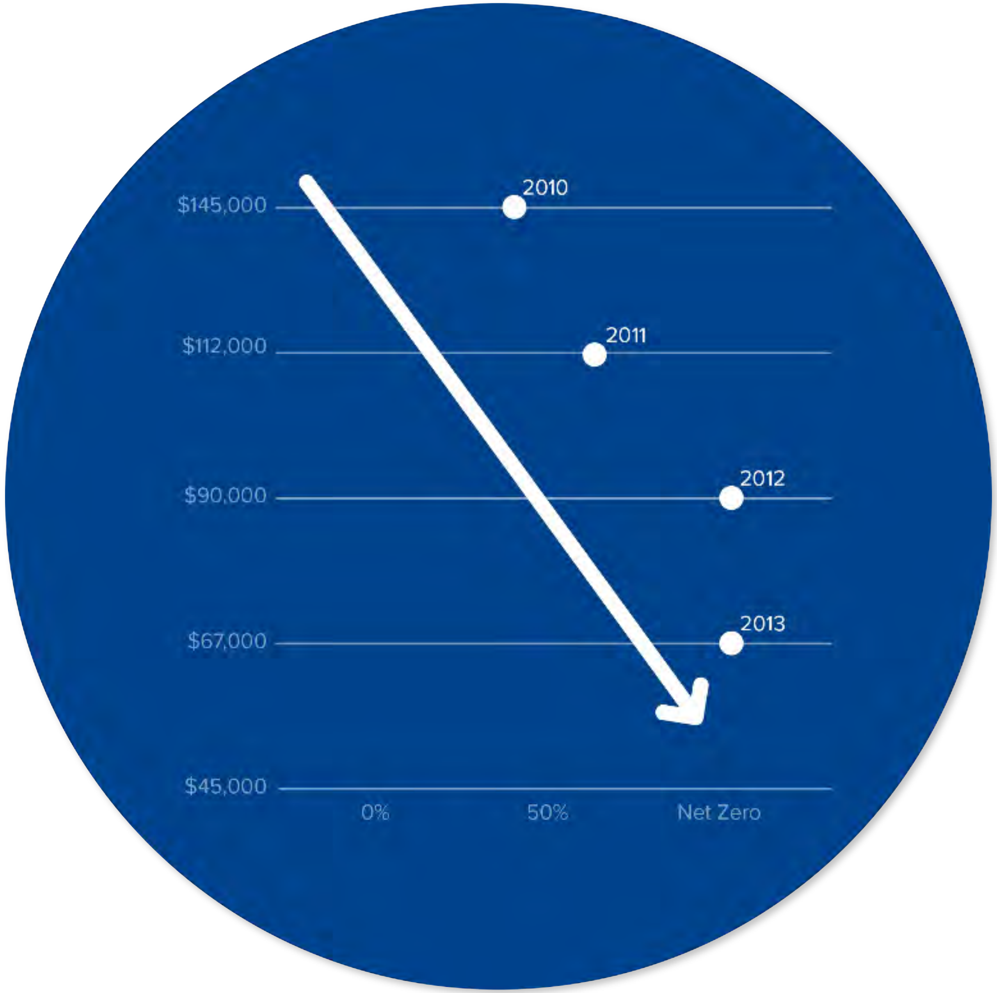
1. Understand the business case for net-zero buildings
2. Identify challenges with financing a net-zero pipeline
3. Propose and develop innovative scalable financing solutions that:
   - monetize the operational savings from net-zero/ deep energy retrofits
   - help fund the incremental upfront cost

$26M in Gap Funding Over 5 Years



- $30.5 Million allocated to program through 2025
- $26M to ensure solutions designed are built
- $4.5M designated for program implementation
- Gap funding solicitation in Q4 2018

Cost Compression is Key



Achievements of the Energiesprong program

- Cost reduction: Net Zero buildings at 40% of the cost of initial pilots
- The market is scaling up
  - 2,500 retrofits completed
  - 2,500 n/c projects completed
  - 20,000 projects in the pipeline

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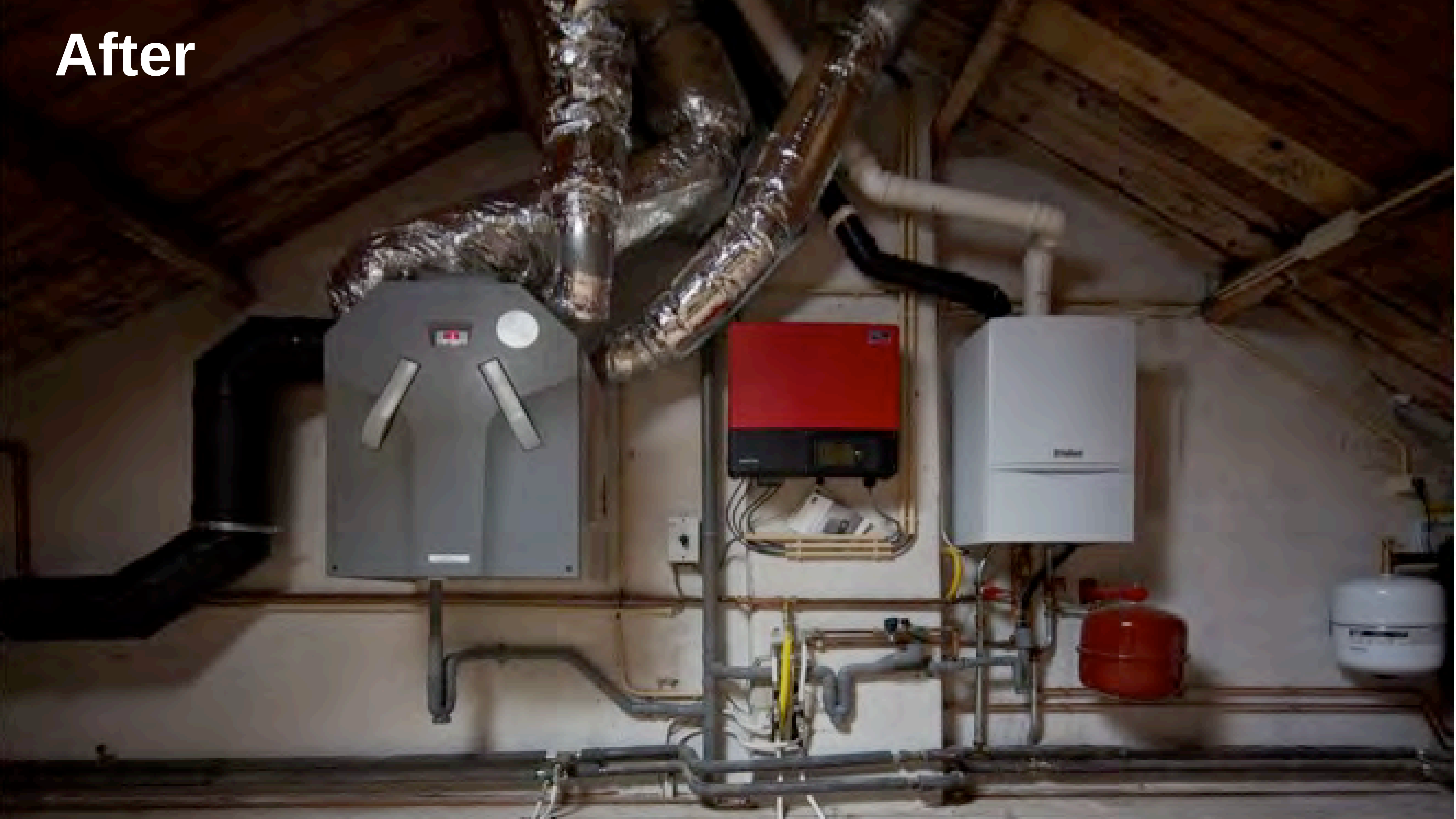
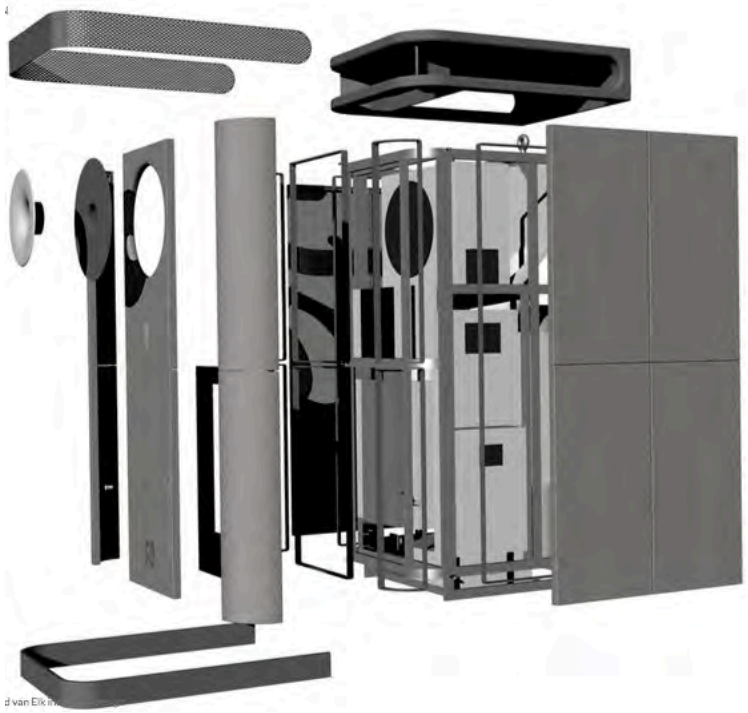
Before

After



Where we want to go



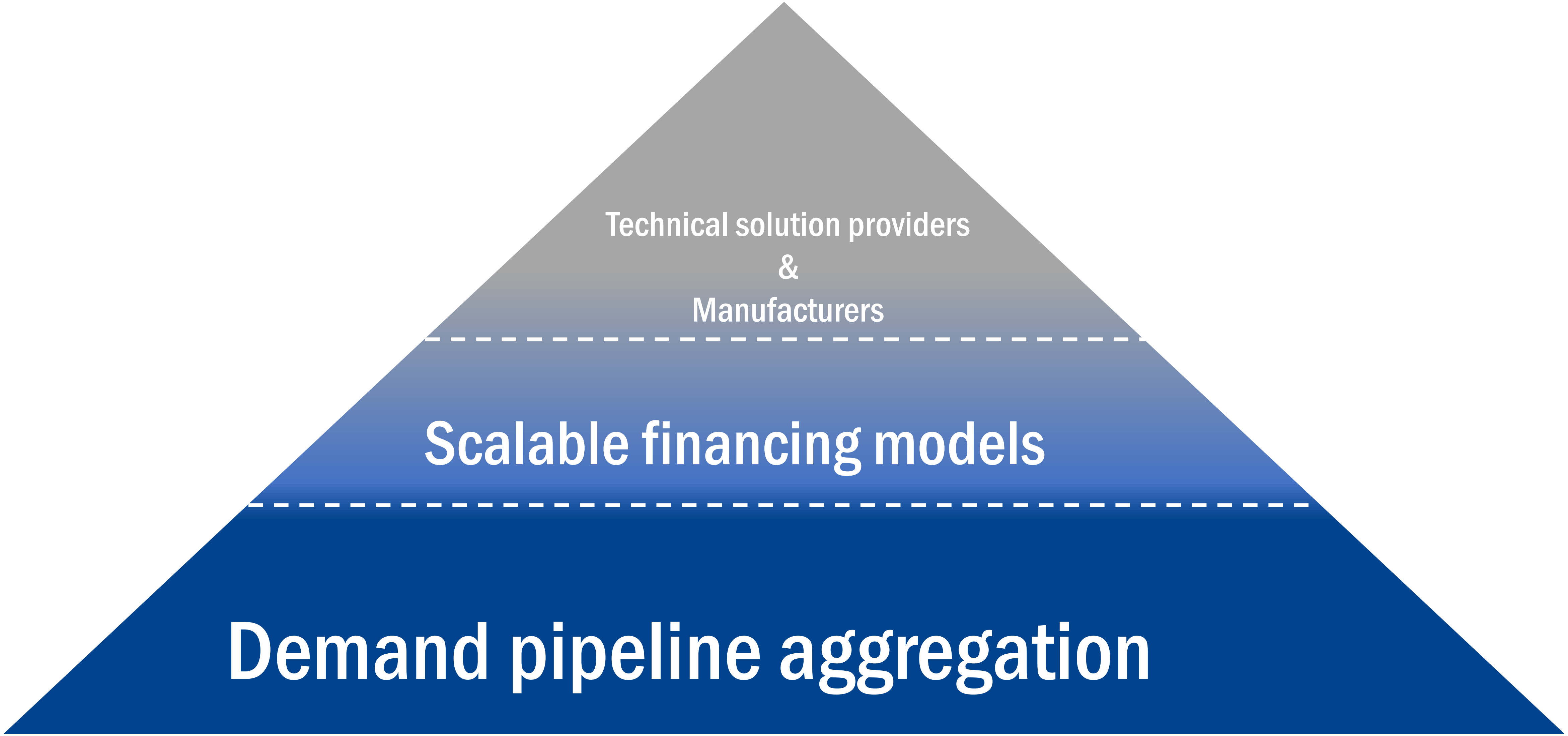
- scale essential to transforming industry
- Achieving manufacturing efficiencies


50

Program Focus on Pipeline Building and Manufactures Needs

1. Understanding manufactures needs
2. Aggregation of guaranteed pipeline
   - HCR
   - HPD
   - SUNY
   - NYCHA
   - Military Housing
   - Other States

Near-Term Program Objectives



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Thank you

RetrofitNY@nyserda.ny.gov

RetrofitNY

PRE-WAR MASONRY (BRONX NY)

PROJECT TEAM: BRIGHT POWER / VOLMAR / MAGNUSSON ARCHITECTURE & PLANNING / DAGHER ENGINEERING / OLIVE BRANCH CONSULTING

EXISTING CONDITIONS

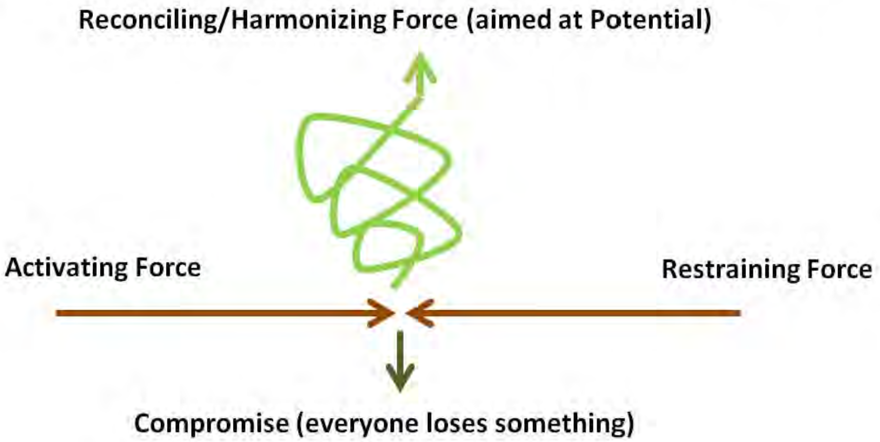
- DUE FOR DEEP RETROFIT
- MASONRY LOAD BEARING EXTERIOR WALLS
- WOOD JOISTS FLOORS + ROOF
- PRE-WAR BUILT 1913
- 5 STORY + BASEMENT

- 8"+ BETWEEN PROP LINE AND FAÇADE
- NEW KITCHENS AND BATHS NEEDED
- GAS FIRED BOILER NEEDS REPLACING
- NEW WINDOWS + ROOF NEEDED

- WASTE MANAGEMENT NEEDED
- PEST ISSUES
- ILLEGAL WASHERS IN MANY APARTMENTS
- LARGE UNUSED AREAS IN BASEMENT

INTEGRATIVE PROCESS

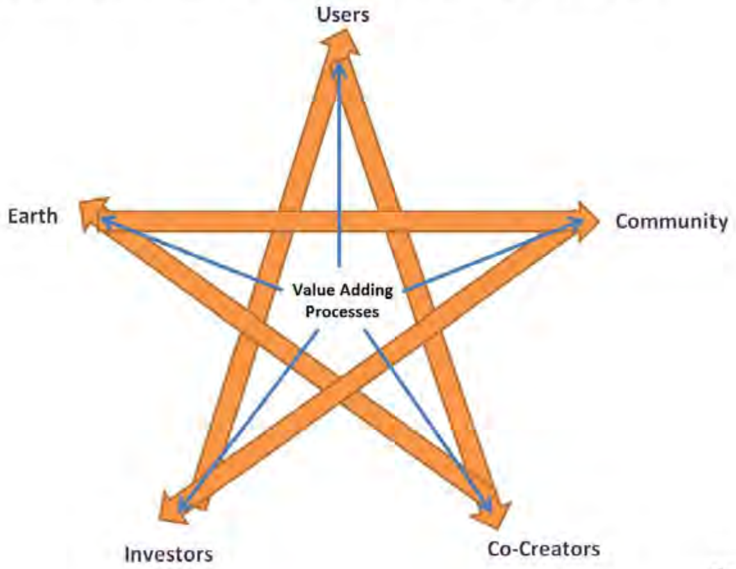
Law of Three:
This framework images the necessity of restraints to engage and develop creative outcomes through discovery of reconciling (or harmonizing) processes by focusing on Potential: *(from Charles Krone)*



Graphic by Sarah Klinetob

(framework from Carol Sanford, The Responsible Business)

- The Users (building occupants)
- The Co-creators (design, construction, operations team)
- The Community (community members within which the building is nested)
- The Earth's value-adding processes (soil health, clean water, clean air, healthy habitat, etc.)
- The Investors (Owner, NYSERDA – and others, including taxpayers)



Graphic by Sarah Klinetob

Coach: 7Group (John Boecker)

PROJECT GOALS

- TO: ***develop*** a replicable approach for designing, constructing, and operating an earth-centric tenant-in-place, affordable multi-family housing retrofit.

- IN A WAY THAT: ***invites*** meaningful discovery through a co-creative process that benefits all stakeholders and values the roles of all participants

- SO THAT: the project ***serves*** as an instrument for cost-neutral, net zero energy, regenerative retrofits becoming the standard in NY and beyond.

DESIGN – PATH TO NET ZERO

A BALANCE OF KEY INTERVENTIONS:
ENVELOPE
VENTILATION + IAQ
SPACE HEATING + COOLING
DOMESTIC HOT WATER
MISC ELECTRIC LOADS
DISTRIBUTED ENERGY RESOURCES

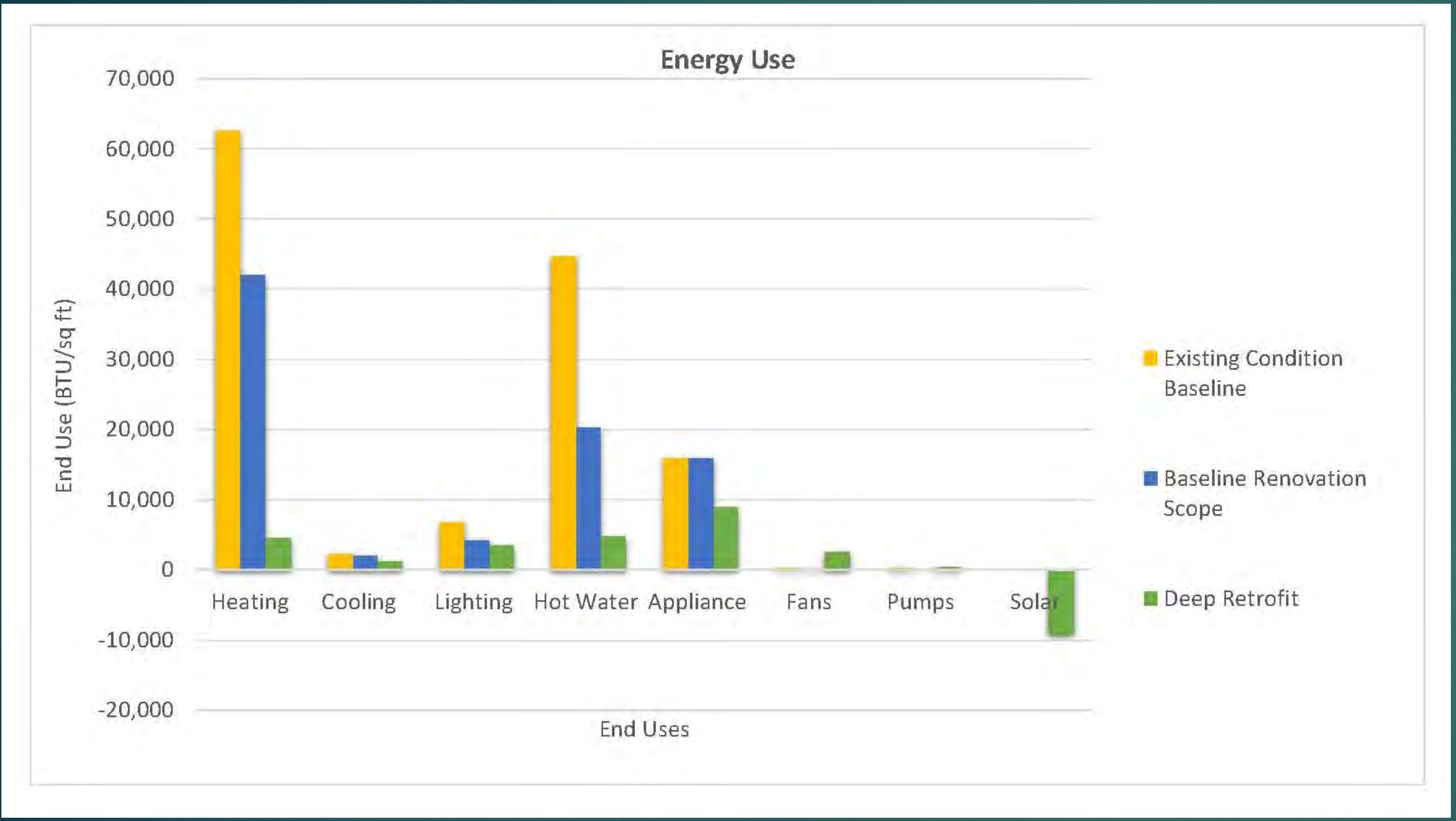
RESULTANT METRICS:
BUILDING PERFORMANCE
LIFE CYCLE COST ANALYSIS
CONSTRUCTION BUDGET
CONSTRUCTION SCHEDULE

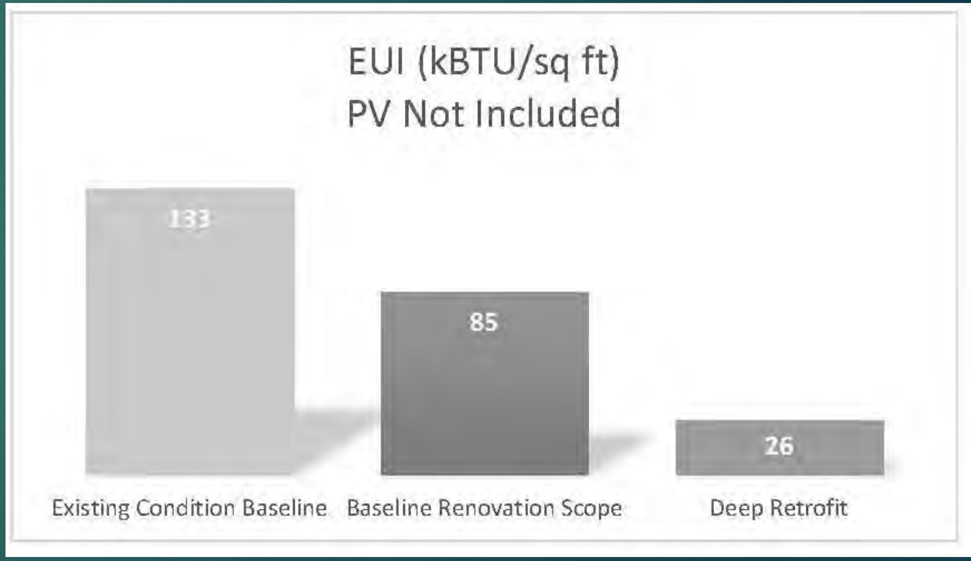
Current EUI 26.2 (w/o solar)
Current ROI over 30 yrs

DESIGN – PATH TO NET ZERO

Component	Baseline	Option B Without Renewables				Option C Without Renewables				Comments
	Bundle 1 Option A	Bundle 1 Option B	% additional energy savings	% additional Cost savings	Additional $ Savings	Bundle 1 Option C	% additional energy savings	% additional Cost savings	Additional $ Savings	
Exterior insulation of 1st floor street facade	6"	6" + interior insulation	0.03%	0.03%	$ 5	No ext insulation +int insulation	-0.21%	-0.21%	$ (37)	Interior insulation not required in addition to ext insulation. Interior insulation instead of ext may be okay.
Exterior insulation of the exterior walls - other walls	all the way down past grade (sidewalk and courtyard) on all facades 3'	down to grade	-3.6%	-3.6%	$ (643)					3' past grade should be selected
Roof Insulation	R-50+ Stone Wool 4"	R-50 + nothing	-0.11%	-0.11%	$ (20)	R-50 + Stone wool 8"	0.09%	0.09%	$ 16	Adding insulation on deck has no impact => remove deck insulation
Windows	Tilt & Turn / Casement (tripple glazed) U-0.203 SHGC 0.206	Tilt & Turn / Casement (double glazed) U-0.277 SHGC 0.258	-0.9%	-0.9%	$ (166)					Triple pane adds significant energy savings => keep
Slab Insulation	rigid stone wool: R16 (4") over existing slab + floated floor	No slab insulation	-2.2%	-2.2%	$ (397)					Slab insulation adds significant energy savings => keep if possible.
Heating & Coling	VRF	Mini Splits	-3.1%	-3.1%	$ (547)	Air to water Heat Pump	-5.0%	-5.0%	$ (892)	VRF is significantly more efficient than mini-splits and heat pump to water => choose VRF
DHW Heating	HP Water Heater	Electric Resistance	-37.9%	-37.9%	$ (6,753)					Heat pump water heater has a VERY significant impact on energy savings => use heat pumps.
Washers and Dryers	1 laundry room for 2 buildings	in unit			$ -					Option already selected (central laundry)
Grey water heat recovery	Grey water heat recovery	No recovery	-7.0%	-7.0%	$ (1,250)					Grey water adds significant energy savings.
Shades	No shades	Horiz and Vertical Shades	0.00%	0.00%	$ -	horizontal shades	0.1%	0.1%	$ 12	b. Heating penalty outweighting cooling savings => include?
Metal Girts	Thermally broken Girts	Metal Girts	-0.14%	-0.14%	$ (25)					

DESIGN – PATH TO NET ZERO





DESIGN – PATH TO NET ZERO

ENVELOPE (AIRTIGHT & INSULATED)

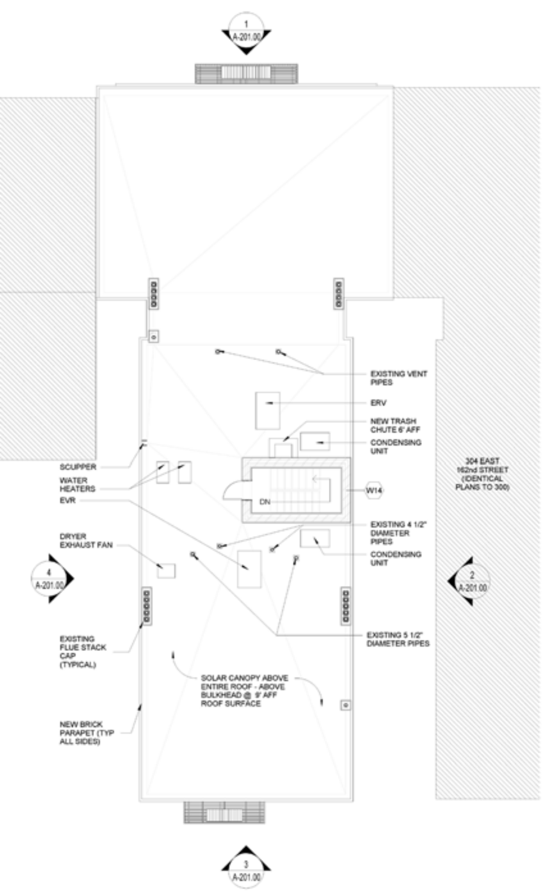
- ROOF + PARAPET
- FIRE ESCAPE
- MEETING GRADE
- PROPERY LINE
- NEIGHBORING BUILDING
- WINDOWS + STOREFRONTS

PROGRAM

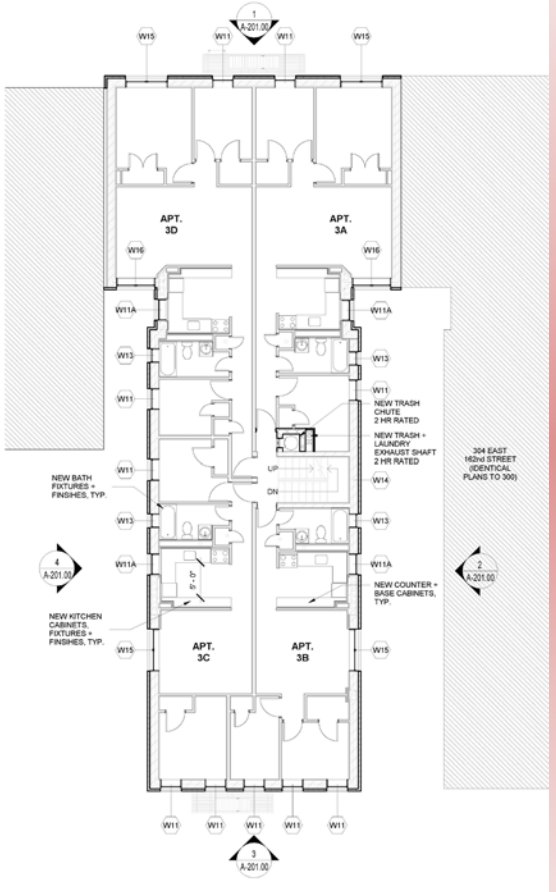
- TRASH CHUTE
- LAUNDRY ROOM

MOST COST EFFECTIVE SOLUTION FOR LOWEST EUI + PROGRAM

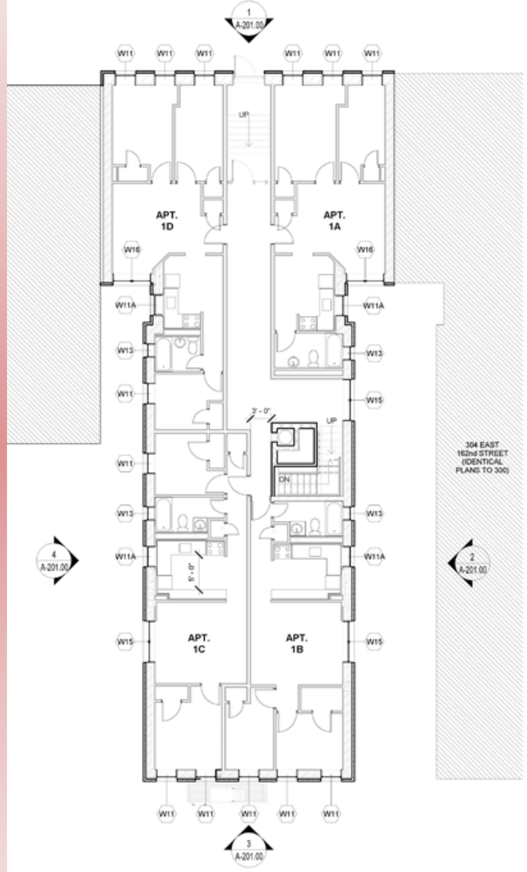
DESIGN– PATH TO NET ZERO



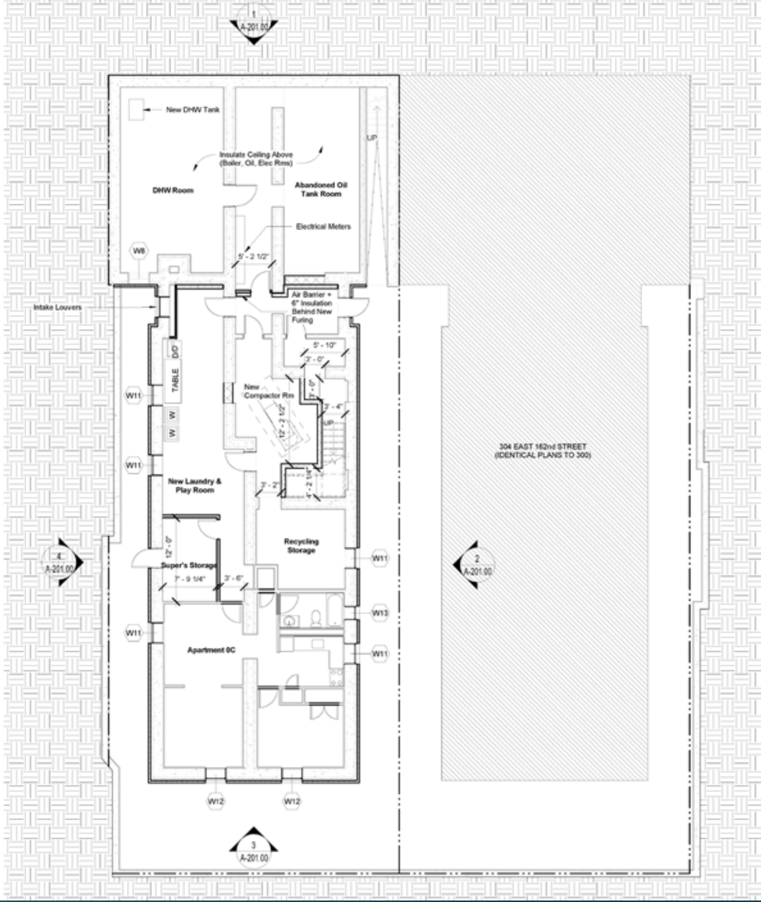
ROOF



TYPICAL FLOOR

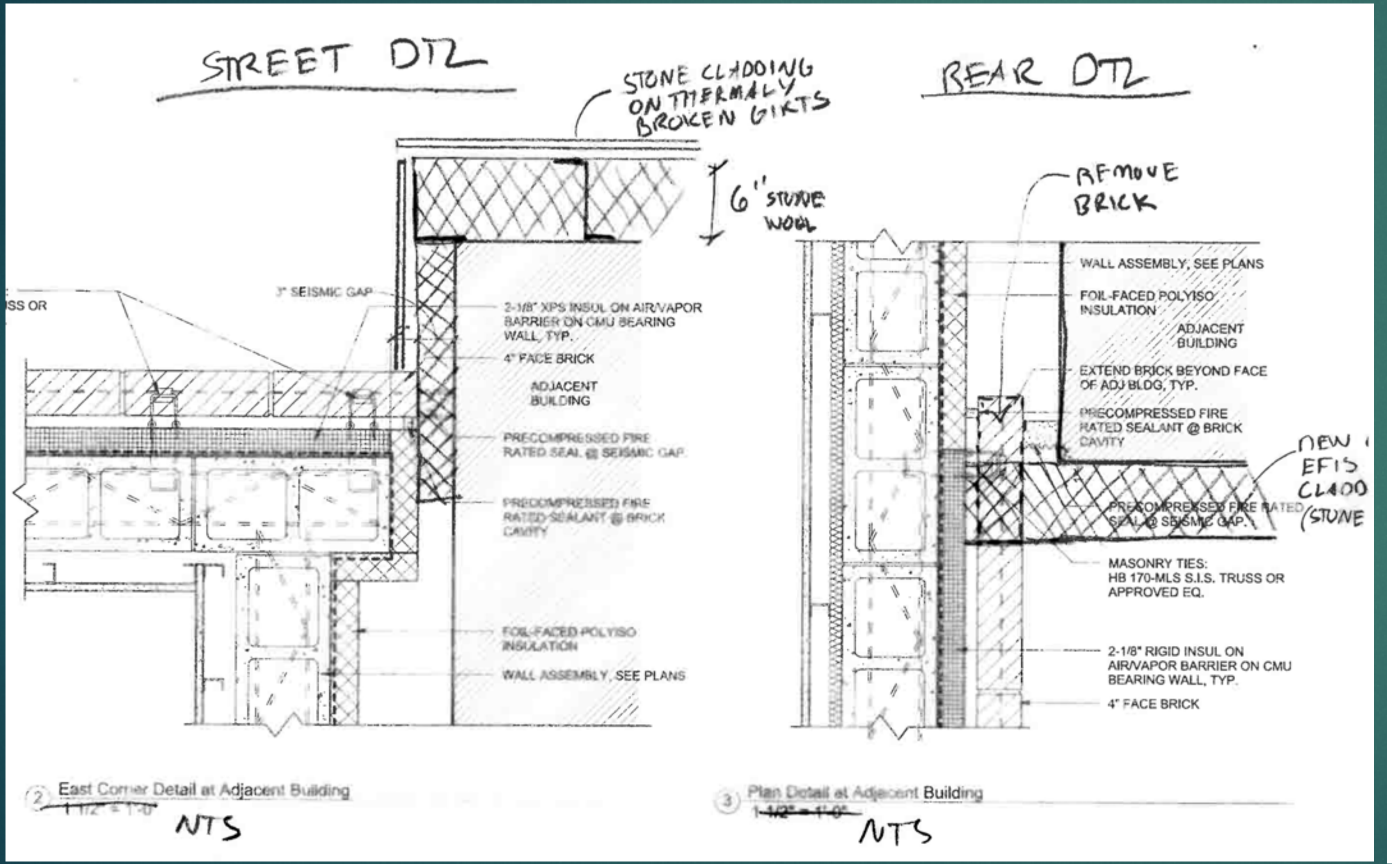


FIRST FLOOR

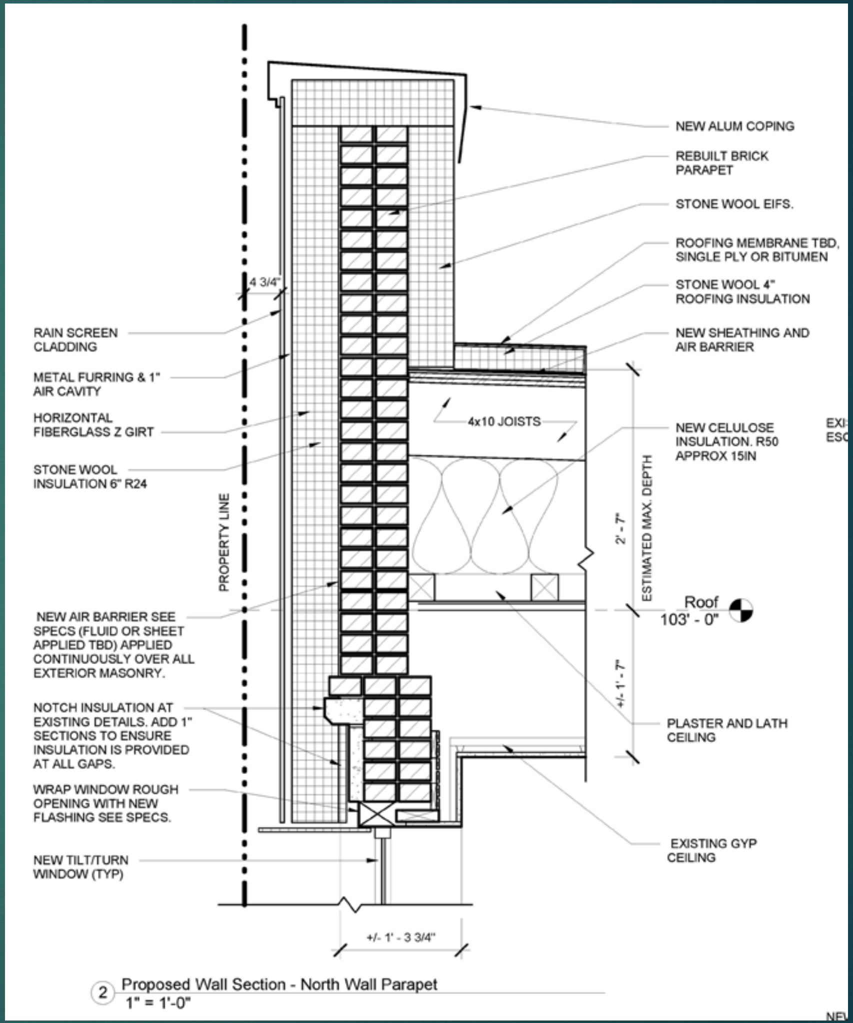


BASEMENT

ENVELOPE – PATH TO NET ZERO

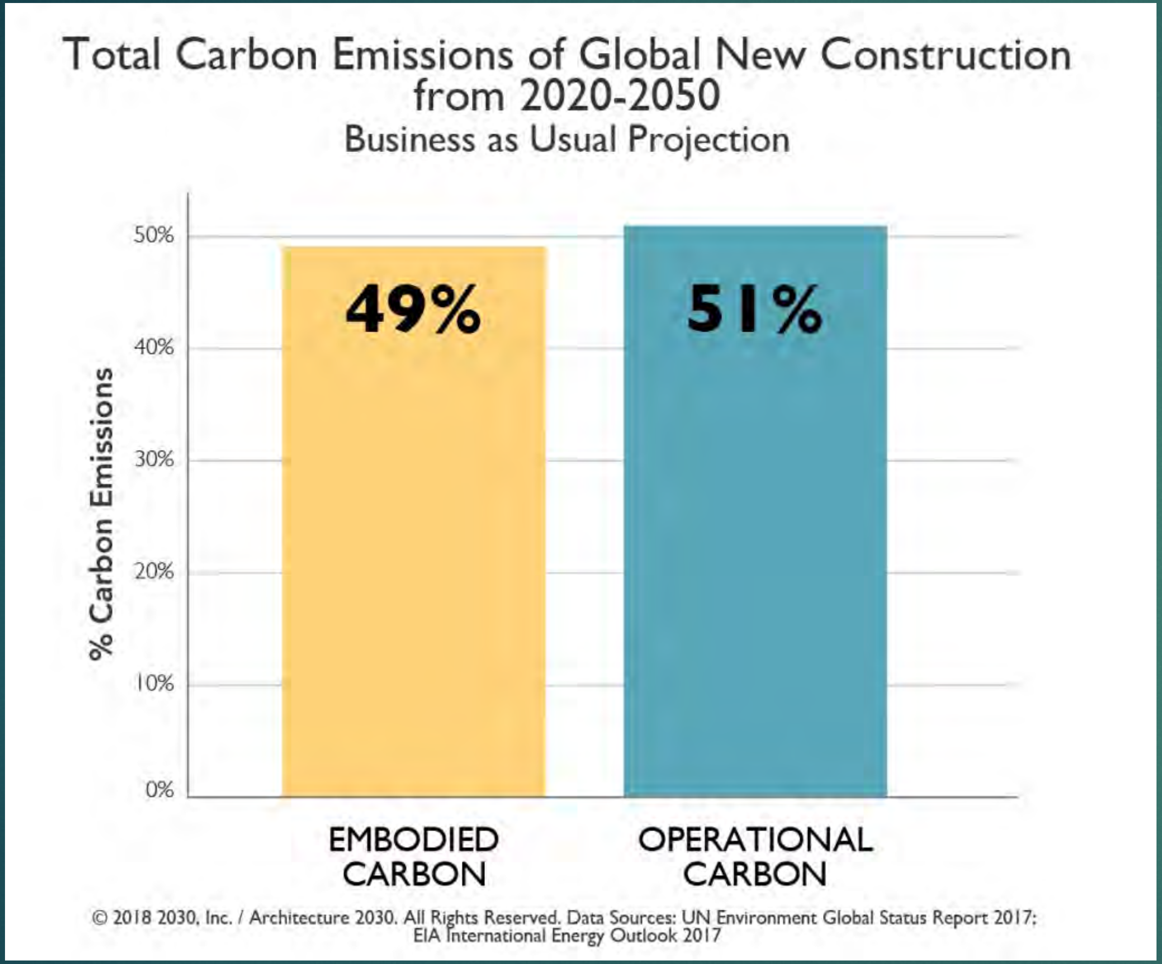


NEIGHBORING LOT LINE - ADIABATIC



ROOF – PREVENT CONDENSATION AT SHEATHING

EMBOIDED ENERGY/GWP



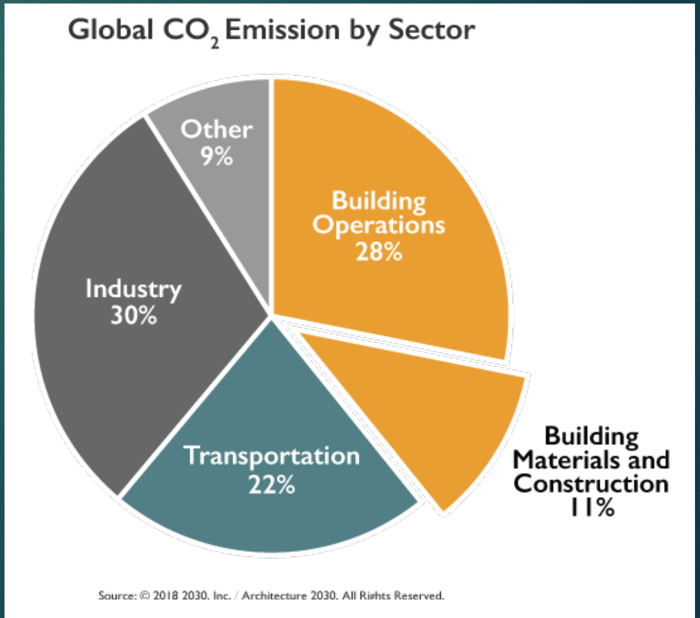
BUSINESS AS USUAL EMISSIONS
Source: AIA Architecture 2030

EMISSIONS WE PRODUCE BETWEEN NOW AND 2050 WILL DETEMINE IF WE MEET THE PARIS CLIMATE ACCORD

(….and prevent the worst effects of climate change.)

PATH TO CARBON NEUTRAL
HOW LONG IS CARBON PAYBACK OF OUR INTERVENTION?

YEARLY EMISSIONS



ENVELOPE – PATH TO NET ZERO

	Name	Full Name / Alt Name	Material Composition	R Value (per inch)	Locations/Uses	Installation	Installation Concerns / Notes	Air Barrier	Moisture Relationship	Fire Resistance/Class Rating /Install requirements	Flame Retardant Chemicals	Reaction to Fire	Density/ Compressive Strength /Structure	Blowing Agent Global Warming Potential	Embodied Energy MJ/k Entropy	Lifetime GWP (FYI: CO2=1) /cubic ft x R	Recyclability / Recycled content	Durability over Time	Toxicty in Manufacturing	Toxicty to Installers	Toxicity to Occupants	Toxicity at End of Life	Industry Notes
	Sprayed In Place Insulation																						
1	Closed Cell SPF - with HFC	Closed Cell Spray Polyurethane foam - with Hydrofluorocarbon (Thermaset Plastic)	2 parts: polypol and isocyanate (HFC-245fa) (polyurethane is a syntheic resin)	3.5 to 6.5 per inch (can start out at 7 but looses about some value (1R) over time)	wall cavity, ceiling cavity, foundation areas, if drainage is provided can be installed sub slab	Sprayed, then expands and cures	1) Must be done properly to avoid contamination 2) installed in layers of 2inches, if not, excess heat from the curing (exothermic process) can cause a fire 3) Potential Shrinkage and air barrier lost 4) wet framing components causes improper installation	yes	Class II vapor retarder	Not inhertently, chemicals are added. Does not prevent fire. / Class I Fire Rating but must cover with thermal break	Cholorinated phosphate flame retardant	does not melt (bc its a "thermaset plastic")	1.5 - 3.5 lbs per cubic ft (use different densities for differnet locations) / can add stiffness to structure	1,030 (HFC-245a)	72	1.48	No/None	does not move well with building movement	Pollutants associated with petroleum drilling and refining	Highly Toxic, respirators required, no occupancy for at least 48 hours during curing	After 48 hours off gassing is minimal IF installed correctly. Isocyanate is one of 6 chemicals on EU's REACH list of chemicals banned unless with exception. The flame retardant is a carcinogen.	cannot be recycled	
2	*Closed Cell SPF - with HFO*	*Closed Cell Spray Polyurethane foam with Hydrofluoroolefin (Thermaset Plastic)*	*2 parts: polypol and isocyanate (HFO-1234zd and HFO 1234ze) (polyurethane is a synthetic resin)*	*3.5 to 6.5 per inch (higher than Hydrofluorocarbon version)*	*same*	*same*	*same*	*yes*	*Class II vapor retarder*	*same*	*same*	*same*	*higher than HFC version*	*? (HFO)*	*72?*	*?*	No/None	*same*	*Pollutants associated with petroleum drilling and refining*	*Highly Toxic, respirators required, no occupancy for at least 48 hours during curing*	*same*	cannot be recycled	*The industry plans to move to this version of closed cell SPF by 2018*
3	Air Krete	Inorganic Foam-cement /Cementitious Foam		3.9				no (assumed)															
4	Open Cell SPF	Open Cell Spray Polyurethane foam	Blowing Agent: water and carbon dioxide	3.7	wall cavity, ceiling cavity	Sprayed, then expands and cures. Expands much more than closed cell SPF. Then it is screeded against the studs	1) Must be done properly to avoid contamination	yes (some products) (survies as air barrier better than closed cell)	Class III vapor retarder	Not inhertently, chemicals are added. Does not prevent fire. / Class I Fire Rating but must cover with thermal break	Cholorinated phosphate flame retardant	does not melt (bc its a "thermaset plastic")	0.5 - 1.4 lbs. per cubic ft	1	72	0.0154	No/None	will remain flexible and less likely to crack with building movement	Pollutants associated with petroleum drilling and refining	Highly Toxic, respirators required, no occupancy for at least 48 hours during curing	After 48 hours off gassing is minimal IF installed correctly. Isocyanate is one of 6 chemicals on EU's REACH list of chemicals banned unless with exception. The flame retardant is a carcinogen.	cannot be recycled	
5	UFFI/PFFI	urea-formaldehyde or phenol-formaldehyde	formaldehyde	do not use		Retrofit into CMU cavity walls																	
6	Spray in place Fiberglass	Same/ Depends on density and application strategy	melted glass (silica sand+boron (finite supply)) spun into fibers + a binder (sometimes)	3.7-4.2 per inch	wall cavity, ceiling cavity	"dense" pack " blow at high density to prevent settling or "blow in blanket" with polyethelye mesh at inner face of studs	1) should be done by certified installer. 2) Windwashing can occur if not installed behind an air barrier	no (at times a layer of SPF is added called "flash and batt"	Class III vapor retarder - Semi-permiable will loose R value if gets wet, can become waterlogged and slump in cavity (but less so than batts)	Yes	none	does not burn (lower melting point than stone wool though)	1.0-1.8 per cubic ft (higher densities are better to prevent convective loops)	0	28?	0.0165	contains min 25% recycled glass	will slump if not installed properly	Some formaldehyde is released	Respirator and skin irritant. Wear protection. A pesticide is used in the JM Spider product for	Must be covered with a resonable air tight layer (drywall) / recently almost all is produced without formaldehyde as a binder (packaging will say prominantly)		JM spider uses no binder
7	Cellulose	same	post consumer newspaper (done by "fiberizing" the paper)	3.6-3.8 per inch	wall cavity, ceiling cavity	loose-fill, dense-pack or damp-spray	1) Damp spray: for specialized contractors only, sprayed, then screed, then left to dry full (min 48 hrs) before closing wall	no (but better air barrier than fiberglass)	Avoid use if moisture is a concern and if wall will not dry. Water soaked cellulose will slump	Not inhertently, chemicals are added. Does not prevent fire. / Class I/Class A Fire Rating	Borate (premium/finite supply) or ammonium sulfate (corrosive)	fire resistant	dense pack is 3.5-4 pcf (to minimize settling)	0	2.1	0.0033	88% post consumer recycled content (celluose is the largest use of recycled	take care it stays dry	Low embodied energy or toxicity	loose fibers and dust may be irritant. Wear protection	For people with ink sensitivity, may be an issue. / Flame retardant borate is on the candidate list of potential toxic chemicals in EU's		
8	Natural Wool																						
	Board Insulation																						
1	XPS	Extruded Polystyrene (is a Thermaplastic) Closed Cell foam plastic insulation	Styrene monomer is polymerized to produce polystyrene then extruded (derived from natural gas and petroleum)	5 per inch. Can reduce over time	Rigid boardstock, often used below grade. And can be used in IRMA roof	high compressive stregnth is attactive for below slab and foundation walls. Sometimes used in SIPS and ICFS	Do not install where temps can go above 150F (roof?)	yes, can be if taped	high moisture resistance. Low vapor permeability, can restrict drying. Can act as a capillary break.	None, retardant is added. Must protect with thermal barrier	HBCD (persistant and bioccumulative)	Will melt	High compressive strength, above 25psi	1,430 (HFC-134a)	89	1.77	20% (according to manufacturer ie not verified)	looses some R value over time	Product of the Petroleum industry. Benzene (carcinogen) used in manfuacter and these are released during production. Blowing Agent high GWP and released during manfuacture but no ozone depletion. Flame retardant HBCD is persistant and bioccumulative and toxic	flakes released during cutting on site	none released during us. During a fire HBCD is released.	Thermoplastics can be recycled but this is not often done. It is unclear what happens to the flame retardant if recycled.	
2	EPS	Expanded Polystyrene (is a Thermaplastic) Closed Cell foam plastic insulation	Styrene monomer is polymerized to produce polystyrene then expanded (derived from natural gas and petroleum)	3.1-4.3 (but measured at 75degrees) Graphite enhanced has higher R values up to 4.59. Can reduce over time	Rigid boardstock	used in SIPS and ICFS (majority) And EIFS. Easier to cut than XPS and make different sizes/shapes	Termites can tunnel through it. A chemical is added for below grade applications	no	moisture resistant. Low vapor permeability (varies with density), can use higher compressive strength for below grade or under slabs.	None, retardant is added. Must protect with thermal barrier	HBCD (persistant and bioccumulative)	Will melt	.9 - 2.0	7 (Pentane)	89	0.036	none verified. Perhaps some is recycled from scraps in the factory	looses some R value over time	Product of the Petroleum industry. Benzene (carcinogen) used in manfuacter and these are released during production (some can be captured but this is not often done). Blowing Agent lower GWP (still 7) and released during manfuacture but no ozone depletion. Flame retardant HBCD is persistant and	flakes released during cutting on site	none released during use. During a fire HBCD is released.	Thermoplastics can be recycled but this is not often done. It is unclear what happens to the flame retardant if recycled.	
3	Mineral Wool	"Stone Wool"	iron ore slag and/or basalt rock + binder	3.8-4.4 (does not reduce with time)	sub slab, exterior walls, interior wall, cavities, roof, (everywhere)	board stock - glued or tacked or compression fit.	1) used often in rain screen applications (provides fire protection NFPA 285)	no	hydrophoic (repels moisture) effective drainage board. Class III vapor retarder	Class I (no added retardant)	none	Fire proof	3-8.5 per cubic ft (different applications)	0	17	0.0455	73-93% recycled content (preconsumer iron ore slag)	does not loose performance over time. Insect - resistant	by product of the steel industry - inherent ties to high polluting industry	loose fibers and dust may be irritant. Wear protection.	none (but don't leave exposed fibers - this is less of a problem with board stock than batt)	Can be recycled	Rockwool and Thermafiber have (in2017) removed the phenol formaldehyde binder, replaced with sugar-based binder used in fiberglass batts
4	Expanded Cork																						
5	Foamed Celluar Glass																						
6	Rigid Fiberglass															28							
7	Polyiso	Foam Plastic insulation / PIR / closed cell thermoset plastic	Polyol and isocyanate + blowing agent + flame retardant (derived from natural gas and petroleum)	6 per inch (aged) - R value decreases at colder temps	rigid boardstock, walls, slabs, roofs. Do not use belowgrade	boardstock (cannot be compression fit). Often faced with foil (helps to prevent gasses from escaping)	1)install on warm side of the wall so that it performs better at low temps. 2) Foil faced products are vapor impermeable 3) expands and contracts, less dimensionaly stable that others	yes, can be if taped	will abosrb moisture, do not use below grade unless have superior drainage in place.	None, retardant is added. Must protect with thermal barrier	TCPP (uknown toxicty - assumed toxic) some manufactures over non bromine or chlorine flame retardants, chemical known (premium products)	does not melt (bc its a "thermaset plastic")	1.5 per cubic ft	7 (Pentane)	72	0.0317	none	looses R value over time a bit. Aged values are most often reported.	isocyanates highly toxic, MDI, bromopropage toxic as well. Pentane has GWP. Energy intensive process	flakes released during cutting on site	none released during use	cannot be recycled because it is a thermoset	

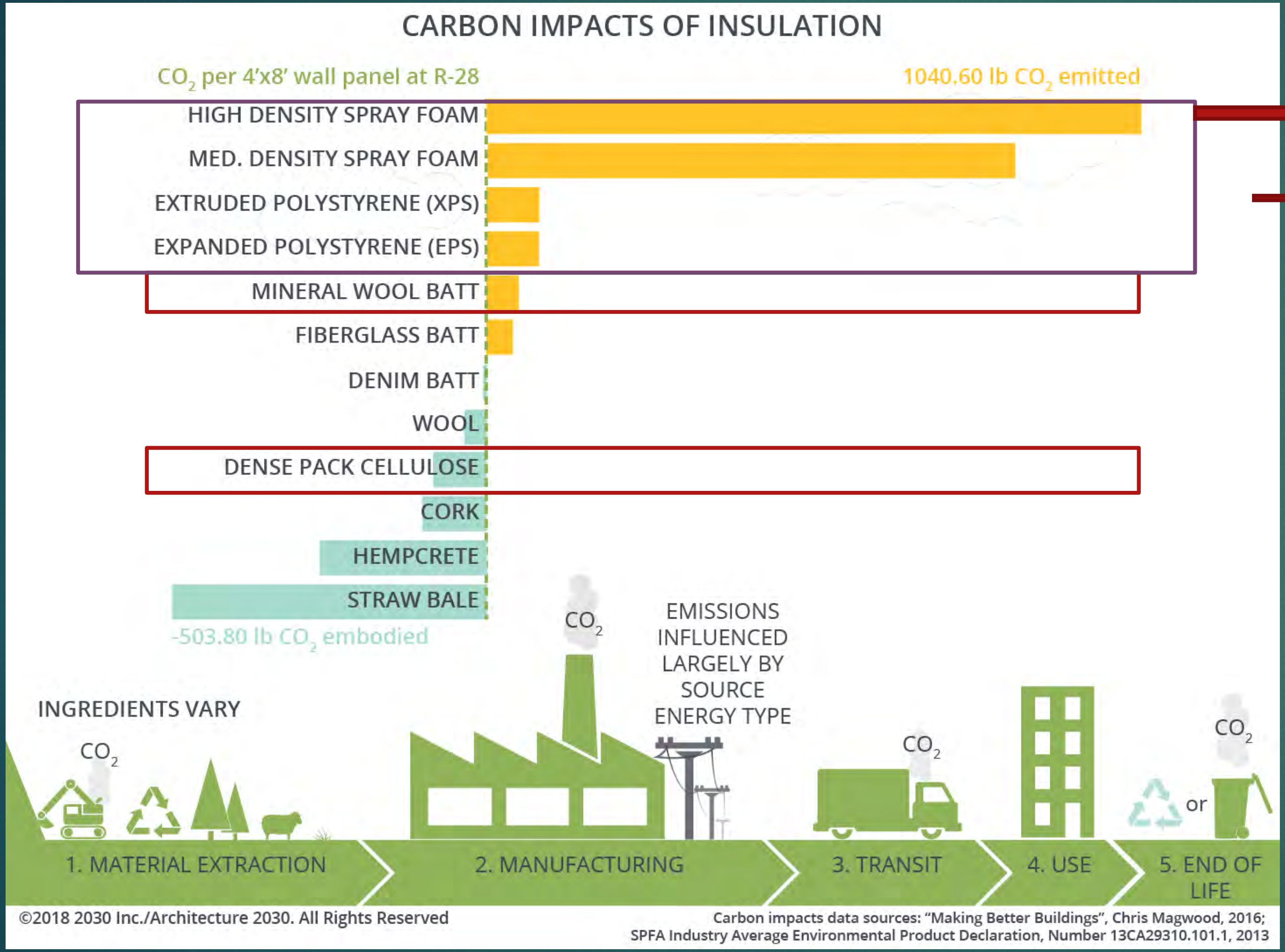
SPRAYFOAM

CELULOSE

EPS

STONE WOOL

GWP RESOURCES EMERGING



Petroleum products

(Review XPS in this chart, are they indicating new blowing agent HFO? Current HCF 134a is over 1,450k GWP)

Also of concern are toxic and bio-cumulative flame retardants in XPS + EPS.

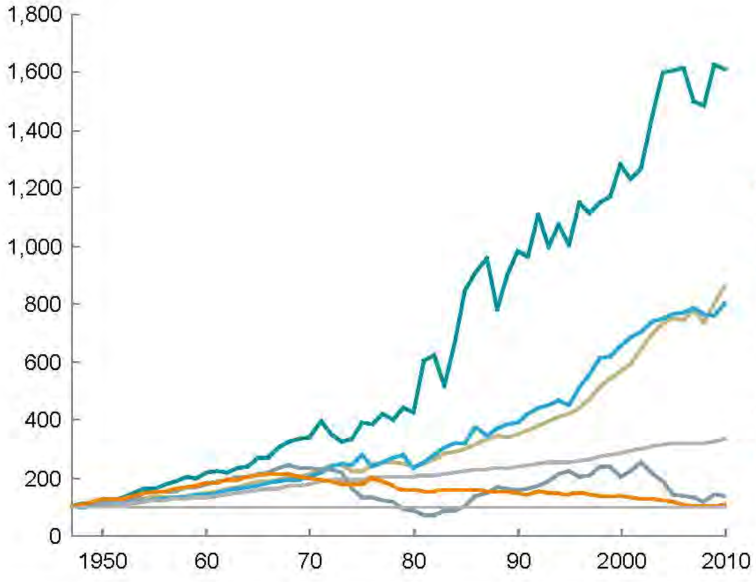
Source: Materialspallette.org/insulation

INDUSTRIALIZE + SCALE

Exhibit 9

In the United States, labor productivity in construction has declined since 1968, in contrast to rising productivity in other sectors

Gross value added per hour worked, constant prices
Index: 100 = 1947



	Compound annual growth rate, 1947–2010 %	Total change
Agriculture	4.5	16.1x
Manufacturing	3.5	8.6x
Wholesale and retail	3.4	8.0x
Overall economy	1.9	3.3x
Mining	0.5	1.4x
Construction	0.1	1.1x

Many sectors have transformed and achieved quantum leaps in productivity; construction has changed little, limiting productivity gains
Key advances, 1947–2010

Agriculture	Manufacturing	Retail	Construction
Leveraged scale through land assembly and automation; deployed advanced bioengineering to increase yields	Implemented entirely new concepts of flow, modularized and standardized designs, and aggressively automated to increase production	Utilized scale advantages and cutting-edge logistics to provide affordable goods to the masses	Limited improvements in technological capabilities, production methods, and scale

SOURCE: World KLEMS; BLS; BEA; McKinsey Global Institute analysis

MCKINSEY GLOBAL INSTITUTE - REPORT 2017 “REINVENTING CONSTRUCTION: A ROUTE TO HIGHER PRODUCTIVITY”

INDUSTRIALIZATION

INDUSTRIALIZATION

RetrofitNY

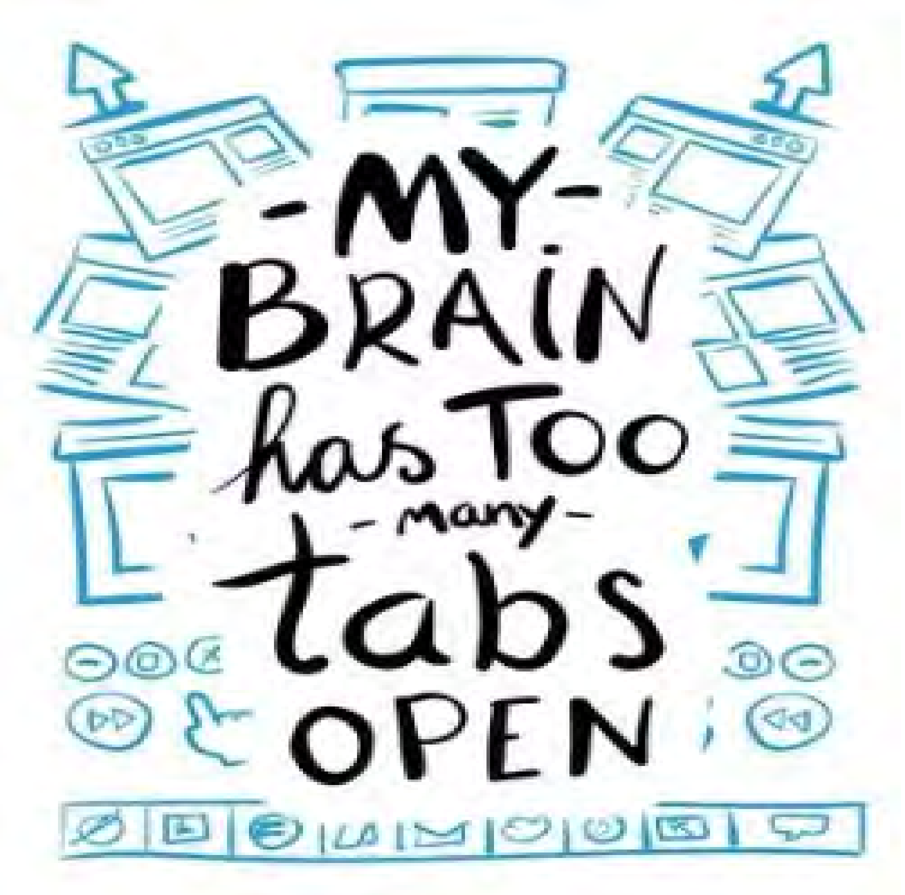
300 & 304 East 162nd St

Project Team:
Volmar, **Bright Power,**
MAP Architects,
Dagher Engineering,
Olive Branch Consulting

October 15, 2018

Considerations for Design Decisions

- 100% electrification
- EUI of 20
- Budget of $30,000/unit
- Replicability
- Lifecycle analysis
- Embodied energy/global warming potential
- Indoor air quality
- Residents in place
- Durability/sustainability
- Resident engagement
- Aesthetics
- Utility bills (who pays for what?)
- Realistic O&M of new systems



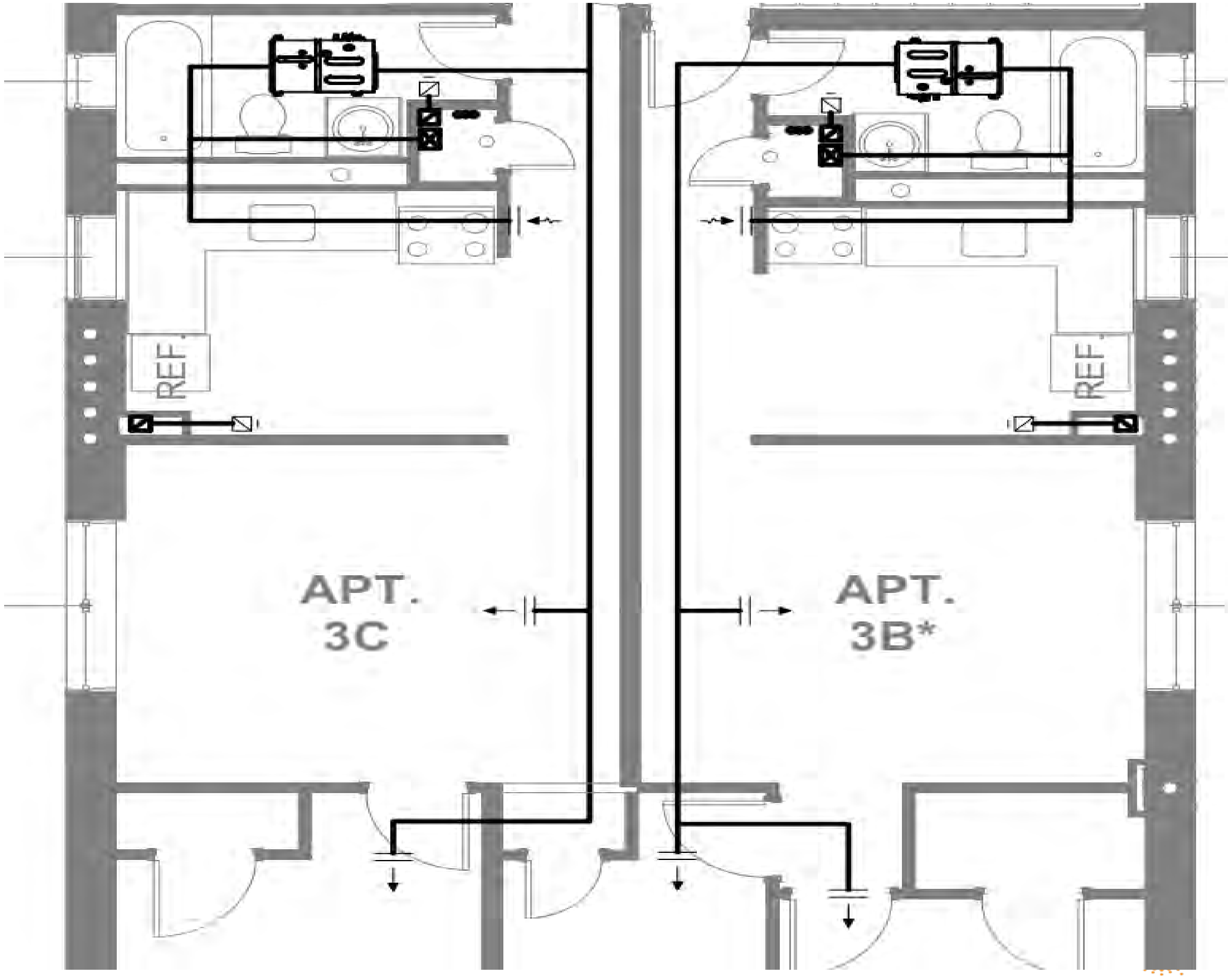
Design Concepts – Heating/Cooling

Variable Refrigerant Flow (VRF)

- Heat pump (no heat recovery)
- Ducted evaporators (indoor units)

Meeting considerations

- Readily available technology
- Reduced loads
- Reduced refrigerant piping
- Increased comfort
- Decent maintenance
- Runs on electricity



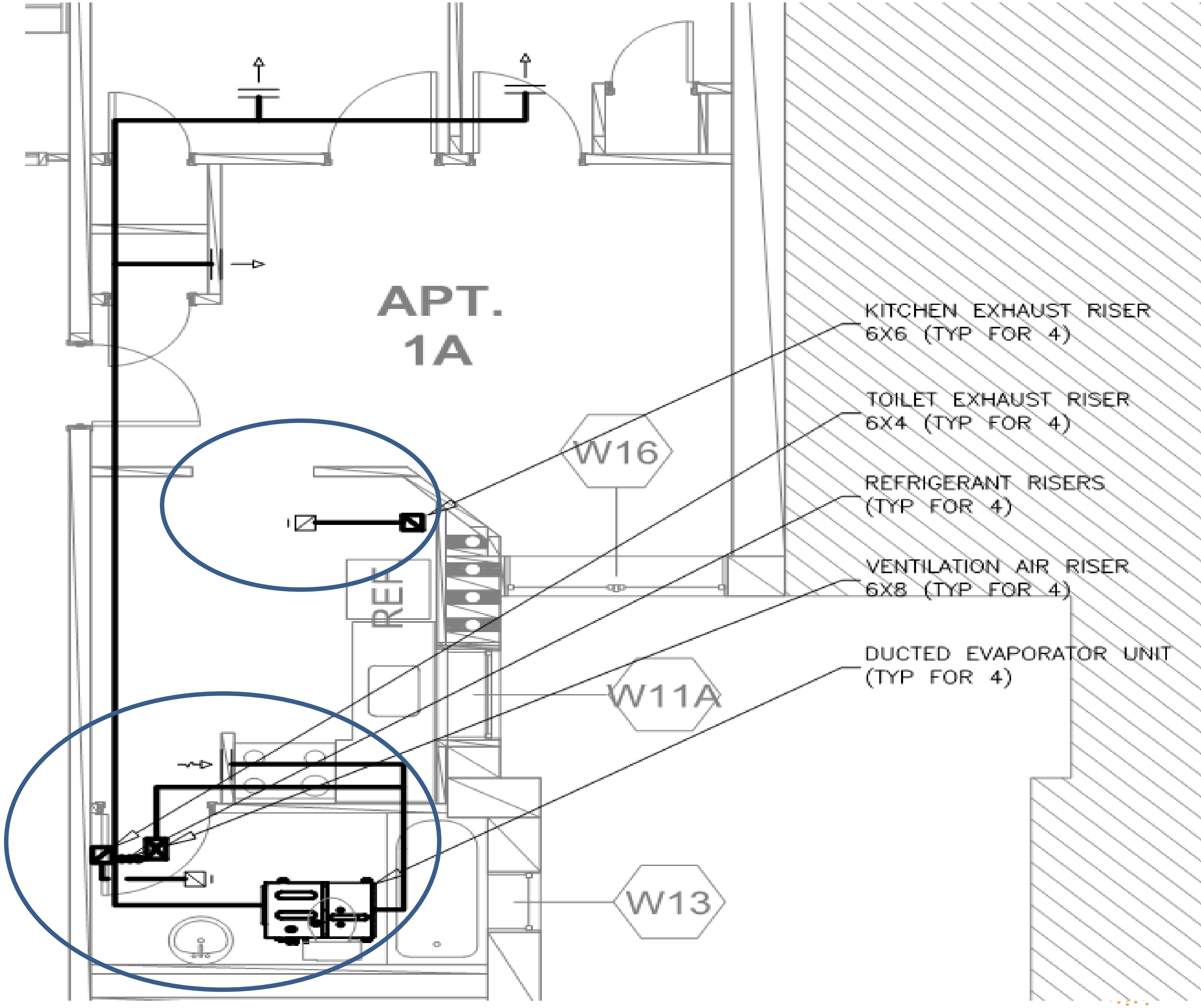
Design Concepts - Ventilation

Energy Recovery Ventilation (ERV)

- Centralized (2 units on roof)
- Supply to each living space
- Exhaust in kitchens and bathrooms
- Supply air ducted to evaporator unit

Meeting considerations

- Optimized ductwork
- Efficient system
- Increased indoor air quality
- Accessibility for maintenance
- Readily available technology
- Runs on electricity



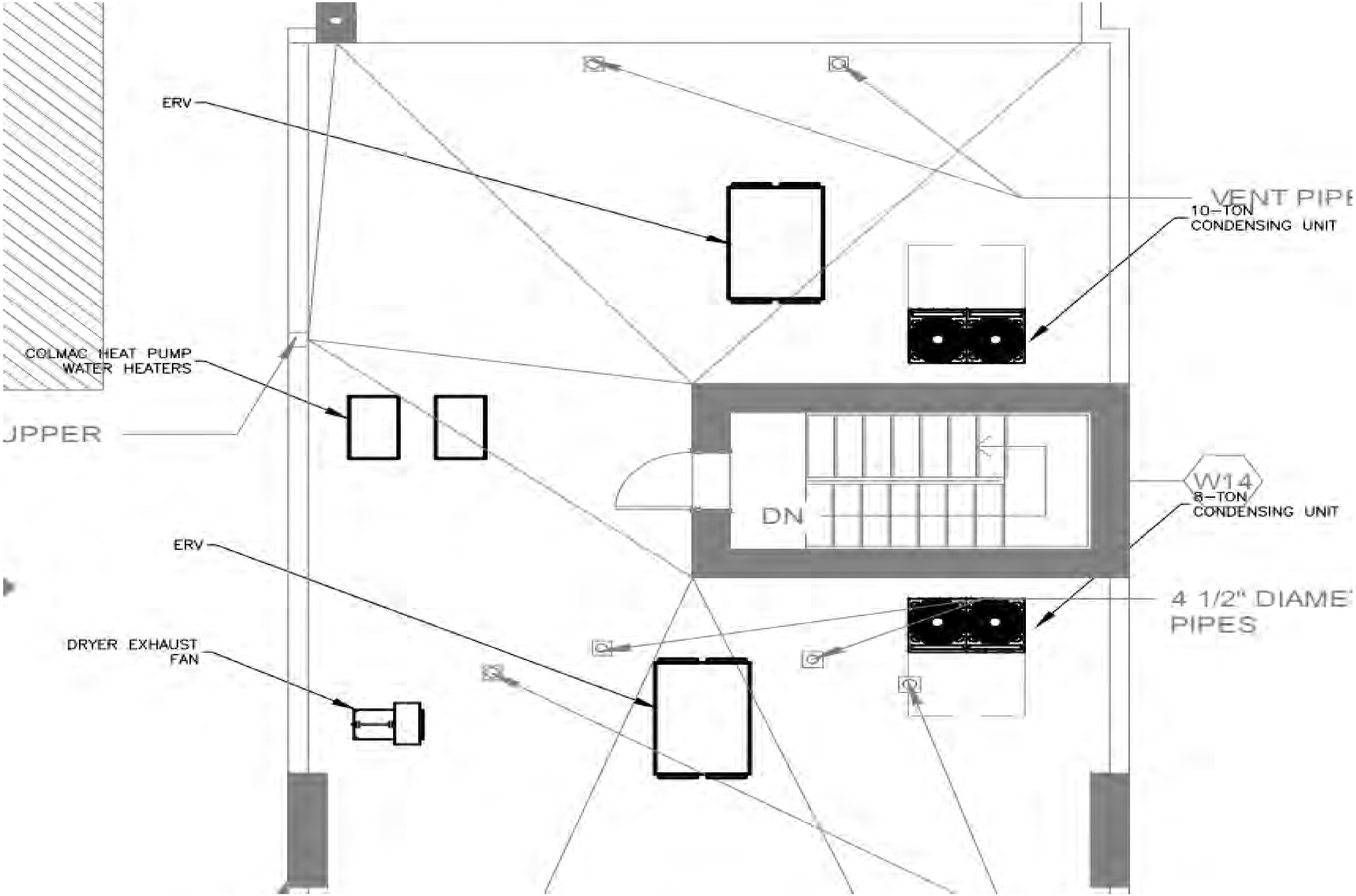
Design Concepts - DHW

Heat Pump Water Heater
(air source)

- Units mounted on roof
- Combined with low flow plumbing fixtures

Meeting considerations

- *Expensive*
- *Few multifamily options available*
- *Winter COP not great*
- Runs on electricity
- Extreme affect on building performance
- Plumbing fixture flow rates selected with residents in mind

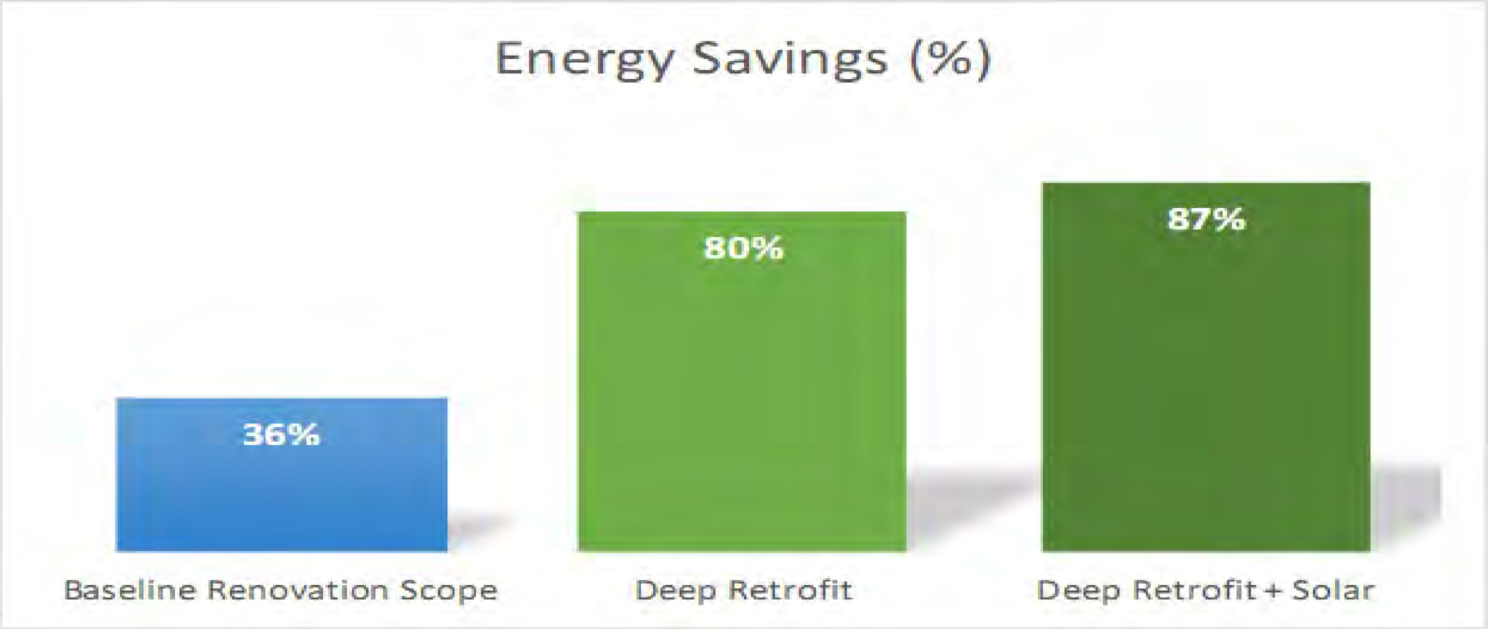


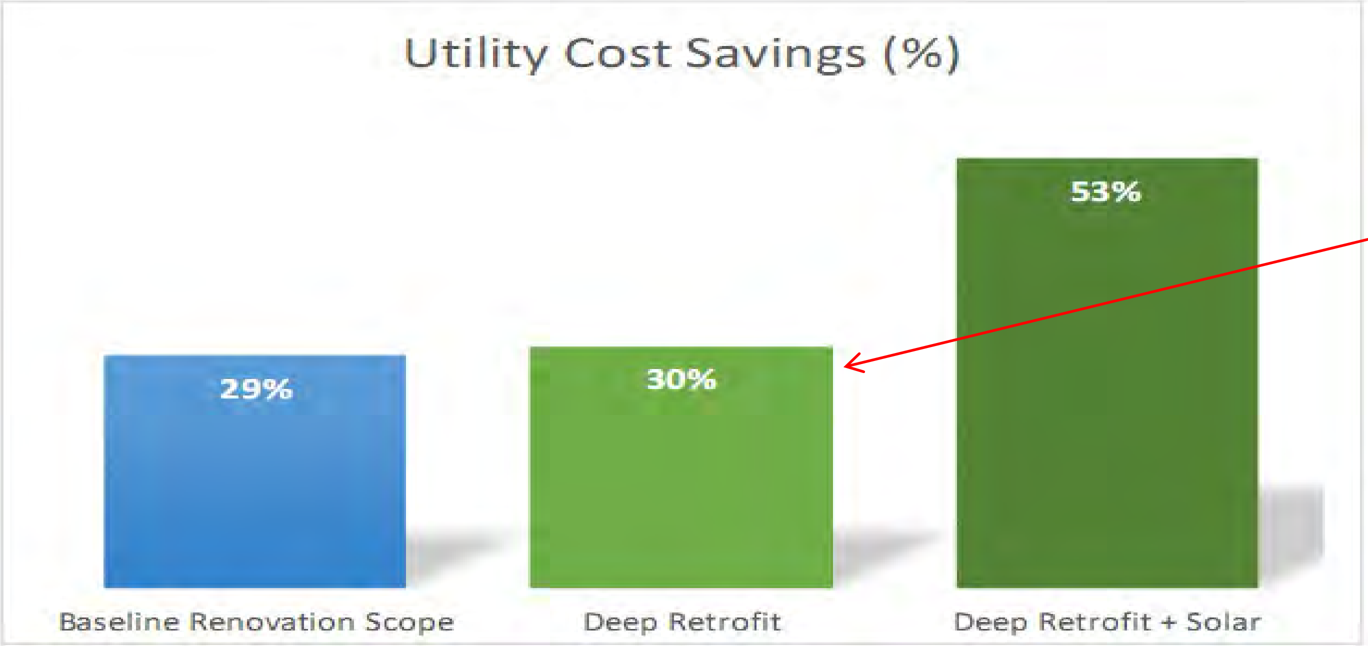
ERV
VENT PIPE
10–TON
CONDENSING UNIT
COLMAC HEAT PUMP
WATER HEATERS
JPPER
DN
W14
8–TON
CONDENSING UNIT
ERV
4 1/2" DIAME
PIPES
DRYER EXHAUST
FAN

Parametric Analysis

Component	Baseline	Option B Without Renewables			
	Bundle 1 Option A	Bundle 1 Option B	% additional energy savings	% additional Cost savings	Additional $ Savings
Exterior insulation of 1st floor street facade	6"	6" + interior insulation	0.03%	0.03%	$ 5
Exterior insulation of the exterior walls - other walls	all the way down past grade (sidewalk and courtyard) on all facades 3'	down to grade	-3.6%	-3.6%	$ (643)
Roof Insulation	R-50+ Stone Wool 4"	R-50 + nothing	-0.11%	-0.11%	$ (20)
Windows	Tilt & Turn / Casement (tripple glazed) U-0.203 SHGC 0.206	Tilt & Turn / Casement (double glazed) U-0.277 SHGC 0.258	-0.9%	-0.9%	$ (166)
Slab Insulation	rigid stone wool: R16 (4") over existing slab + floated floor	No slab insulation	-2.2%	-2.2%	$ (397)
Heating & Coling	VRF	Mini Splits	-3.1%	-3.1%	$ (547)
DHW Heating	HP Water Heater	Electric Resistance	-37.9%	-37.9%	$ (6,753)
Washers and Dryers	1 laundry room for 2 buildings	in unit			$ -
Grey water heat recovery	Grey water heat recovery	No recovery	-7.0%	-7.0%	$ (1,250)
Shades	No shades	Horiz and Vertical Shades	0.00%	0.00%	$ -
Metal Girts	Thermally broken Girts	Metal Girts	-0.14%	-0.14%	$ (25)

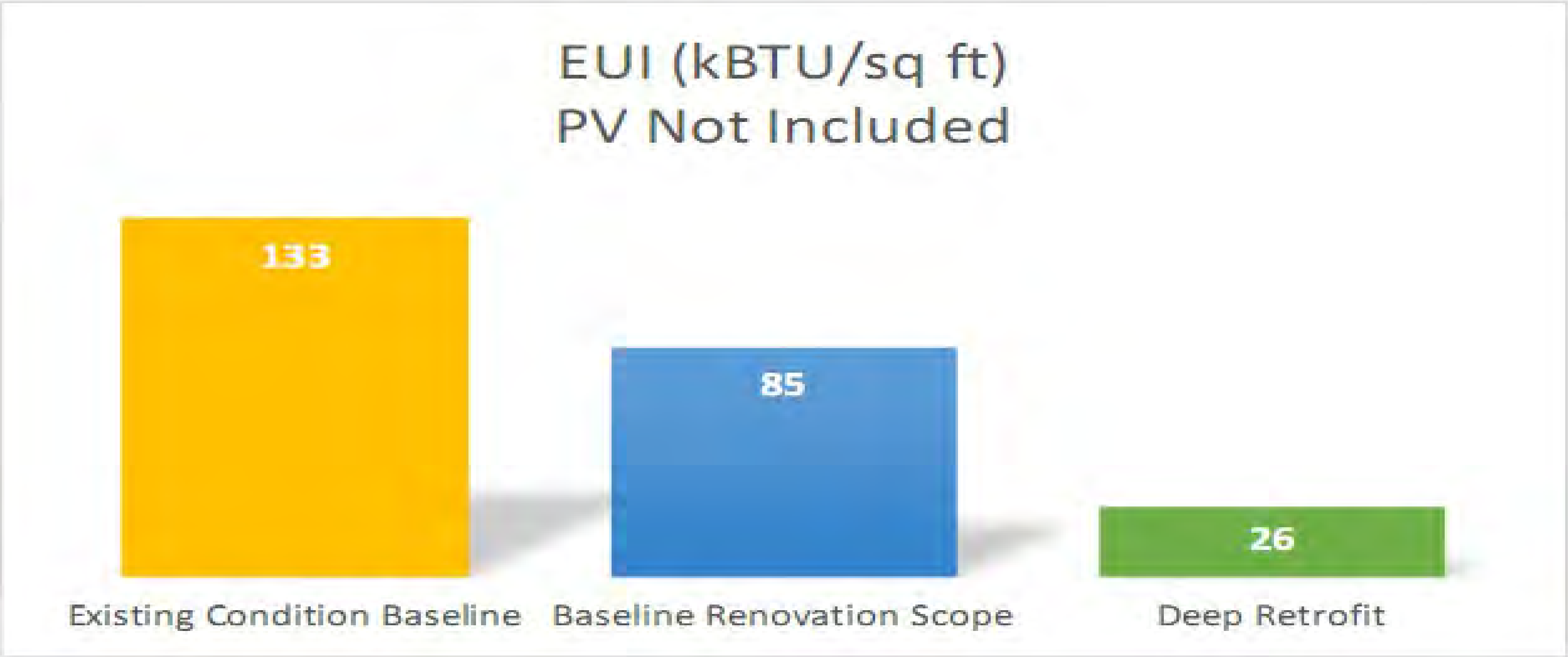
Results





Due to electrification!

Results - continued



Thank you!

Andrea Mancino, Director of New Construction

amancino@brightpower.com

646-780-5512

October 15, 2018

439 West 125th Street

The Team

The Levy Partnership

JOE NYC
JOINT OWNERSHIP ENTITY

PETERSON
PEG
ENGINEERING GROUP LLC

McLaren
ENGINEERING
GROUP

M
SQUARE
BUILDERS

ROCKY MOUNTAIN
INSTITUTE

SOLARONE

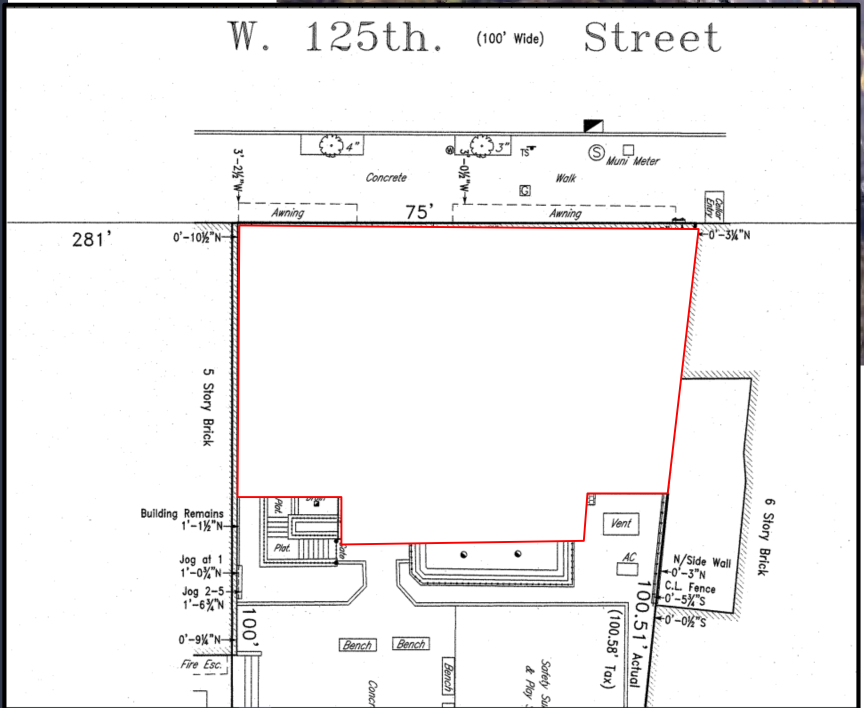
PASSIVE
DWELLINGS

SENTIENT
BUILDINGS

The Building

439 West 125th Street, Manhattan

- Multifamily affordable housing
- 1997 construction
- 23,004 SF, counting basement
- Built to lot line on 3 of 4 sides

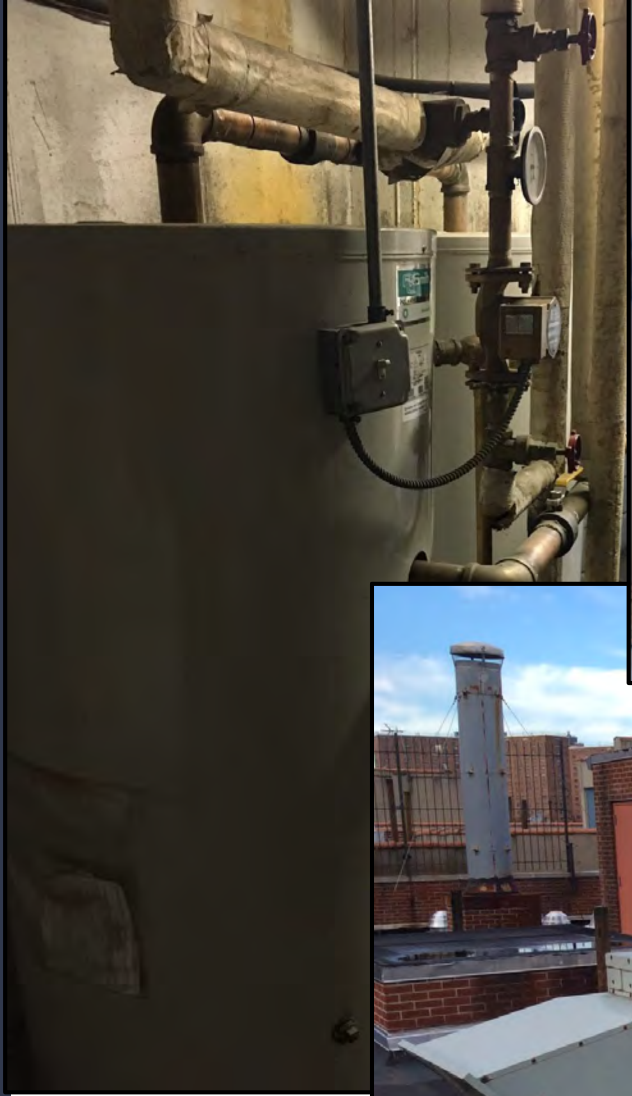


The Building

- 6 story elevator building
- 21 residential units
- 2 commercial units
- Community room

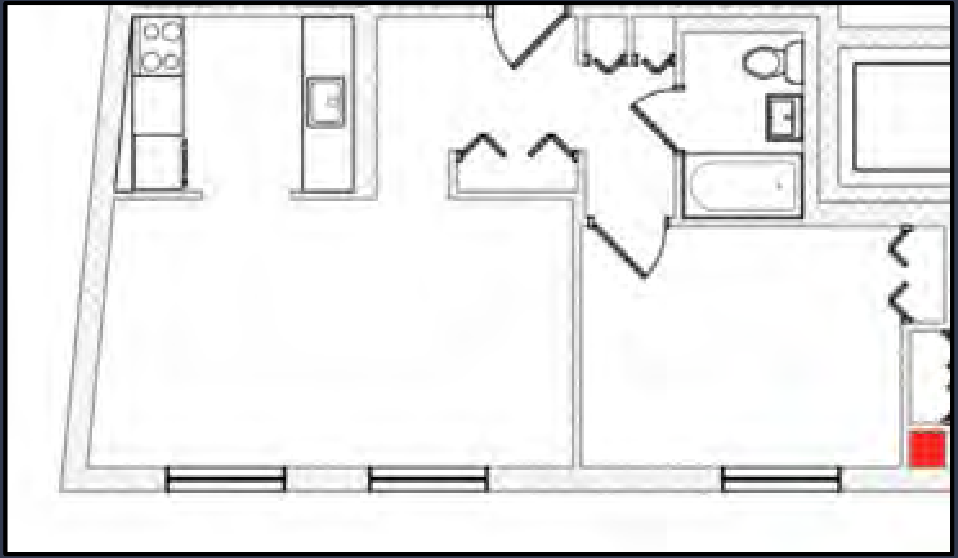
Systems

- Natural gas fired boiler
- Baseboard forced hot water distribution
- Natural gas fired DHW storage tanks
- Window and through-wall AC units
- Exhaust fan ventilation
- Hallway ventilation air handler/heater



Access

- Located on busy 125th street
- Construction in rear - no access
- 8’ ceilings
- “Efficient” floor plans



Street Facade

- Built to lot line at street
- Code prohibits post-1968 buildings from overcladding over street line
- Options:
  - Strip brick & EIFS
  - Pursue variance
  - No overclad

3202.2 Encroachments above grade. Encroachments into the public right-of-way above grade shall be prohibited except as provided for in Sections 3202.2.1 through 3202.2.3.

3202.2.1 Encroachments subject to the area limitations. Encroachments that are subject to area limitations are those elements listed in Sections 3202.2.1.1 through 3202.2.1.9, generally of an architectural character, that form an integral part of the building facade. The aggregate area of all such elements constructed to extend beyond the street line shall not exceed 10 square feet (0.93 m^2) within any 10 feet (3048 mm) by 10 feet (3048 mm) square area of wall, except that a veneer may be applied to the entire facade of a building erected before December 6, 1968, if such veneer does not project more than 4 inches (102 mm) beyond the street line. The area of any such projection shall be measured at that vertical plane, parallel to the wall, in which the area of the projection is greatest. This plane of measurement may be at the street line, the line of maximum projection or any point in between. For the purpose of measuring the projected area of a balcony, air spaces of less than 6 inches (152 mm) between closely spaced railing or guards elements shall contribute to the area of the projection.

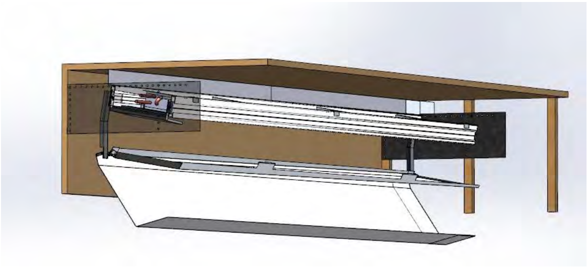
Street Facade: Energy & Budget Impacts

- 30 year NPV of EIFS energy savings = ~$20,000
- System sizing savings = ~$5,000
- Gap financing required for all scenarios

Strategy	Cost	Energy	Notes
Strip Brick, add 4” EIFS	~$126,700	-4160 kWh / year	Requires scaffolding
4” EIFS	~$66,700	-4160 kWh / year	Requires variance, requires scaffolding
No Overclad	Energy penalty	Energy penalty	Increases HVAC size for front units

Space Conditioning Options

- Unitary heat pumps (i.e. mini-splits)
- Central VRF
- Hydronic with valance
- Hydronic with radiant panels



Unitary Heat Pumps

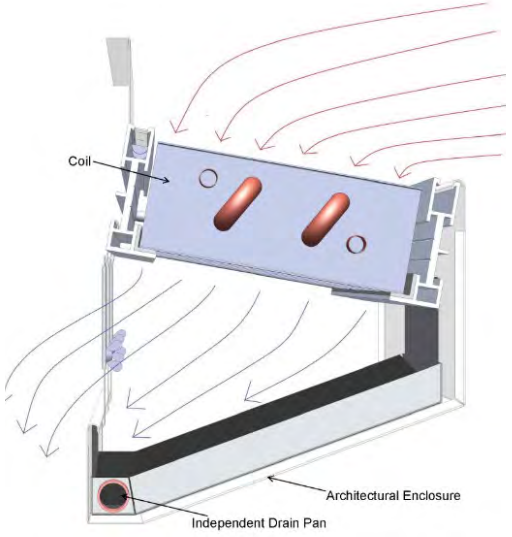
Pros	Cons
Individual control	Need to locate ~24 condensers
Easily available labor for installation and maintenance	Many units to maintain
Each system simpler	More refrigerant line runs
	Less replicable

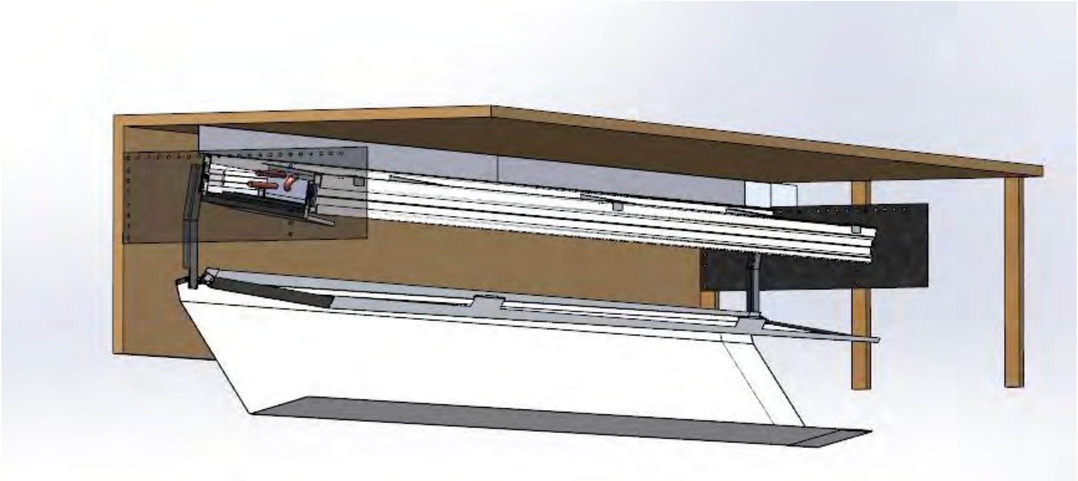
Radiant Panels

- Heated/Chilled Water System
- Ceiling mounted radiant panels

Pros	Cons
Potential reuse of pipe distribution system	High up-front cost
No refrigerant distributed to apartments	Issues with UL and other necessary certifications for use in NYC
Comfort	Dehumidification critical

Valance





Pros	Cons
Individual controls	Unfamiliar technology for users
Use of water instead of refrigerant distribution	Unfamiliar technology for design - some unknowns
	Can’t reuse existing hydronic piping
	Installation labor may be more expensive
	Water leaks a potential problem

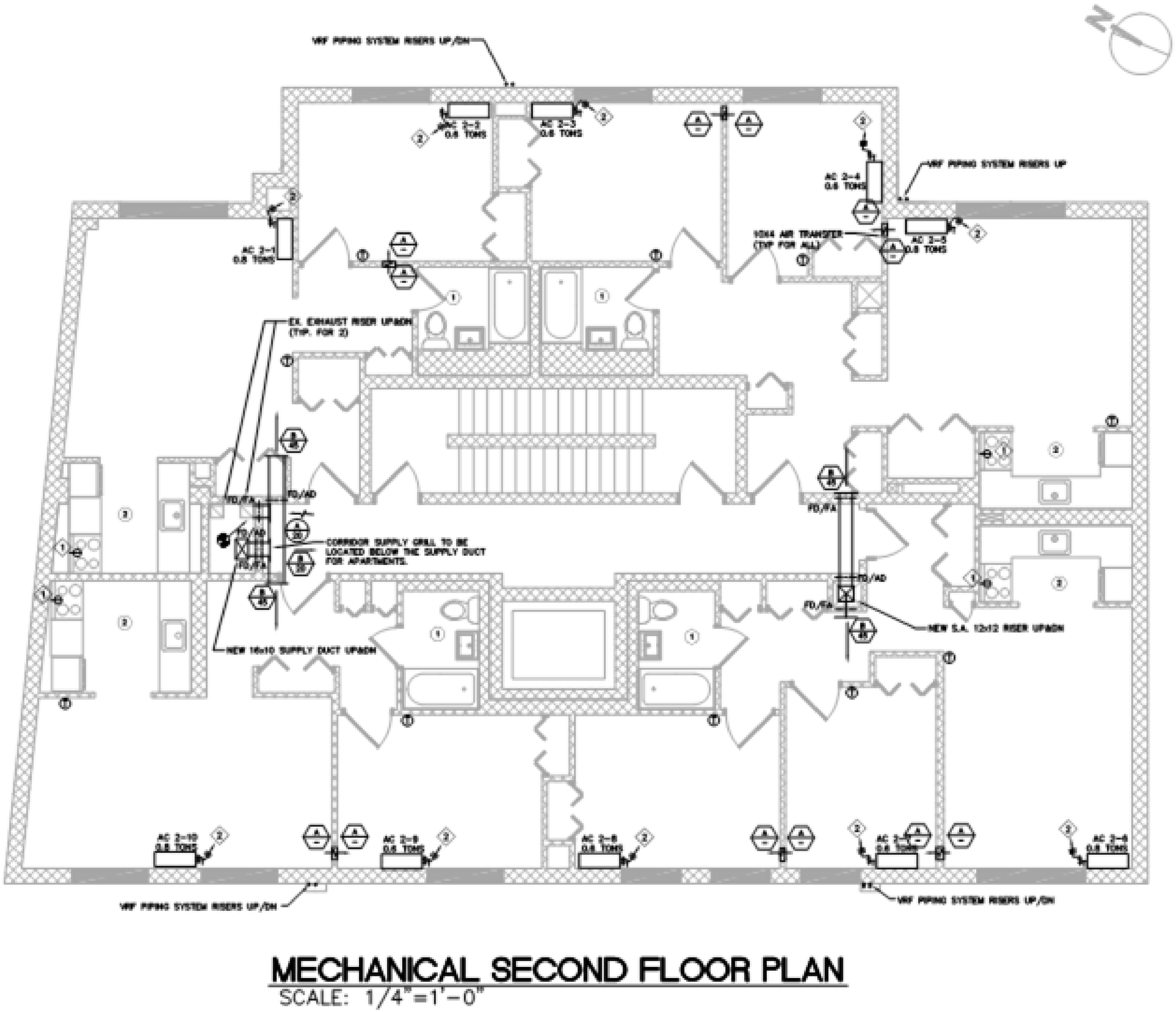
Central VRF

- Central VRF was established as primary strategy
- Least occupant disturbance
- Easier for maintenance
- Most replicable

Pros	Cons
Familiar technology	Limited to 2 zones (no space for branch controllers)
Thermostatic controls in each room	No simultaneous heating/cooling within each zone
Central system for maintenance	Use of refrigerants - large volume, requires through-wall vents
Consolidated refrigerant lines	

Central VRF

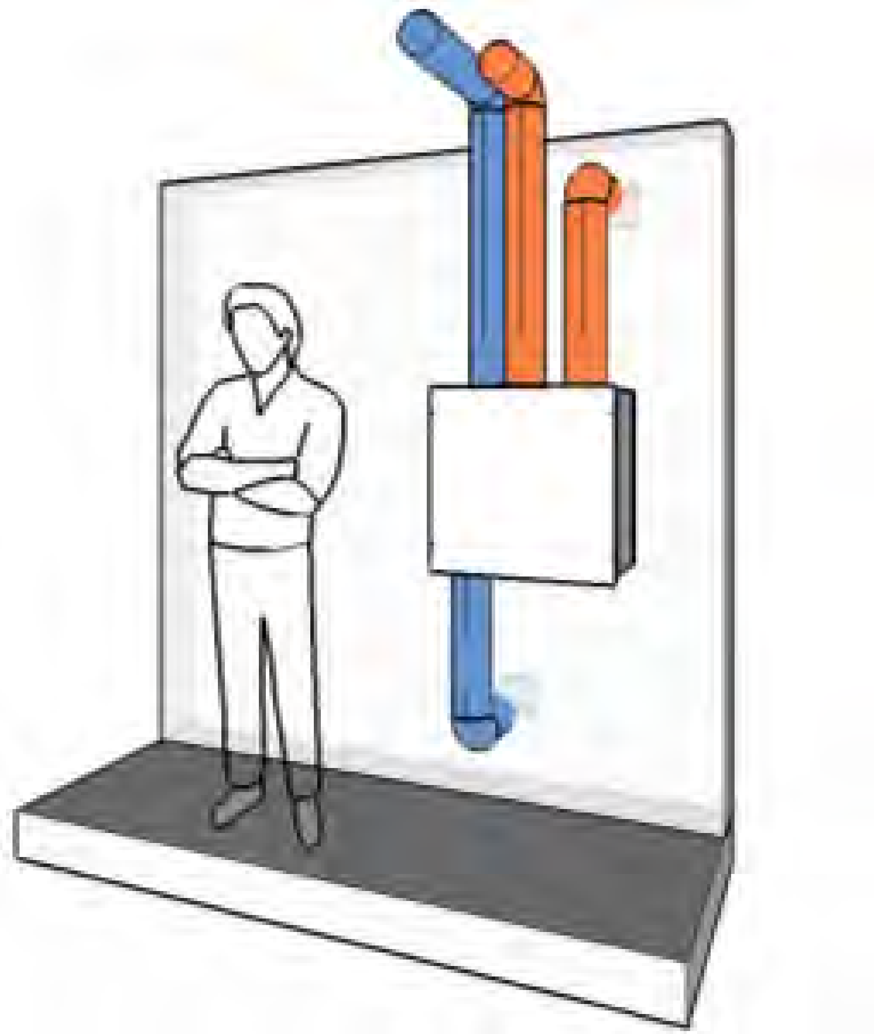
- Wall or floor mounted air handlers possible
- Through wall vents
- Exterior refrigerant lines



Ventilation System Options

- HRV vs ERV
- Unitary ventilators
- Central ventilators

Ventilation - Unitary systems



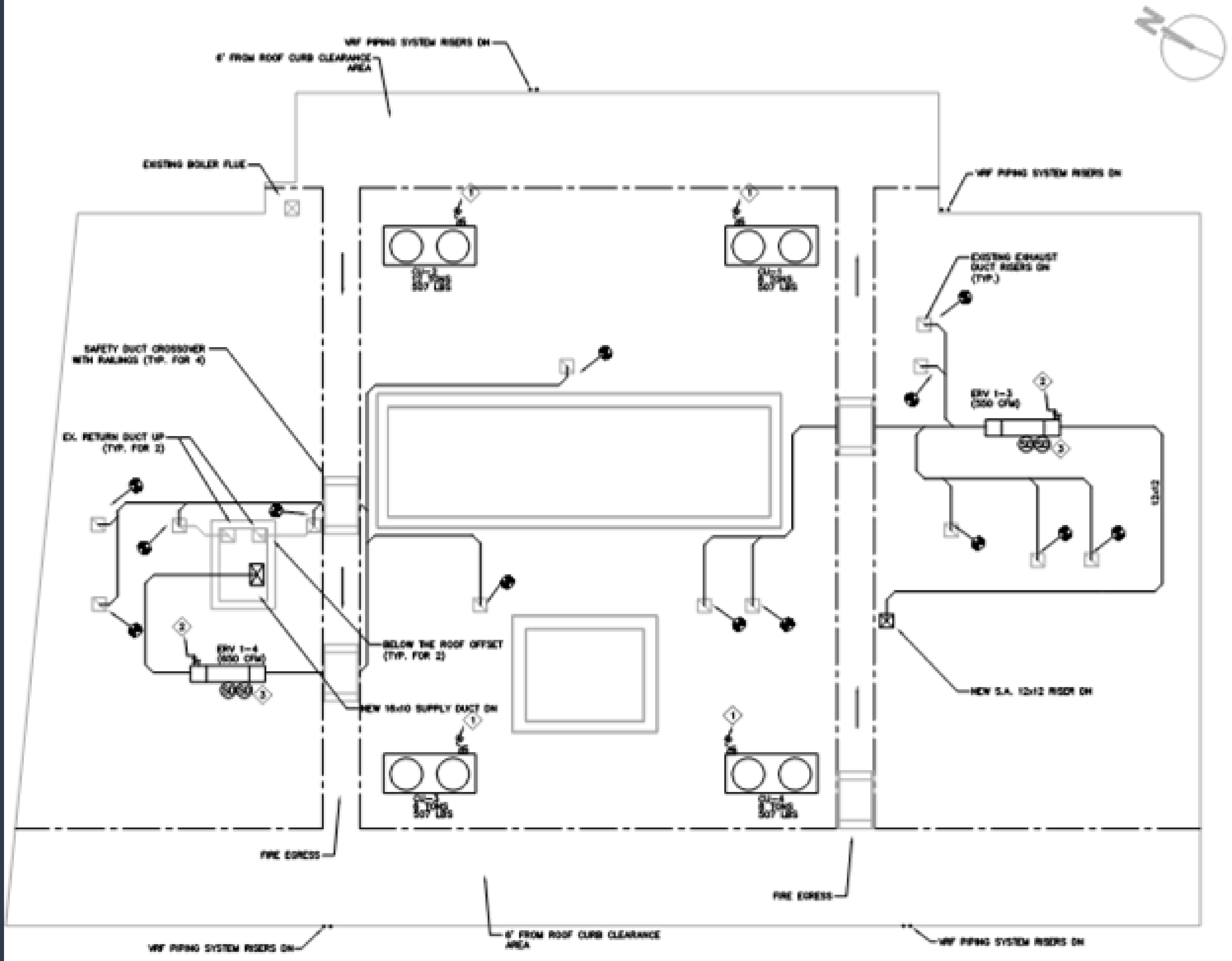
Pros	Cons
Higher efficiency	Need to locate unit in apartments - no space
Reliable commissioning	Ductwork takes up interior space
	Disruptive to tenants - work in apartments
	Maintenance in apartments
	More expensive
	More difficult to add dehumidification capability

Ventilation Central system

Pros	Cons
Central system for maintenance - not in apartments	Challenging to design supply ducts
Reuse existing exhaust ducts	Less efficient
	Harder to commission flows

Ventilation

- Collect exhaust ducts at two locations
- Plan shows four VRFs - may reduce to two
- Two ventilation/dehumidification units
- FDNY access paths



MECHANICAL ROOF PLAN
SCALE: 1/4"=1'–0"

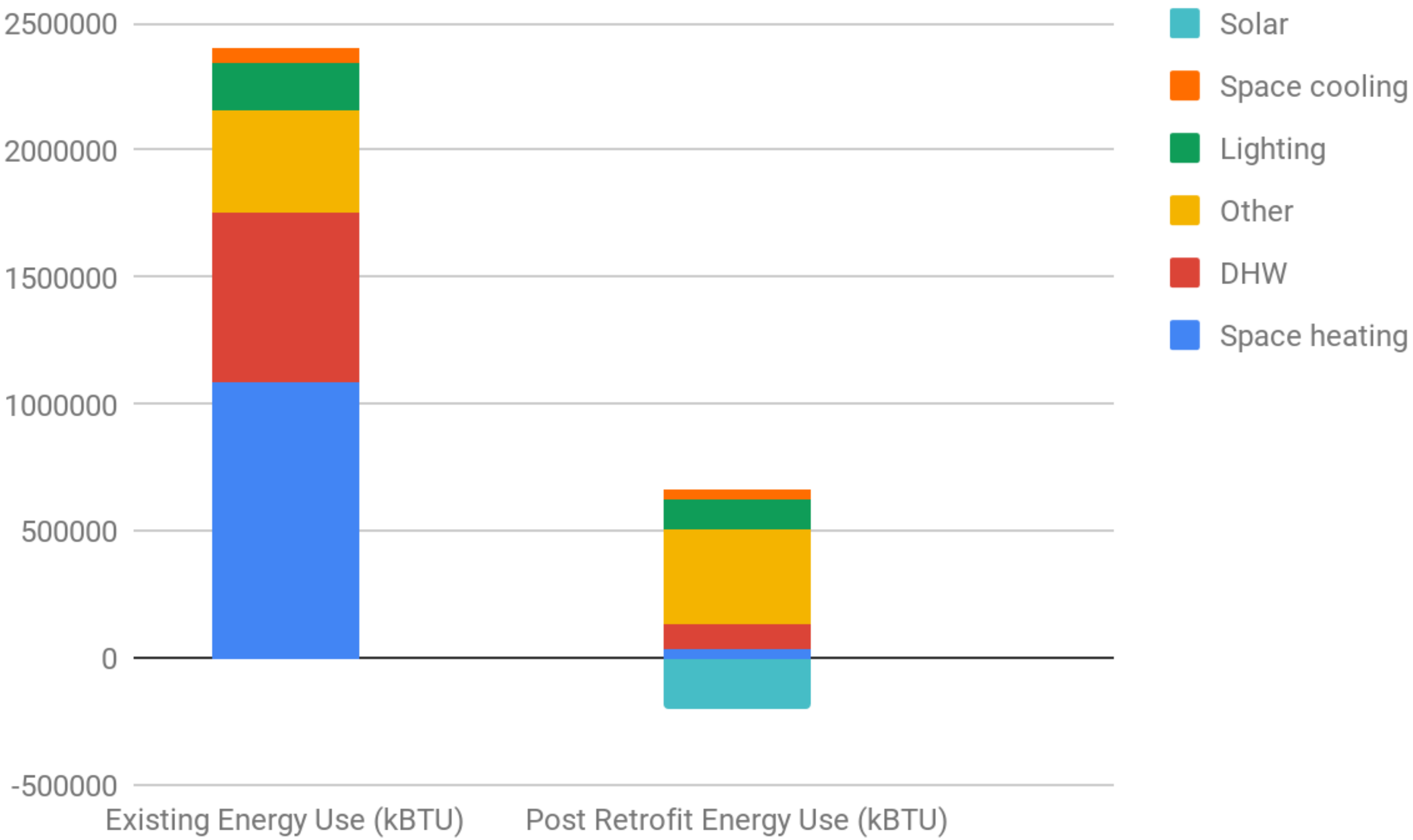
Domestic Hot Water

	Energy (kBTU)	Cost
Existing	667,471	$8,476
Proposed (Modeled)	94,216	$6,428

- Solar hot water not chosen due to need to maximize space for PV
- Ground source heat pump no replicable
- Heat pump water heater selected

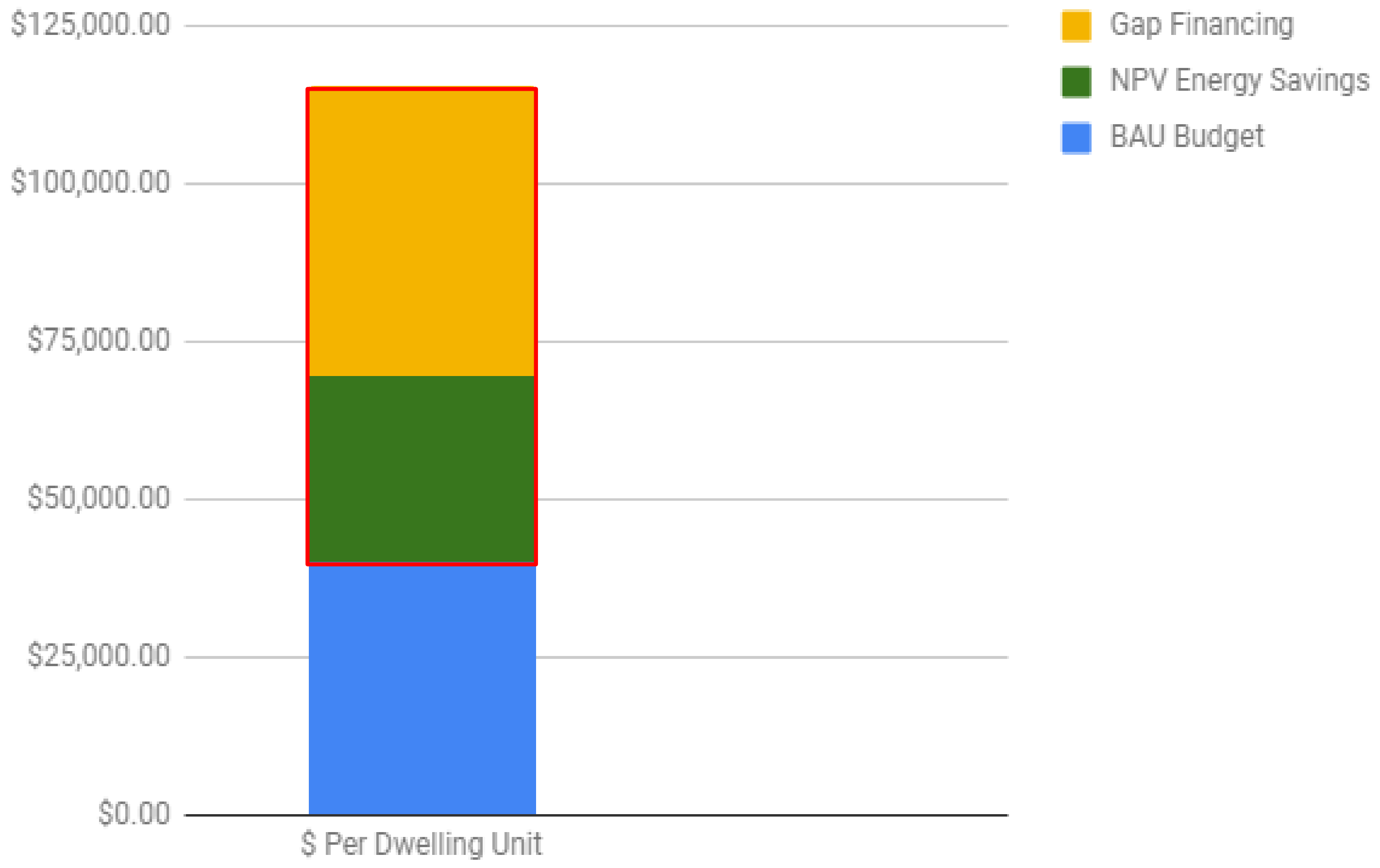
Energy Modeling

- Existing energy performance taken from historic utility bills
- WUFI used to model post-retrofit performance



Finance Targeting

- $40,000 /DU business as usual budget
- ~$29,000 /DU net present value energy savings
- ~$46,000 /DU gap financing



Finance Targeting

- Adjusted budget, assuming no monetized energy savings
- ~$93,000 / DU
- ~$53,000 / DU incremental gap