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CHICAGO 2022

REALIZE
RMI
ENERGY TRANSFORMED

ONION FLATS
ARCHITECTURE

PLACETAILOR
BUILDING EVOLUTION CORPORATION
Achieve Performance & Durability Through A Holistic Approach℠

Tim McDonald
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215.783.5591


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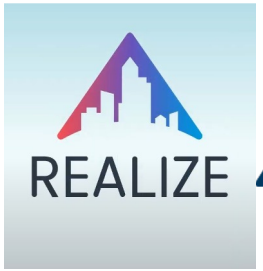
the
YMCA


POAH
Allston
Brighton
COMMUNITY
DEVELOPMENT
CORPORATION


REALIZE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FLATS
ARCHITECTURE


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RENEW
BOSTON
TRUST


Odin
PROPERTIES

DEVELOPERS

FACILITATOR

SOLUTION PROVIDER

ARCHITECT
ENERGY MODELING
R+D PANELIZATION

CONSTRUCTION
MANAGER

HVAC / ENVELOP ENGINEER

DEVELOPERS

FACILITATOR

SOLUTION PROVIDER

ARCHITECT
ENERGY MODELING
R+D PANELIZATION

CONSTRUCTION
MANAGER

HVAC / ENVELOP ENGINEER

PANELIZERS

*** NOTE: ALL PROJECTS ARE IN FEASIBILITY PHASE**

DEVELOPERS

the YMCA

POAH

Allston Brighton COMMUNITY DEVELOPMENT CORPORATION

RENEW BOSTON TRUST

Odin PROPERTIES

FACILITATOR

REALIZE

RMI ENERGY. TRANSFORMED.

SOLUTION PROVIDER

ARCHITECT ENERGY MODELING R+D PANELIZATION

ONION FLATS ARCHITECTURE

CONSTRUCTION MANAGER

PLACETAILOR

BUILDING EVOLUTION CORPORATION

Achieve Performance & Durability Through A Holistic Approach℠

HVAC / ENVELOP ENGINEER

METALLEVE WALL SYSTEMS

blueprint robotics

TREMCO Construction Products Group

EXOSHELL A COMPOSITE EXTERIOR WALL PANEL

RCPANELS

EASTERN EXTERIOR WALL SYSTEMS INC.

G·OLOGIC

sto Building with conscience.

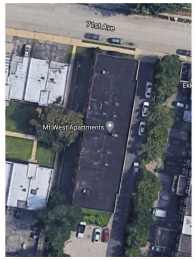
DEXTALL

PANELIZERS

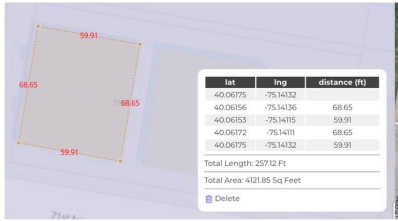
Odin PROPERTIES

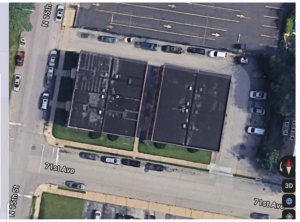
Odin affiliates currently own and manage approximately 9,000 apartments and 200,000 square feet of commercial space in 14 US States.

- Mount West 2 ***1414 71st Ave, Philadelphia, PA 19126***

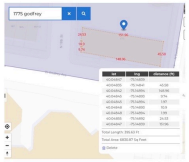


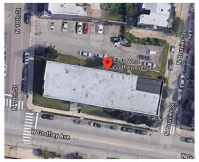
- 7101 N. 15th St ***7101 N. 15th St, Philadelphia, PA 19126***



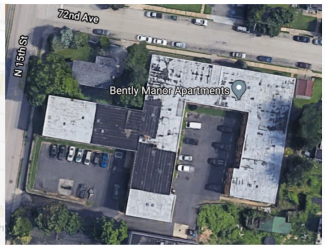


- 1775 Godfrey St, Philadelphia, PA 19126

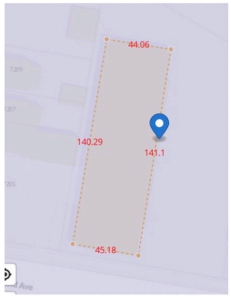


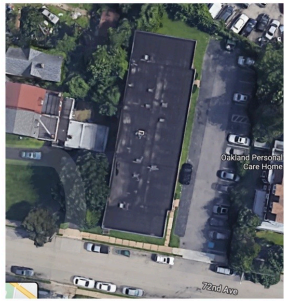


- Bentley Manor ***1410 72nd Ave, Philadelphia, PA 19126***



- Mount West 1 ***1411 76th Ave, Philadelphia, PA 19126***





Bldg Info

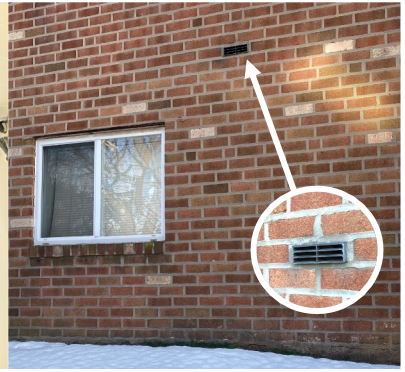
Mount West
1414 71st Ave, Philadelphia, PA 19126
Year Built - 1950s-1960s
Size - 20,901 GSF
Units - 28 (22 1 Bed, 6 2 Bed)
Materials - Brick, CMU, 2x floor framing and roof framing

Existing Systems Analysis

Summary of replacement strategy, options, and age of equipment

Existing Thru-wall Air-Conditioning

Existing Hydronic Baseboard Heating



Existing Bath Ventilation

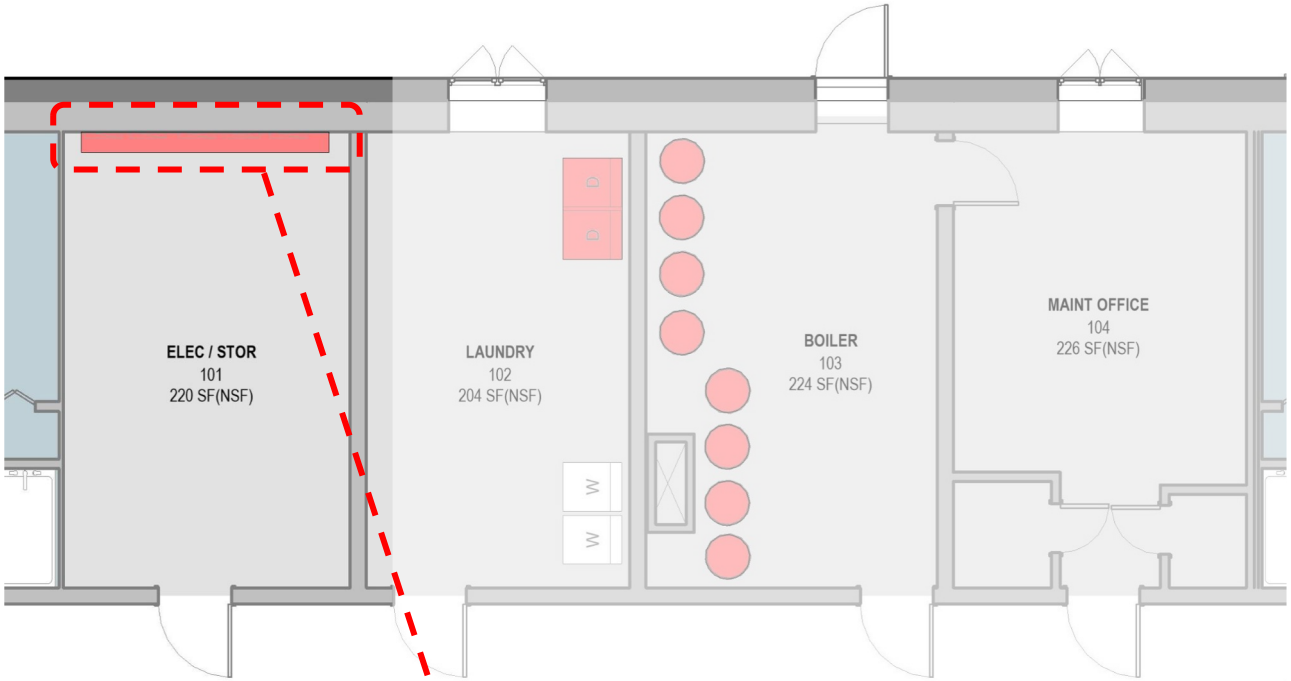
Existing Gas Water Heating

Existing Centralized Gas Boiler for Heating

Existing 40 Amp Panel in Unit

71st Ave

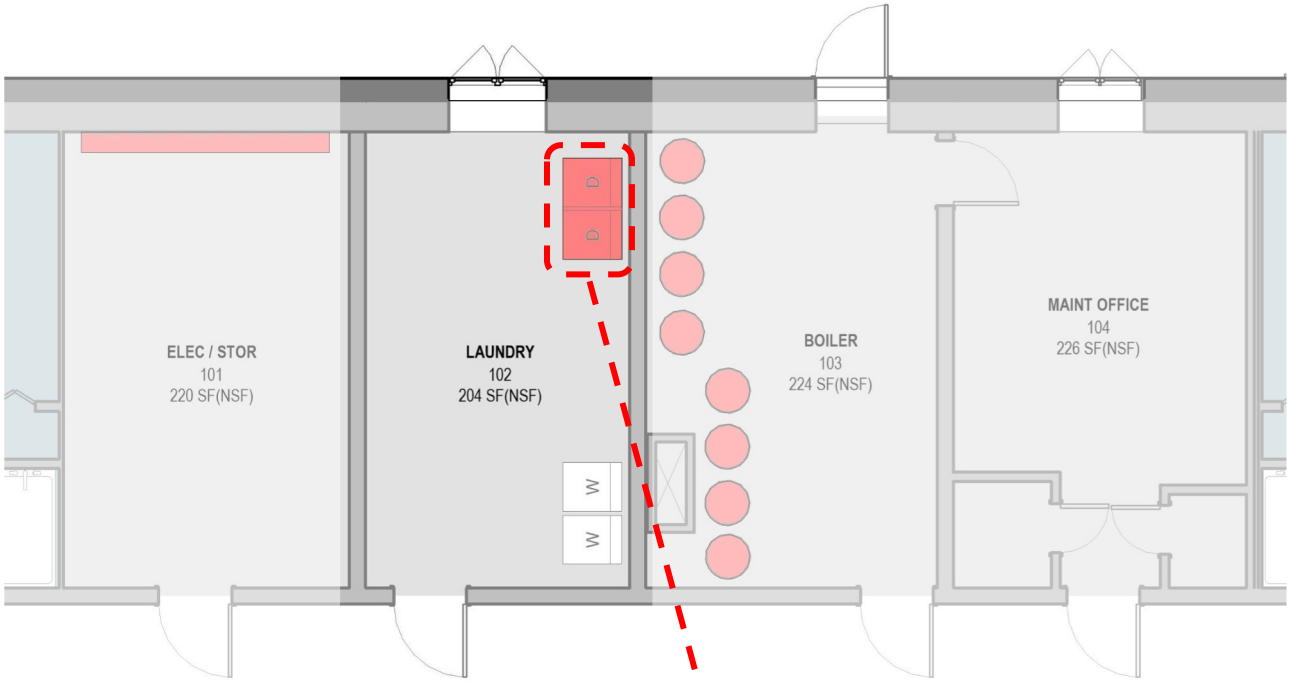
Basement Layout



Mechanical Spaces
Electrical Meter Room:

- Replace existing 800 amp service with 1200 amp service

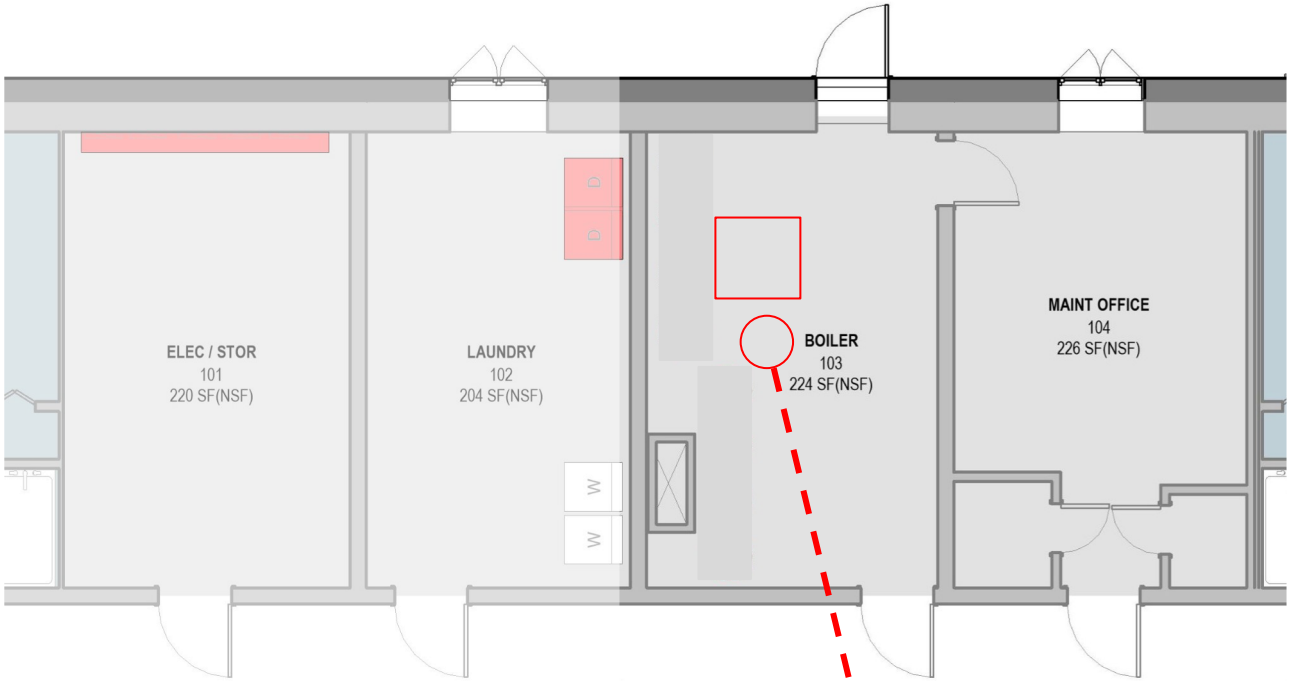
Existing elec. panel and sub-meters



Existing vented gas dryers

Mechanical Spaces
Laundry Room:

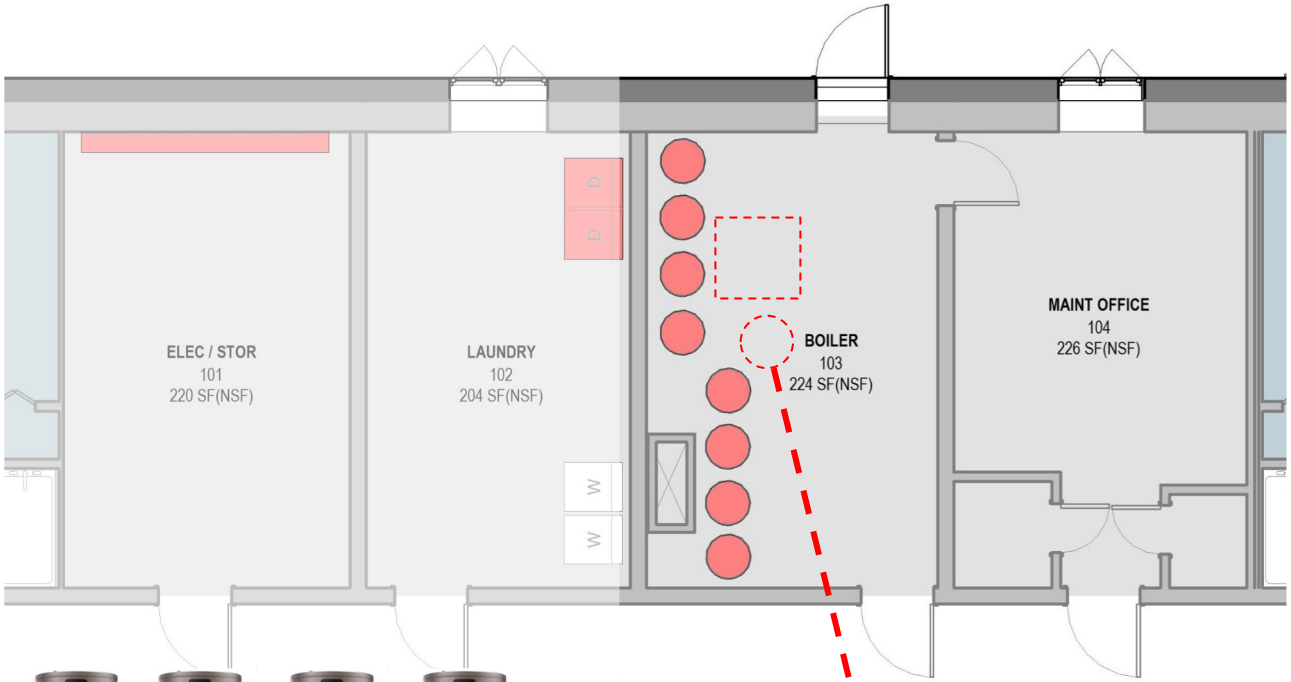
- Replace Gas dryers w/ condensing HP dryers
- Eliminate dryer vents



Mechanical Spaces
Boiler Room:

- Remove Gas-fired boiler

Existing boiler and gas HW heater

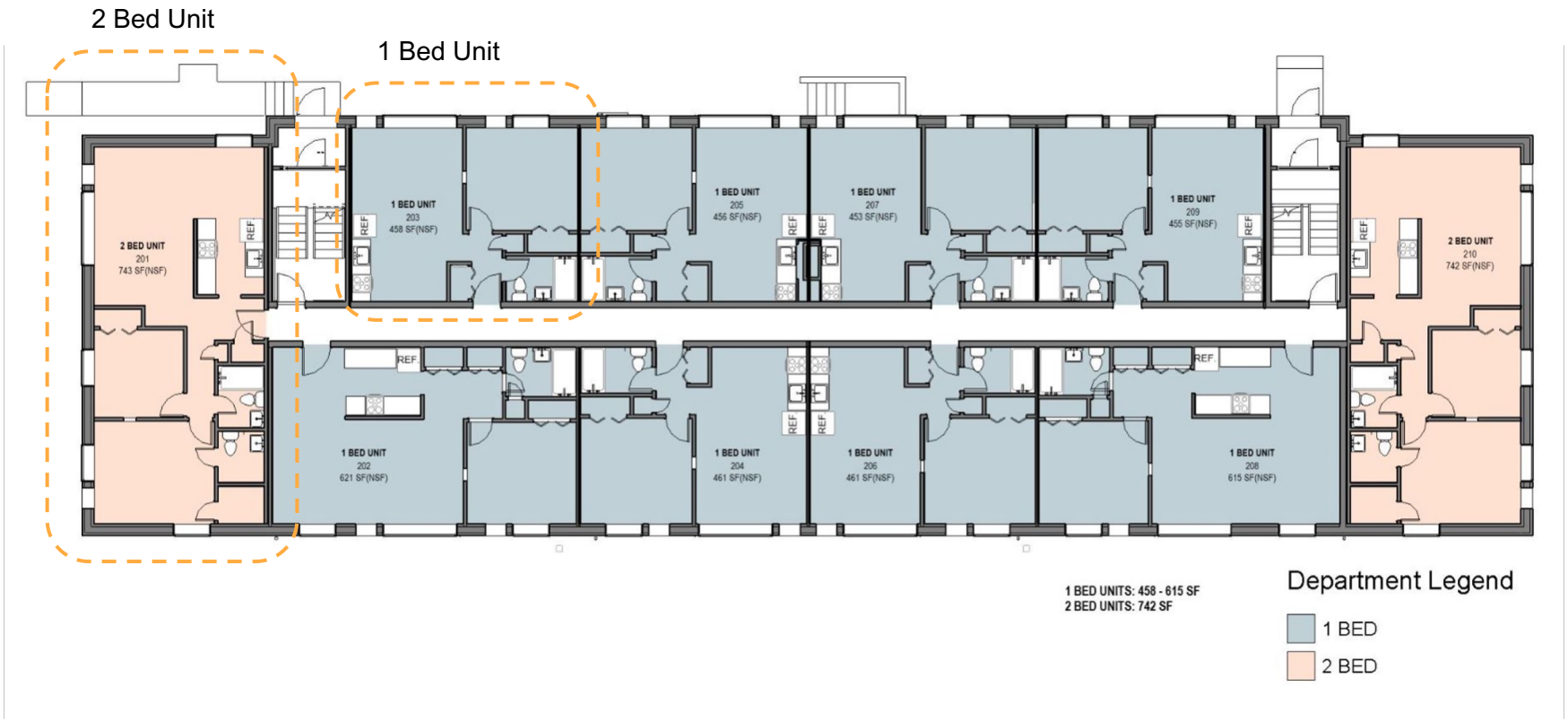


Heat pump Water HeaterCost - $2000 per unit

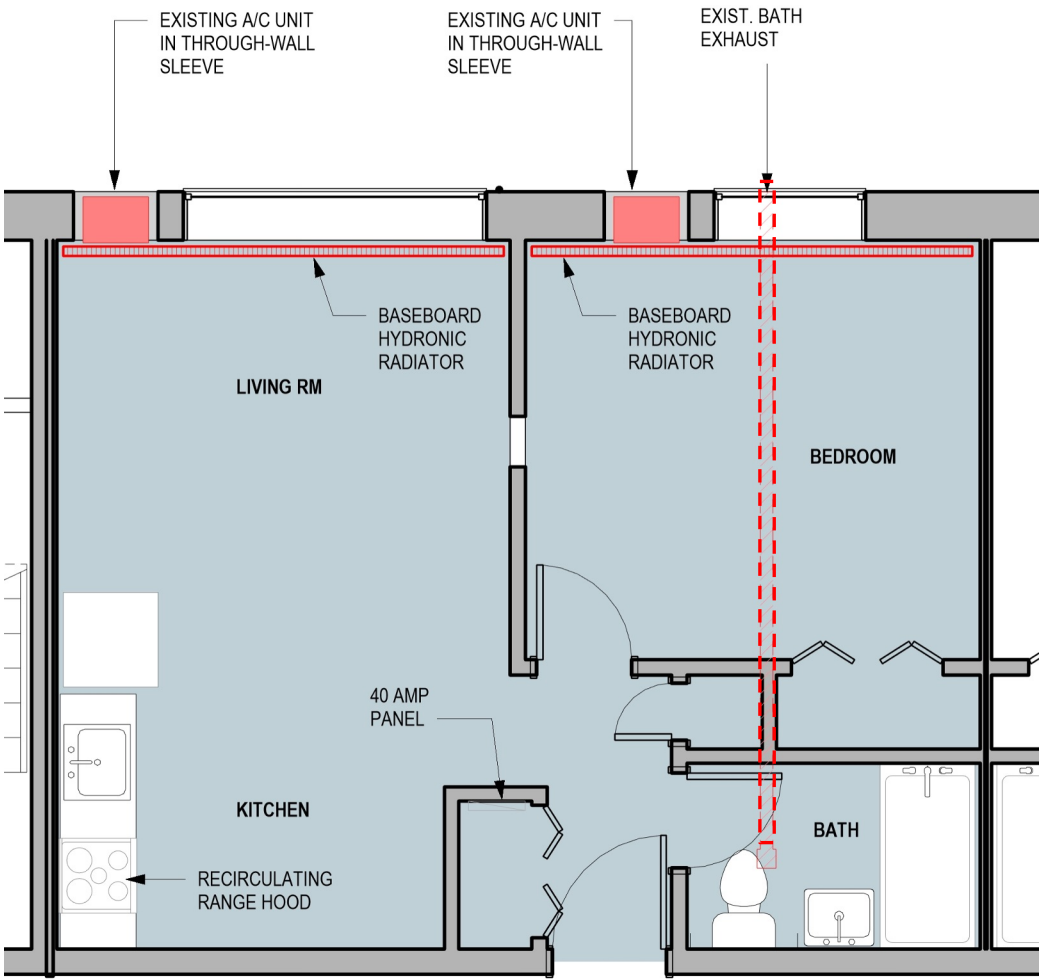
Existing boiler and gas HW heater

Mechanical Spaces
Boiler Room:

- Remove boiler
- Replace with HP water heaters
- Cap & abandon pipes
- Install (8) 80 gal Rheem HP WH


2 Bed Unit
1 Bed Unit
2 BED UNIT
201
743 SF(NSF)
1 BED UNIT
203
458 SF(NSF)
1 BED UNIT
205
456 SF(NSF)
1 BED UNIT
207
453 SF(NSF)
1 BED UNIT
209
455 SF(NSF)
2 BED UNIT
210
742 SF(NSF)
1 BED UNIT
202
621 SF(NSF)
1 BED UNIT
204
461 SF(NSF)
1 BED UNIT
206
461 SF(NSF)
1 BED UNIT
208
615 SF(NSF)
REF.
1 BED UNITS: 458 - 615 SF
2 BED UNITS: 742 SF
Department Legend
1 BED
2 BED

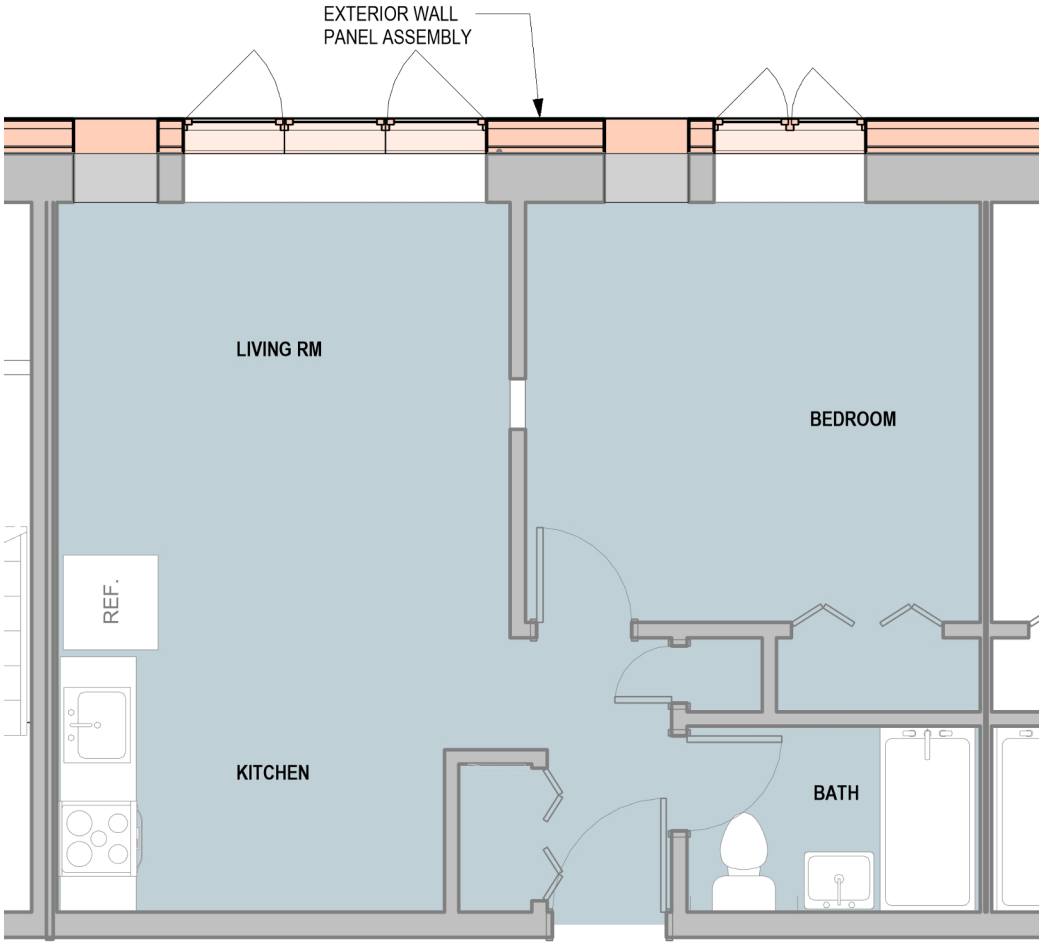
Level 1.5



Typical 1-Bed Unit

EXISTING SYSTEM:

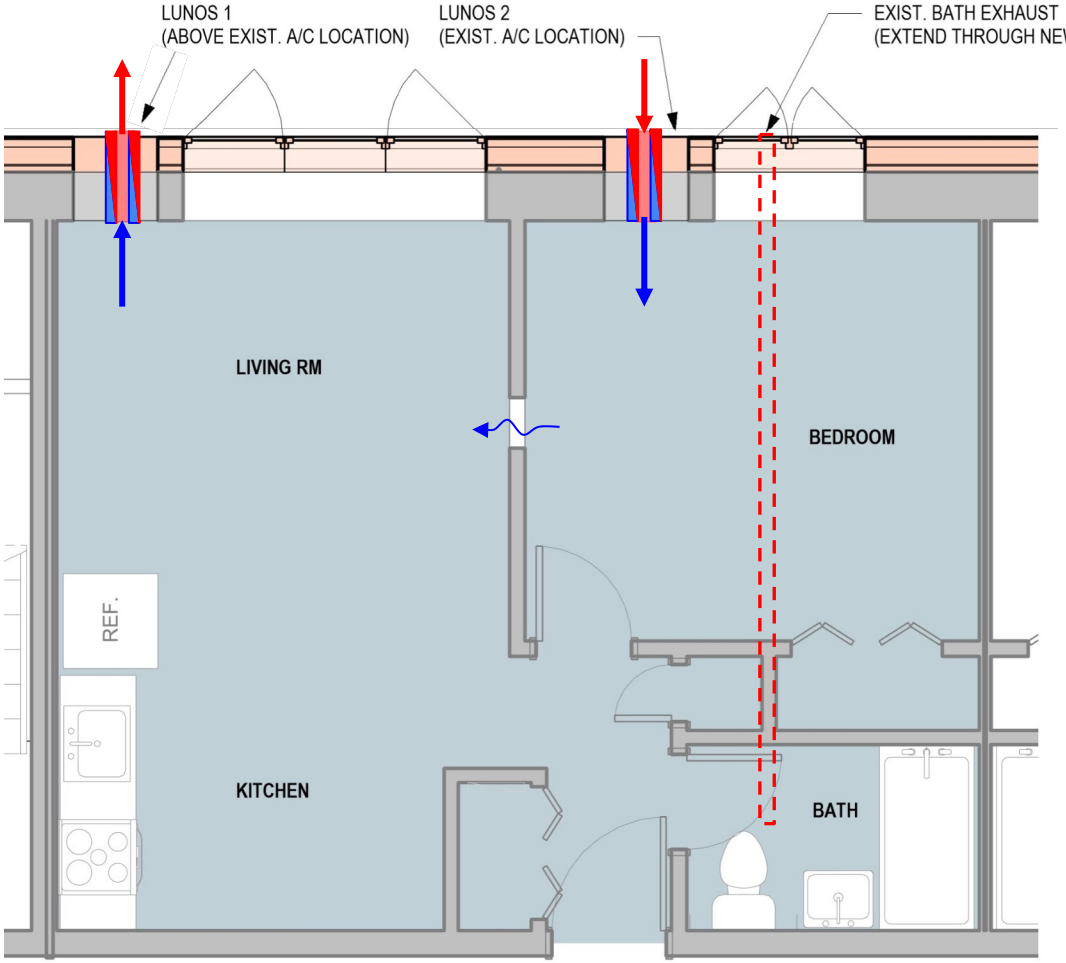
- Plug-in A/C unit in through-wall sleeve
- Centralized hydronic baseboard heating
- Exhaust fan in bathroom ducted to exterior wall
- Recirculating range hood with charcoal filter
- 40 amp elec panel



Typical 1-Bed Unit

New Wall Panel:

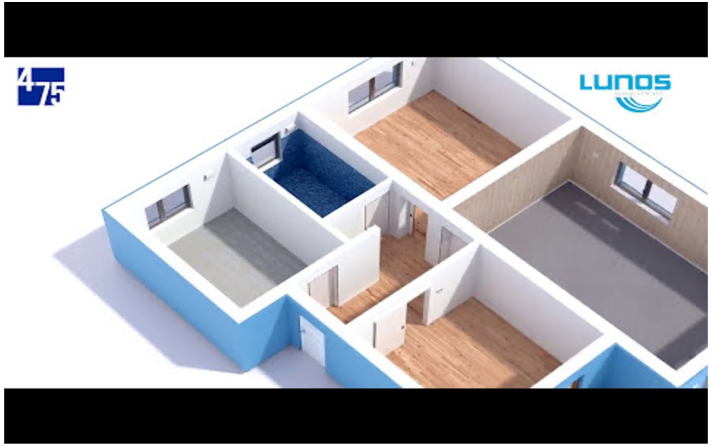
- Prefabricated exterior wall panel system
- Factory-installed windows in existing window locations
- Vapor-open insulated wall assembly

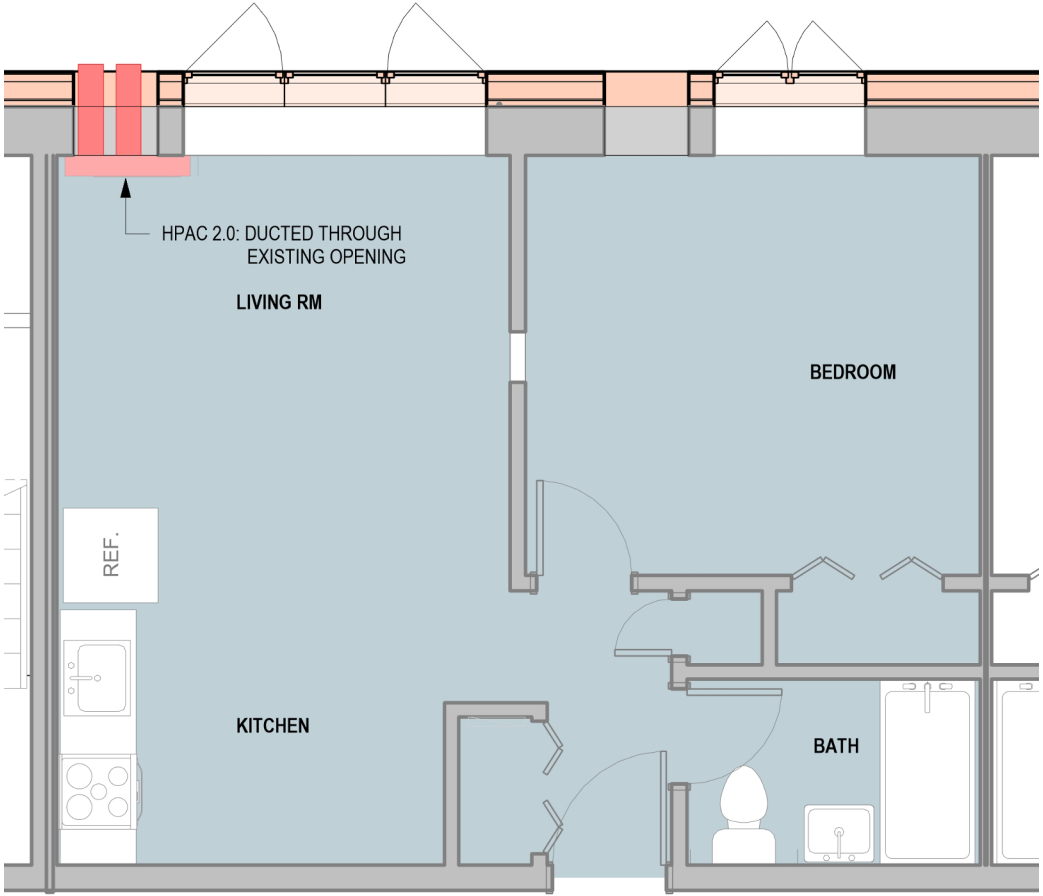


Typical 1-Bed Unit

Ventilation SYSTEM:

- Lunos ET2 HRV pair in Bedroom and Living Room
- Transfer grille installed between Bedroom and Living Room for air circulation through unit
- Panasonic ERV for Bath exhaust

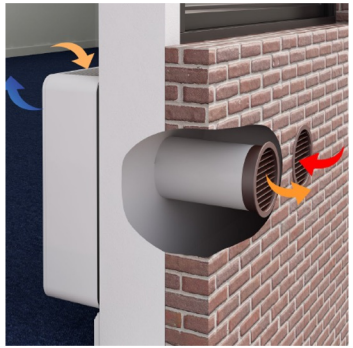




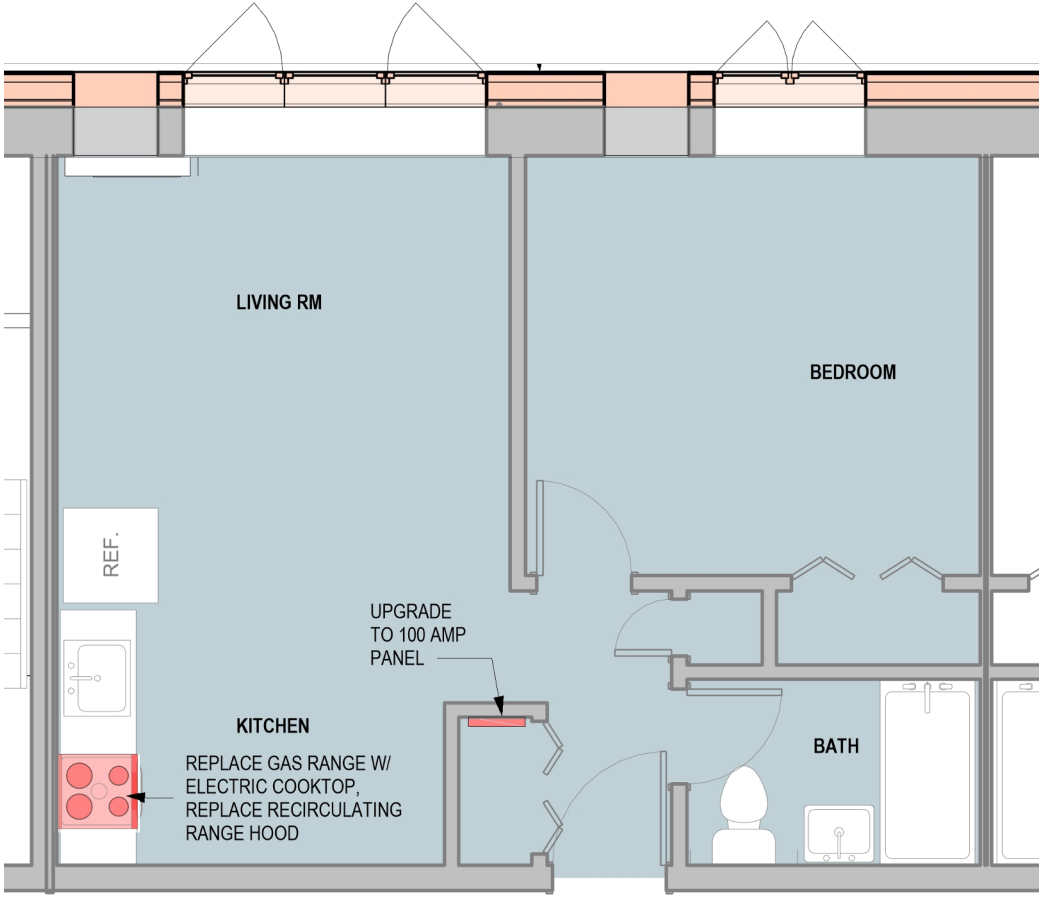
Typical 1-Bed Unit

Heating/Cooling SYSTEM:

- Ephoca monoblock heat pump unit provides heat, cooling, and humidity control
- (2) through-wall ducts installed in existing A/C opening in Living room



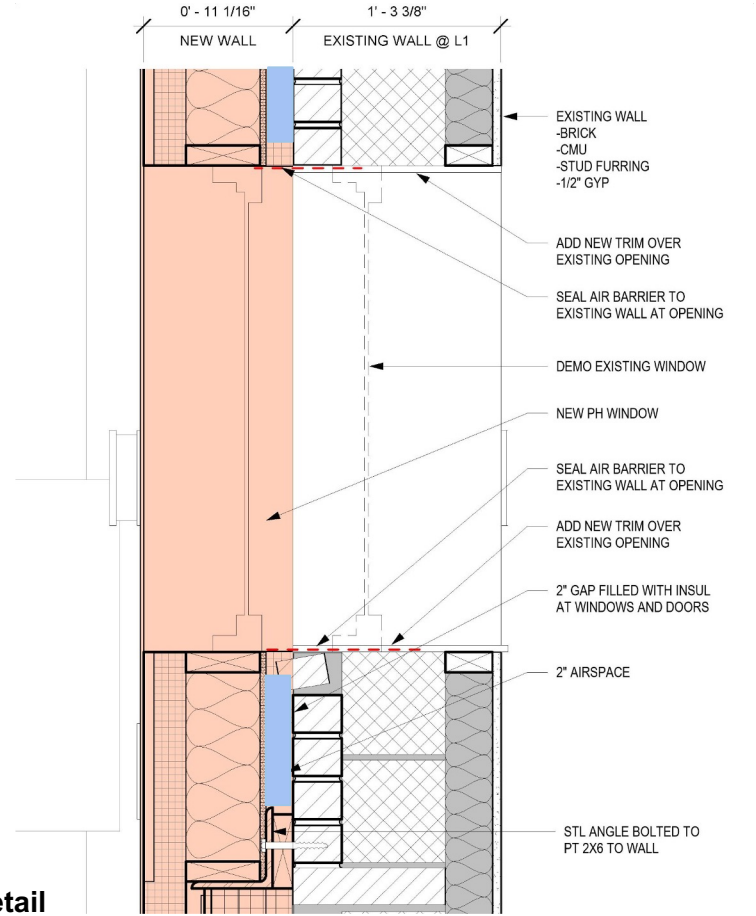
Cost - $2,500 per unit
Size - 39.7” W x 21.9” H x 6.5” D



Typical 1-Bed Unit

ALL-ELECTRIC SYSTEM:

- Eliminate gas appliances throughout: replace gas range with electric cooktop
- Replace recirculating range hood
- Upgrade electrical sub-panel in unit to 100 amps



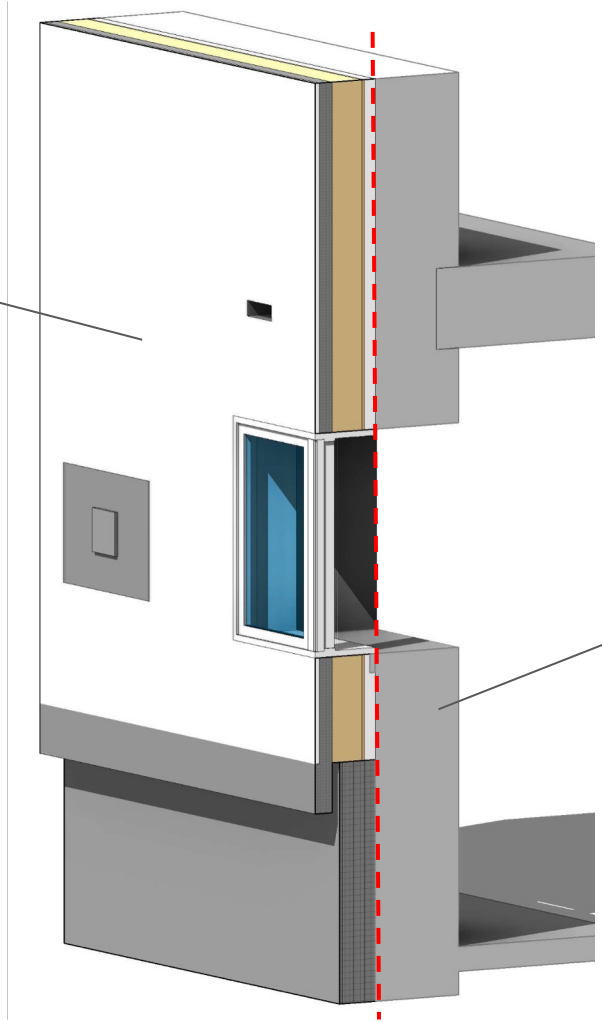
Window/Base Detail

Assembly Details

Detail of overall construction approach between existing and new wall at window opening

New Wall Assembly

- siding
- 2 ½” of steico exterior insul
- 2x6 wood framing
- dense pack cellulose Insul
- 7/16” plywood
- 2” air space



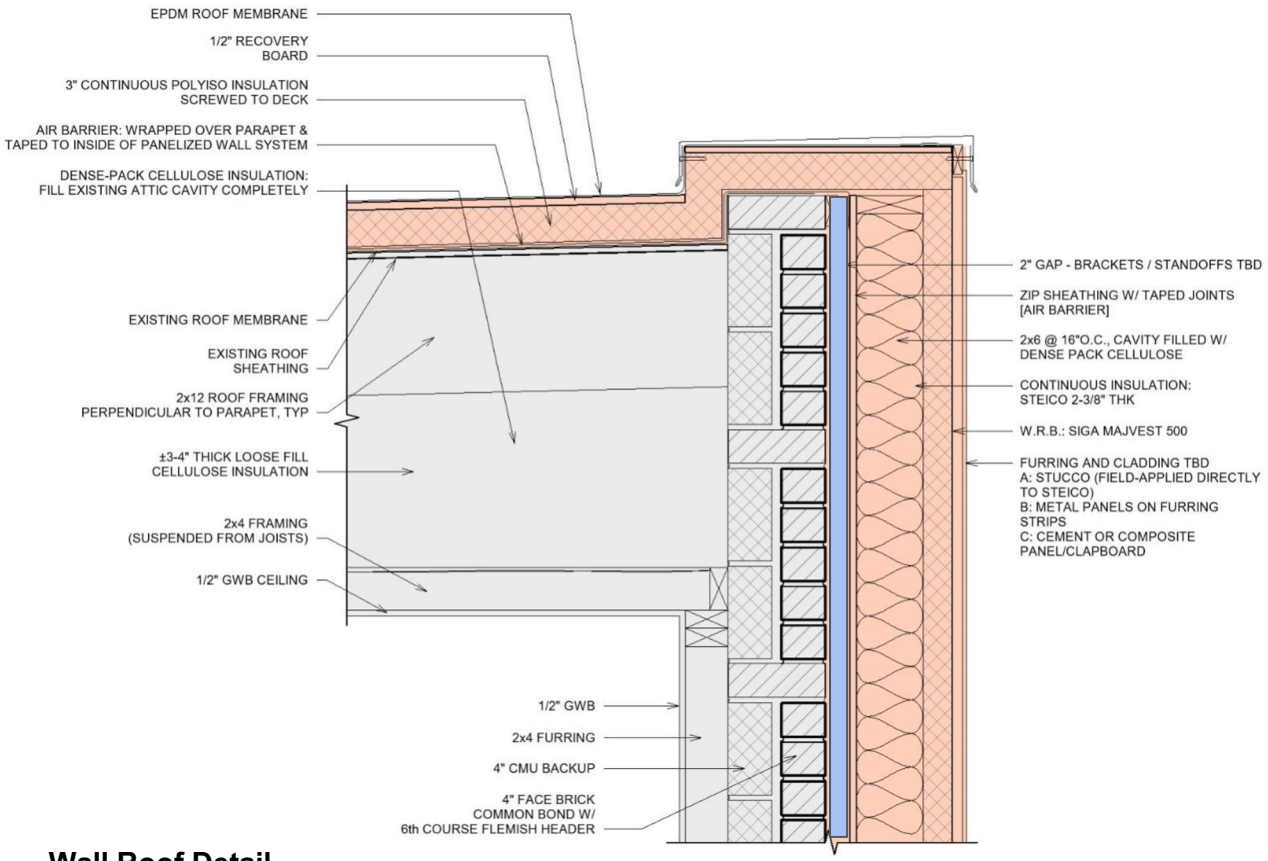
Existing Wall Assembly

Wall Details

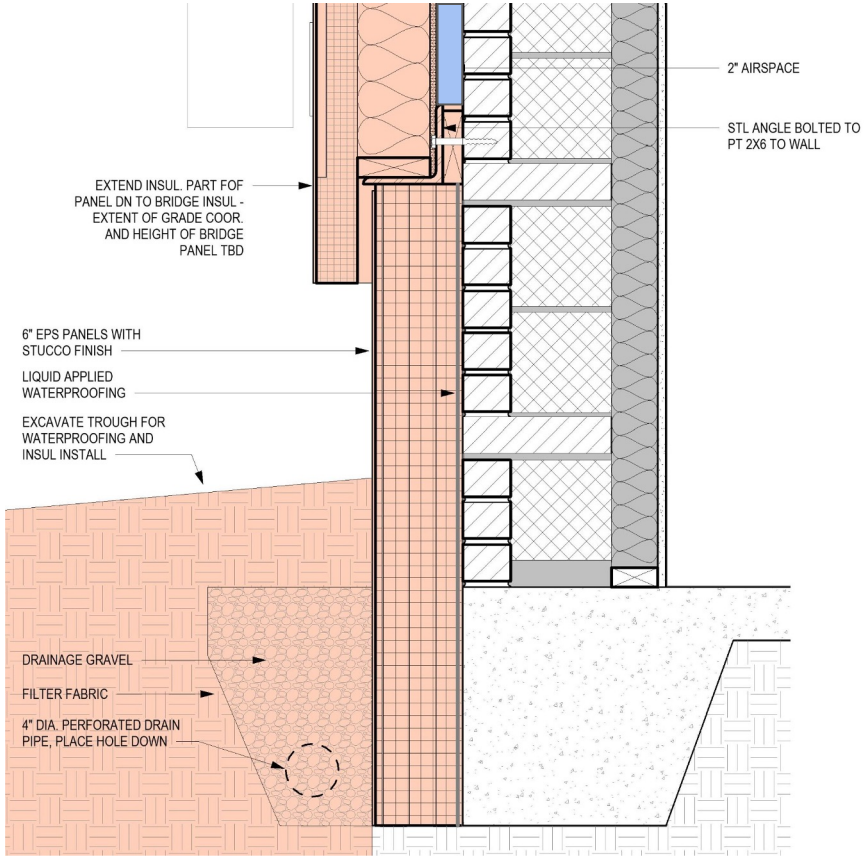
- Vapor open assembly
- Prefab and Panelized

Assembly Details

Detail of overall construction approach between wall and roof



Wall Roof Detail



Foundation Detail

Assembly Details

Detail of overall construction approach at base of wall at perimeter

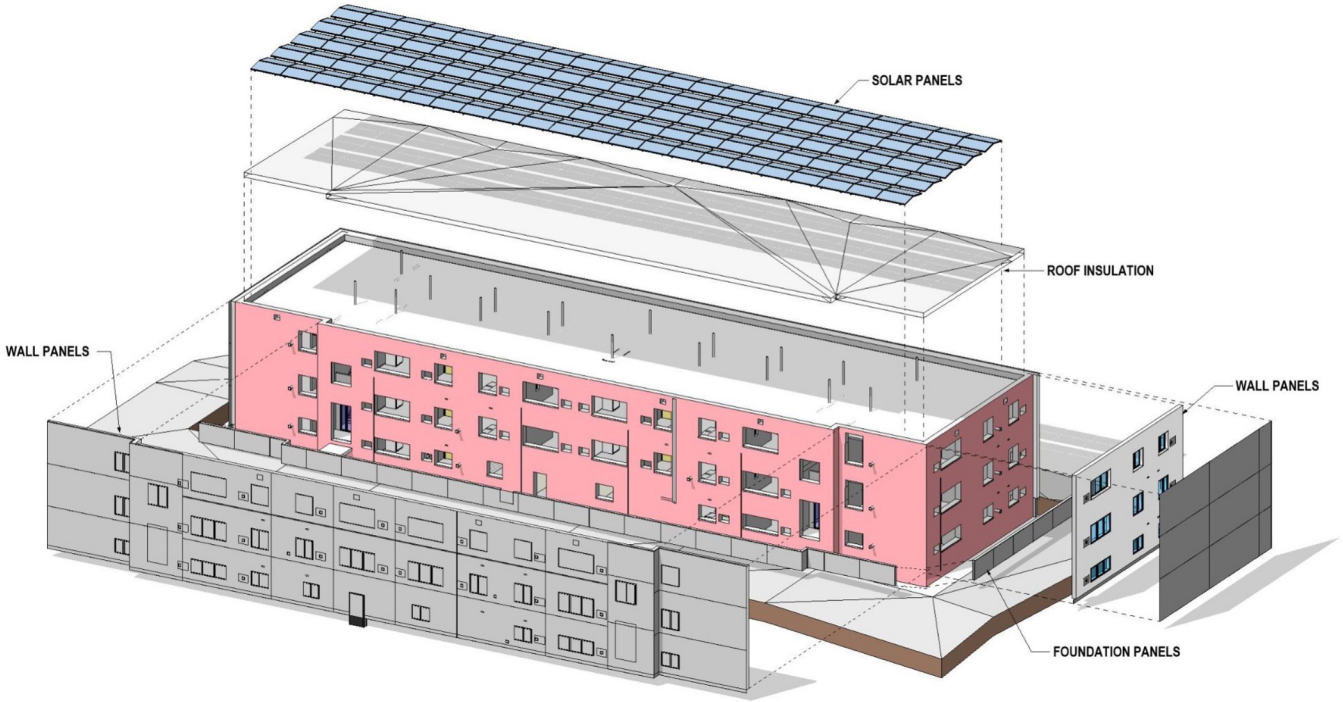
Prefab Fabrication

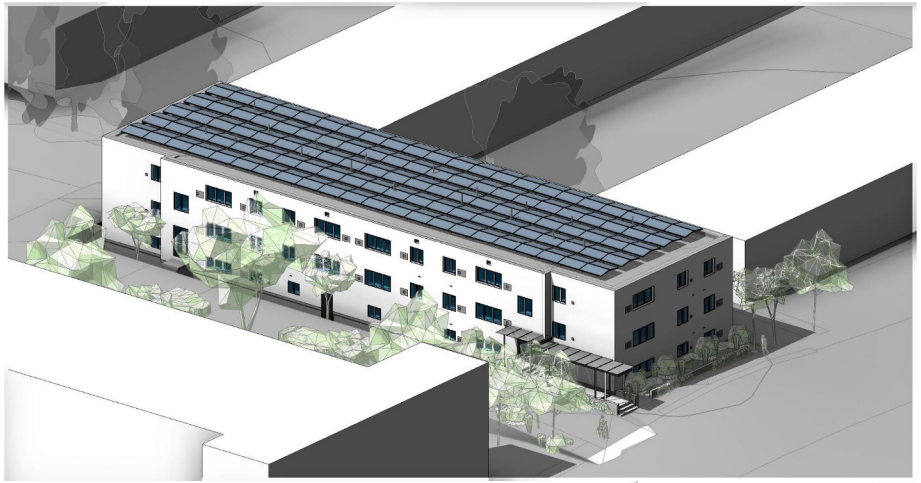
Costs, construction timeline, and info about blueprint prefab

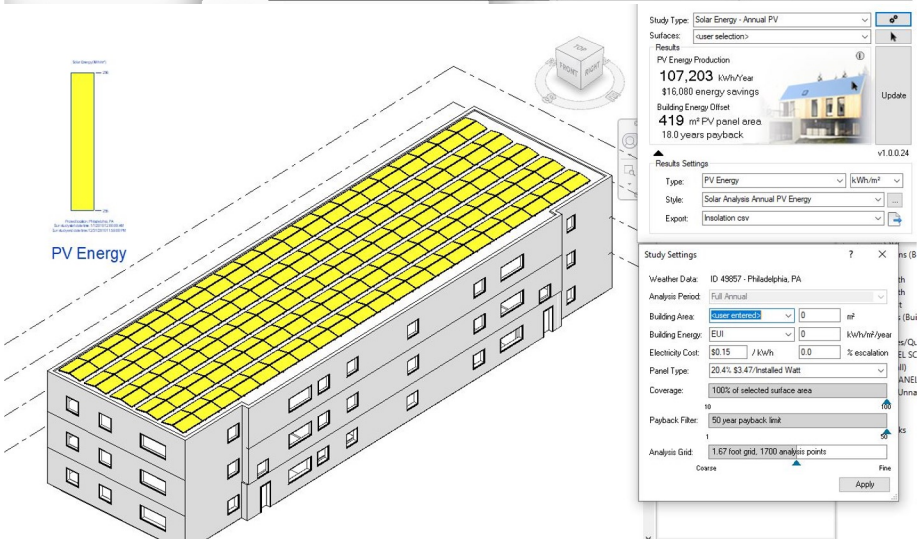
blueprint robotics

Thermal Envelope

Exploded axon showing new walls and roof insulation over existing building including perimeter excavations







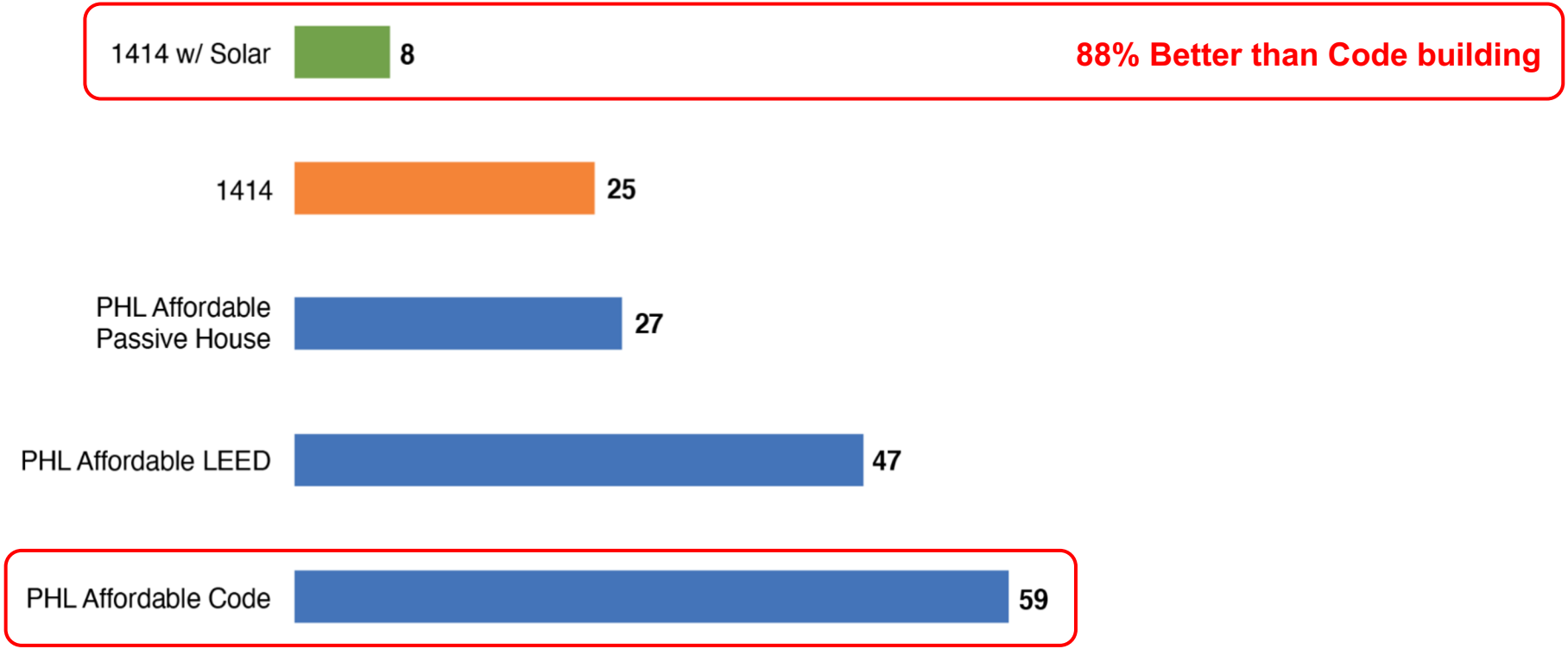
Rooftop Solar

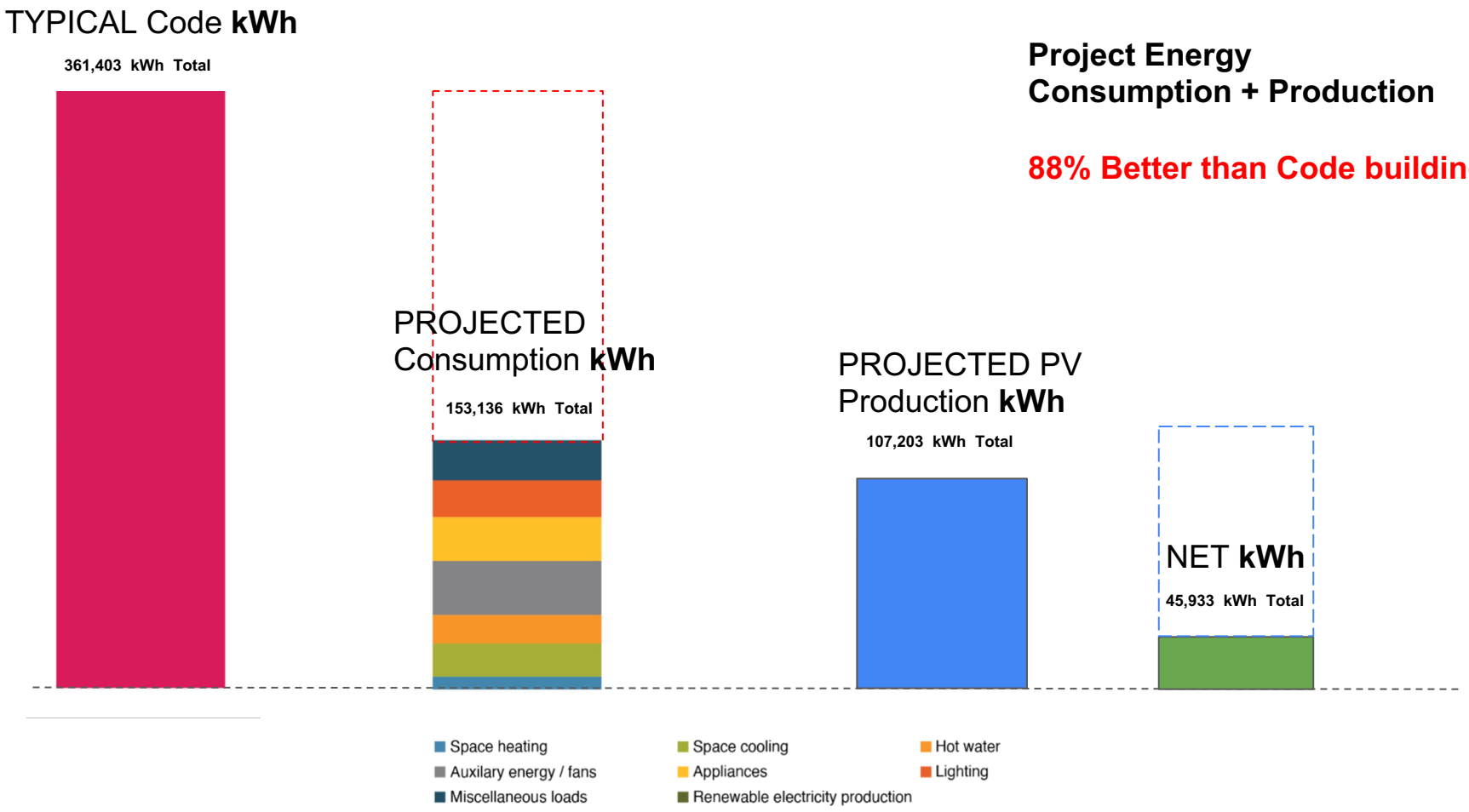
(220) 300W solar panels on 10 deg east west roof racks for maximum efficiency

Total Array Size - 66kw
Generates 107,203 kWh/yr or 70% of total consumption

EUI: Site Energy Use Intensity Comparison (**kBtu/SF**)

Project Energy Consumption + Production





Project Energy Consumption + Production

88% Better than Code building

TYPICAL Code **kWh**

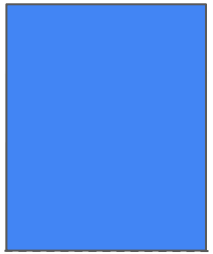
361,403 kWh x $.11kWh =
$39,754/year/building
$1419/year/unit
$118/month/unit

Project Energy Consumption + Production

88% Better than Code building

PROJECTED Consumption **kWh**

PROJECTED PV Production **kWh**



45,933 kWh x $.11kWh =
$5052/year/building
$180/year/unit
$15/month/unit

NET **kWh**

Space heating
Space cooling
Hot water
Auxilary energy / fans
Appliances
Lighting
Miscellaneous loads
Renewable electricity production

71ST AVENUE			
Budget bareakdown	**sf**	**$/sf**	**TOTAL**
BUILDING BUDGET	20901		
Panels (Blueprint Robotics)	11068	$69.12	$765,000.00
EPS for foundations ($1.5/sf material)	1390		$20,000.00
Miscellaneous Site work (Drainage tiles, waterproofing...)			$50,000.00
Roof (based on Topline bid)	6967	$15.30	$106,595.10
EPHOCA (in BR scope)	28	$4,000.00	
Excavation			$50,000.00
Patching interiors/windows (in BR scope)			
Exterior Finish	12458	$30.00	$373,740.00
NEW Electrical service upgraded from 800amp to 1200amps			$20,000.00
NEW 100amp panels and services run to all 28 units		$4000/unit	$112,000.00
Demolition: stairs, boilers			$25,000.00
New Concrete Stairs			$30,000.00
Dense pack roof insulation	6967	$6.00	$41,802.00
220 Line to stove (in BR scope)	28	$700.00	
New stoves	28	$600.00	$16,800.00
Entrance canopy			$25,000.00
Solar	82800	$1.50	$124,200.00
HARDCOST SUBTOTAL		$84.21	$1,760,137.10
Hardcost Contingency		6%	$96,807.54
HARDCOST TOTAL		$88.84	$1,856,944.64
SOFT COSTS			
Our Fee: Arch/predevelop		10%	$176,013.71
Our Fee: GC		6%	$105,608.23
Admin Management fee		3%	$52,804.11
Insurance		1%	$8,800.69
Permitting		1%	$8,800.69
Contingency		6%	$96,807.54
General Conditions		10%	$176,013.71
TOTAL		**$118.74**	**$2,481,793.31**

Overview of Cost

Construction cost details

$2,481,793.31	Total Cost
- 868,627.65	4% LIHTC
- $500,000	Mun. Grant
- $500,000	State Grant
$613,165.65	5% MORTGAGE
Annual Mortgage	**$39,492.00**

$88,635.46 per Apartment

Existing Facade

Existing brick facade with exterior applied cooling units, elec conduit and vents

Facade Renderings

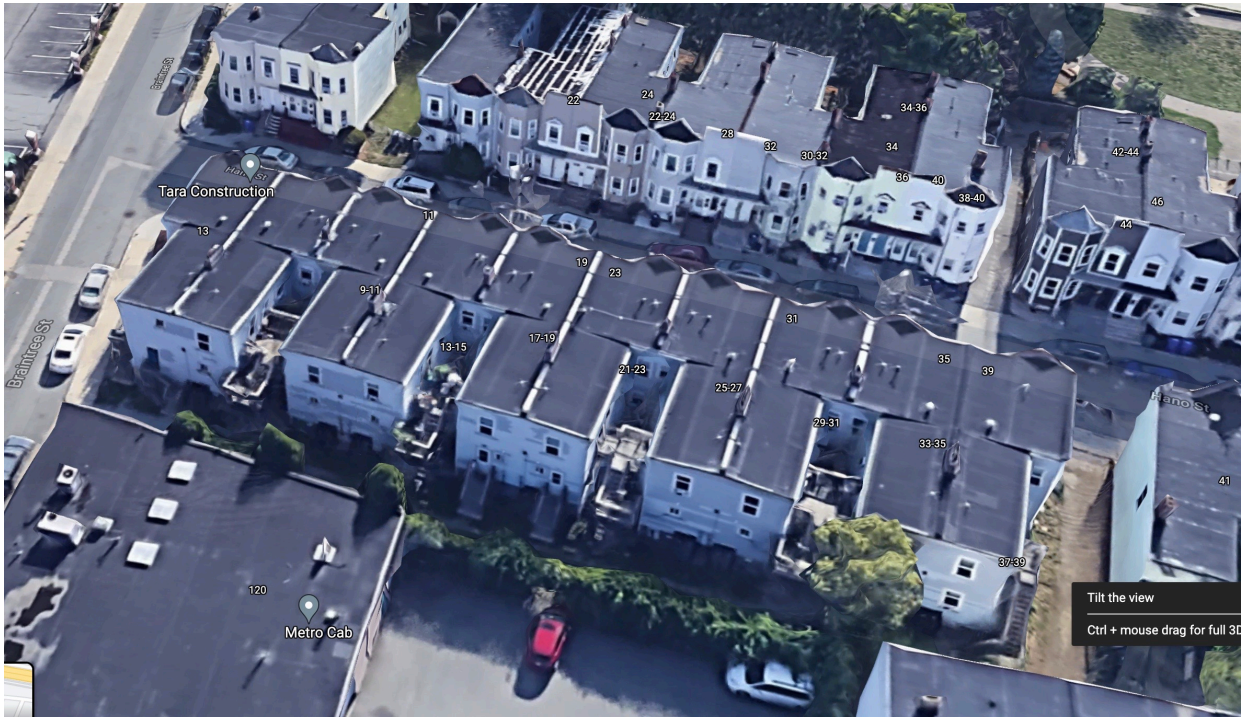
Initial facade option exploring panel divisions and window shading

Facade Renderings

Process facade rendering exploring panel divisions and window shading and color

Facade Renderings

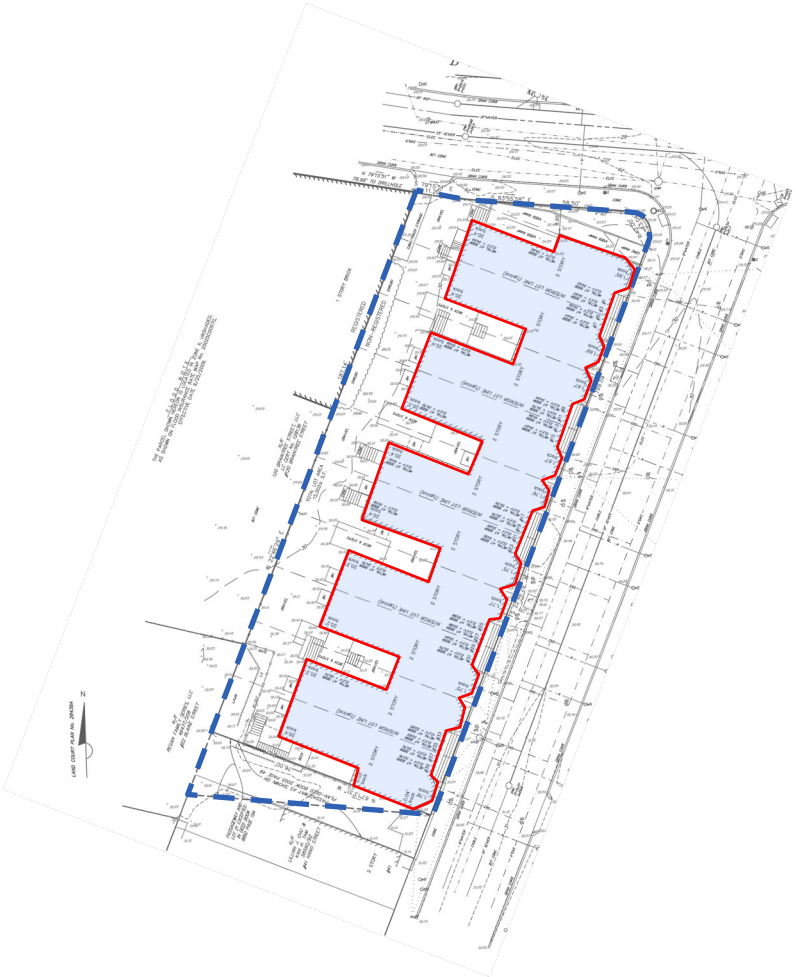
Process facade rendering exploring colors, entry canopy, and planting



Bldg Info

1-39 Hano Street,
Allston Brighton, MA

- Year Built – 1888
- Size – 24,083 GSF
- Zoning: R-3
- 10 Duplexes, 20 Units
- Materials – Wood framed, masonry fire walls



RECENT SURVEY PLAN

- Challenging building form
- Very tight access at street
- Overhead wires make front panelization difficult
- Model as one building or Ten?

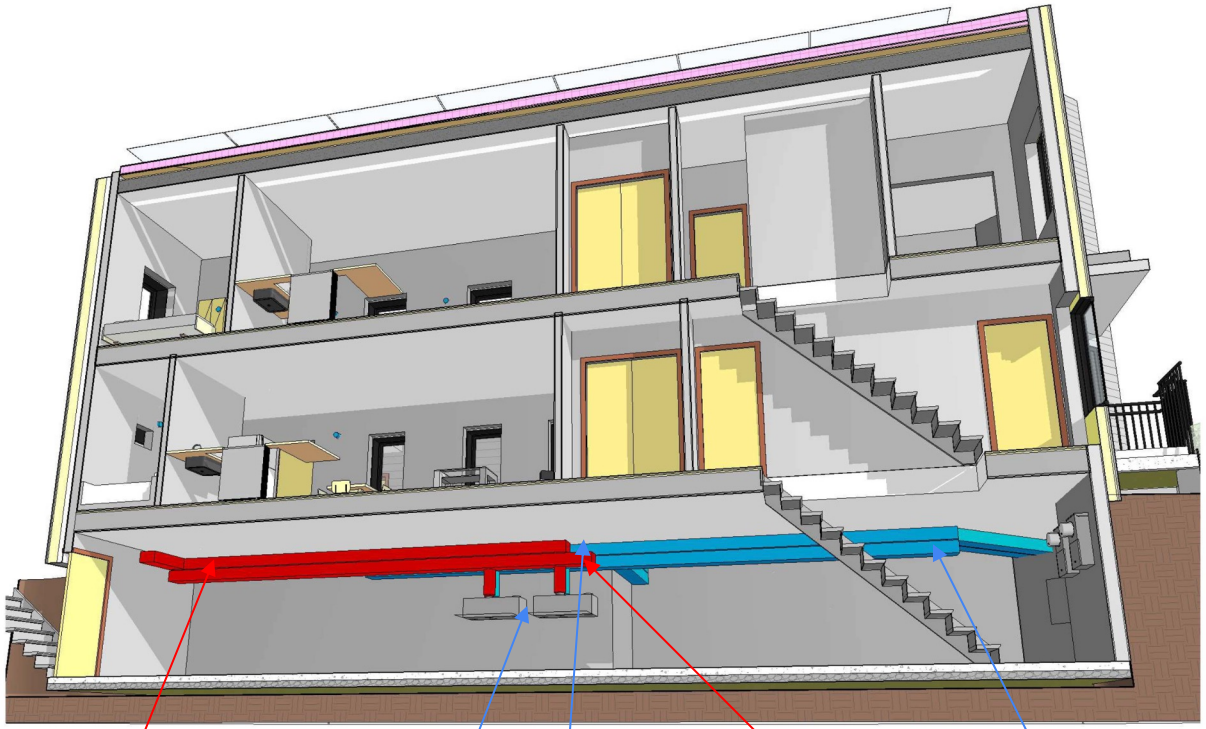
RECENT SURVEY PLAN

- Challenging building form
- Very tight access at street
- Overhead wires make front panelization difficult
- Model as one building or Ten?
- Chose to model one duplex at a time.

HVAC STRATEGY

EXISTING CONDITIONS

- Eliminate gas and centralized boiler for heating
- Eliminate gas and DHW tanks
- No cooling



Minotair units

1st floor supply/exhaust ducts
Flush to ceiling and feed 1st floor
Through floor registers

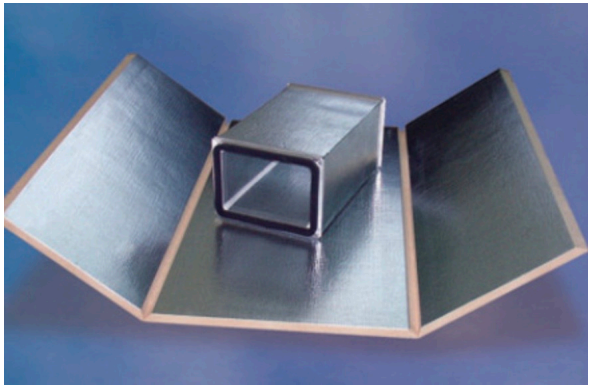
2nd floor supply/exhaust ducts
Sandwiched below 1st floor ducts
feed 2nd floor on outside

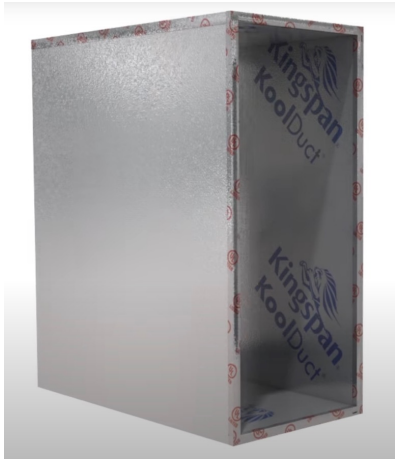
HVAC STRATEGY

- Decentralized ventilation, heating, and cooling strategy
- Replace gas water heaters with Heat Pump Water Heaters (HPWH)
- Use Minotair Unit

KoolDuct®

Kingspan®



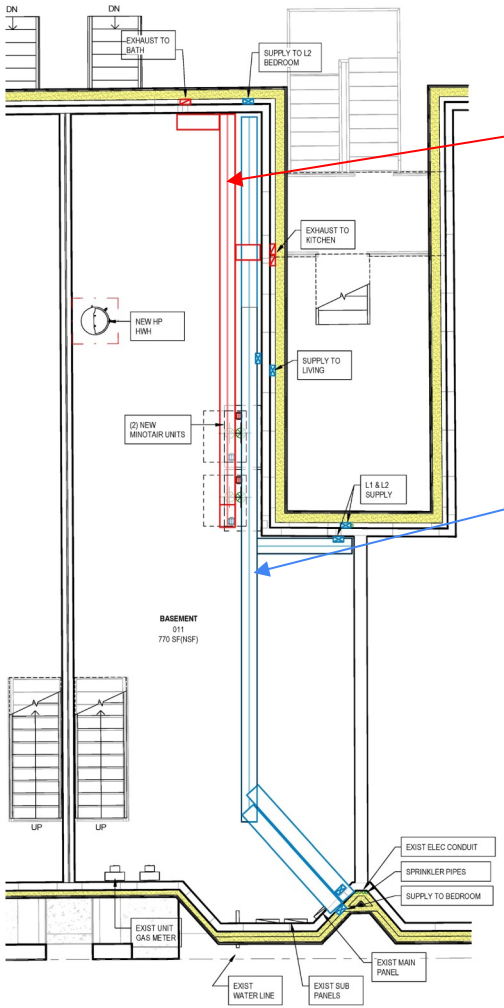


Allston Brighton COMMUNITY DEVELOPMENT CORPORATION

HA NO HOMES

HVAC STRATEGY

- Decentralized ventilation, heating, and cooling strategy
- Replace gas water heaters with Heat Pump Water Heaters (HPWH)
- Use Minotair Unit
- Use KOOL DUCT



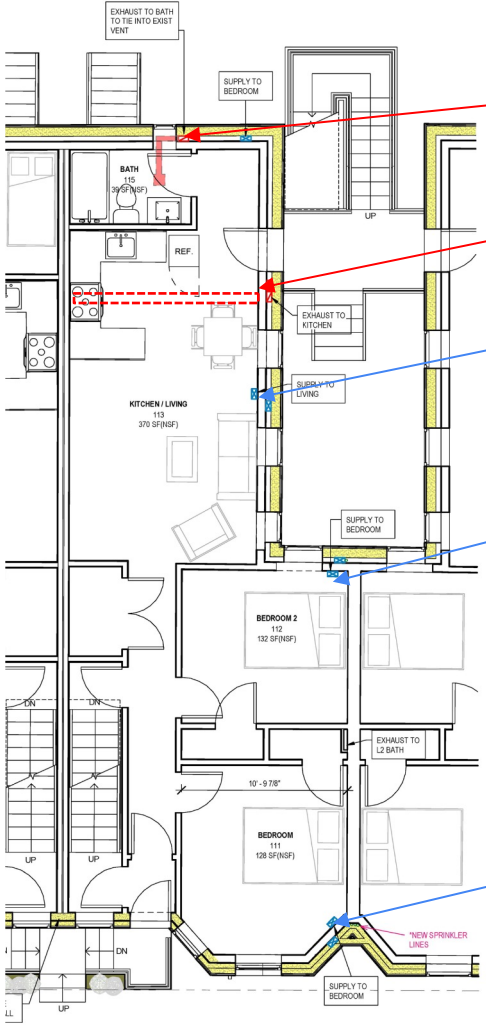
EXHAUST Ducts to 1st + 2nd floor bathrooms And kitchens.

SUPPLY Ducts to Bedrooms and living areas

BASEMENT PLAN

HVAC STRATEGY

- Decentralized ventilation, heating, and cooling strategy
- Replace gas water heaters with Heat Pump Water Heaters (HPWH)
- Use Minotair Unit
- Use KOOL DUCT



Exhaust connected to existing Bath exhaust to exterior

Exhaust connected to existing Kitchen exhaust to exterior

Supply Floor register

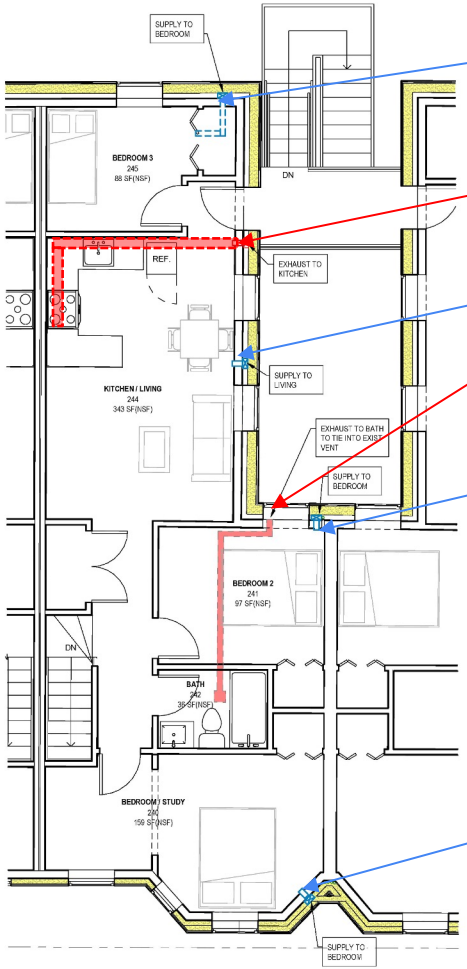
Supply Floor register

Supply Floor register

1st FLOOR PLAN

HVAC STRATEGY

- Decentralized ventilation, heating, and cooling strategy
- Replace gas water heaters with Heat Pump Water Heaters (HPWH)
- Use Minotair Unit
- Use KOOL DUCT
- Service 1st floor unit through floor registers



Supply Wall register

Exhaust connected to existing
Kitchen exhaust to exterior

Supply Wall register

Exhaust connected to existing
Bath exhaust to exterior

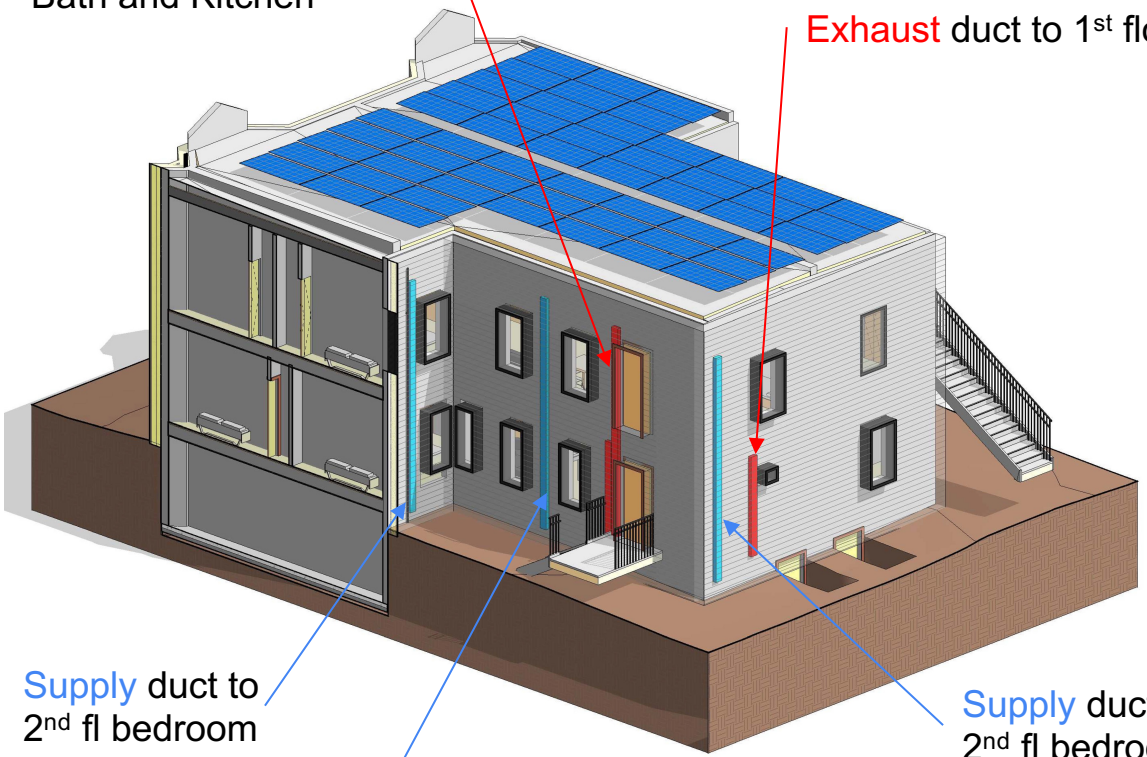
Supply Wall register

Supply Wall register

2nd FLOOR PLAN

HVAC STRATEGY

- Decentralized ventilation, heating, and cooling strategy
- Replace gas water heaters with Heat Pump Water Heaters (HPWH)
- Use Minotair Unit
- Use KOOL DUCT
- Service 1st floor unit through floor registers
- Service 2nd floor from outside between new and existing envelop



AXONOMETRIC

HVAC STRATEGY

- Decentralized ventilation, heating, and cooling strategy
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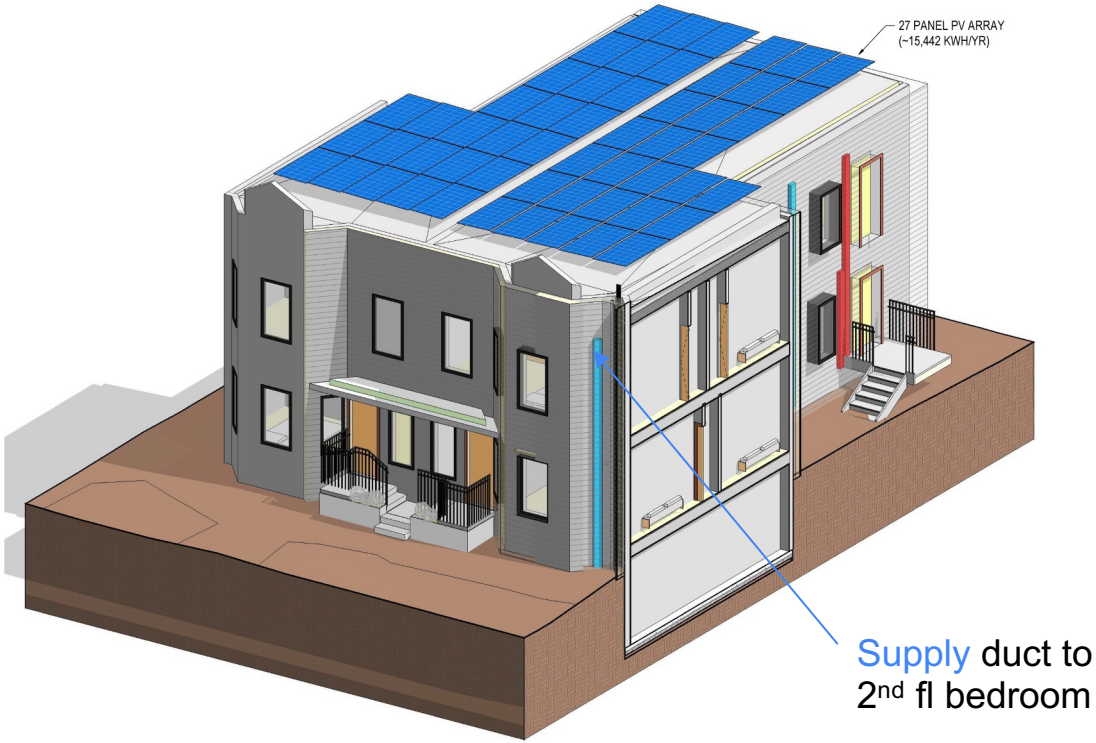

AXONOMETRIC

HVAC STRATEGY

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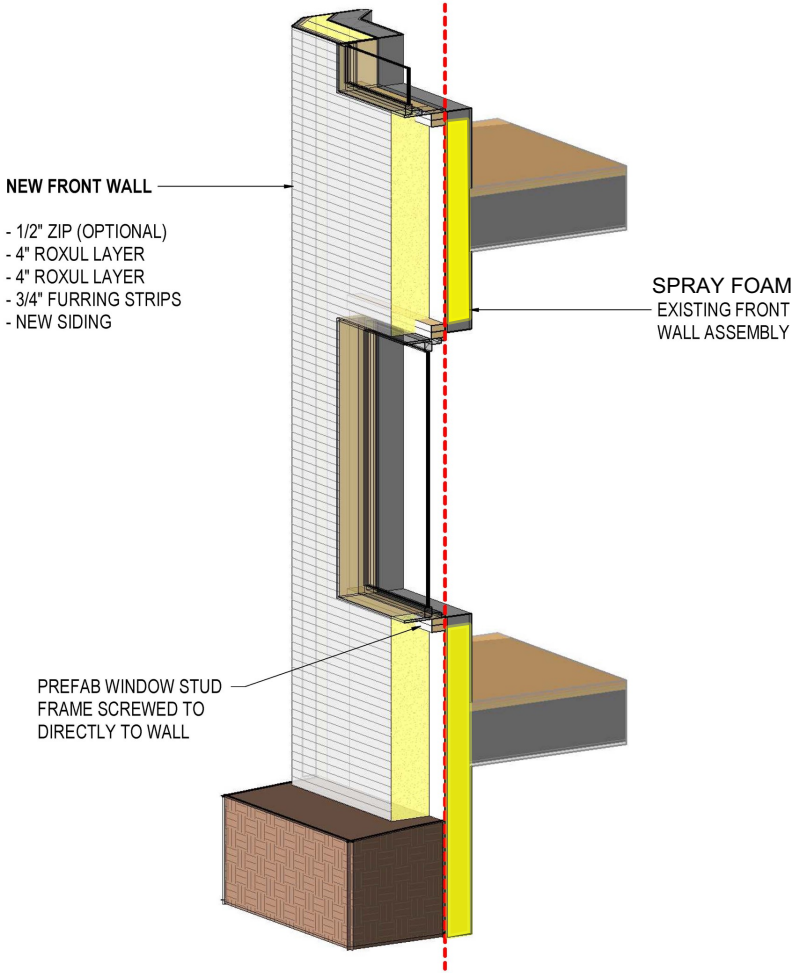


Allston Brighton COMMUNITY DEVELOPMENT CORPORATION

HA NO HOMES

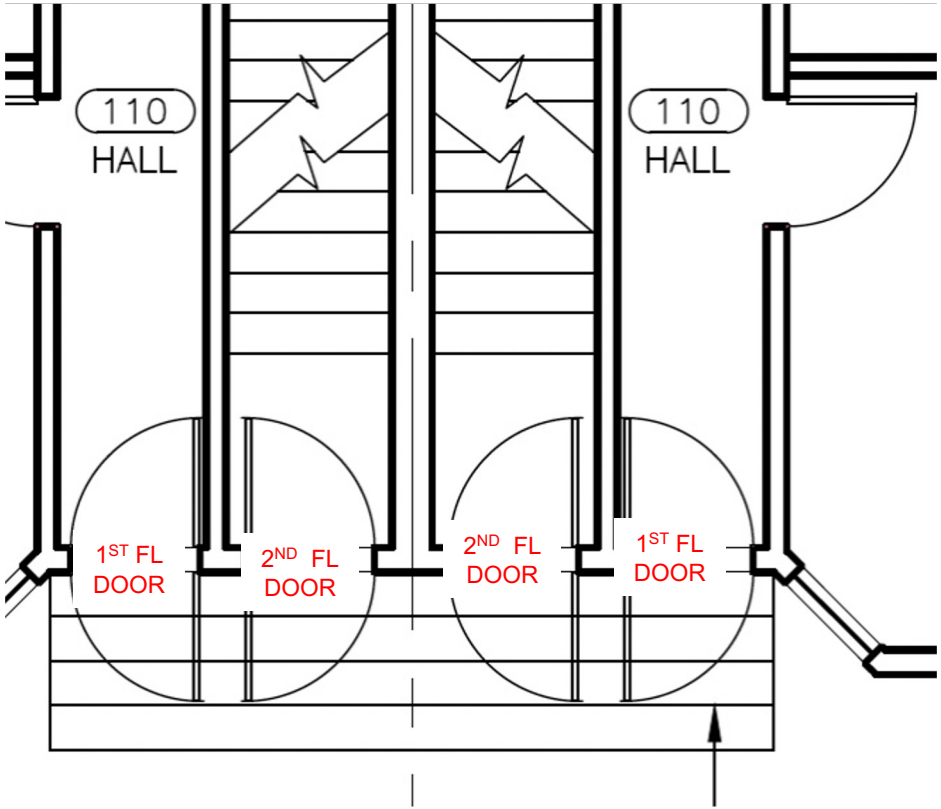
ENVELOP STRATEGY

FRONT WALL

- Strip existing skin from building down to studs
- Spray foam EXISTING stud walls
- Install new ½” Zip layer as primary AIR BARRIER
- Install PRE-FRAMED window screwed directly to existing wall
- Install 1 layer of 4” RECYCLED polyiso insulation AND 2 - 4” layers of Roxul on bays
- Furring strips and new siding

HANO STREET VIEW

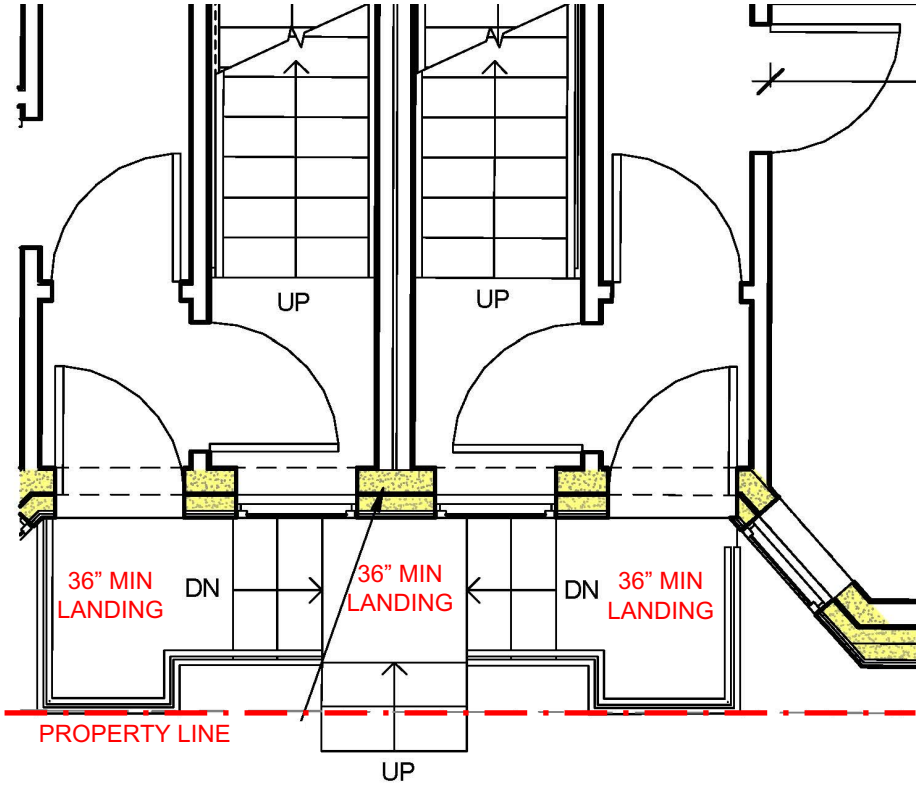
HOW TO MAKE ENTRANCE CODE COMPLIANT?



ENTRANCE

HOW TO MAKE ENTRANCE CODE COMPLIANT?

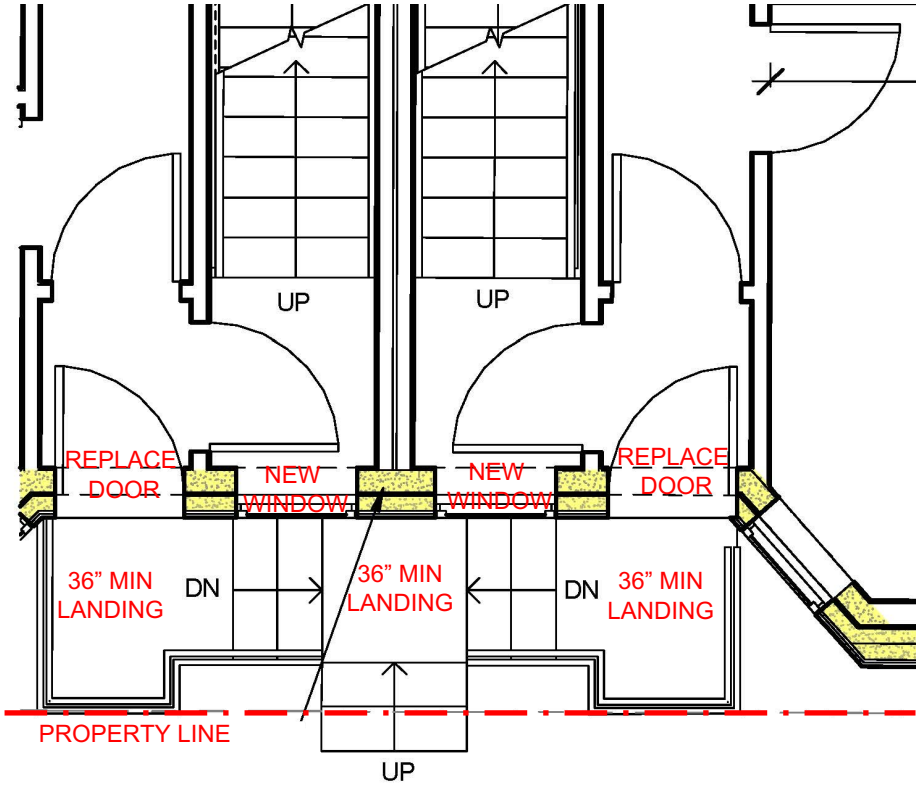
- No 36” landing for steps
- Steps extend into sidewalk
- 32” wide doors



ENTRANCE

HOW TO MAKE ENTRANCE CODE COMPLIANT?

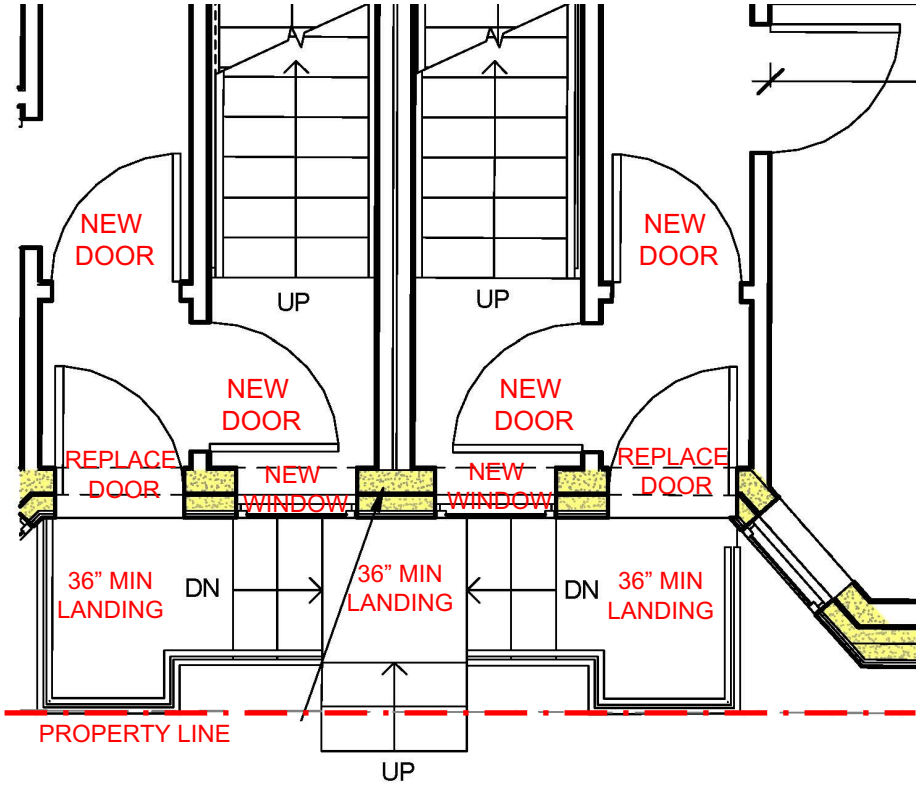
- Min 36” landings for steps



ENTRANCE

HOW TO MAKE ENTRANCE CODE COMPLIANT?

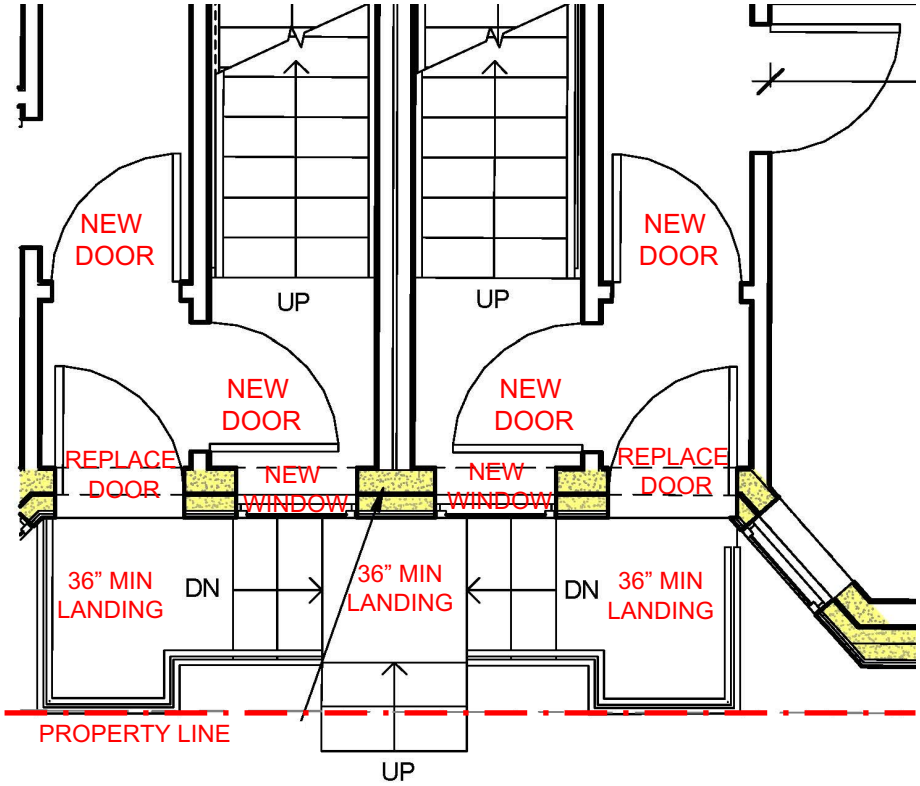
- Min 36" landings for steps
- Replace 1st floor unit doors
- Replace 2nd floor unit doors with windows



ENTRANCE

HOW TO MAKE ENTRANCE CODE COMPLIANT?

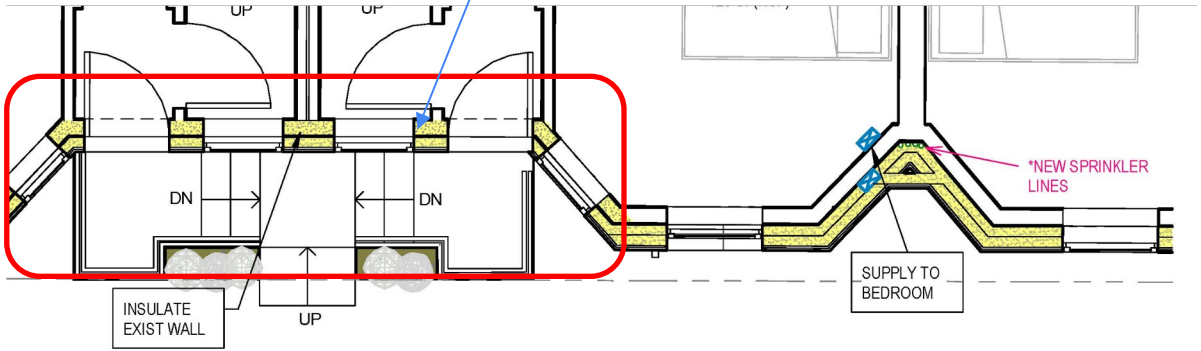
- Min 36" landings for steps
- Replace 1st floor unit doors
- Replace 2nd floor unit doors with windows
- Install new interior doors to both units



ENTRANCE

HOW TO MAKE ENTRANCE CODE COMPLIANT?

Insulate existing wall here by filling existing wall cavity with SPRAY FOAM and 4” of used polyiso IN THIS ZONE

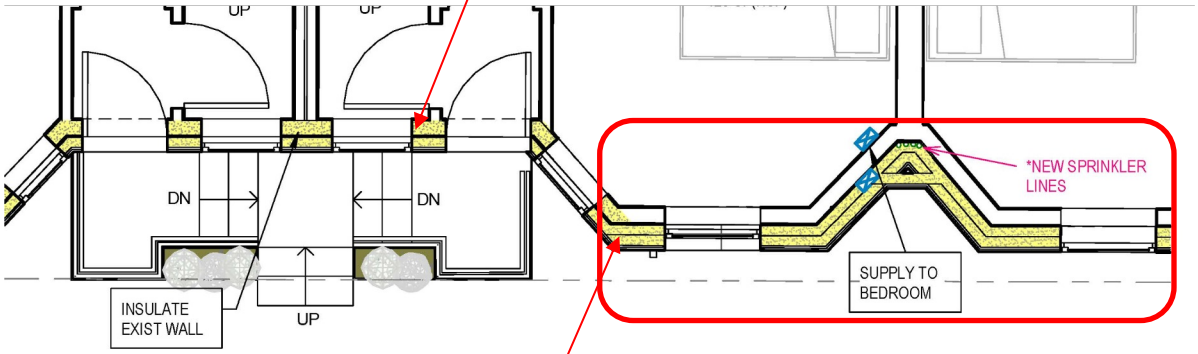


ENVELOP STRATEGY

FRONT WALL

- Strip existing skin from building down to studs
- Spray foam EXISTING stud walls
- Install new ½” Zip layer as primary AIR BARRIER
- Install PRE-FRAMED window screwed directly to existing wall
- Install 1 layer of 4” RECYCLED polyiso insulation AND 2 - 4” layers of Roxul on bays
- Furring strips and new siding

Insulate existing wall here by filling existing wall cavity with SPRAY FOAM and 4” of used polyiso IN THIS ZONE



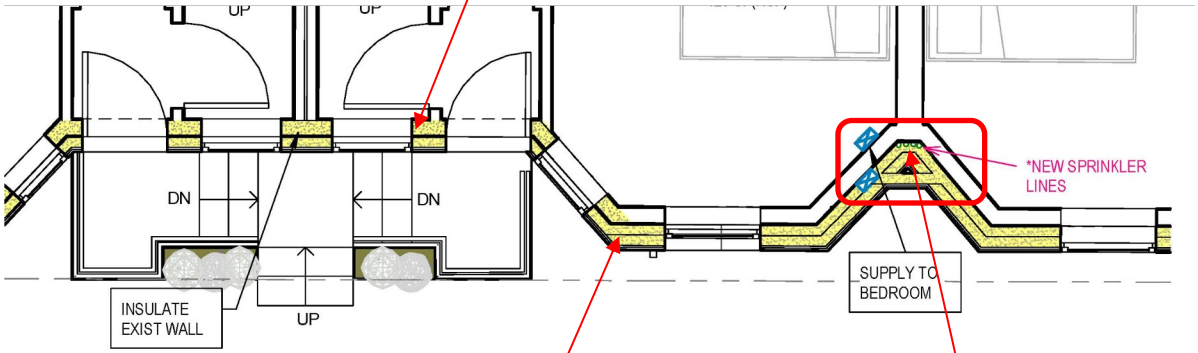
Insulate 2 layers of 4” Roxul IN THIS ZONE

ENVELOP STRATEGY

FRONT WALL

- Strip existing skin from building down to studs
- Spray foam EXISTING stud walls
- Install new ½” Zip layer as primary AIR BARRIER
- Install PRE-FRAMED window screwed directly to existing wall
- Install 1 layer of 4” RECYCLED polyiso insulation AND 2 - 4” layers of Roxul on bays
- Furring strips and new siding

Insulate existing wall here by filling existing wall cavity with SPRAY FOAM and 4” of used polyiso IN THIS ZONE



Insulate 2 layers of 4” Roxul IN THIS ZONE

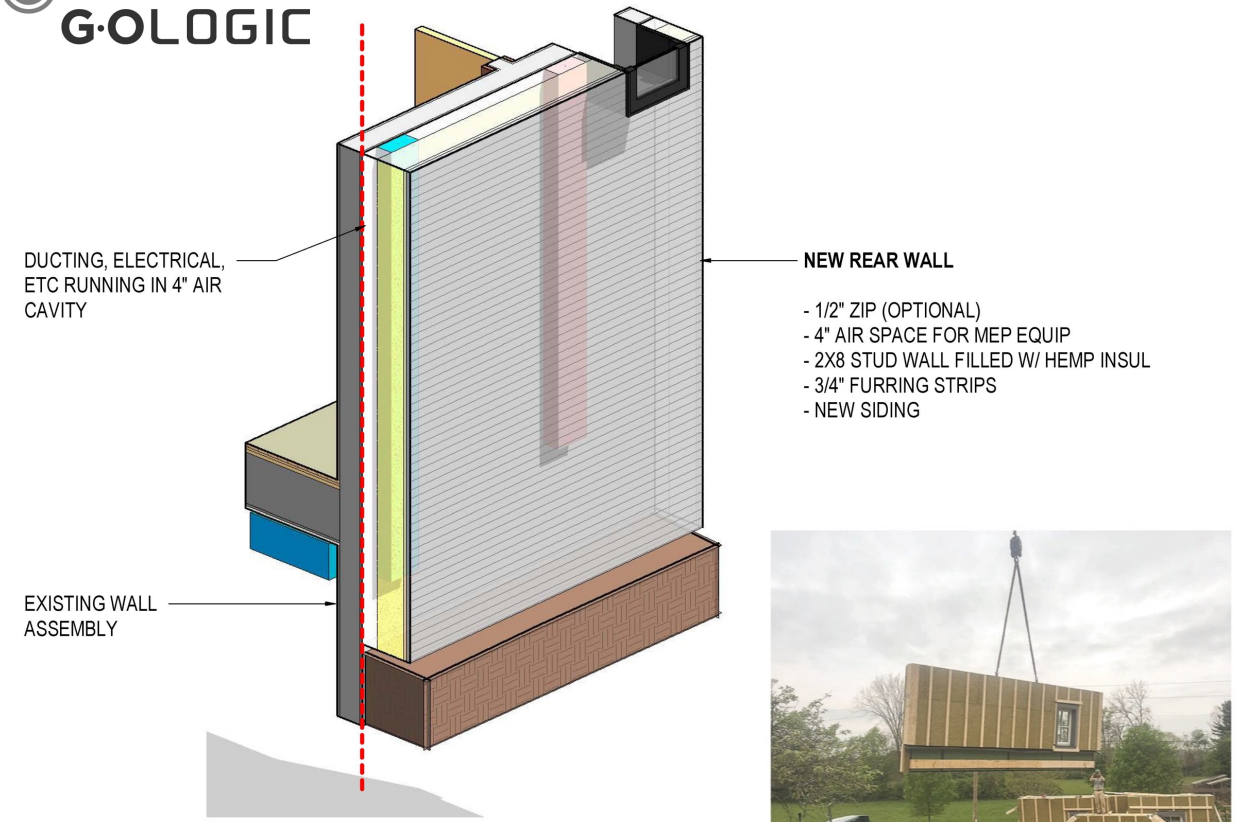
New Sprinkler lines If necessary

ENVELOP STRATEGY

FRONT WALL

- Strip existing skin from building down to studs
- Spray foam EXISTING stud walls
- Install new ½” Zip layer as primary AIR BARRIER
- Install PRE-FRAMED window screwed directly to existing wall
- Install 1 layer of 4” RECYCLED polyiso insulation AND 2 - 4” layers of Roxul on bays
- Furring strips and new siding
- Run sprinkler lines between old and new envelops

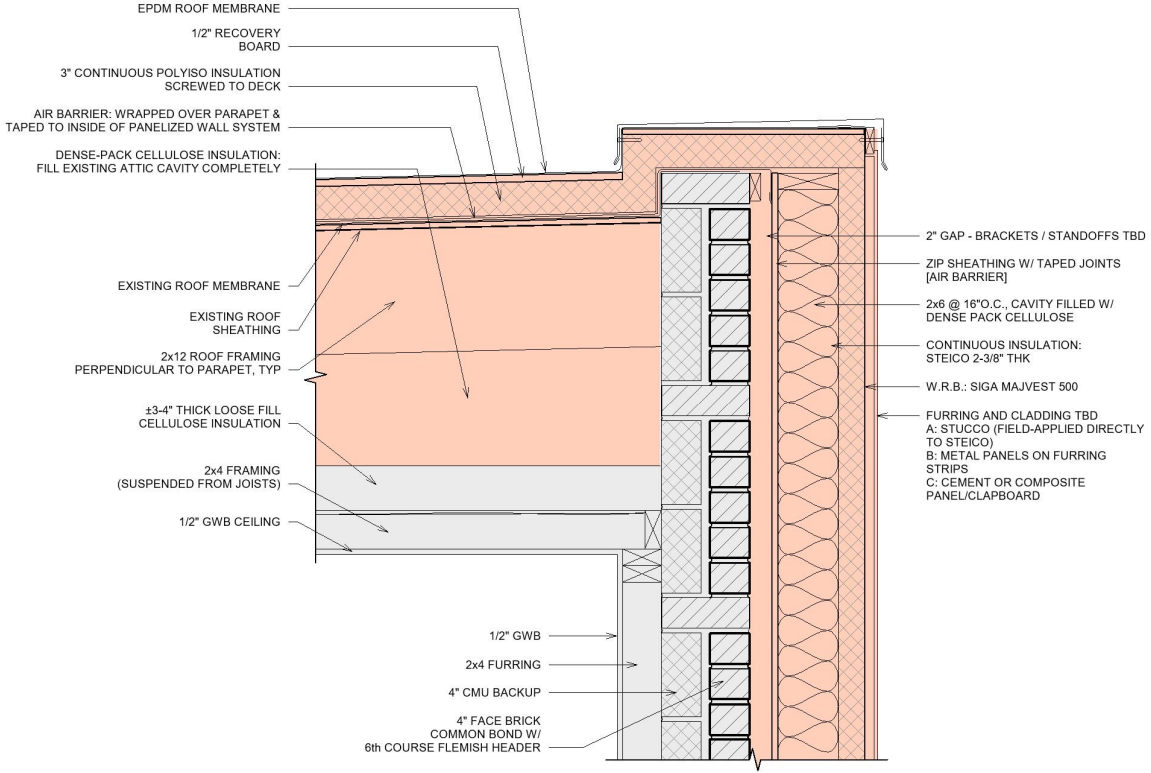
G·OLOGIC



ENVELOP STRATEGY

ALL OTHER WALLS

- Strip existing skin from building down to studs
- Install new ½” Zip layer as primary AIR BARRIER
- Install 2X8 stud wall filled with Hemp Insulation, spaced 4” from existing wall
- Furring strips and new siding
- Run sprinkler lines AND ductwork in 4” air space between old and new envelops



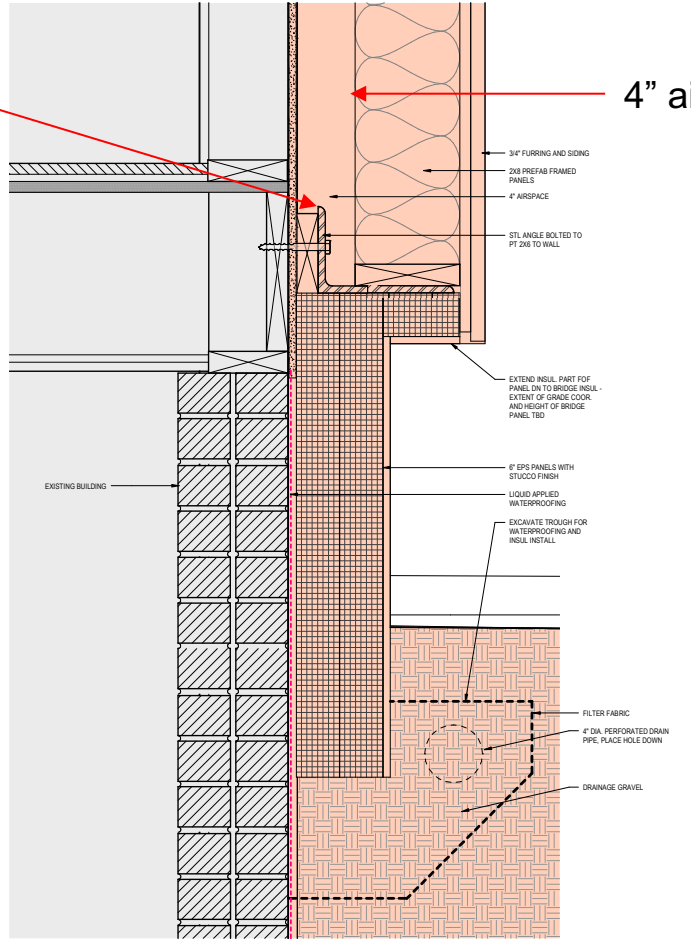
Wall Roof Detail

ENVELOP STRATEGY

ALL OTHER WALLS

- Strip existing skin from building down to studs
- Install new ½” Zip layer as primary AIR BARRIER
- Install 2X8 stud wall filled with Hemp Insulation, spaced 4” from existing wall
- Furring strips and new siding
- Run sprinkler lines AND ductwork in 4” air space between old and new envelops
- Wrap parapet and roof

Anchor shelf angle to existing basement leaving 4’ space for Ductwork

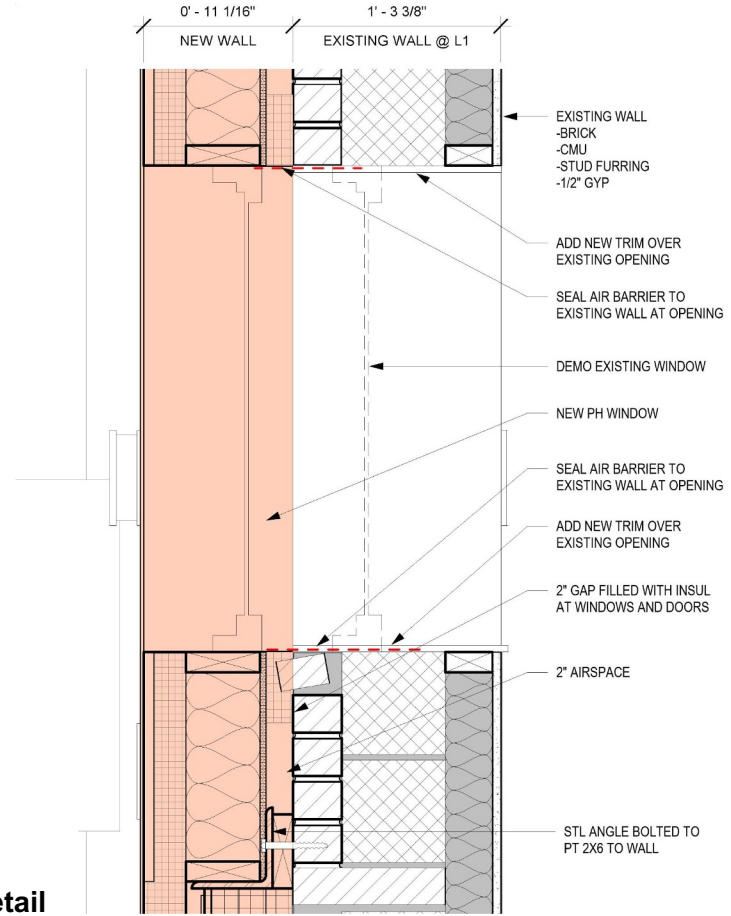


Foundation Detail

ENVELOP STRATEGY

ALL OTHER WALLS

- Strip existing skin from building down to studs
- Install new ½” Zip layer as primary AIR BARRIER
- Install 2X8 stud wall filled with Hemp Insulation, spaced 4” from existing wall
- Furring strips and new siding
- Run sprinkler lines AND ductwork in 4” air space between old and new envelops
- Wrap parapet and roof
- Stop insulation of basement at grade



Window/Base Detail

ENVELOP STRATEGY

ALL OTHER WALLS

- Strip existing skin from building down to studs
- Install new ½” Zip layer as primary AIR BARRIER
- Install 2X8 stud wall filled with Hemp Insulation, spaced 4” from existing wall
- Furring strips and new siding
- Run sprinkler lines AND ductwork in 4” air space between old and new envelops
- Wrap parapet and roof
- Stop insulation of basement at grade
- Remove and seam exist wind

BUILDING INFORMATION

Category:	**Residential**
Status:	**In planning**
Building type:	**Retrofit**
Year of construction:	**1880**
Units:	**2**
Number of occupants:	**7 (Design)**
Occupant density:	**220** ft²/Person

Boundary conditions

Climate:	**BOSTON LOGAN INT ARPT MA**
Internal heat gains:	**1.4** Btu/hr ft²
Interior temperature:	**68** °F
Overheat temperature:	**77** °F

Building geometry

Enclosed volume:	**27,014.3** ft³
Net-volume:	**11,440** ft³
Total area envelope:	**3,535.9** ft²
Area/Volume Ratio:	**0.1** 1/ft
Floor area:	**1,540** ft²
Envelope area/iCFA:	**2.296**

PASSIVEHOUSE REQUIREMENTS

Certificate criteria: **PHIUS+ 2018**

Heating demand

specific:	**3.9** kBtu/ft²yr
target:	**8.3** kBtu/ft²yr
total:	6,011.69 kBtu/yr

Cooling demand

sensible:	**2.99** kBtu/ft²yr
latent:	**0.21** kBtu/ft²yr
specific:	**3.2** kBtu/ft²yr
target:	**7** kBtu/ft²yr
total:	4,921.09 kBtu/yr

Heating load

specific:	**5.26** Btu/hr ft²
target:	**6.9** Btu/hr ft²
total:	8,106.39 Btu/hr

Cooling load

specific:	**4.06** Btu/hr ft²
target:	**4.3** Btu/hr ft²
total:	6,256.84 Btu/hr

Source energy

total:	**0** kWh/yr
specific:	**0** kWh/Person yr
target:	**3,840** kWh/Person yr
total:	**0** kBtu/yr
specific:	0 kBtu/ft²yr

Site energy

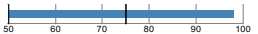
total:	-2,866.57 kBtu/yr
specific:	-1.86 kBtu/ft²yr
total:	-840.19 kWh/yr
specific:	-0.55 kWh/ft²

Air tightness

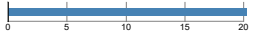
ACH50:	**1.49** 1/hr
CFM50 per envelope area:	**0.05** cfm/ft²
target:	**1.79** 1/hr
target CFM50:	**0.06** cfm/ft²

PASSIVEHOUSE RECOMMENDATIONS

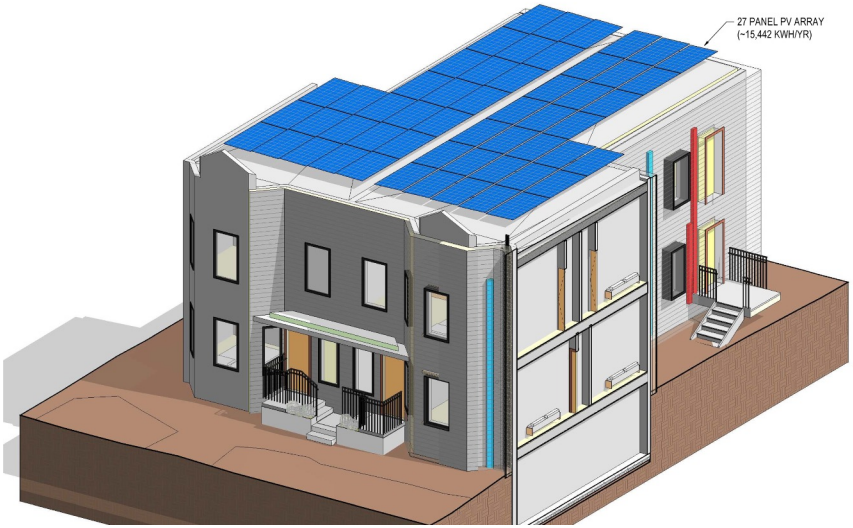
Sensible recovery efficiency: **98** %

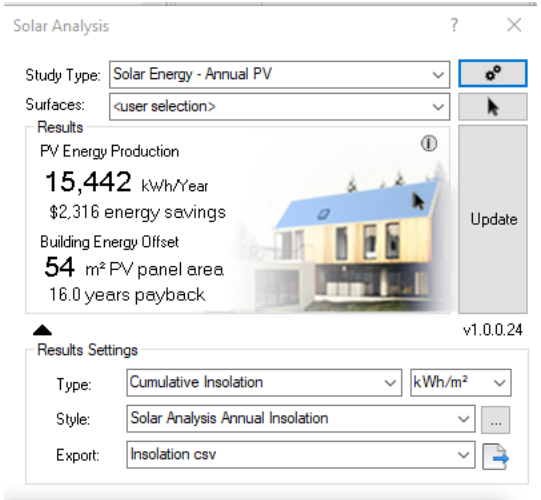


Frequency of overheating: **25.2** %
Cooling system is required



Frequency of overheating only applies if there is not a [properly sized] cooling system installed.





SOLAR

PER DUPLEX:

- (27) 300W solar panels on 10 deg east west roof racks for maximum efficiency
- Total Array Size – 8.1kw per duplex
- **@ $2/watt** = $16,200 per duplex or $8100 per unit or **$162,000.00**

HISTORIC AND PROJECTED ENERGY CONSUMPTION

- Historical data below from the Capital Needs Worksheet shows an average EUI of 75.2 kBTU/sf/yr.

Table 5. Normalized Historical Utility Consumption

Utility	Consumption	Cost ($)	% Total Cost	Your Building	Index	Unit
Water	1,268,030 Gal.	$21,907	33.5%	67.8	61.1	Gal./bedroom/day
Electricity	104,423 kWh	$24,257	37.1%	13.2	10.2	kBtu/ft²
Gas	13,656 therms	$19,307	29.5%	62.0	49.3	kBtu/ft²
TOTAL	1,722 MMBtu	$65,471	100.0%	75.2	59.5	kBtu/ft²

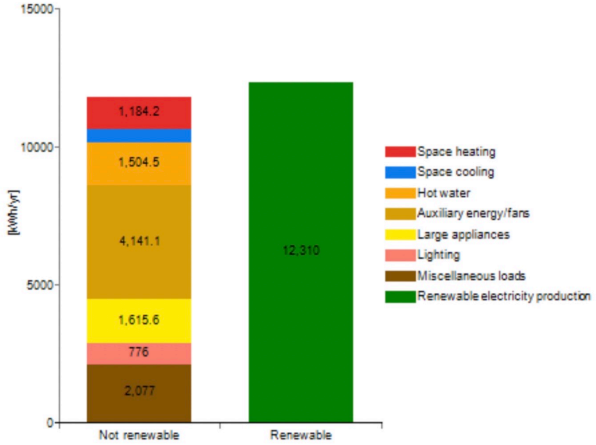
Existing EUI of 75 kBTU/sf/yr

$43,566.00 Annual Cost of Utilities

New EUI after DER: 23 kBTU/sf/yr

The chart below summarizes the results of the WUFI Passive model and projected energy consumption, as well as energy generation based on a 11.2 kW PV array ***per building*** (28, 400 watt LG panels). Without the solar, the EUI is projected to be ***23 kBTU/sf/yr*** (70% better than historical data). With the projected energy generation from the solar, the projected EUI is ***0 kBTU/sf/yr***, or Net Zero Energy:

NET ZERO ENERGY
$43,566.00 SAVINGS PER YEAR



WUFI Passive EUI Calculator		Project: Hano Homes
		1/10 Units
Gross sf		
L1	890.00	
L2	890.00	
Total Gross Sf	1,780.00	
Total ICFA	1431.00	
Total Site Energy Use kBtu/yr		41,213.89
kWh/yr		12079.10
kwh/yr to kBtu/yr		41213.89
Specific Source Energy Use kBtu/sfyr		19.80
EUI kBtu/sf/yr:	23.15	

EUI is expressed as energy per square foot per year.
It is calculated **by dividing the total energy consumed by the building in one year by the total gross floor area of the building**.

PLACETAILOR | Urban Design Build | Occupy the Future.

Project Name 1-39 Hano Homes
Project #
Title Feasibility Study Construction Pricing
Date 02/10/2022

A ITEM	B DESCRIPTION OF WORK	C Direct Cost	D Markup	E Material Cost	F Material Markup	G Sub Contractor	H Sub Con. Markup	I Total
			10.00%		13.60%		15%	
	Division 1: General Requirements							
	01 29 76.00 Project Invoicing	$5,000	$500	$0	$0	$0	$0	$5,500
	01 31 13.00 Project Management	$20,000	$2,000	$0	$0	$0	$0	$22,000
	01 31 19.00 Project Meetings	$5,000	$500	$0	$0	$0	$0	$5,500
	01 32 13.00 Project Scheduling	$10,000	$1,000	$0	$0	$0	$0	$11,000
	01 51 13.02 Temp Electricity	$1,000	$100	$0	$0	$0	$0	$1,100
	01 51 36.02 Temp Water Service	$750	$75	$0	$0	$0	$0	$825
	01 51 40.02 Tool Equipment Rental	$75,000	$7,500	$0	$0	$0	$0	$82,500
	01 52 19.02 Sanitary Facilities	$2,000	$200	$0	$0	$0	$0	$2,200
	01 55 26.02 Traffic Control	$3,000	$300	$0	$0	$0	$0	$3,300
	01 56 26.02 Temporary Fencing	$1,000	$100	$0	$0	$0	$0	$1,100
	01 57 16.02 Temporary Pest Control	$1,200	$120	$0	$0	$0	$0	$1,320
	01 73 00.00 Site Supervision	$30,000	$3,000	$0	$0	$0	$0	$33,000
	01 74 16.00 Site Maintenance	$10,000	$1,000	$0	$0	$0	$0	$11,000
	01 74 19.02 Waste Disposal	$5,500	$550	$0	$0	$0	$0	$6,050
	01 74 23.02 Final Clean	$2,000	$200	$0	$0	$0	$0	$2,200
	01 78 13.00 Punch List	$15,000	$1,500	$0	$0	$0	$0	$16,500
	Division 2 Sitework							
	02 22 00.02 Demolition (Included in 03 31 00.02)	$0	$0	$0	$0	$0	$0	$0
	Division 3 Concrete							
	03 31 00.02 Structural Concrete Foundations Sub	$0	$0	$0	$0	$15,000	$2,250	$17,250
	Division 6 Wood & Plastics							
	06 11 00.00 Wood Framing Demolition	$0	$0	$0	$0	$64,500	$9,675	$74,175
	06 11 00.01 Wood Framing Mtrl	$2,000	$200	$20,000	$2,720	$0	$0	$24,920
	06 11 00.02 Wood Framing Sub	$0	$0	$0	$0	$50,000	$7,500	$57,500
	06 20 43.01 Interior Trim & Base Mtrl	$500	$50	$3,000	$408	$0	$0	$3,958
	06 20 43.02 Interior Trim & Base Sub	$0	$0	$0	$0	$17,975	$2,696	$20,671
	06 43 16.01 Deck & Railing Mtrl	$1,000	$100	$10,000	$1,360	$0	$0	$12,460
	06 43 16.02 Deck & Railing Sub	$0	$0	$0	$0	$70,000	$10,500	$80,500
	Division 7 Thermal & Moisture Protection							
	07 14 00.02 Fluid-Applied Waterproofing Sub	$1,000	$100	$0	$0	$12,000	$1,800	$14,900
	07 21 13.01 Insulation Mtrl	$0	$0	$48,970	$6,660	$0	$0	$55,629
	07 21 13.03 Insulation Sub	$2,000	$200	$0	$0	$35,216	$5,282	$42,698
	07 27 00.01 Air Barrier Mtrl	$2,000	$200	$25,000	$3,400	$0	$0	$30,600
	07 27 00.02 Air Barrier Sub	$1,000	$100	$0	$0	$62,000	$9,300	$72,400
	07 42 63.01 Fabricated Wall Panel Assemblies Mtrl	$0	$0	$580,617	$78,964	$0	$0	$659,580
	07 42 63.02 FWP Assemblies Sub	$10,000	$1,000	$0	$0	$211,529	$31,729	$254,258
	07 46 00.00 Siding Demolition	$0	$0	$0	$0	$43,500	$6,525	$50,025
	07 46 00.01 Siding Mtrl	$4,000	$400	$55,000	$7,480	$0	$0	$66,880
	07 46 00.02 Siding Sub	$4,000	$400	$0	$0	$107,600	$16,140	$128,140
	07 50 00.00 Membrane Roofing Demolition (Included in 07 50 00.0	$0	$0	$0	$0	$0	$0	$0

A ITEM	B DESCRIPTION OF WORK	C Direct Cost	D Markup	E Material Cost	F Material Markup	G Sub Contractor	H Sub Con. Markup	I Total
	07 50 00.02 Membrane Roofing Sub	$4,000	$400	$0	$0	$180,000	$27,000	$211,400
	07 55 00.02 Green Roof Systems Sub	$0	$0	$0	$0	$37,500	$5,625	$43,125
	07 71 00.02 Roofing Specialties/Gutter Sub (Included in 07 50 00.0	$0	$0	$0	$0	$0	$0	$0
					$22			
	Division 8 Doors, Window & Interiors							
	08 14 10.01 Exterior Doors Mtrl (included in 08 50 00.01)	$0	$0	$0	$0	$0	$0	$0
	08 14 10.02 Exterior Doors Sub	$0	$0	$0	$0	$63,000	$9,450	$72,450
	08 50 00.01 Windows Mtrl	$0	$0	$200,035	$27,205	$0	$0	$227,240
	08 50 00.02 Window Sub (Included in 07 42 63.01)	$0	$0	$0	$0	$0	$0	$0
	Division 9 Finishes							
	09 21 00.02 Plaster Sub	$2,000	$200	$0	$0	$82,650	$12,398	$97,248
	09 91 13.01 Exterior Painting Mtrl	$500	$50	$2,500	$340	$0	$0	$3,390
	09 91 13.02 Exterior Painting Sub	$2,000	$200	$0	$0	$47,500	$7,125	$56,825
	09 91 23.01 Interior Paint Mtrl	$0	$0	$400	$54	$0	$0	$454
	09 91 23.02 Interior Paint Sub (Included in 09 21 00.02)	$0	$0	$0	$0	$0	$0	$0
	Division 11 Equipment							
	11 30 13.01 Kitchen Appliances Mtrl	$1,000	$100	$17,000	$2,312	$0	$0	$20,412
	11 30 13.02 Kitchen Appliances Sub	$0	$0	$0	$0	$3,636	$545	$4,181
	Division 12 Furnishings							
	Division 21 Fire Suppression							
	21 00 00.02 Fire Suppression Sub	$6,000	$600	$0	$0	$132,647	$19,897	$159,144
	Division 22 Plumbing							
	22 00 00.00 Plumbing Demolition	$0	$0	$0	$0	$0	$0	$0
	22 00 00.02 Plumbing Sub	$1,000	$100	$0	$0	$0	$0	$1,100
	22 33 00.01 Plumbing Water Heaters Mtrl	$1,000	$100	$57,570	$7,830	$0	$0	$66,500
	Division 23 HVAC							
	23 72 00.01 HVAC ERV Mtrl	$6,000	$600	$128,200	$17,435	$0	$0	$152,235
	23 72 00.02 HVAC ERV Sub	$0	$0	$0	$0	$124,000	$18,600	$142,600
	Division 26 Electrical							
	26 00 00.00 Electrical Demolition (Included in 26 00 00.02)	$0	$0	$0	$0	$0	$0	$0
	26 00 00.02 Electrical Sub	$2,000	$200	$0	$0	$115,000	$17,250	$134,450
	26 50 00.01 Lighting Fixtures Mtrl	$1,000	$100	$5,502	$748	$0	$0	$7,350
	26 31 00.01 Photovoltaic Sub	$1,000	$100	$0	$0	$235,617	$35,343	$272,059
	Division 28 Electronic Safety and Security							
	28 00 00.02 Electronic Safety Sub	$0	$0	$0	$0	$89,670	$13,451	$103,121
	Division 31 Earthwork							

A ITEM	B DESCRIPTION OF WORK	C Direct Cost	D Markup	E Material Cost	F Material Markup	G Sub Contractor	H Sub Con. Markup	I Total
	Division 32 Exterior Improvements							
	32 10 00.02 Paving Sub	$0	$0	$0	$0	$3,000	$450	$3,450
	32 16 23.02 Sidewalks Sub	$0	$0	$0	$0	$1,950	$293	$2,243
	32 90 00.02 Landscape Sub	$1,000	$100	$0	$0	$8,000	$1,200	$10,300
	Division 33 Utilities							
	33 11 19.02 Fire Suppression Utility Water Sub	$1,000	$100	$0	$0	$25,000	$3,750	$29,850
	33 40 00.02 Stormwater Utilities Sub	$1,000	$100	$0	$0	$25,000	$3,750	$29,850
	33 40 00.02 Stormwater Utilities Sub - Add Alt. Cutlec	$0	$0	$0	$0	$3,000	$450	$3,450
							Total	$ 3,726,000.00
							Cost by Unit	$ 186,300.00
							SQFT cost by GSF	$ 149.04
							SQFT cost by GSF of Envelope	$ 207.83

	Add Alternate - Field Installed Insulation in lieu of panels							
	06 11 00.01 Wood Framing Mtrl (1x3 wood strapping) - Add	$0	$0	$12,000	$1,632	$0	$0	$13,632
	07 21 13.01 Insulation Mtrl -Add	$0	$0	$114,739	$15,605	$0	$0	$130,344
	07 21 13.03 Insulation Sub - Add	$2,000	$200	$0	$0	$ 45,780.80	$6,867	$54,848
	07 21 13.03 Insulation Sub - Deduct	($2,000)	($200)	$0	$0	($35,216)	($5,282)	-$42,698
	07 27 00.01 Air Barrier Mtrl - Deduct	($2,000)	($200)	($25,000)	($3,400)	$0	$0	-$30,600
	07 42 63.01 Fabricated Wall Panel Assemblies Mtrl - Deduct	$0	$0	($580,617)	($78,964)	$0	$0	-$659,580
	07 42 63.02 FWP Assemblies Sub - Deduct	($10,000)	($1,000)	$0	$0	($211,529)	($31,729)	-$254,258
	08 50 00.02 Window Sub -Add	$0	$0	$0	$0	$9,299.81	$13,395	$10
							Add Total	-$685,618
							Adjusted Total	$3,040,382
							Cost by Unit	$ 152,019.08
							SQFT cost by GSF	$ 121.62
							SQFT cost by GSF of Envelope	$ 169.59

PANELIZED
$149.00/SF
TOTAL: $3,726,000.00

$186,000.00 per Apartment

SITE BUILT
$121.00/SF
TOTAL: $3,040,392.00

$152,019.00 per Apartment

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7 Bolster St, Jamaica Plain, MA 02130

- High level DER Feasibility study
- School District was planning on limited Retrofit with a robust geothermal system for heating/cooling
- We proposed a DER to radically reduce energy consumption, with panelized system, all-electric building, new HVAC and Domestic hot water
- No WUFI model but used average 25 kBTU/sf/yr as target EUI (*65% utility savings from baseline*)
- Existing utility data says the baseline EUI is 71 kBTU/sf/yr
- Explored 3 HVAC strategies, looking for most appropriate and cost-effective.
- High level pricing exercise to determine if this is the more cost-effective approach to this retrofit

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JFK Elementary School
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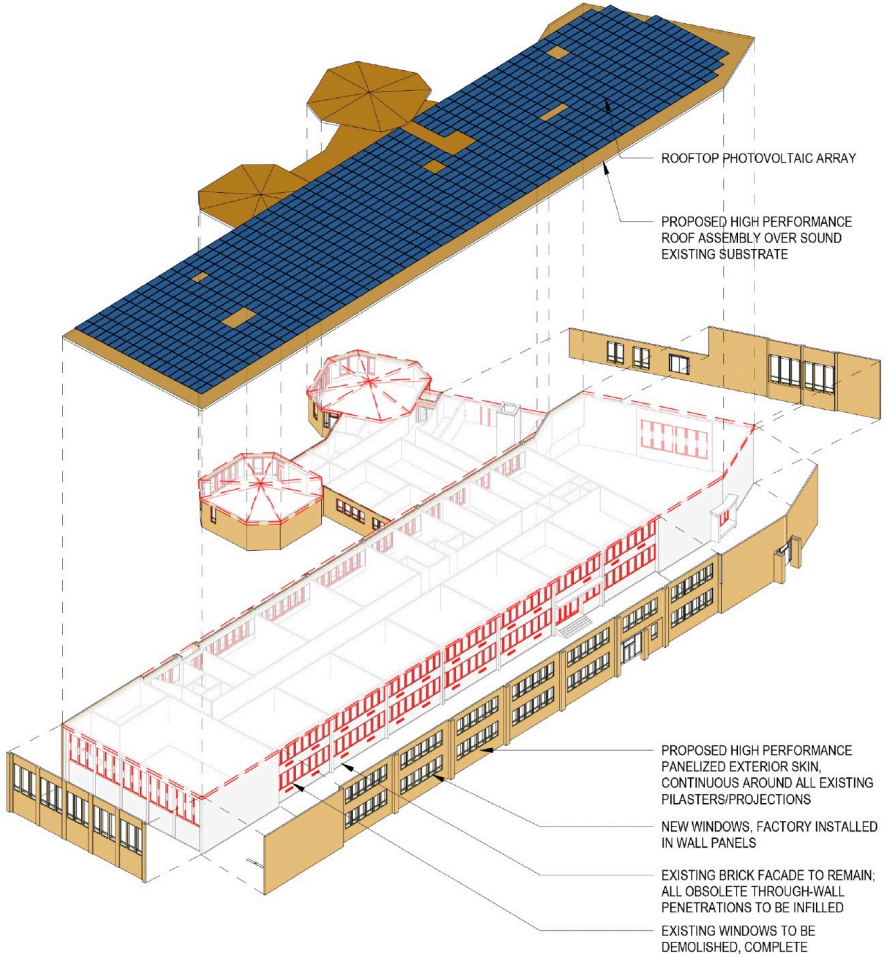
- 2 story structure
- Prefabricated exterior wall panels cladding the entirety of the above-grade building enclosure.
- Given the limited extents of this study and the limited existing documentation available, the Project Team has assumed a panel thickness of 6” with an Rvalue of 35 as a placeholder.
- Given the limited extents of this study and the limited existing documentation available, the Project Team has assumed a roof assembly thickness of 12” (Rvalue of 72) as a placeholder.



(Exploded axonometric diagram depicting proposed high performance panelized skin)

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HVAC/DHW SYSTEMS: BUILDING EVOLUTION CORPORATION
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VENTILATION STRATEGY #1: UNITARY ERVS

PROS
- Reduced cross-contamination between spaces
- Minimized ductwork, coring, smoke dampers, etc.
- Occupancy based ventilation rates for each space are much easier to implement
- Preserves roof area for solar array
- May be most energy efficient option (depending on equipment selection)

CONS
- Added maintenance costs due to individual unit filters
- Large number of individual ERVs may be more expensive than a central ERV
- Need to run electrical to each unit
- Added penetrations to building exterior

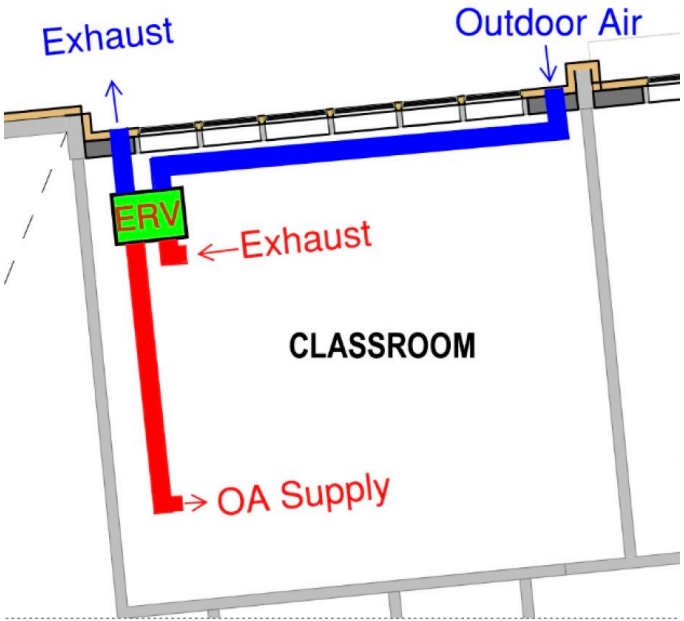

Figure 1 – Example Unitary ERV Layout

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VENTILATION STRATEGY #2: CENTRALIZED ERVS

PROS

- Fewer ERV's may have less upfront and maintenance costs, depending on ductwork, dampers and coring costs.
- Maintenance has fewer units to maintain (such as changing filters)
- Can incorporate post-ERV conditioning of air to control moisture load and comfort.

CONS

-Reduces roof space availability for solar array
- More ductwork
- Limited ability to turn down ventilation rates in specific spaces when not occupied

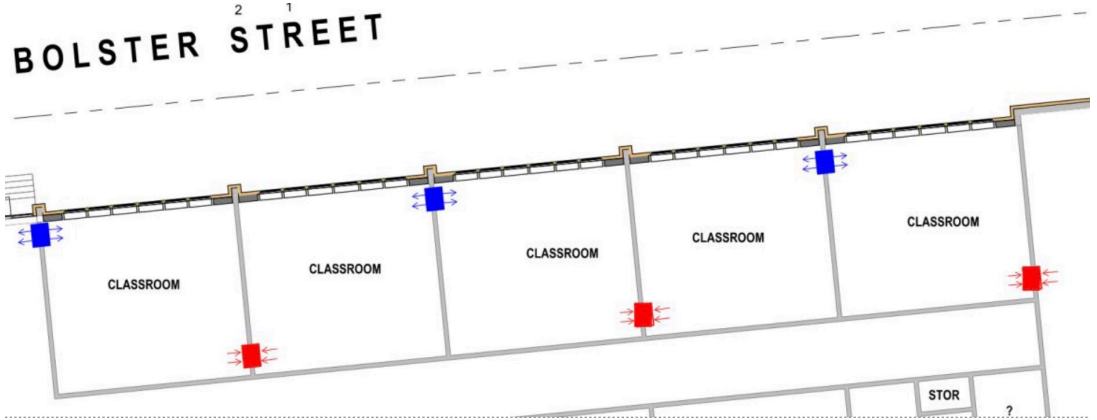

Figure 2 – Example layout of central ERV exhaust and supply locations

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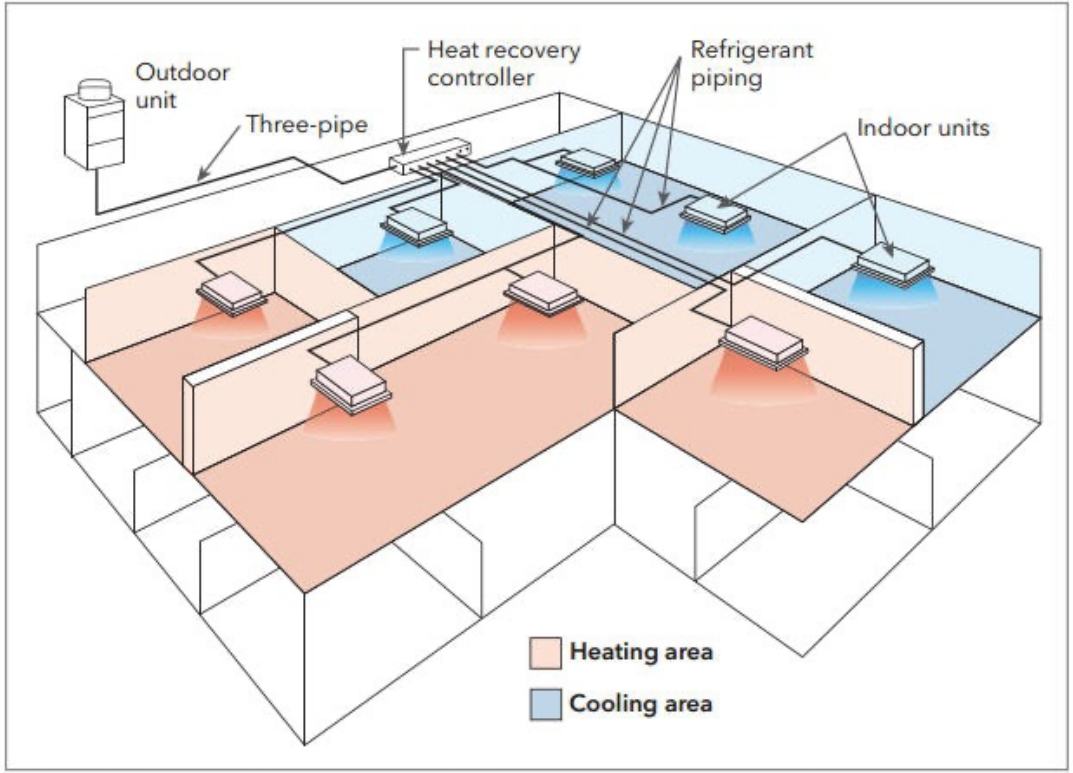
HEATING/COOLING STRATEGY #1: VRF (RECOMMENDED)

PROS
- Minimal footprint of outdoor equipment
- Efficient system minimizes operating costs
- Simultaneous heating and cooling with energy recovery
- Refrigerant lines, branch controllers and terminal units are relatively low impact additions to the interior

CONS
- Upfront costs may be high
- Depending on installation contractor, a poor install quality can result in refrigerant leaks and inefficient operation



Variable refrigerant flow systems can deliver cooling to some zones and heating to others, with no reheat needed (an air-source system is shown here).

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HEATING/COOLING STRATEGY #2: CENTRAL HEX SYSTEM

PROS
- Utilizes standard hydronic distribution
- Reduces refrigerant and potential leakage points
- Simultaneous heating and cooling with energy recovery
- Minimal footprint of outdoor equipment
- Efficient system minimizes operating costs
- Conducive to future refrigerants or heat pump technology upgrades

CONS
- Slightly less efficient than standard VRF
- WSHPs are single speed and may be noisy when kicking on

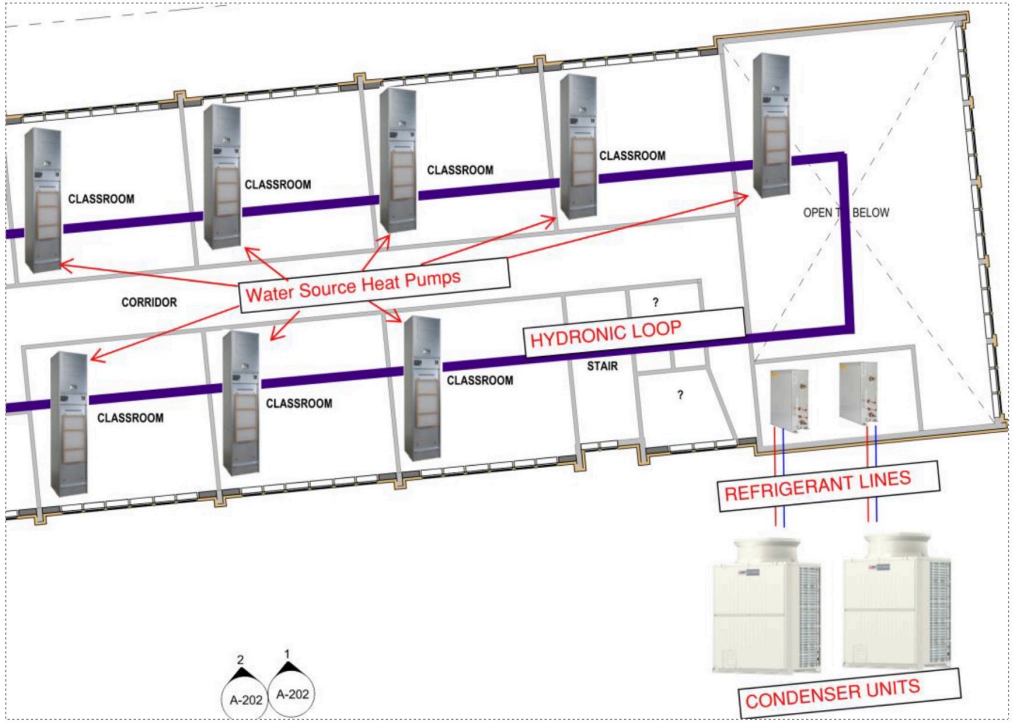

Figure 3 – Example HEX System Layout

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HEATING/COOLING STRATEGY #3: EPHOCA

PROS

- Relatively efficient units
- Low upfront costs due to inexpensive units and limited distribution required
- Preserves roof space for solar panels
- Install is minimally invasive and can utilize existing wall penetrations
- **CONS**
- Limited heating capacity at cold temperatures
- Would need multiple units per space to meet load.
- Not suitable for large spaces with moderate to high heating/cooling load.

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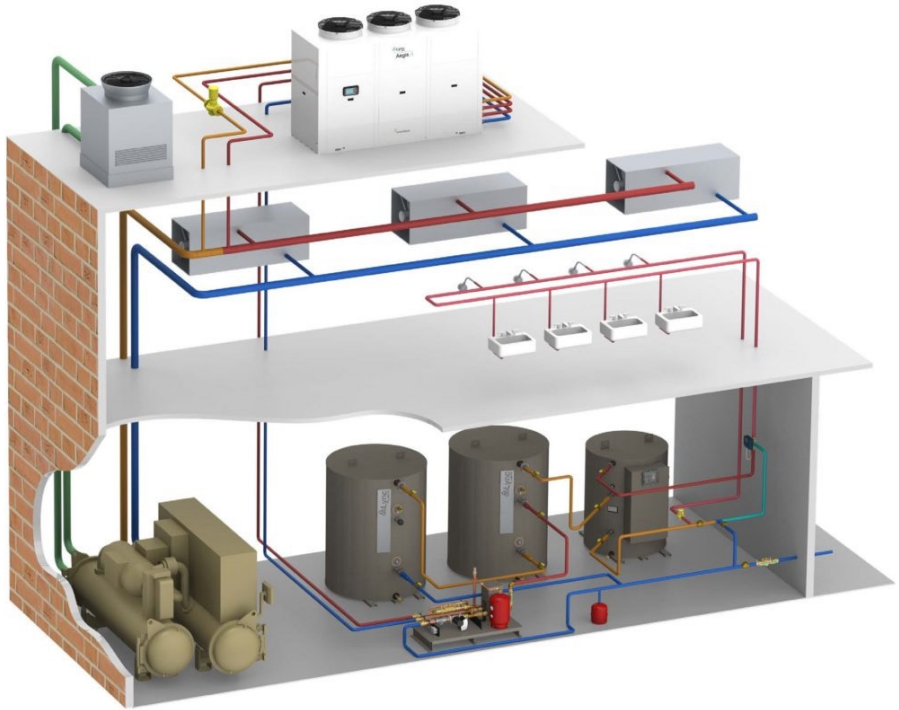
HOT WATER STRATEGY : Air-to-Water Heat pump (Aegis, Mitsubishi Q-Mark, LG Hydrokit)

PROS
- Efficient, all-electric systems
- Can produce hot water even during cold outdoor temperatures
- Can potentially piggyback off of heating/ cooling equipment

CONS
- Requires large amounts of storage to meet peak loads
- Upfront costs typically higher than fossil fuel systems



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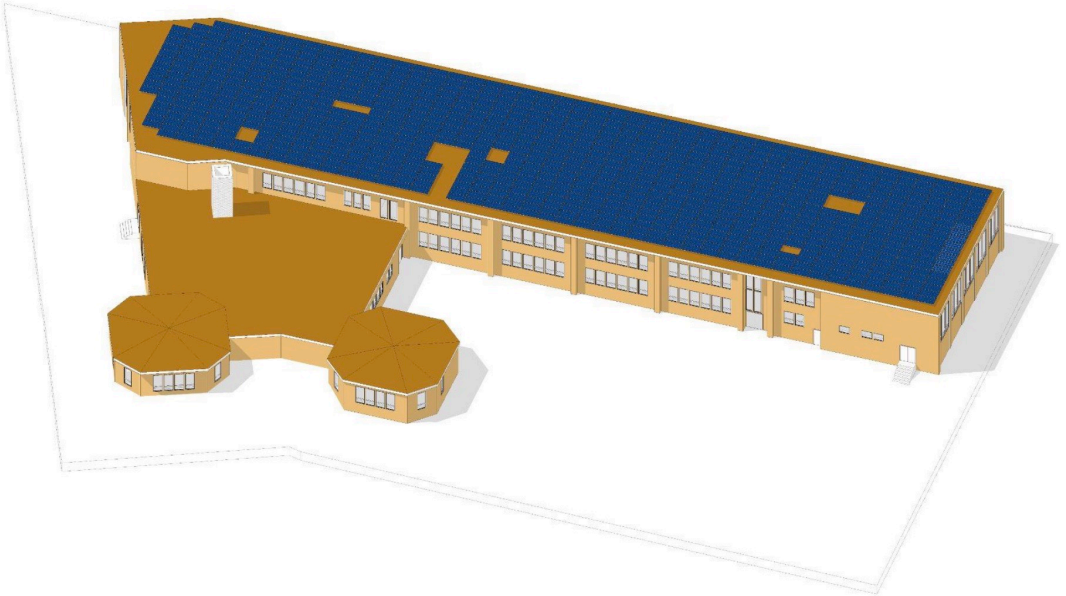
Renewable Energy Generation

- For the purposes of this study, the Project Team has developed a preliminary plan depicting a rooftop photovoltaic array consisting of approximately 823 - 400W panels. The equivalent system output of an array of this size is approximately 378,264 kWh/yr.
- The proposed post-DER, pre-solar Energy Usage Intensity (EUI) goal is 25 kBTU/sf yr. Based on the gross area of the building, a site EUI of 25 is equivalent to a site energy use of 376,414 kWh/yr; therefore, with the implementation of a 378,264 kWh/yr solar array, the resulting site EUI drops to -0.12, projecting a ***Net Positive Energy building***.
- *If the utility/cost data provided to us is correct this would translate into approximate utility savings of **$78,000/year**.*



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JFK Elementary School
7 Bolster St, Jamaica Plain, MA 02130

BUDGET: PLACETAILOR

BOD :

1. **Decentralized Ventilation**
2. **Centralized VRF**
3. **Panelized envelop**
   $254/sf (Union Labor)

A ITEM	B DESCRIPTION OF WORK	C Unit Price Estimate	D Direct Cost	E Markup	F Material Cost	G Material Markup	H Sub Contractor	I Sub Con. Markup	J Total
	26 50 00.01 Lighting Fixtures Mtrl		$1,000	$100	$8,000	$1,088	$0	$0	$10,200
	48 14 00 Solar Energy Electrical Power Generation Equipment Sub	$3.00	$5,000	$500	$0	$0	$148,200	$22,200	$175,900
	Division 32 Exterior Improvements								
	32 10 00.02 Paving Sub		$0	$0	$0	$0	$3,450	$518	$4,000
	32 16 23.02 Sidewalks Sub		$0	$0	$0	$0	$5,300	$795	$6,095
	32 90 00.02 Landscape Sub		$1,000	$100	$0	$0	$2,800	$420	$4,320
								Total	**$12,539,000**
								Cost by Classroom	**$417,967**
								SQFT cost by GSF	**$254**
								SQFT cost by GSF of Envelope	**$224**

	Add Alternate 001 - Centralized Ventilation System								
	23 72 00.02 Centralized ERV System Sub - Add	$40.00	$10,000	$197,620	$0	$0	$1,976,200	$296,430	$2,470,250
	23 72 00.01 Unitized HVAC ERV MTH - Deduct		$0	$1,000	-$147,430	-$20,050	$0	$0	-$166,480
	23 72 00.02 Unitized HVAC ERV Sub - Deduct		$10,000	$1,000	$0	$0	-$142,400	-$21,390	-$152,990
								Add Total	**$2,150,780**
								Adjusted Total	**$14,689,780**
								Cost by Classroom	**$489,659**
								SQFT cost by GSF	**$297**
								SQFT cost by GSF of Envelope	**$262**
	Add Alternate 002 - Central Water Source Heat Exchanger System								
	23 81 46 Centralized Water Source HEX System - Add	$80.50	$10,000	$397,710	$0	$0	$3,977,100	$596,600	$4,971,400
	23 76 28 VRF Air-conditioning System Sub - Deduct	$70.00	$10,000	$1,000			-$3,458,350	-$518,800	-$3,966,200
								Add Total	**$1,005,200**
								Adjusted Total	**$13,544,200**
								Cost by Classroom	**$451,473**
								SQFT cost by GSF	**$274**
								SQFT cost by GSF of Envelope	**$242**
	Deduct Alternate 003 - Ephoca Pro - Decentralized Heat Pumps								
	23 81 40 - Ephoca Pro Heat Pump Units System - Add	$6,100.00	$10,000	$1,000	$0	$0	$427,000	$64,100	$492,100
	23 76 28 VRF Air-conditioning System Sub - Add (Major spaces only)	$35.00	$10,000	$1,000	$0	$0	$1,729,175	$259,400	$1,999,600
	23 76 28 VRF Air-conditioning System Sub - Deduct	$70.00	$10,000	$1,000	$0	$0	-$3,458,350	-$518,800	-$3,966,200
								Add Total	**-$1,474,500**
								Adjusted Total	**$11,044,500**
								Cost by Classroom	**$368,817**
								SQFT cost by GSF	**$224**
								SQFT cost by GSF of Envelope	**$198**

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Project Name JFK Elementary School, Jamaica Plain, MA
Project #
Title Feasibility Study Construction Pricing - Draft 2
Date 06/24/2022

A ITEM	B DESCRIPTION OF WORK	C Unit Price Estimate	D Direct Cost	E Markup	F Material Cost	G Material Markup	H Sub Contractor	I Sub Con. Markup	J Total
				10.00%		20.00%		15.00%	
	Division 1: General Requirements								
	01 29 76.00 Project Invoicing		$5,000	$500	$0	$0	$0	$0	$5,500
	01 31 13.00 Project Management		$20,000	$2,000	$0	$0	$0	$0	$22,000
	01 31 19.00 Project Meetings		$5,000	$500	$0	$0	$0	$0	$5,500
	01 32 13.00 Project Scheduling		$10,000	$1,000	$0	$0	$0	$0	$11,000
	01 51 13.02 Temp Electricity		$1,000	$100	$0	$0	$0	$0	$1,100
	01 51 36.02 Temp Water Service		$750	$75	$0	$0	$0	$0	$825
	01 51 40.02 Tool Equipment Rental		$75,000	$7,500	$0	$0	$0	$0	$82,500
	01 52 19.02 Sanitary Facilities		$2,000	$200	$0	$0	$0	$0	$2,200
	01 55 26.02 Traffic Control		$3,000	$300	$0	$0	$0	$0	$3,300
	01 56 26.02 Temporary Fencing		$5,000	$500	$0	$0	$0	$0	$5,500
	01 57 16.02 Temporary Pest Control		$1,200	$120	$0	$0	$0	$0	$1,320
	01 73 00.00 Site Supervision		$30,000	$3,000	$0	$0	$0	$0	$33,000
	01 74 16.00 Site Maintenance		$10,000	$1,000	$0	$0	$0	$0	$11,000
	01 74 19.02 Waste Disposal		$15,000	$1,500	$0	$0	$0	$0	$16,500
	01 74 23.02 Final Clean		$10,000	$1,000	$0	$0	$0	$0	$11,000
	01 78 13.00 Punch List		$15,000	$1,500	$0	$0	$0	$0	$16,500
									$228,745
	Division 2 Sitework								
	02 22 00.02 Demolition (Included in 03 31 00.02)		$0	$0	$0	$0	$0	$0	$0
	Division 4 Masonry								
	04 21 13.02 Brick Masonry Repair		$0	$0	$0	$0	$5,400	$810	$6,200
	Division 6 Wood & Plastics								
	06 43 10.01 Millwork Mtrl		$0	$0	$40,000	$8,000	$0	$0	$48,000
	06 43 10.02 Millwork Sub		$500	$50	$0	$0	$58,500	$8,775	$67,800
					$5				
	Division 7 Thermal & Moisture Protection								
	07 14 00.02 Fluid-Applied Waterproofing Sub		$1,000	$100	$0	$0	$13,800	$2,100	$17,000
	07 21 13.01 Insulation Mtrl (Included in 07 21 13.02)		$0	$0	$0	$0	$0	$0	$0
	07 21 13.02 Insulation Sub	$2.50	$0	$0	$0	$0	$2,800	$420	$3,200
	07 27 00.01 Air Barrier Mtrl		$0	$0	$10,000	$2,000	$0	$0	$12,000
	07 27 00.02 Air Barrier Sub (Included in 07 42 63.01)		$0	$0	$0	$0	$0	$0	$0
	07 42 63.01 Fabricated Wall Panel Assemblies Mtrl	$60.00	$0	$0	$1,488,600	$297,720	$0	$0	$1,786,300
	07 42 63.02 FWP Assemblies Sub	$15.00	$15,000	$1,500	$0	$0	$372,150	$55,800	$444,500
	07 50 00.00 Membrane Roofing Demolition (Included in 07 50 00.02)		$0	$0	$0	$0	$0	$0	$0
	07 50 00.02 Membrane Roofing Sub	$10.00	$7,000	$700	$0	$0	$494,100	$74,100	$575,900
	07 71 00.02 Roofing Specialties	$29.00	$7,000	$700	$33,350	$6,670	$0	$0	$47,700
	Division 8 Doors, Window & Interiors								
	08 14 10.01 Exterior Doors Mtrl (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0	$0
	08 14 10.02 Exterior Doors Sub (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0	$0
	08 41 13.00 Glazing Demo		$0	$0	$0	$0	$15,000	$2,250	$17,250
	08 50 00.01 Windows Mtrl (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0	$0
	08 50 00.02 Window Sub (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0	$0
	Division 9 Finishes								
	09 91 23.02 Interior Paint Sub (included in 09 21 00.02)		$1,000	$100	$0	$0	$3,000	$450	$4,550
	Division 22 Plumbing								
	22 00 00.00 Plumbing Demolition (included in 22 00 00.02)		$0	$0	$0	$0	$0	$0	$0
	22 00 00.01 Plumbing Mtrl (included in 22 00 00.02)		$0	$0	$0	$0	$0	$0	$0
	22 00 00.02 Plumbing Sub	$25.00	$5,000	$500	$0	$0	$1,235,100	$185,300	$1,425,900
	Division 23 HVAC								
	23 72 00.01 Unitized HVAC ERV Mtrl		$14,000	$1,400	$256,400	$38,460	$0	$0	$310,300
	23 72 00.02 Unitized HVAC ERV Sub		$0	$0	$0	$0	$248,000	$37,200	$285,200
	23 81 29 VRF Air-Conditioning System Sub	$70.00	$0	$0	$0	$0	$3,458,350	$518,800	$3,977,200
	Division 26 Electrical								
	26 00 00.00 Electrical Demolition (included in 26 00 00.02)		$0	$0	$0	$0	$0	$0	$0
	26 00 00.01 Electrical Mtrl (included in 26 00 00.02)		$0	$0	$0	$0	$0	$0	$0
	26 00 00.02 Electrical Sub	$50.00	$10,000	$1,000	$0	$0	$2,470,250	$370,538	$2,851,800

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BUDGET: PLACETAILOR

- **NOTE: WE WERE TOLD A BUDGET HAS YET TO BE CREATED FOR THE PROJECT**
- **WAITING ON FEEDBACK FROM RENEW BOSTON TRUST**

$12,539,000.00 Total Budget

Preliminary Pricing Narrative

Project Name:	JFK Elementary DER	**Date:**	06/24/2022
Project #:		**Revision:**	0
Project Address:	7 Bolster St, Jamaica Plain, MA 02130		

Basis of Design Scope of Work

HVAC basis of design is a decentralized ventilation system and a centralized VRF system as recommended in BOD Mechanical Report provided by BEC. Ventilation would be provided by unitary ERVs. Heating and Cooling would be provided by a Central VRF System.

Electrical basis of design scope is to provide power to the new electric VRF and ERV systems and install photovoltaic panels on the new roof.

Plumbing basis of design scope is to provide new hookups and distribution for new VRF and ERV systems

Envelope basis of design scope is to install a prefabricated panelized exterior insulation system to enclose the building as well as a new TPO roofing membrane system. Panel components include windows and exterior doors installed in the factory and an integrated air and vapor barrier to seal the existing facades minimizing heat loss,

Major BOD Pricing Line Items

HVAC	$4,572,700.00
Plumbing	$1,425,900.00
Electrical	$2,851,800.00
Solar Energy	$175,900.00
Envelope	$2,806,700.00
Overhead	$444,500.00
Associated project costs	$261,500.00
TOTAL	$12,539,000.00

Add Alternates

Add Alternate 001 - Centralized Ventilation System - Central rooftop ERV providing ventilation to whole building	$2,157,800.00
Add Alternate 002 - Central Water Source Heat Exchanger System - HEX heating/cooling system serving whole building	$1,005,200.00
Add Alternate 003 - Ephoca Pro - Decentralized Air-to-Air Heat Pumps for heating/cooling with reduced, semi-centralized VRF heating/cooling system for the larger spaces.	-$1,474,500.00

This is preliminary pricing based on the feasibility study provided Building Evolution Corp and Onion Flats.


POAH


REALIZE

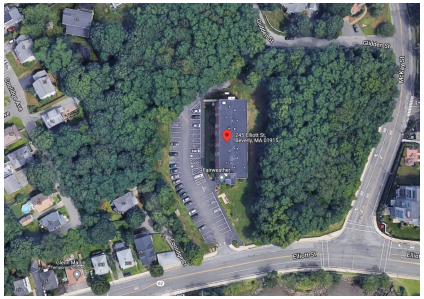

RMI
ENERGY. TRANSFORMED.


ONION FLATS
ARCHITECTURE


PLACETAILOR
BUILDING EVOLUTION CORPORATION
Achieve Performance & Durability Through A Holistic Approach℠

FAIRWEATHER SALEM

FAIRWEATHER BEVERLY



FAIRWEATHER DANVERS

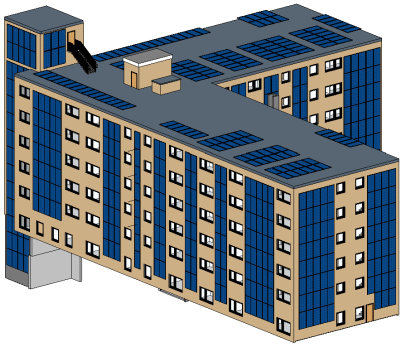
FAIRWEATHER PEABODY

POAH

FAIRWEATHER SALEM

127 unit, 73,920 sf, 6 stories
Feasibility Study
Deep Energy Retrofit
Goals:

1. ***Research 7 Panelized manufacturers for most cost-effective, factory-built, high performance envelop, including new roof***
2. ***Research 3-4 HVAC strategies for most cost-effective approach to bringing heating, cooling and ventilation to every apartment and communal space***
3. ***Research all-electric centralized Domestic Hot Water Systems to replace gas boiler***
4. ***Eliminate all gas equipment and appliances from building for all-electric building***
5. ***Create WUFI model of proposed design to meet the Passive House standard.***
6. ***Incorporate as much PV renewable energy as possible with goal of Net Zero Energy.***
7. ***Create preliminary budget for DER***



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FAIRWEATHER SALEM

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FAIRWEATHER SALEM

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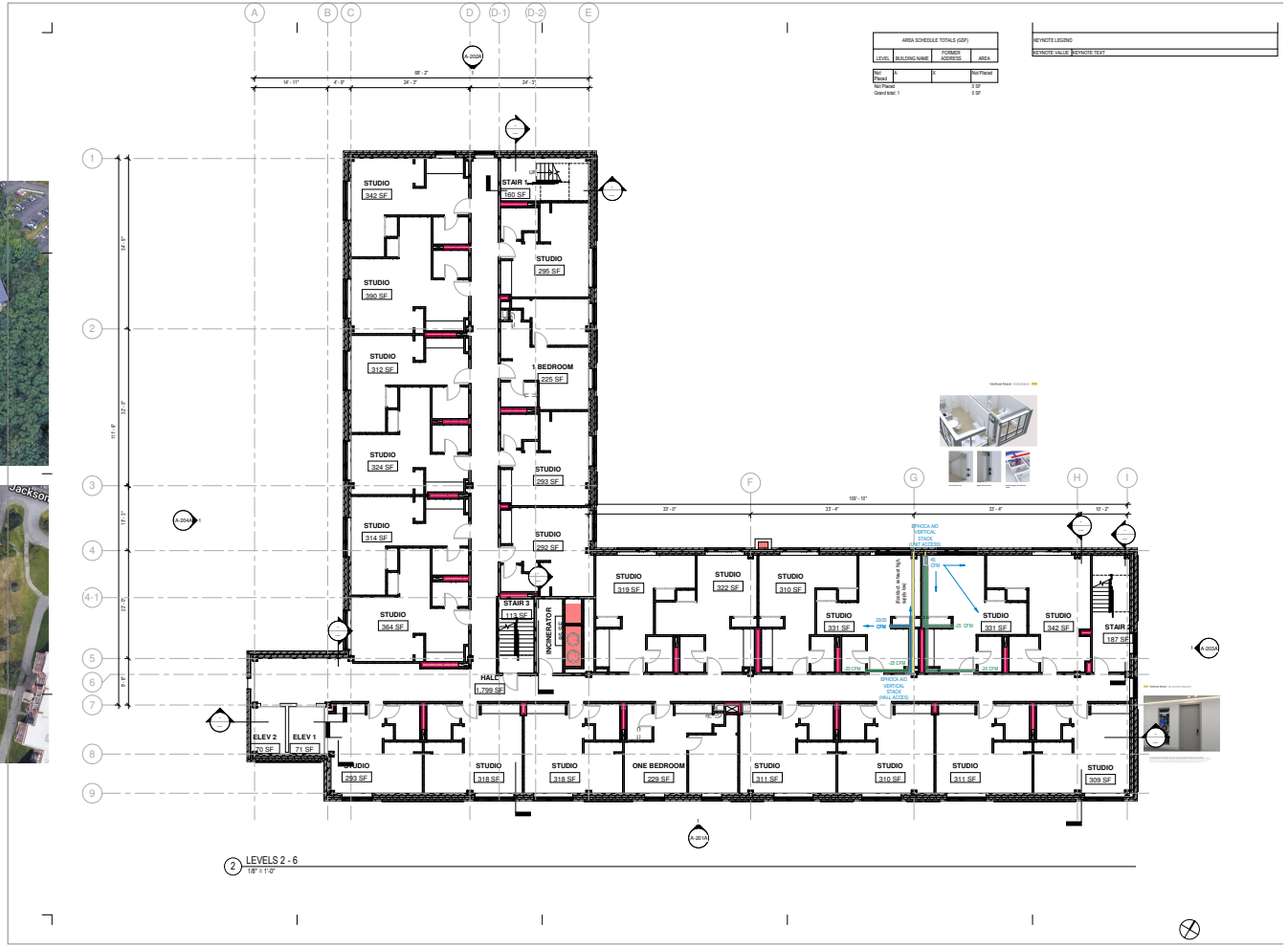


FAIRWEATHER SALEM

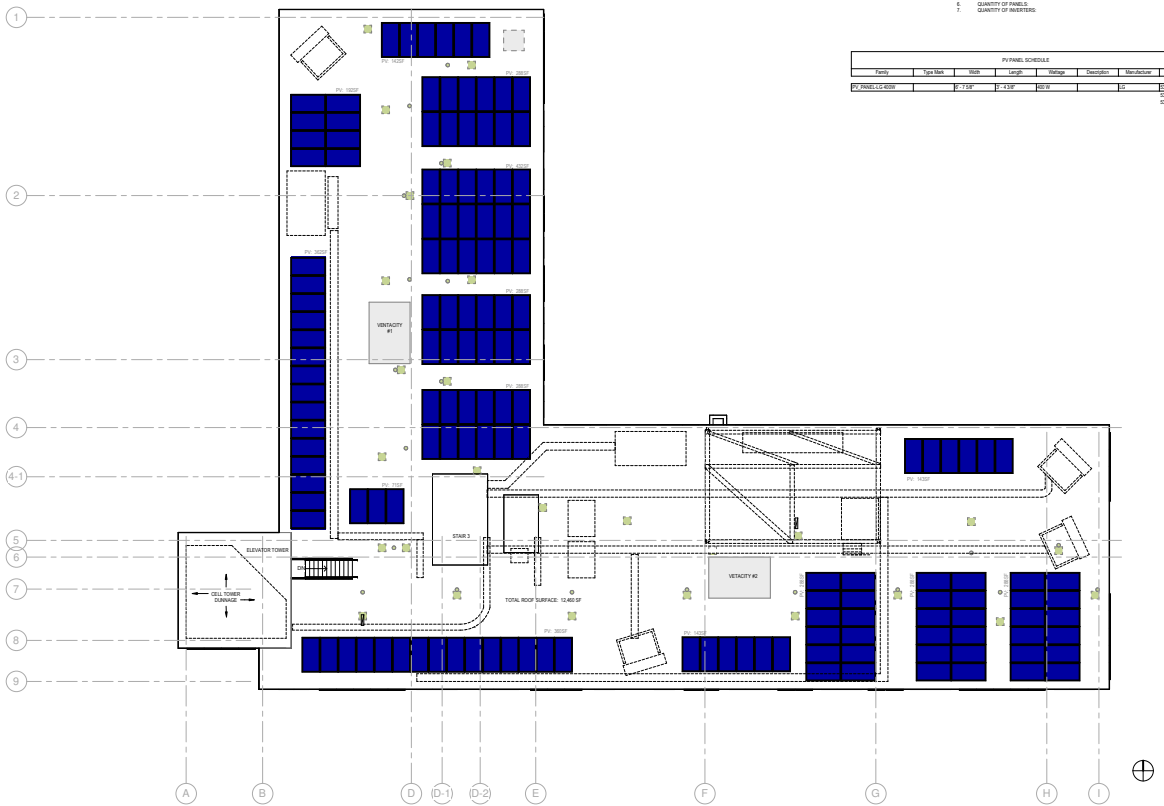
POAH

SOLAR PV BASIS OF DESIGN

1. TYPE OF SOLAR PV SYSTEM:
2. SYSTEM LOCATION:
3. SYSTEM MOUNTING STRATEGY:
4. PV PANEL SIZE(S):
5. SYSTEM EXPECTED YIELD:
6. QUANTITY OF PANELS:
7. QUANTITY OF INVERTERS:

PV PANEL SCHEDULE

Family	Type Mark	Width	Length	Wattage	Description	Manufacturer	Count
PV_PANEL-LG-400W		3' - 7 5/8"	6' - 4 3/8"	400 W		LG	322
							322
							322



1 ROOF PLAN
1/8" = 1'-0"

FAIRWEATHER SALEM

POAH

KEYNOTE LEGEND	
KEYNOTE VALUE	KEYNOTE TEXT

WINDOW AREA & COUNTS

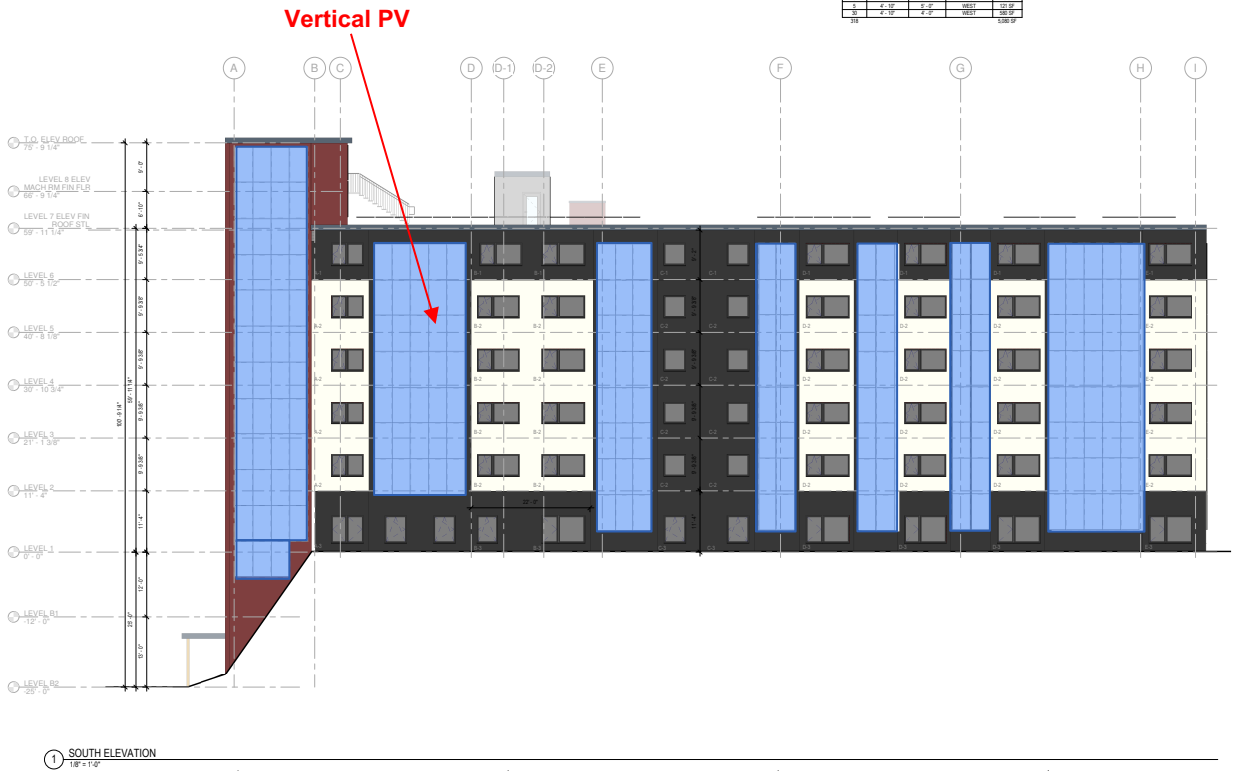
QTY	WINDOW WIDTH	WINDOW HEIGHT	WINDOW ORIENTATION	AREA
65	3'-0"	4'-0"		780 SF
5	3'-0"	4'-0"		60 SF
13	3'-0"	5'-0"		195 SF
5	4'-0"	5'-0"		100 SF
10	4'-0"	4'-0"		160 SF
11	4'-10"	5'-0"		266 SF
60	4'-10"	4'-0"		1,160 SF
2	3'-0"	2'-0"		12 SF
15	3'-0"	4'-0"	EAST	180 SF
10	3'-0"	4'-0"	EAST	120 SF
2	3'-0"	5'-0"	EAST	30 SF
1	3'-0"	5'-0"	EAST	15 SF
4	4'-0"	5'-0"	EAST	80 SF
20	4'-0"	4'-0"	EAST	320 SF
1	4'-10"	5'-0"	EAST	24 SF
5	4'-10"	4'-0"	EAST	97 SF
10	4'-0"	4'-0"	NORTH	160 SF
5	2'-4"	5'-10"	WEST	196 SF
30	3'-0"	4'-0"	WEST	360 SF
5	3'-0"	5'-0"	WEST	75 SF
5	4'-10"	5'-0"	WEST	121 SF
30	4'-10"	4'-0"	WEST	580 SF
318				5,080 SF

WINDOW AREA-BY ORIENTATION

QTY	WINDOW ORIENTATION	AREA
171		2,733 SF
58	EAST	888 SF
10	NORTH	160 SF
79	WEST	1,321 SF
318		5,080 SF

WALL AREA (LESS DOORS AND WINDOWS)

Wall Orientation	Area
EAST	14,337 SF
NORTH	14,604 SF
SOUTH	10,336 SF
WEST	12,042 SF
Grand total: 43	51,319 SF



1 SOUTH ELEVATION
1/8" = 1'-0"

KEYNOTE LEGEND	
KEYNOTE VALUE	KEYNOTE TEXT

WINDOW AREA & COUNTS

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1	4'-10"	5'-0"	EAST	24 SF
5	4'-10"	4'-0"	EAST	97 SF
10	4'-0"	4'-0"	NORTH	160 SF
5	2'-4"	5'-10"	WEST	68 SF
30	3'-0"	4'-0"	WEST	360 SF
5	3'-0"	5'-0"	WEST	75 SF
5	4'-10"	5'-0"	WEST	121 SF
30	4'-10"	4'-0"	WEST	580 SF
318				5,080 SF

WINDOW AREA-BY ORIENTATION

QTY	WINDOW ORIENTATION	AREA
171		2,733 SF
58	EAST	888 SF
10	NORTH	160 SF
79	WEST	1,321 SF
318		5,080 SF

WALL AREA (LESS DOORS AND WINDOWS)

Wall Orientation	Area
EAST	14,337 SF
NORTH	14,604 SF
SOUTH	10,336 SF
WEST	12,642 SF
Grand total: 43	51,919 SF

FAIRWEATHER SALEM

POAH

Front Flats, 174 kW array, Phila, Onion Flats

F G H I

KEYNOTE LEGEND	
KEYNOTE VALUE	KEYNOTE TEXT

WINDOW AREA & COUNTS

QTY	WINDOW WIDTH	WINDOW HEIGHT	WINDOW ORIENTATION	AREA
65	3'-0"	4'-0"		780 SF
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1	3'-0"	5'-0"	EAST	15 SF
4	4'-0"	5'-0"	EAST	80 SF
20	4'-9"	5'-0"	EAST	309 SF
1	4'-10"	5'-0"	EAST	24 SF
5	4'-10"	4'-0"	EAST	97 SF
10	4'-0"	4'-0"	NORTH	160 SF
5	2'-4"	5'-10"	WEST	136 SF
30	3'-0"	4'-0"	WEST	360 SF
5	3'-0"	5'-0"	WEST	75 SF
5	4'-10"	5'-0"	WEST	121 SF
30	4'-10"	4'-0"	WEST	580 SF
318				5,080 SF

WINDOW AREA-BY ORIENTATION

QTY	WINDOW ORIENTATION	AREA
171		2,733 SF
58	EAST	888 SF
10	NORTH	160 SF
79	WEST	1,321 SF
318		5,080 SF

WALL AREA (LESS DOORS AND WINDOWS)

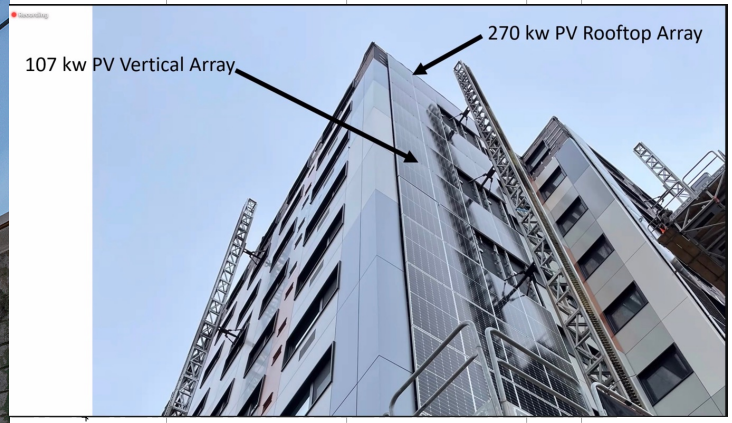
Wall Orientation	Area
EAST	14,337 SF
NORTH	14,604 SF
SOUTH	10,336 SF
WEST	12,042 SF
Grand total: 43	51,319 SF

FAIRWEATHER SALEM

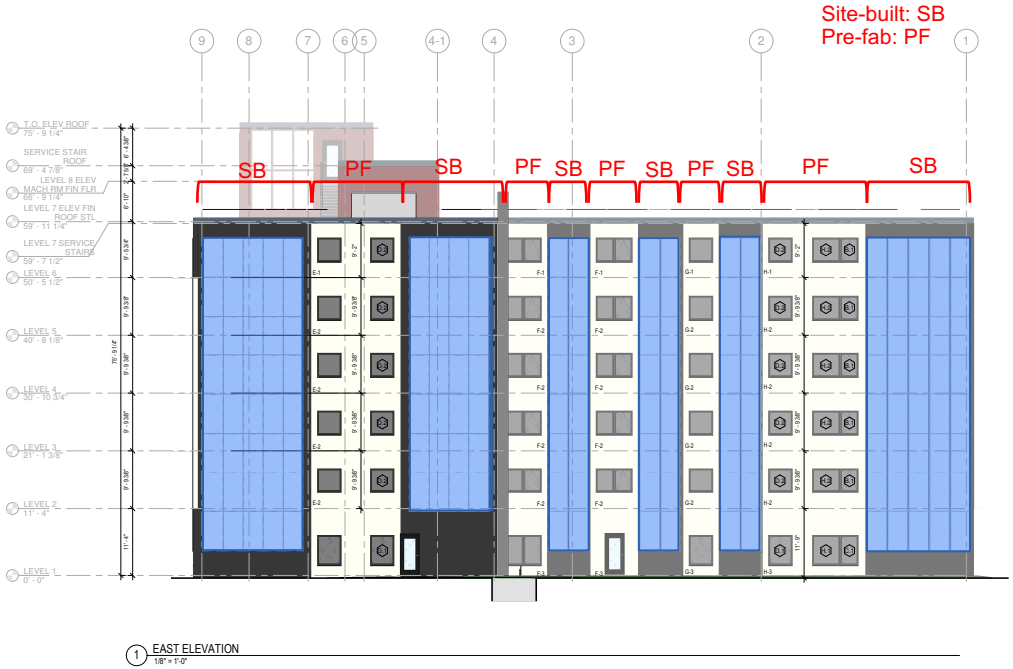
POAH

Front Flats, 174 kW array, Phila, Onion Flats

Salem Heights, Salem, MA, POAH



FAIRWEATHER SALEM



POAH

FAIRWEATHER SALEM

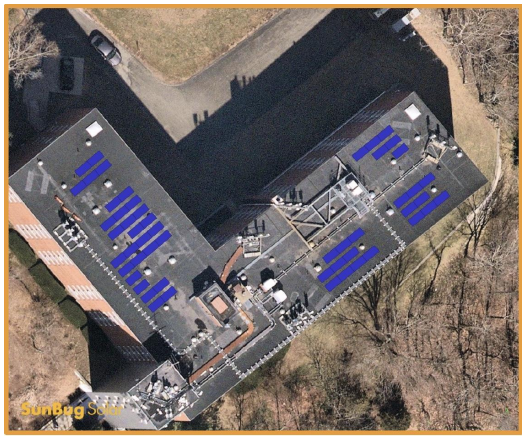
23 KW array
28,000 kWh/yr

POAH

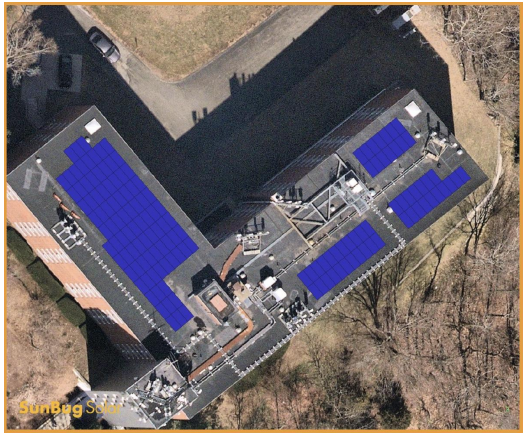
Renewable Energy Generation

Only after the enclosure and mechanical systems have been analyzed for optimization can the Project Team begin to understand the renewable energy requirements for reaching NZE. POAH directly engaged Sunbug Solar to review the existing site/building conditions and prepare recommendations for solar coverage. Due to extensive tree coverage adjacent to the building as well as the cellular service infrastructure on the roof to remain, it was determined there are likely two options for rooftop solar implementation:

(1) Ballasted array yielding 23.9 kW, or approximately 28,000 kwh/yr



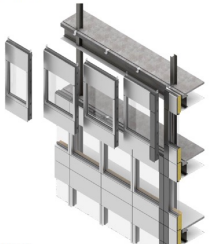
Above: 23.9 kW array



Above: 63.5 kW array

PANELIZATION

DEXTALL



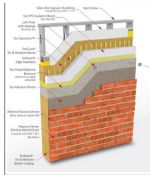
EXOSHELL
A COMPOSITE EXTERIOR WALL PANEL

RCPANELS

METALLEVE WALL SYSTEMS

sto Building with conscience.

EASTERN EXTERIOR WALL SYSTEMS INC.

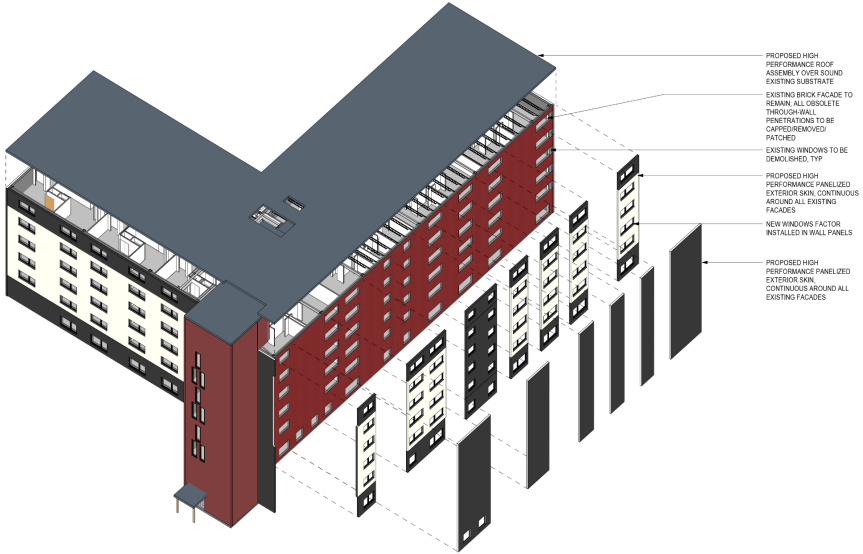


TREMCO
Construction Products Group

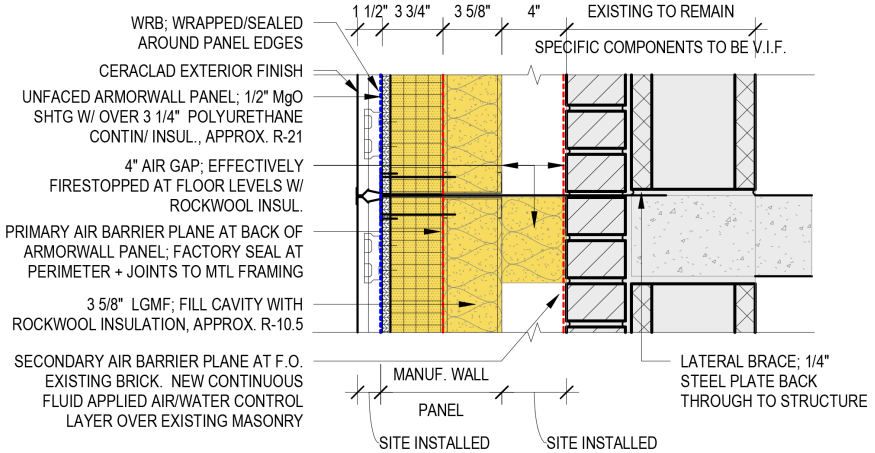
The following is a summary of seven manufacturers and how they compared when assuming all things equal from a thermal/building performance standpoint. Further analysis of pro/cons per manufacturer is included in the attached Panelizer Comparison Matrix.

	Local	Interested / Responsive	Competitive Pricing	Multiple Finish Options
Dextall				X
Eastern Exterior Walls				X
Exoshell		X	X	X
Metalleve	X*	X	X	X
RC Panels		X	X	
Sto				
Tremco				

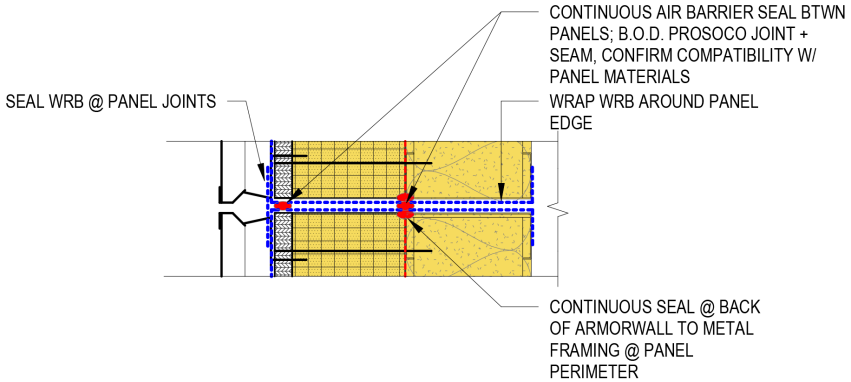
** Located in Harvard, MA*



PANELIZATION



PROPOSED METALLEVE WALL PANEL
1 1/2" = 1'-0"



PROPOSED METALLEVE WALL PANEL JOINT DETAIL
3" = 1'-0"

HVAC/DHW SYSTEMS

BUILDING EVOLUTION CORPORATION
Achieve Performance & Durability Through A Holistic Approach™

ephoca

Vertical stack

1.



2.


+

+


3.


+

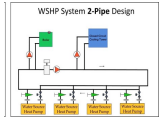
or


4.


+

or


5.



+

or


Heating, Cooling, & Ventilation

Heating & Cooling Options	Ventilation Options	Ventilation & Ducting Requirement
1. Ephoca Vertical Stack: all-in-one. Requires supplemental electric duct heaters during winter.		Through wall ventilation; horizontal exhaust bathroom and kitchen, supply at Ephoca unit
2. Ephoca Through-Wall, no integral ventilation. Requires	a. Central Rooftop ERV	i. Vertical duct riser cored internally in units
		ii. Vertical duct riser external to building, within enclosure
supplemental electric heaters during winter.	b. Unitary ERV	i. Through wall ventilation; horizontal exhaust bathroom and kitchen, supply at ERV
3. VRF with Heat Recovery, branch controllers, and wall hung FCUs	a. Central Rooftop ERV	i. Vertical duct riser cored internally in units
		ii. Vertical duct riser external, within enclosure
	b. Unitary ERV	i. Through wall ventilation; horizontal exhaust bathroom and kitchen, supply at ERV
4. VRF without Heat Recovery and wall hung FCUs	a. Central Rooftop ERV	i. Vertical duct riser cored internally in units
		ii. Vertical duct riser external, within enclosure
	b. Unitary ERV	i. Through wall ventilation; horizontal exhaust bathroom and kitchen, supply at ERV
5. HEX, Condenser Loop, WSHP/Bulldog	a. Central Rooftop ERV	i. Vertical duct riser cored internally in units
		ii. Vertical duct riser external, within enclosure
	b. Unitary ERV	i. Through wall ventilation; horizontal exhaust bathroom and kitchen, supply at ERV

Domestic Hot Water

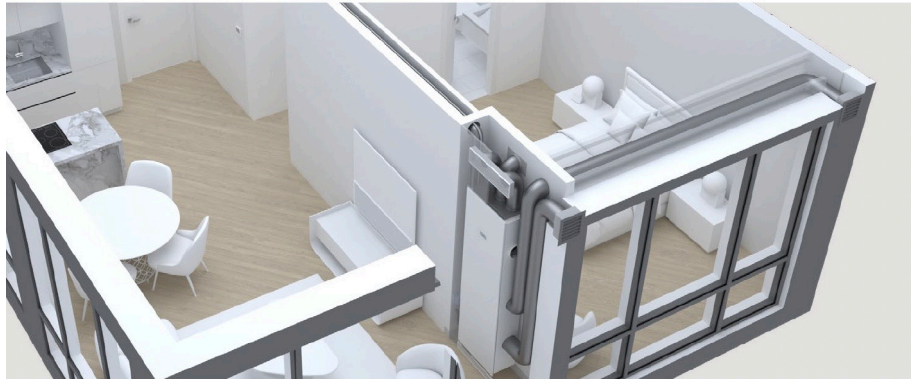
Option	Equipment
1. Central Heat Pump DHW	Outdoor CO2-based condenser, storage and swing tanks, recirculation pump(s)

HVAC/DHW SYSTEMS: **BUILDING EVOLUTION CORPORATION**
Achieve Performance & Durability Through A Holistic Approach™

1. Ephoca Vertical Stack

PROS
- Single heating/cooling/ventilation solution
- Easy to schedule installation
- Can exhaust bathroom and kitchen area
- Does not require fire-stopping and smoke dampers
- Reduced risk of refrigerant leak in apartments

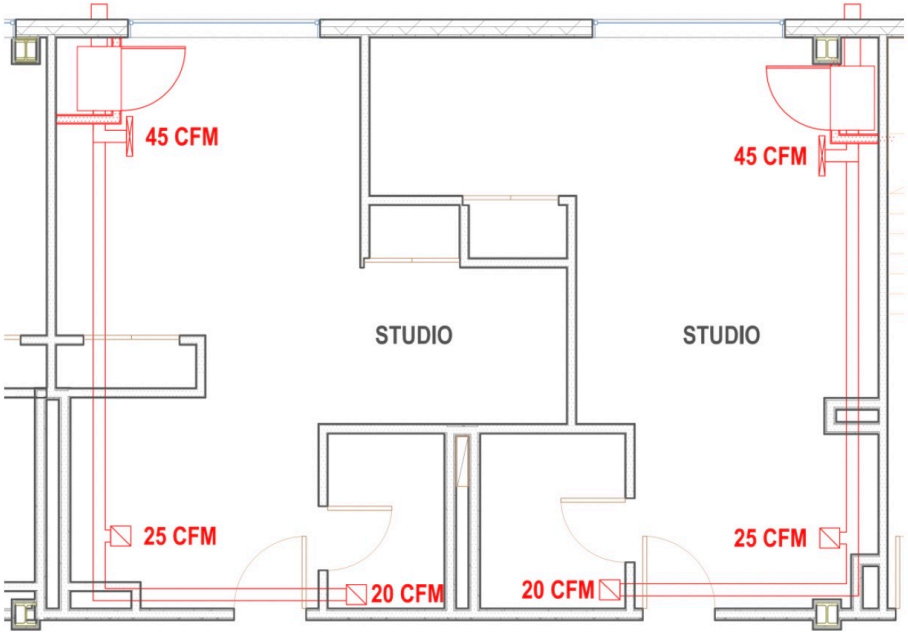
CONS
- Added maintenance costs due to individual unit filters
- Higher operating cost compared to centralized heat recovery VRF system
- Requires two penetrations through enclosure per apartment
- More work in occupied rehab compared to wall hung FCUs and central ventilation system
- Lower ERV efficiency compared to central ventilation system
- Will require electric resistance heating for winter design conditions



Vertical stack

ephoca

1 Condenser and fresh air intake (left, right or rear)
2 Twin rotary inverter compressor
3 ECM condenser fan
4 High efficiency outdoor heat exchanger
5 Condenser + stale air exhaust (left, right or rear)
6 Return vents
7 MERV 13 filter
8 EC supply fans
9 High-efficiency indoor heat exchanger
10 Supply air vent (top or front)
11 Stale air exhaust
12 Condensate mister system
13 Hybrid recovery core
14 Stale air ECM exhaust fan
15 Fresh air ECM supply fan
16 Touch controller
17 Electrical controls
18 Condensate drain



2. Ephoca Wall mounted + De-coupled ventilation

PROS
- Re-use existing enclosure penetration locations
- Does not require fire-stopping and smoke dampers
- Easy to schedule installation
- Reduced risk of refrigerant leak in apartments

CONS
- Added maintenance costs due to individual unit filters
- Higher operating cost compared to centralized heat recovery VRF system
- Requires two penetrations through enclosure per unit without benefit of ventilation
- May not be adequately sized for common spaces
- May require electric resistance heating for winter design conditions
- Does not address ventilation needs

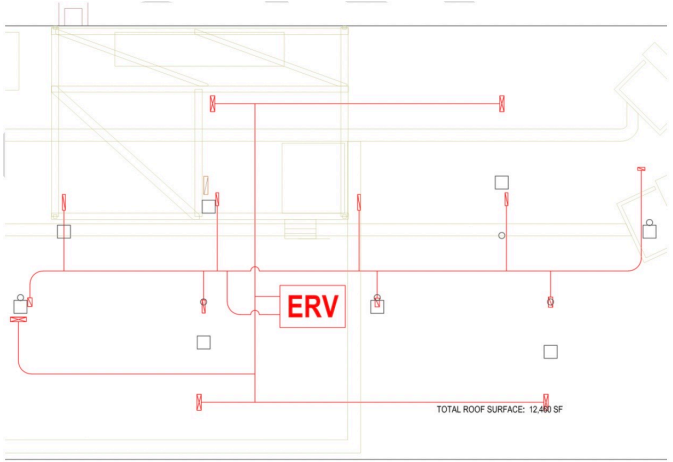


Figure 6: Rooftop layout with internal supply duct risers

Heating/Cooling

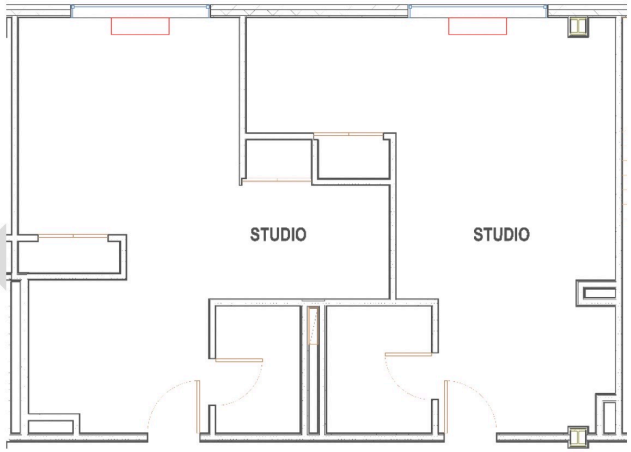
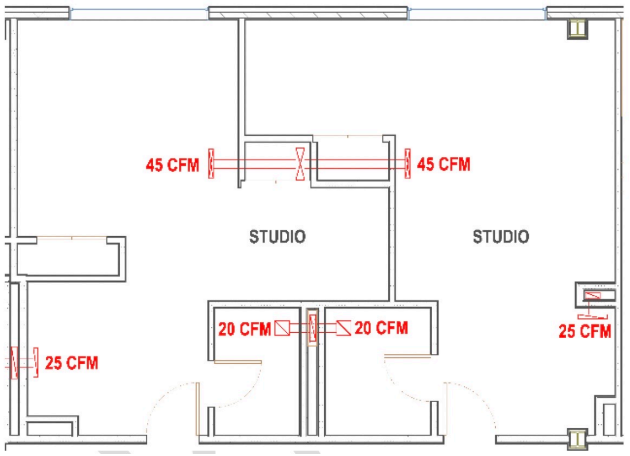


Figure 2: Through wall unit apartment layout

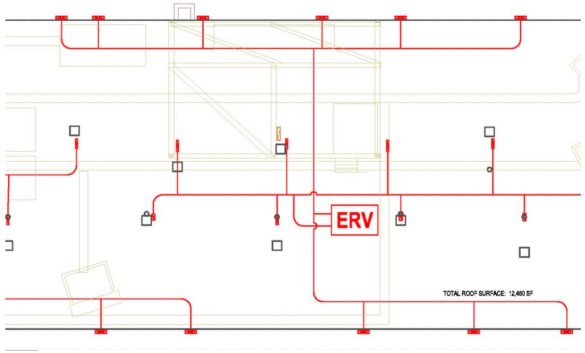
Ventilation



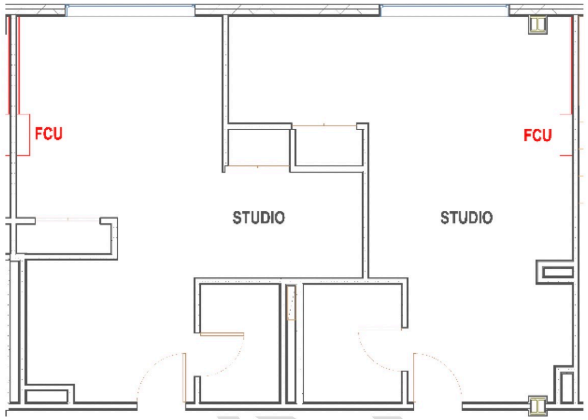
3. VRF w/Heat Recovery and wall hung FCUs + De-coupled ventilation

PROS
- Lowest overall operating cost with heat recovery benefit
- Wall-mounting FCUs does not take away real estate in apartments
- Improved comfort with independent control of heating and cooling
- System can scale to heating/cooling load requirements
- Central maintenance (condensers, controls)

CONS
- Reduces roof space availability for solar array
- Limited space within building to mount branch controllers, may have to be installed on roof in purpose built semi-conditioned space
- Vertical chases for refrigerant lines may still require fire-stopping
- Externally run refrigerant lines will still require maintenance access



Heating/Cooling



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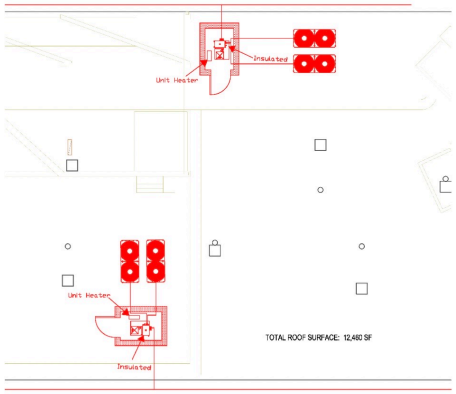

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Ventilation

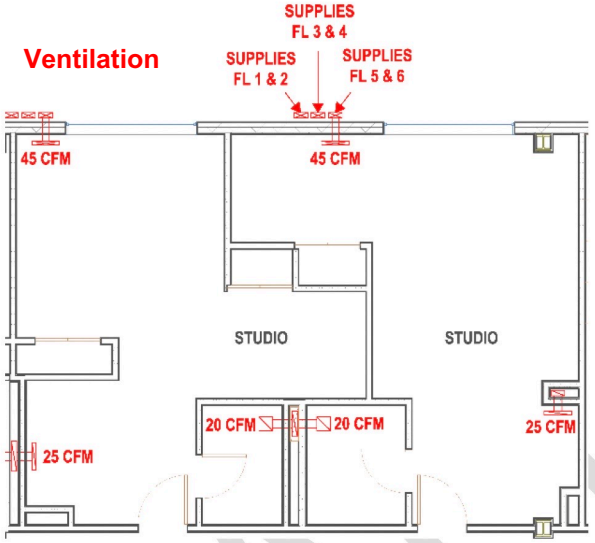
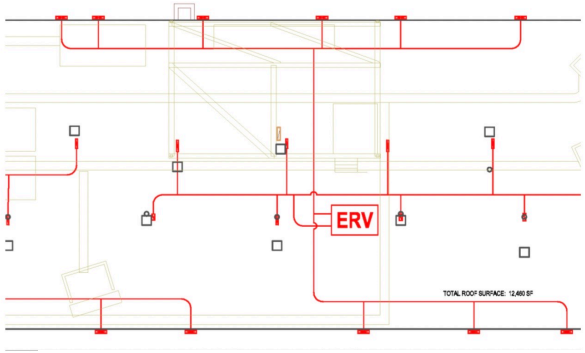


Figure 10: External ductwork staggered

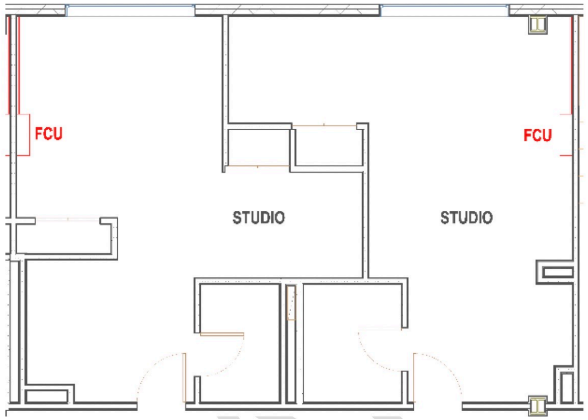
4. VRF WITHOUT Heat Recovery and wall hung FCUs + De-coupled ventilation

PROS
- Lower cost compared to heat recovery VRF option
- Does not require branch controllers
- Wall-mounting FCUs does not take away real estate in apartments
- System can scale to heating/cooling load requirements
- Central maintenance (condensers, controls)

CONS
- Higher operating cost compared to heat recovery VRF option
- Reduces roof space availability for solar array
- Reduced comfort without independent control of heating and cooling
- Vertical chases for refrigerant lines may still require fire-stopping
- Externally run refrigerant lines will still require maintenance access



Heating/Cooling



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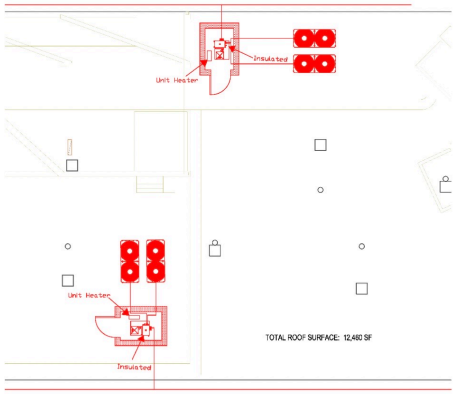

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Ventilation

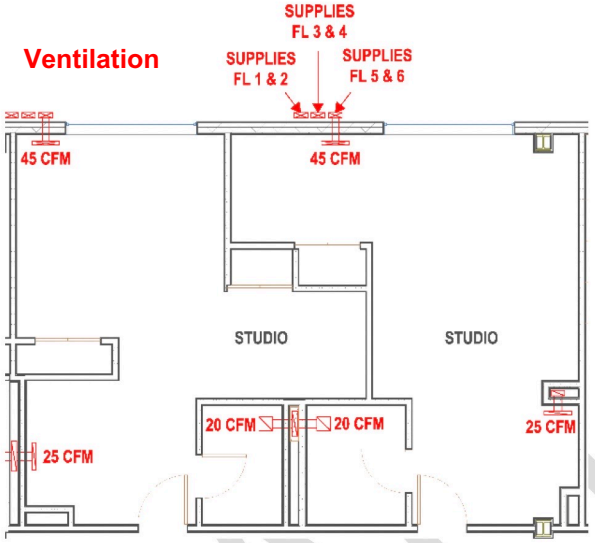


Figure 10: External ductwork staggered

HVAC/DHW SYSTEMS: BUILDING EVOLUTION CORPORATION
Achieve Performance & Durability Through A Holistic Approach™

5. HEX, Condenser Loop, WSHP/Bulldog + De-coupled ventilation

PROS
- Simultaneous heating and cooling with heat recovery
- Reduced refrigerant running through occupied space
- CUs can be located at grade in a central location to serve the entire building.
- May be less expensive than other central options as contractors are familiar with WSHPs, and two pipe hydronic systems

CONS
- Lower efficiency compared to VRF system
- Loss of real estate in apartments

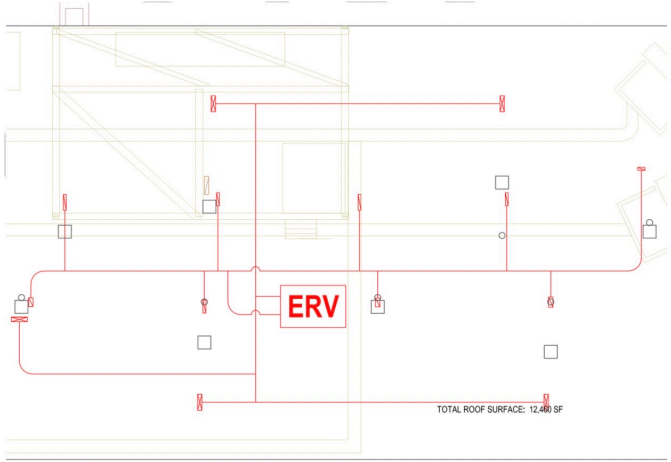
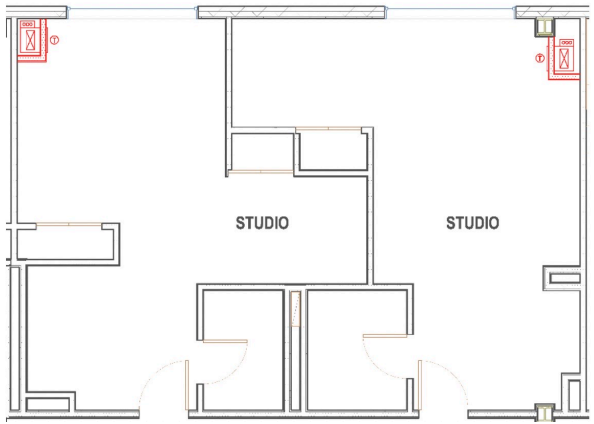


Figure 6: Rooftop layout with internal supply duct risers

Heating/Cooling



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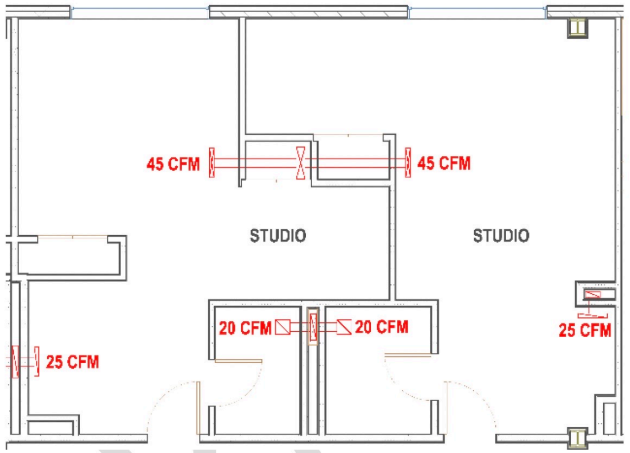
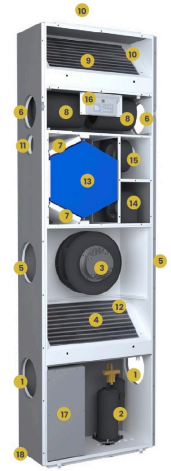
Ventilation

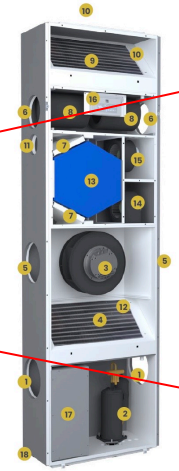




1 Condenser and fresh air intake (left, right or rear)
2 Twin rotary inverter compressor
3 ECM condenser fan
4 High efficiency outdoor heat exchanger
5 Condenser + stale air exhaust (left, right or rear)
6 Return vents
7 MERV 13 filter
8 EC supply fans
9 High-efficiency indoor heat exchanger
10 Supply air vent (top or front)
11 Stale air exhaust
12 Condensate mister system
13 Hybrid recovery core
14 Stale air ECM exhaust fan
15 Fresh air ECM supply fan
16 Touch controller
17 Electrical controls
18 Condensate drain

HVAC Options:

1. Unitary Ephoca vertical stack with ERV: **$3,076,246 [$42/sf]; $24,222/unit**
2. Ephoca thru-wall with centralized ERV:
    a. ERV ductwork through internal shaft/core: **$4,311,600 [$58/sf]; $33,949/unit**
    b. ERV ductwork at exterior: **$3,759,900 [$51/sf]; $29,605/unit**
3. VRF with heat recovery with centralized ERV:
    a. ERV ductwork through internal shaft/core: **$3,163,900 [$43/sf]; $29,605/unit**
    b. ERV ductwork at exterior: **$3,575,200 [$48/sf]; $28,151/unit**
4. HEX refrigerant-water heat exchangers, VRF, condenser loop and water source heat pumps, with centralized ERV:
    a. ERV ductwork through internal shaft/core: **$3,514,700 [$47/sf]; $27,647/unit**
    b. ERV ductwork at exterior: **$3,926,000 [$53/sf]; $30,913/unit**



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***Saves $1million in relocation costs…**

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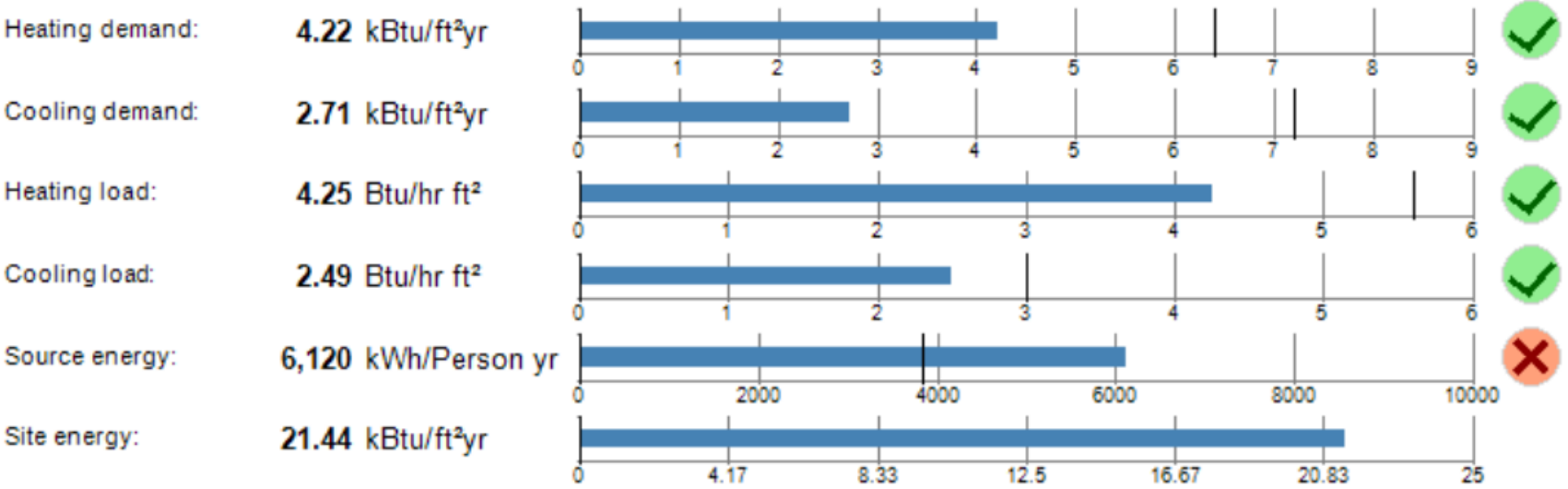
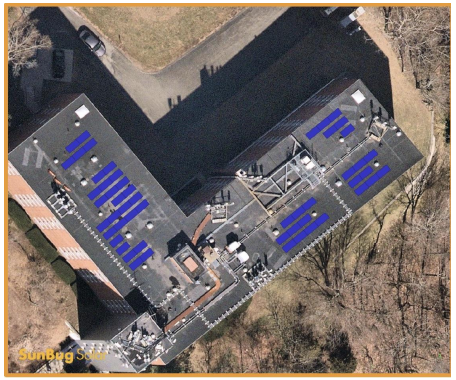
WUFI

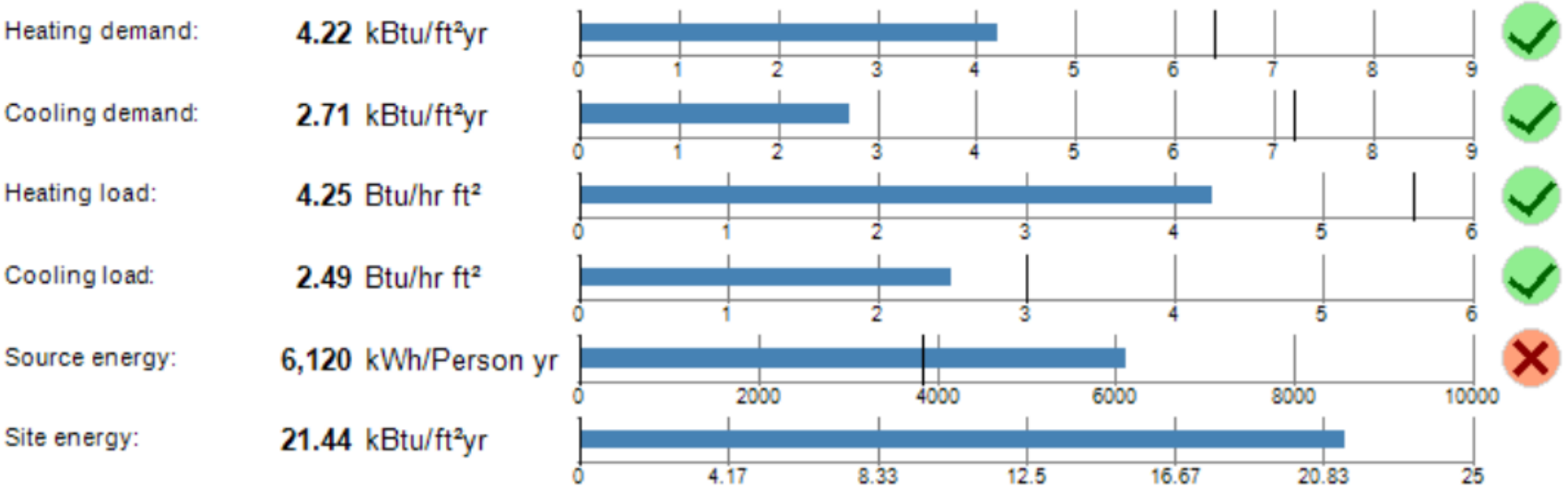

Heating demand:
4.22 kBtu/ft²yr
0 1 2 3 4 5 6 7 8 9
Cooling demand:
2.71 kBtu/ft²yr
0 1 2 3 4 5 6 7 8 9
Heating load:
4.25 Btu/hr ft²
0 1 2 3 4 5 6
Cooling load:
2.49 Btu/hr ft²
0 1 2 3 4 5 6
Source energy:
6,120 kWh/Person yr
0 2000 4000 6000 8000 10000
Site energy:
21.44 kBtu/ft²yr
0 4.17 8.33 12.5 16.67 20.83 25

WUFI + SOLAR

23 KW array
28,000 kWh/yr



Above: 23.9 kW array



EUI

BASELINE EUI: 165 kBTU/sf/yr

SITE EUI WITH SOLAR: 18 kBTU/sf/yr

87% BETTER THAN BASELINE

COMPARING EXISTING SALEM FAIRWEATHER ENERGY CONSUMPTION AND COST OF UTILITIES WITH POST-DEER FAIRWEATHER									
		Baseload					Baseload: With AHU		
			Rate	Usage	Spending	EUI	Usage (kWh)	Spending	EUI (kBTU/sf/yr)
EXISTING SALEM FAIRWEATHER	Electricity	$	0.21	316,027	$ 66,468		556,224	$ 116,973	
	Gas	$	0.97	68,712	$ 66,791		92,307	$ 89,731	
	Solar			28,257			28,257		
	Total				*$ 133,259*	*106*		*$ 206,704*	*165*
DEER SALEM FAIRWEATHER	Electricity	$	0.21				469,203	$98,673	21.44
	Solar	$	0.21				97,000	$20,399	
	Total						*372,203*	*$78,274*	*18*
EUI COMPARISON %									*87%*
UTILITY COST SAVINGS PER YEAR								*$ 128,430*	*62%*

PRICING:

PLACETAILOR

Basis Of Design:

- VRF with Centralized ventilation
- Panelized System: $65/sf installed
- $10,971,000.00 Hard Cost Budget
- $148/sf (GFA)
- $86,386.00 per unit

- Saves $1million in relocation costs

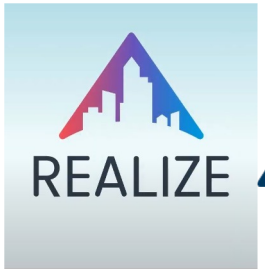
PLACETAILOR Urban Design Build | Occupy the Future.

Project Name Fairweather Apartment , Salem, MA
Project # PTBH 22-7
Title Feasibility Study Construction Pricing - Panelized Excluding Capital Improvements
Date 08/25/2022

A	B	C	D	E	F	G	H	I	J	K
ITEM	DESCRIPTION OF WORK	Unit Price Estimate	Direct Cost	Markup	Material Cost	Material Markup	Sub Contractor	Sub Con. Markup	Pre-DER Costs	Total
				10.00%		20.00%		10.00%		
	Division 1: General Requirements									
	01 29 76.00 Project Invoicing		$7,000	$760	$0	$0	$0	$0		$8,200
	01 31 13.00 Project Management		$30,000	$3,000	$0	$0	$0	$0		$33,000
	01 31 19.00 Project Meetings		$7,400	$740	$0	$0	$0	$0		$8,140
	01 32 13.00 Project Scheduling		$14,800	$1,480	$0	$0	$0	$0		$16,280
	01 51 13.02 Temp Electricity		$11,100	$1,110	$0	$0	$0	$0		$12,210
	01 51 36.02 Temp Water Service		$1,500	$150	$0	$0	$0	$0		$1,650
	01 51 40.02 Tool Equipment Rental		$112,600	$11,260	$0	$0	$0	$0		$123,860
	01 52 19.02 Sanitary Facilities		$3,000	$300	$0	$0	$0	$0		$3,300
	01 55 26.02 Traffic Control		$4,400	$440	$0	$0	$0	$0		$4,840
	01 56 26.02 Temporary Fencing		$7,400	$740	$0	$0	$0	$0		$8,140
	01 57 16.02 Temporary Pest Control		$1,500	$150	$0	$0	$0	$0		$1,650
	01 73 00.00 Site Supervision		$45,200	$4,520	$0	$0	$0	$0		$49,720
	01 74 16.00 Site Maintenance		$14,800	$1,480	$0	$0	$0	$0		$16,280
	01 74 19.02 Waste Disposal		$22,200	$2,220	$0	$0	$0	$0		$24,420
	01 74 23.02 Final Clean		$14,800	$1,480	$0	$0	$0	$0		$16,280
	01 78 13.00 Punch List		$22,200	$2,220	$0	$0	$0	$0		$24,420
	Division 2 Sitework									
	02 22 00.02 Demolition		$0	$0	$0	$0	$0	$0		$0
	Division 3 Concrete									
	03 30 00.02 Cast-in-place Concrete MH		$0	$0	$132,038	$26,408	$0	$0		$158,456
	03 30 00.02 Cast-in-place Concrete Sub		$10,000	$1,000	$0	$0	$132,038	$19,806		$162,800
	Division 4 Masonry									
	04 21 13.02 Brick Masonry Repair		$0	$0	$0	$0	$50,000	$7,500		$57,500
	Division 6 Wood & Plastics									
	06 43 10.01 Millwork MH	$727.00	$0	$0	$40,000	$8,000	$0	$0		$48,000
	06 43 10.02 Millwork Sub	$1,560.00	$500	$50	$0	$0	$290,160	$43,524		$334,235
	Division 7 Thermal & Moisture Protection									
	07 14 00.02 Fluid-Applied Dampproofing Sub		$1,000	$100	$0	$0	$13,800	$2,100		$17,000
	07 21 13.01 Insulation MH (included in 07 21 13.02)		$0	$0	$0	$0	$0	$0		$0
	07 21 13.02 Insulation Sub	$2.30	$0	$0	$0	$0	$3,000	$450		$3,500
	07 27 00.01 Air Barrier MH		$0	$0	$10,000	$2,000	$0	$0		$12,000
	07 27 00.02 Air Barrier Sub (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0		$0
	07 27 26.01 Fluid-Applied Membrane and Vapor Barriers Sub (includes MH)	$7.00	$0	$0	$0	$0	$269,827	$40,474		$310,300
	07 42 63.01 Fabricated Wall Panel Assemblies	$44.52	$0	$0	$2,520,990	$0	$0	$0		$2,521,000
	07 54 23.02 TPO Roofing Membrane Sub	$15.00	$0	$0	$0	$0	$180,000	$27,000	$207,000	
	Division 8 Doors, Window & Interiors									
	08 14 10.01 Exterior Doors MH (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0		$0
	08 14 10.02 Exterior Doors Sub (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0		$0
	08 41 13.00 Glazing Demo	$272.00	$0	$0	$0	$0	$50,592	$7,589		$58,200
	08 50 00.01 Windows MH (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0		$0
	08 50 00.02 Window Sub (included in 07 42 63.01)		$0	$0	$0	$0	$0	$0		$0
	Fire Stopping at Windows &B	$300.00	$0	$0	$0	$0	$53,808	$8,370		$64,200
	Division 9 Finishes									
	09 91 23.02 Interior Paint Sub (included in 09 21 00.02)		$1,000	$100	$0	$0	$20,000	$3,000		$24,100
	Division 22 Plumbing									
	22 00 00.00 Plumbing Demolition (included in 22 00 00.02)		$0	$0	$0	$0	$0	$0		$0
	22 00 00.01 Plumbing MH (included in 22 00 00.02)		$0	$0	$0	$0	$0	$0		$0
	22 00 00.02 Plumbing Sub	$25.00	$5,000	$500	$0	$0	$1,851,600	$277,700		$2,134,800
	Division 23 HVAC									
	VRF with Heat Recovery (60 tons) Branch controllers, Wall hung FCUs		$10,000	$1,000	$0	$0	$0	$0		$3,575,200

A	B	C	D	E	F	G	H	I	J
ITEM	DESCRIPTION OF WORK	Unit Price Estimate	Direct Cost	Markup	Material Cost	Material Markup	Sub Contractor	Sub Con. Markup	Pre-DER Costs	Total
	Division 23 HVAC									
	VRF with Heat Recovery (60 tons) Branch controllers, Wall hung FCUs		$10,000	$1,000	$0	$0	$0	$0		$3,575,200
	Division 26 Electrical									
	26 00 00.00 Electrical Demolition (included in 26 00 00.02)		$0	$0	$0	$0	$0	$0		$0
	26 00 00.01 Electrical MH (included in 26 00 00.02)		$0	$0	$0	$0	$0	$0		$0
	26 00 00.02 Electrical Subs (Unit Panels Upgrades)								$1,200,000	
	26 50 00.02 Electrical Sub (Switchgear and service upgrade)		$10,000	$1,000	$0	$0	$1,800,000	$270,000	$2,081,000	
	26 50 00.01 Lighting Fixtures MH		$1,000	$100	$8,000	$1,088	$0	$0		$10,200
	48 14 00 Solar Energy Electrical Power Generation Equipment Sub	$4 per W	$5,000	$500	$0	$0	$271,800	$40,800		$318,100
	Division 32 Exterior Improvements									
	32 10 00.02 Paving Sub		$0	$0	$0	$0	$3,450	$518		$4,000
	32 16 23.02 Sidewalk Sub		$0	$0	$0	$0	$5,300	$795		$6,100
	32 90 00.02 Landscape Sub		$1,000	$100	$0	$0	$0	$0		$0

Total with HVAC	**$10,971,000**
Cost by Unit	**$86,386**
SQFT cost by GSF	**$148**
SQFT cost by GSF of Envelope	**$281**



LESSONS LEARNED……so far

1. Most panelized manufacturers are very new to this space of Deep Exterior Energy Retrofits, so, many are not yet prepared for scaling up.
2. Many panelized manufacturers are not vertically integrated between the factory and the site installation, and so we are getting a wide range of installation costs. Need to work toward more vertically integrated solutions.
3. Pipelines matter. Several manufacturers became interested only when we could demonstrate to them that there was a pipeline of work which was at a scale that justified their R+D and attention.
4. None of our projects have established budgets so we are designing these strategies in a vacuum. This is not sustainable. While each building is unique, with unique climates, unique labor costs, etc, we need to establish a range of baseline costs that can guide all Solution Providers, Building Owners and Manufacturers.
5. Along with a lack of baseline budget information that has all DERs make sense financially, we also have no replicable strategy to finance these projects. We need a replicable financing strategy for DERs.
6. Have not even begun to think about a Solution Provider offering a GUARANTEE on energy consumption/maintenance as was done with Energiesprong. Need to understand how this could be possible.