Exemplary Building Pre-Construction Energy Study Findings

North Lot, Building A
October 10, 2022

Four Affordable Housing Exemplary Building Demonstration Projects

Higher-than-Normal Seattle City Light Energy Conservation Funding

Purpose: Bring Down the Cost of High Efficiency by Sharing What Is Learned

Project Eligibility Criteria

Permitted under the 2015 SEC.
At least 40% lower kWh/year than code.

Share Lessons Learned.
Enrolled with HDC.
All Electric.

Target City Light Funding

$25,000 for pre-construction EE study.
Up to **$4,000** per Living Unit for EE.

($1,400 per kW PV REC purchases – Shari Weir @ SCL.)

Pre-Con Energy Modeling

% Savings vs. 2015 SEC.
Payback for design decisions.
Comfort maintainability & reliability.
Written & oral presentations.

Compare Model -> The Building

After fully commissioned & occupied

up to $3,500 per living unit.

Compare Model -> Actual Consumption

After one year of occupancy

up to $500 per living unit.

Participants

Hobson Place (DESC);
Sawara (SHA);
Othello (HomeSight);
North Lot (SCIDPDA)

EBP Goals

The purpose of these demonstration projects is to reduce future costs of high efficiency affordable housing by sharing detailed information about some “exemplary” new buildings.

HOUSING DEVELOPMENT consortium

Seattle

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EBP Energy Targets

Achieve one of these Energy Targets

- ≤ 20 Energy Use Intensity (EUI)
- 40% less annual energy than SEC

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North Lot Project Background

Site Location

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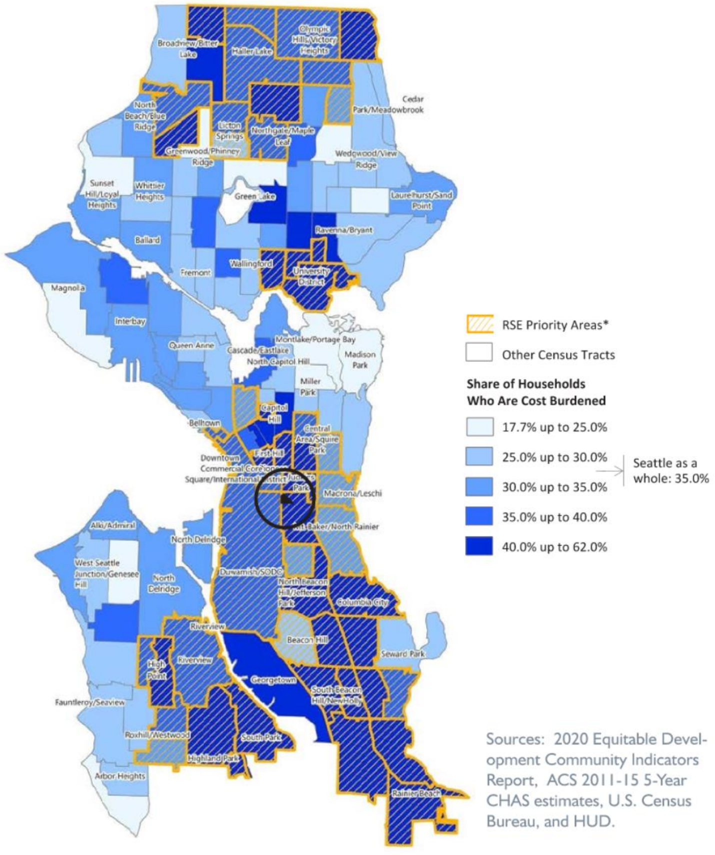
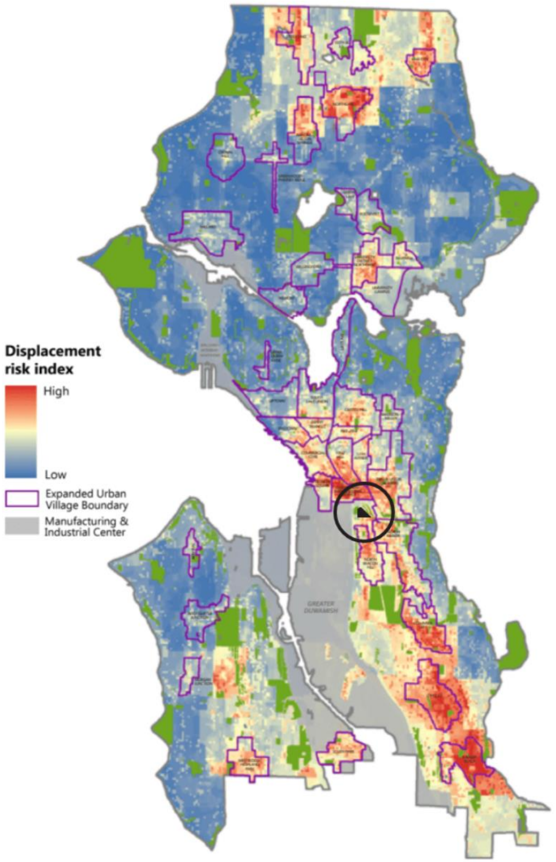
Affordable Housing Crisis + Climate Crisis = Equity Crisis



Sources: 2020 Equitable Development Community Indicators Report, ACS 2011-15 5-Year CHAS estimates, U.S. Census Bureau, and HUD.

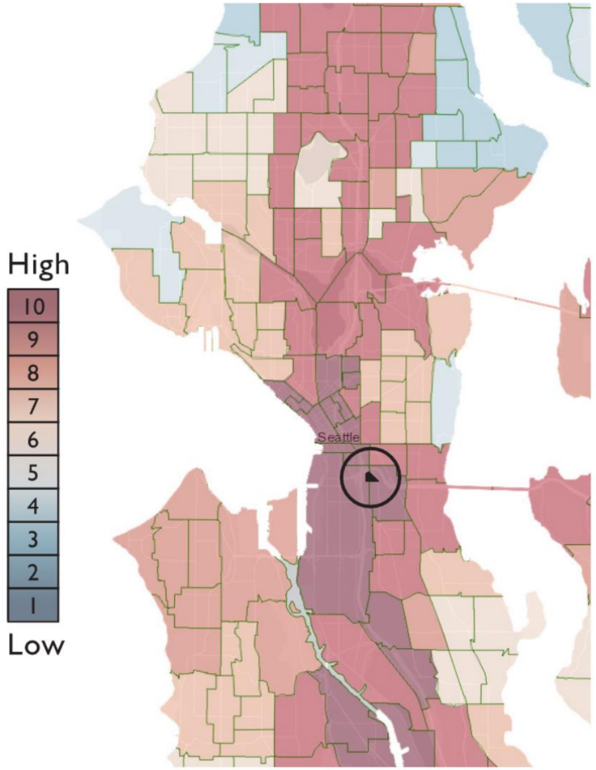
COST-BURDENED

A HOUSEHOLD IS CONSIDERED TO BE COST-BURDENED IF IT SPENDS >30% OF INCOME ON HOUSING



DISPLACEMENT RISK

INDEX INCLUDES FACTORS THAT INCREASE RISK OF MARGINALIZED POPULATIONS BEING DISPLACED



ENVIRONMENTAL EXPOSURES

INCLUDES NOXIOUS DIESEL EMISSIONS, OZONE, PROXIMITY TO HEAVY TRAFFIC, TOXIC RELEASES FROM FACILITIES

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Project Description

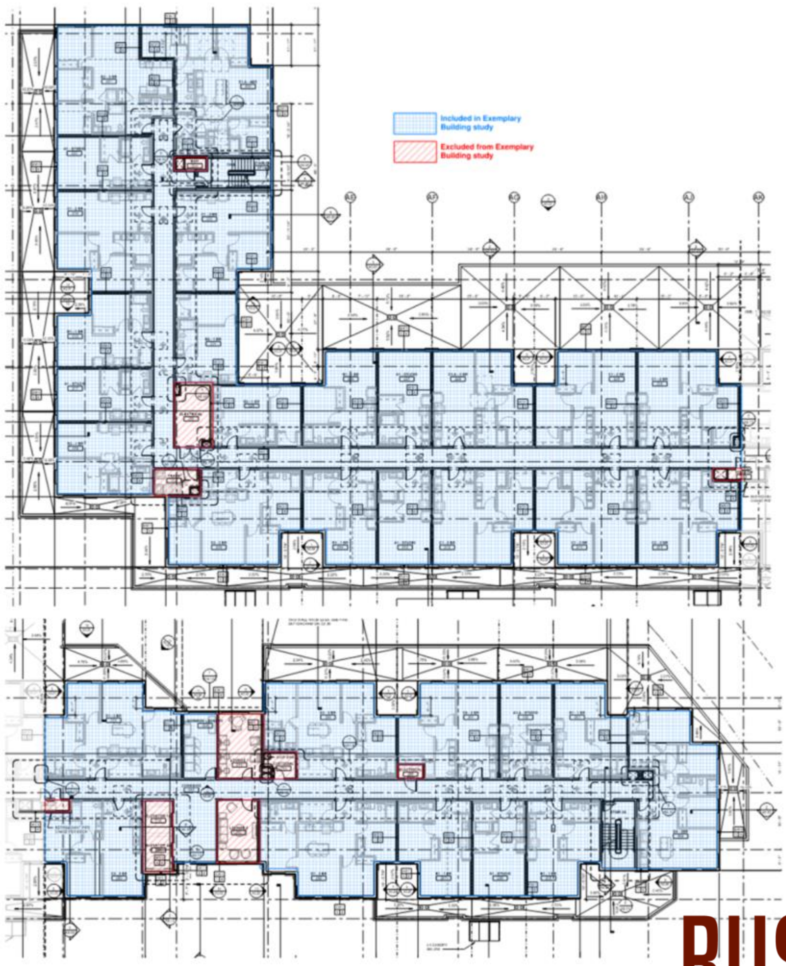
- 6-story above grade multifamily building
- 5 levels of multifamily apartments totaling 160 units
- 1 level with an adult care center and childcare center
- 1 level of partially below grade accessory parking

Areas Included in Energy Study

- The exemplary building scope of this project includes 160 dwelling units ranging from studios to 3-bedroom units, shared laundry facilities, stairs, and corridors.
- Only the building areas directly supporting the residents living functions are included in the scope of this study.

Building Area	Total Square Ft
Dwelling Unit	114,836
Corridor	15,433
Laundry	1,106
Stairs	1,925
Total Included Square Footage	133,300

Level 2



Energy Conservation Measures (ECMs)

ECM ID and Description	Proposed Design	Baseline
ECM-1 Energy Star Appliances	Energy Star Appliances in dwellings	Standard efficiency appliances
ECM-2 Low-Flow Plumbing Fixtures	Low-flow plumbing fixtures	Standard flow plumbing fixtures
ECM-3 High Efficiency Lighting Design	Common area 25% LPD reduction and in-unit 70 lumens/Watt hard wired fixtures	Common area 25% LPD reduction and in-unit 60 lumens/Watt hard wired fixtures
ECM-4 Envelope Design	High performance envelope and ultra-low air infiltration (0.17 cfm/sf)	Prescriptive envelope and reduced air infiltration (0.25 cfm/sf)
ECM-5 Rooftop ERV Heat Pump	Rooftop heat pump with Energy Recovery	Rooftop heat pump without Energy Recovery
ECM-6 Heat Pump Water Heaters (HPWHs)	HPWH central DHW loop	Electric heater central DHW loop
ECM-7 Dwelling unit ERVs	In-unit ERVs providing ventilation	Whole house fans + trickle vents
ECM-8 Recirculation HPWHs	HPWH serving temperature maintenance loop	Electric heater temperature maintenance loop
ECM-9 In-Unit Heat Pump Dryers*	In-unit heat pump dryers	Electric vented dryer
ECM-10 Shared Laundry Heat Pump Dryers*	Commercial heat pump dryers in shared laundry rooms	Electric vented dryers in shared laundry rooms

* Studied but not included in design

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ECM Savings and Payback

ECM ID and Description	EB EUI (kBtu / sf-yr)	Maintenance Costs ($)	EB Energy Savings ($)	Incremental Total Cost with Markups vs. Baseline ($)	Simple Payback (Years)
ECM-1 Energy Star Appliances	39.5	n/a	$3,200	$18,933	5.9
ECM-2 Low-Flow Plumbing Fixtures	37.1	n/a	$8,471	$0	0.0
ECM-3 High Efficiency Lighting Design	37.0	n/a	$326	$0	0.0
ECM-4 Envelope Design	34.9	n/a	$10,342	$387,351	37.5
ECM-5 Rooftop ERV Heat Pump	33.9	$4,500	$3,761	$25,322	6.7
ECM-6 Heat Pump Water Heaters (HPWHs)	27.1	$16,000	$24,512	$543,130	22.2
ECM-7 Dwelling unit ERVs	21.6	$80,000 ($500/unit)	$23,909	$529,522	22.1
ECM-8 Recirculation HPWHs	19.7	Included in ECM-6	$6,589	$31,949	4.8
All ECMs Combined	19.7	$100,500	$81,110	$1,536,207	18.9
ECM-9 In-Unit Heat Pump Dryers*	19.6	$3,000 ($150/unit)	$502	$27,900	65.8
ECM-10 Shared Laundry Heat Pump Dryers*	19.5	$1,500 ($150/unit)	$534	$40,000	88.6

* Studied but not included in design

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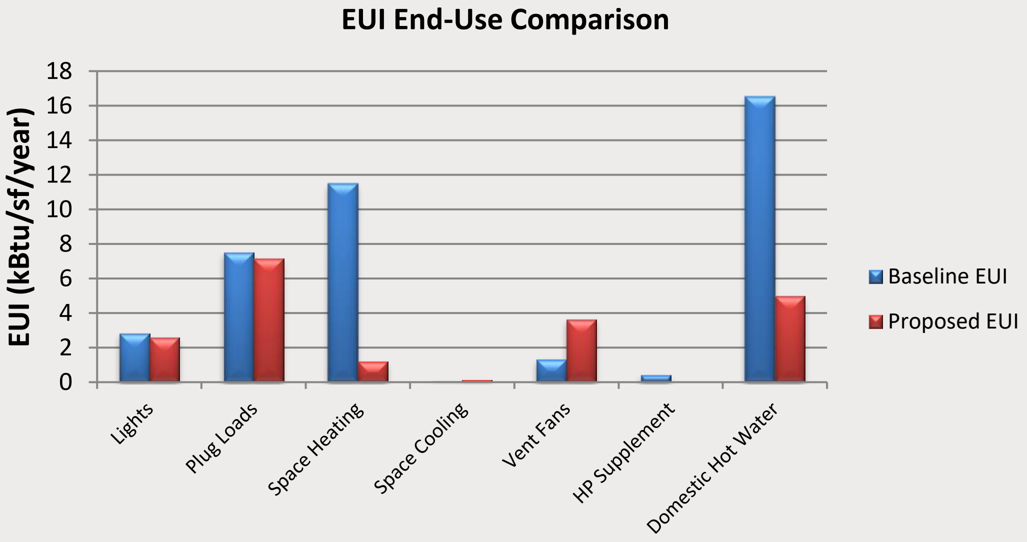
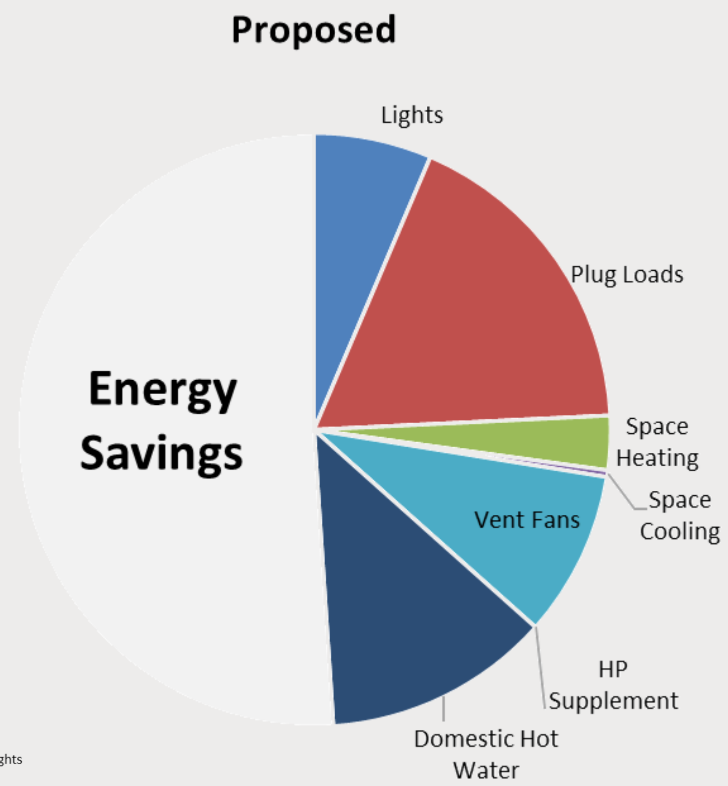
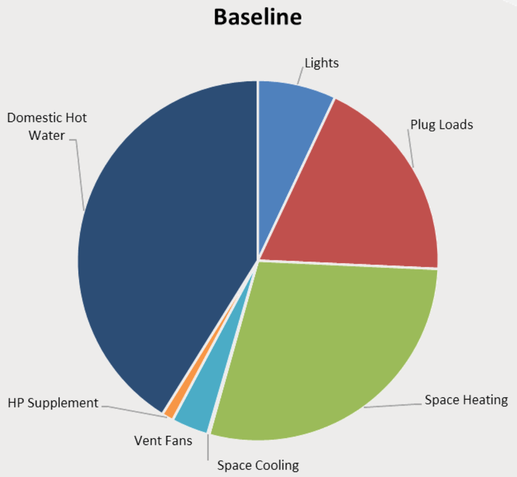
Energy Study Results

	Lights	Plug Loads	Space Heating	Space Cooling	Vent Fans	HP Supp.	DHW	Total
Baseline EUI	2.8	7.5	11.5	0.1	1.3	0.4	16.5	40.2
Proposed EUI	2.6	7.1	1.2	0.1	3.6	0.0	5.0	19.7







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ECM Savings by End-Use

		Lights	Plug Loads	Space Heating	Space Cooling	Vent Fans	HP Supp.	DHW	Total
Baseline		--	--	--	--	--	--	--	--
ECM-1	Energy Star Appliances	0.0	0.4	-0.2	0.0	0.0	0.0	0.6	0.7
ECM-2	Low-Flow Plumbing Fixtures	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.3
ECM-3	High Efficacy Lighting Design	0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.1
ECM-4	Envelope Design	0.0	0.0	2.2	0.0	0.0	0.0	0.0	2.2
ECM-5	Rooftop ERV Heat Pump	0.0	0.0	0.6	0.0	0.0	0.4	0.0	1.0
ECM-6	Central HPWHs	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7
ECM-7	Dwelling unit ERVs	0.0	0.0	7.8	0.0	-2.3	0.0	0.0	5.5
ECM-8	Temperature Maintenance HPWHs	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9
Proposed Model EUI Reduction		**0.2**	**0.4**	**10.3**	**-0.1**	**-2.3**	**0.4**	**11.6**	**20.5**

ECM-9*	In-Unit Heat Pump Dryers	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1
ECM-10*	Shared Laundry Heat Pump Dryers	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1

* Studied but not included in design

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Other Impacts/Considerations of ECMs

ECM ID	ECM Name	Indoor Air Quality	Thermal Comfort	Usability	Durability	Reliability	Acoustics	Ease of Maintenance
ECM-1	**Energy Star Appliances**	NA	NA	NA	NA	NA	NA	NA
ECM-2	**Low-Flow Plumbing Fixtures**	NA	NA	NA	NA	NA	NA	NA
ECM-3	**High Efficacy Lighting Design**	NA	NA	NA	NA	NA	NA	NA
ECM-4	**Envelope Design**			NA				NA
ECM-5	**Rooftop ERV Heat Pump**			NA				
ECM-6	**Central HPWHs**	NA	NA	NA		NA		
ECM-7	**Dwelling unit ERVs**				NA		NA	
ECM-8	**Temperature Maintenance HPWHs**	NA	NA	NA		NA		
ECM-9	**In Unit Heat Pump Dryers**				NA	NA		
ECM-10	**Shared Laundry Heat Pump Dryers**				NA	NA		

Project Lessons & Challenges

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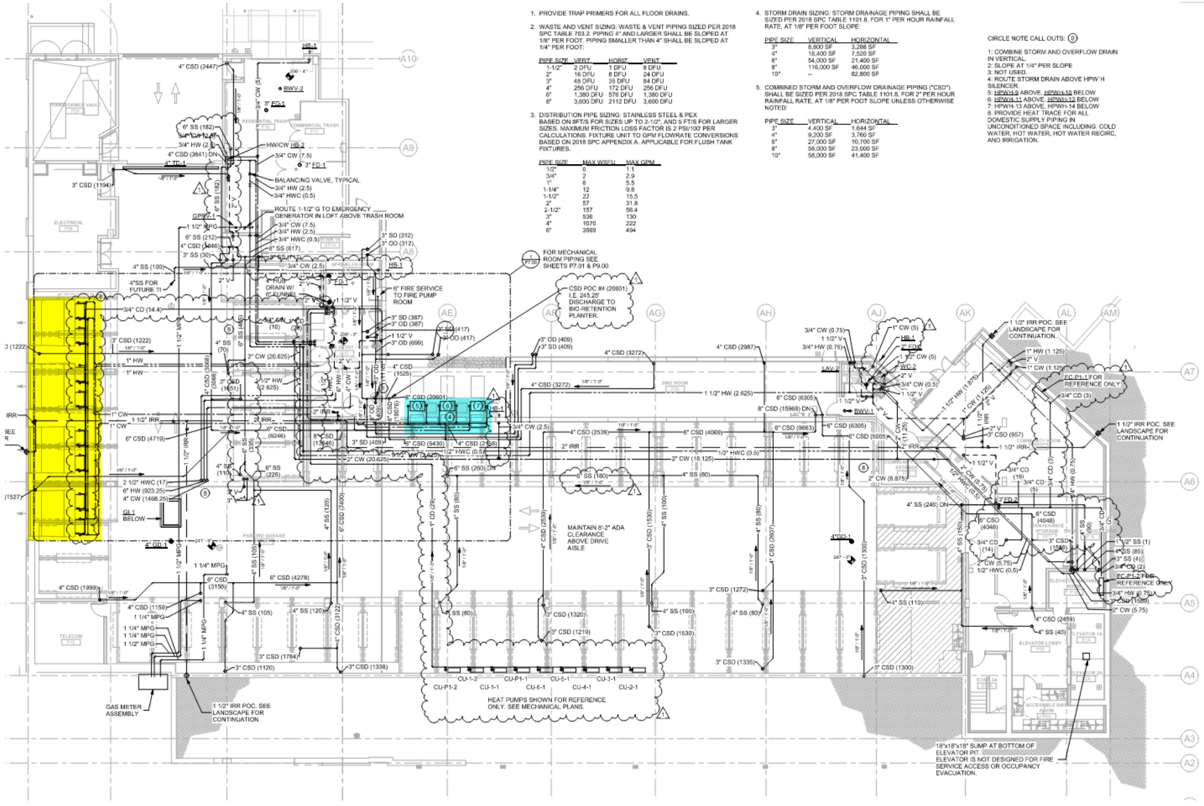
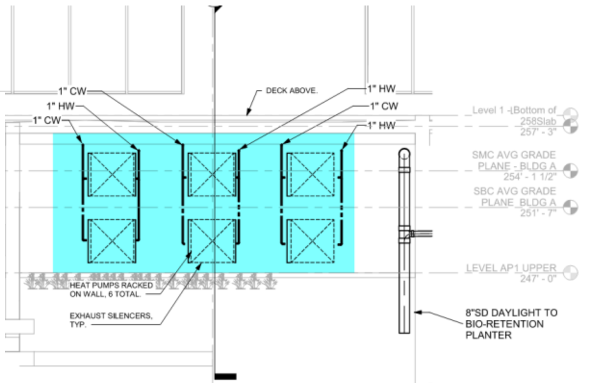
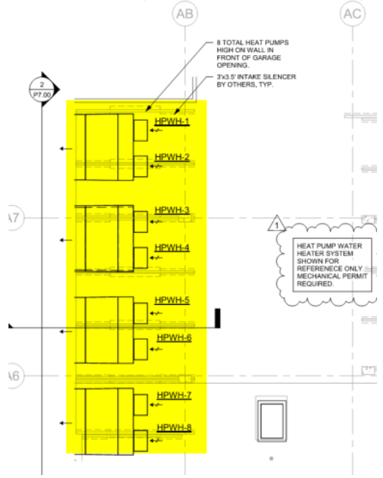
HPWH Location Considerations

- Final layout:
  - 8 units mounted high on wall in garage
  - 6 units mounted at courtyard







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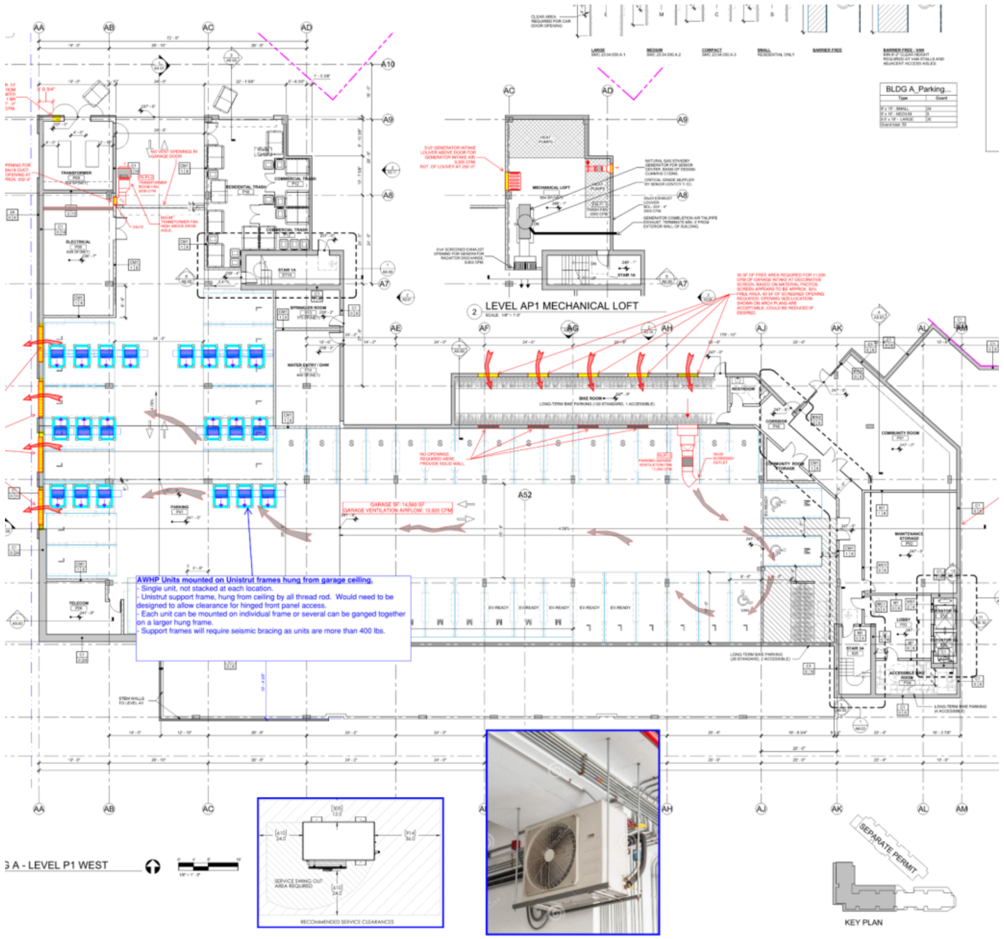
HPWH Location Considerations

- Studied option to mount units on frames hung from the ceiling



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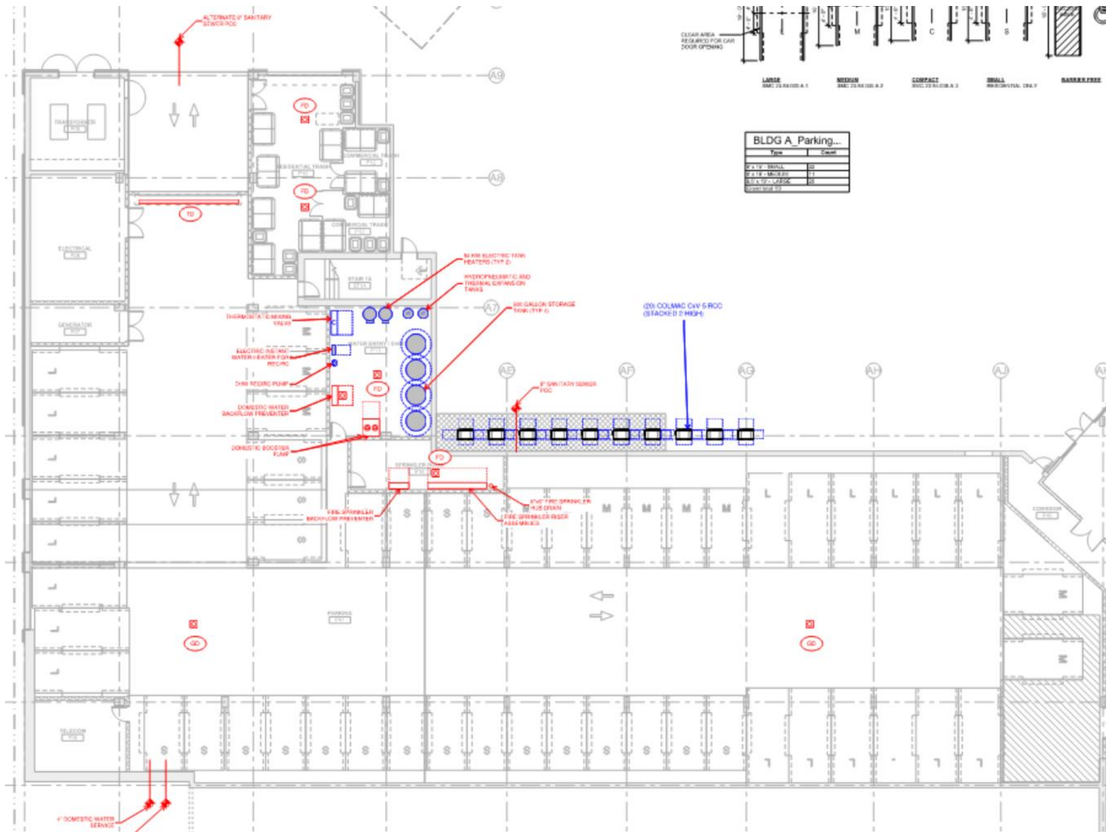
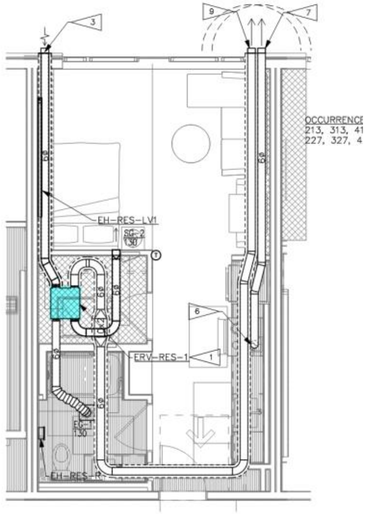
HPWH Location Considerations

- Studied option to locate all units outdoor in the courtyard

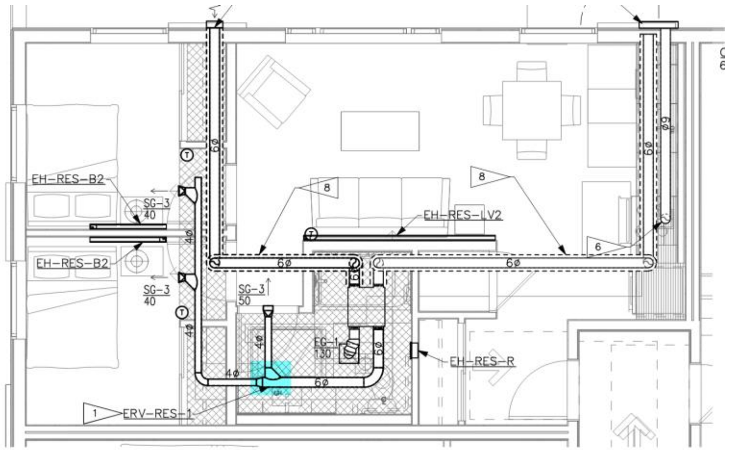


In-Unit ERV Challenges

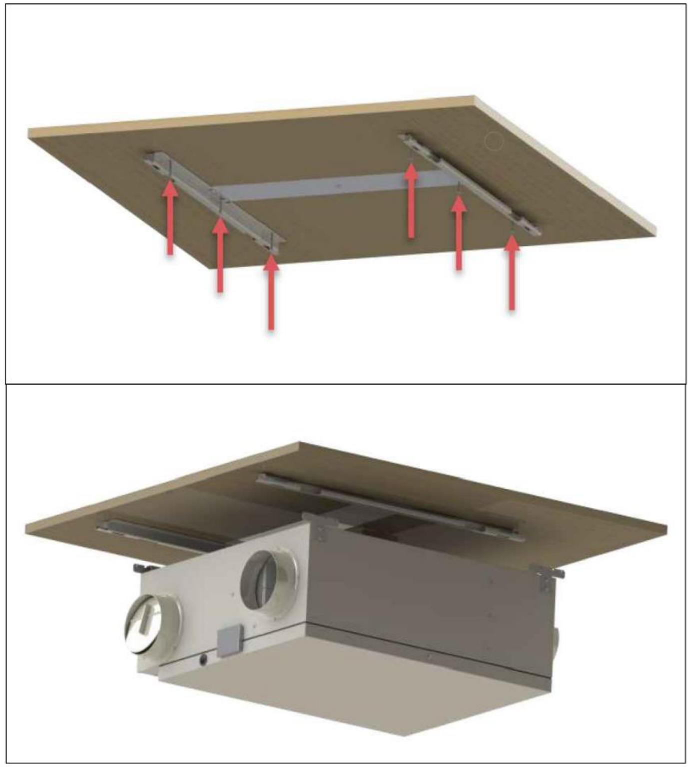
- ERVs located above bathrooms
- Switch from Panasonic to Aldes model due to warranty issues



ENLARGED PLAN – STUDIO A1
SCALE: 1/4" = 1'-0"
1 / M5.00



ENLARGED PLAN – 2-BED C5
SCALE: 1/4" = 1'-0"
4 / M5.02



NOTES:
1. INSTALL USING APPROVED ALDES ERV INSTALLATION BRACKET (PART #609622) PER UNIT INSTALLATION MANUAL.
2. ADDITIONAL REQUIRED PARTS:
   - 2.1. (8x) 609013 – 8-18 x ⅜ SCREW
   - 2.2. (7x) 609012 – #8 x 1-1/2 SCREW
   - 2.3. (4x) 6309040 – TIE WRAP

RESIDENTIAL ERV MOUNTING DETAIL 2 (ALDES INSPIRAIR E130)
DETAIL
SCALE: NONE
6 / M4.01

Other Questions?

- Were there any EB specs/recommendations that were adopt by the project that you think need to be revised?
- What were the driving reasons for type of balanced ventilation system that was selected (centralized vs unitized), and any recommendations for future teams to consider?
- Were there any specific design strategies used to reduce hot water distribution losses?
- Can you provide a general sense of how much better (or worse) the North Lot design is from a new multifamily building designed to 2018 SEC?

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