

An architectural rendering of a modern multi-story building entrance. The building features a mix of brick, concrete, and large glass windows. A central courtyard area is visible with a staircase and lush greenery. In the foreground, a paved plaza has a few people walking and a yellow bicycle parked near a tree. A red door with the number '995' is visible on the right side of the building.

Grid Decarbonization and Resilience at Roosevelt Village

995 East Santa Clara

September 28, 2023
Greenbuild



ID

GOUGH

Gough

Fulton

SPCM



**We design thoughtful places that
allow communities to thrive and
serve as a ‘multiplier of good’**

An aerial view of a city street, likely in San Francisco, showing modern multi-story buildings on both sides. In the distance, the California State Capitol building is visible. The street is busy with cars and has a crosswalk. A street sign for 'Fulton' is visible on the right side. The text is overlaid on the image.

40 years

53 people in 3 offices: SF, OAK, BHM

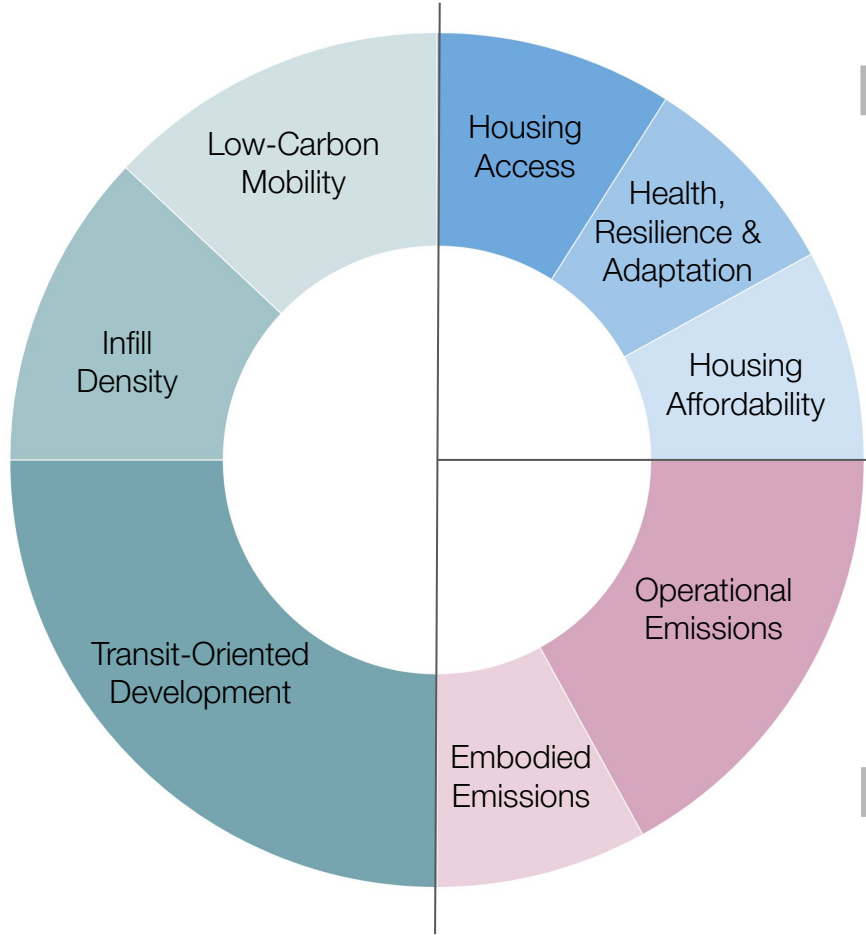
450+ awards

13,000+ homes built

7,000+ affordable homes

Context | Housing & Decarbonization

Site



People

Building



“Better Buildings”



“Secure & Resilient Communities”

Context | IRA Funding for Resilience in Low-Income Communities

1. HUD

Green & Resilient Retrofit Program (GRRP)

Property owners receive grants through 2024

Available Now!

2. Treasury

Investment Tax Credit (ITC)

2x - 3x amount of funding

Direct pay available

Available Now!

3. EPA

GHG Reduction Fund - 3 grant competitions

\$14B National Clean Investment Fund

\$ 6B Clean Communities Investment Accelerator

\$ 7B Solar for All

**Look for funds
Q2 2024**

4. DOE

Equipment & Retrofit Rebate Programs

States and tribes setting up programs now

**Look for funds
Q1 2024**



Case Study

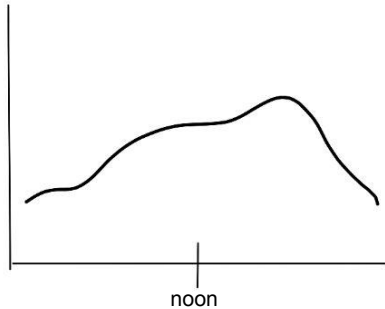
The Villages at Roosevelt

📍 SITE

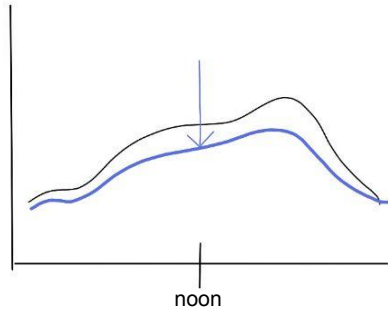
San Jose, California

Grid-Interactive Building Concept

What is the optimum way to combine Efficiency, DERs (PV + battery) and load management strategies?

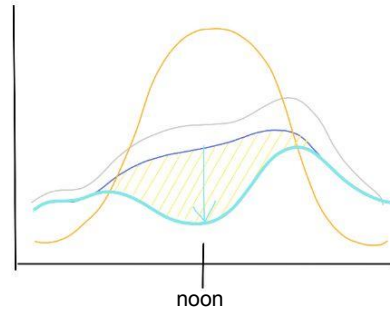


Daily demand



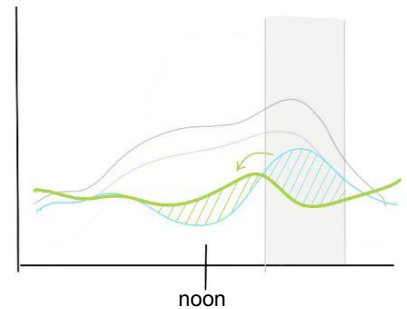
Load reduction

- Efficiency
- Energy recovery



Renewables

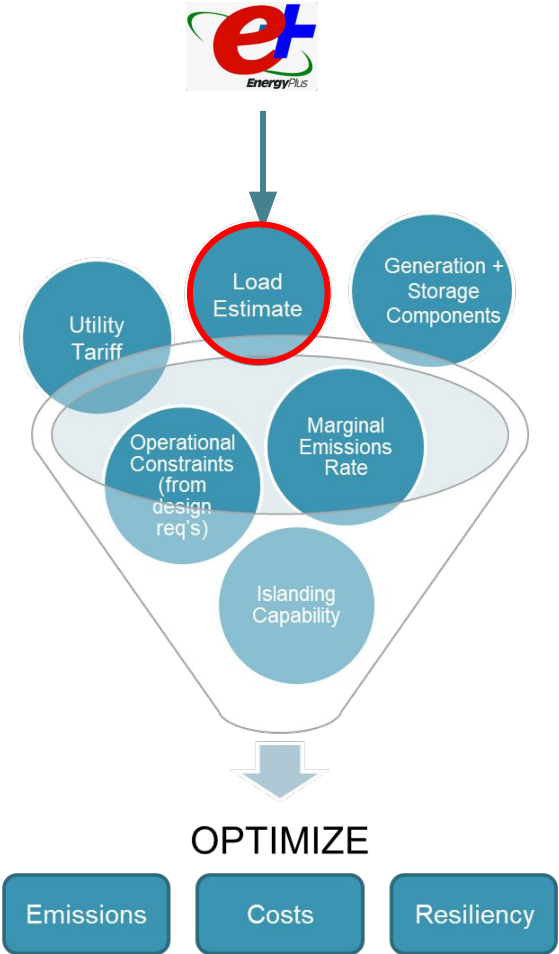
- Rooftop PV



Load shift

- Load management
- Thermal Storage
- Battery Storage

Xendee | Cost & Carbon Optimization

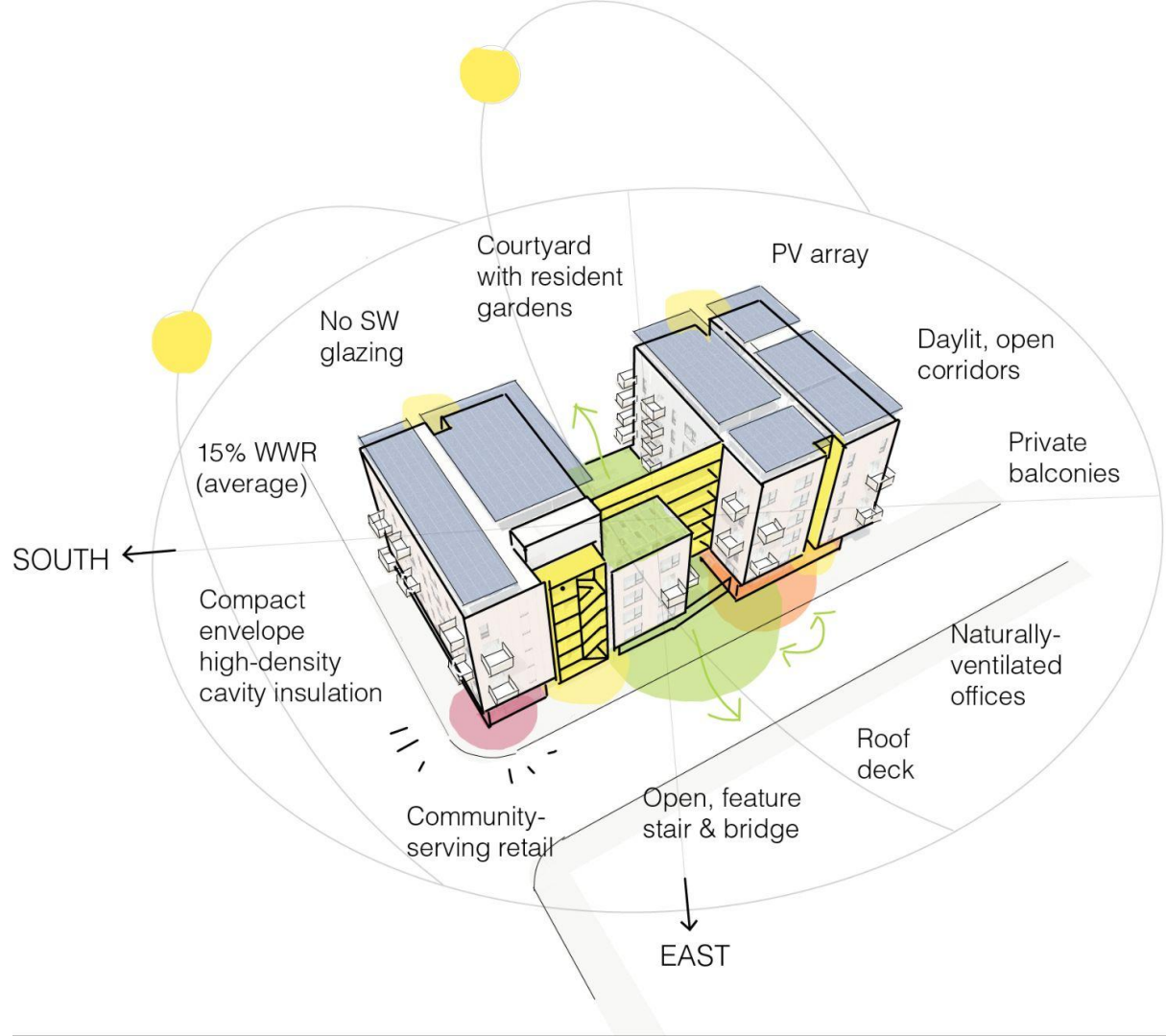


74 Apartments serving formerly homeless and very low income seniors

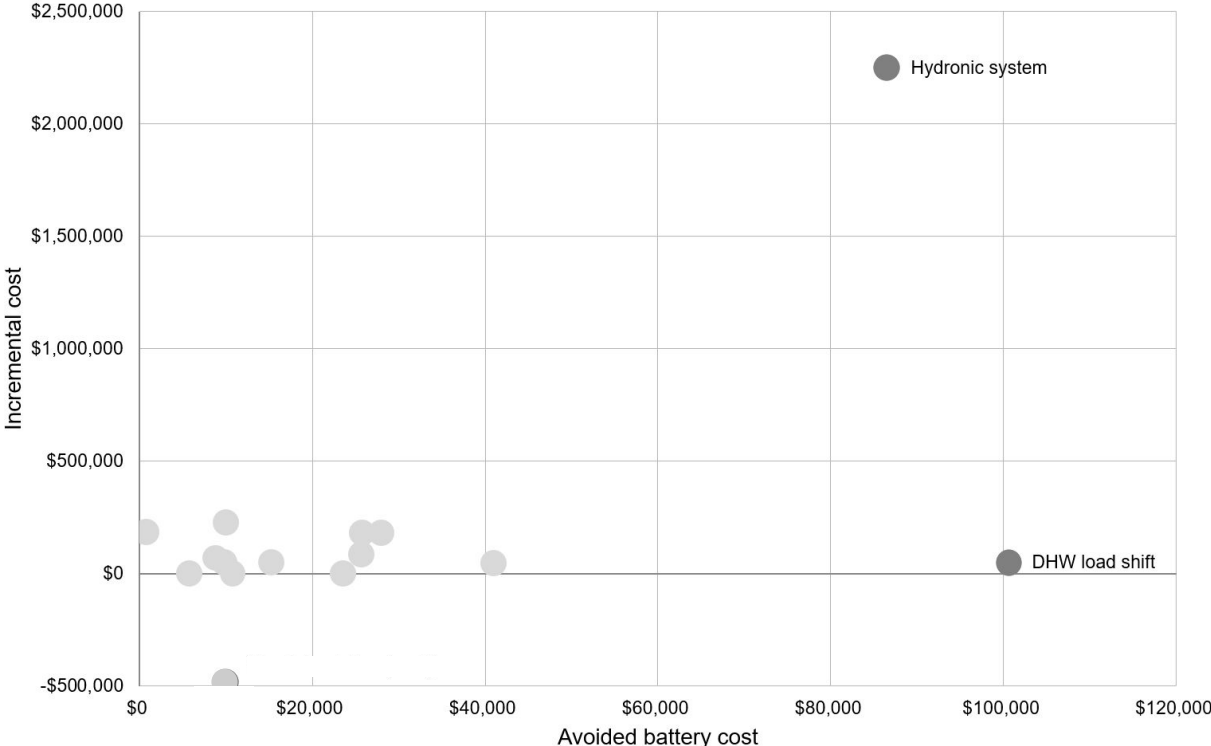
Includes 2 manager's units

6 Stories
Type III / Type I Construction
76,000 SF

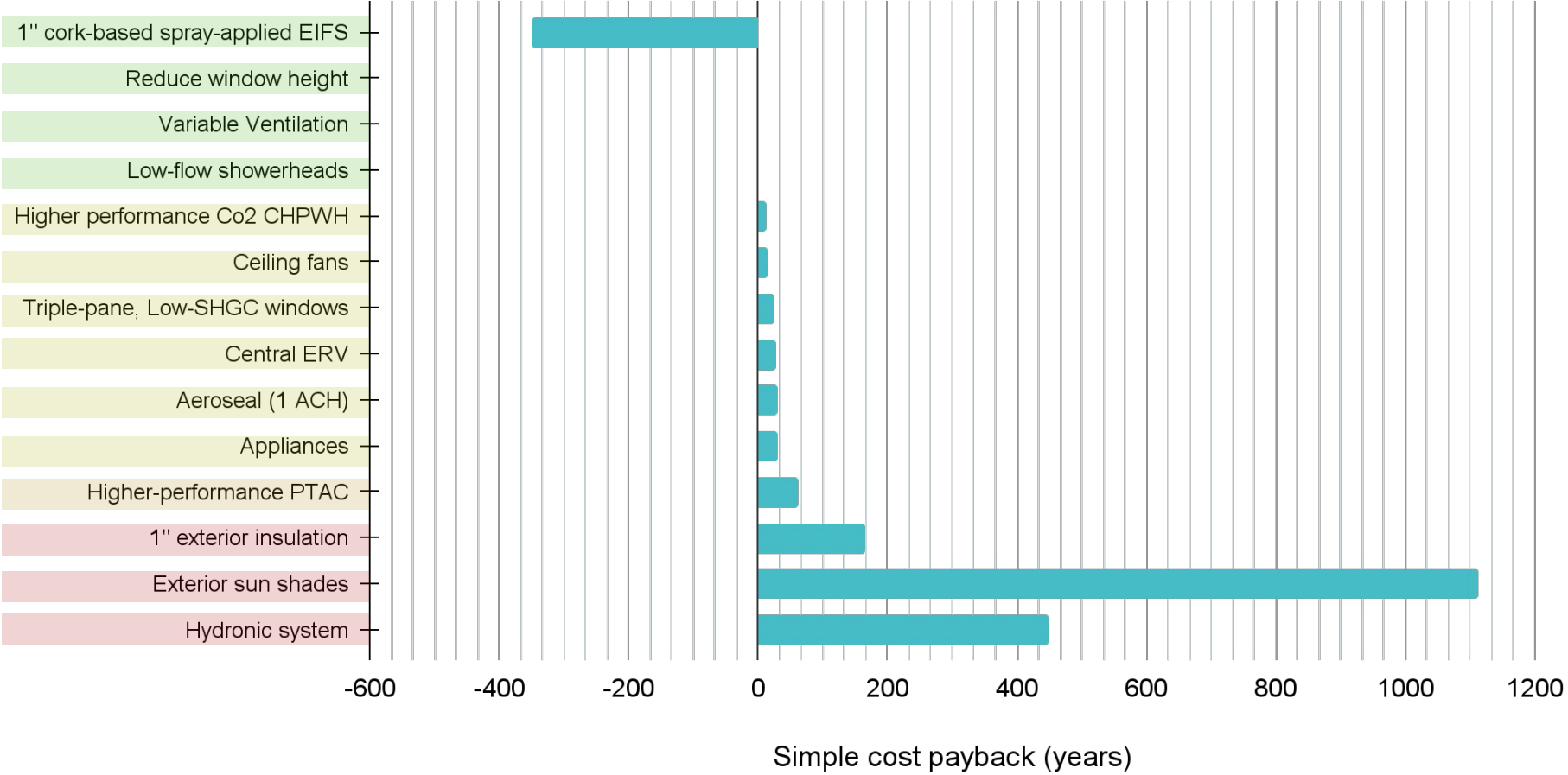
LEED Platinum (goal)



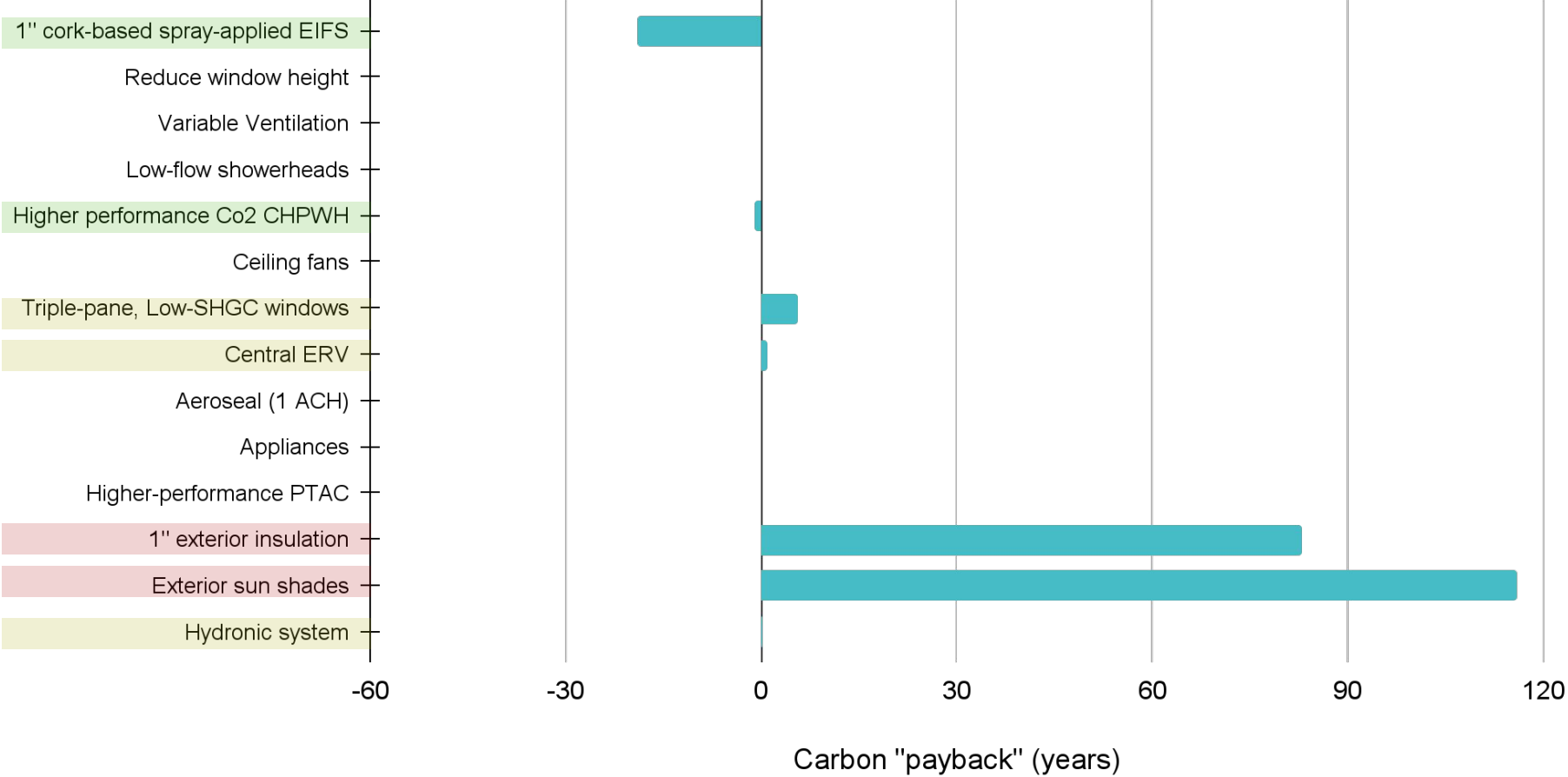
Energy Reduction Measures | Cost effectiveness, peak savings



Energy Reduction Measures | Simple Cost Payback



Energy Reduction Measures | Carbon "Payback"



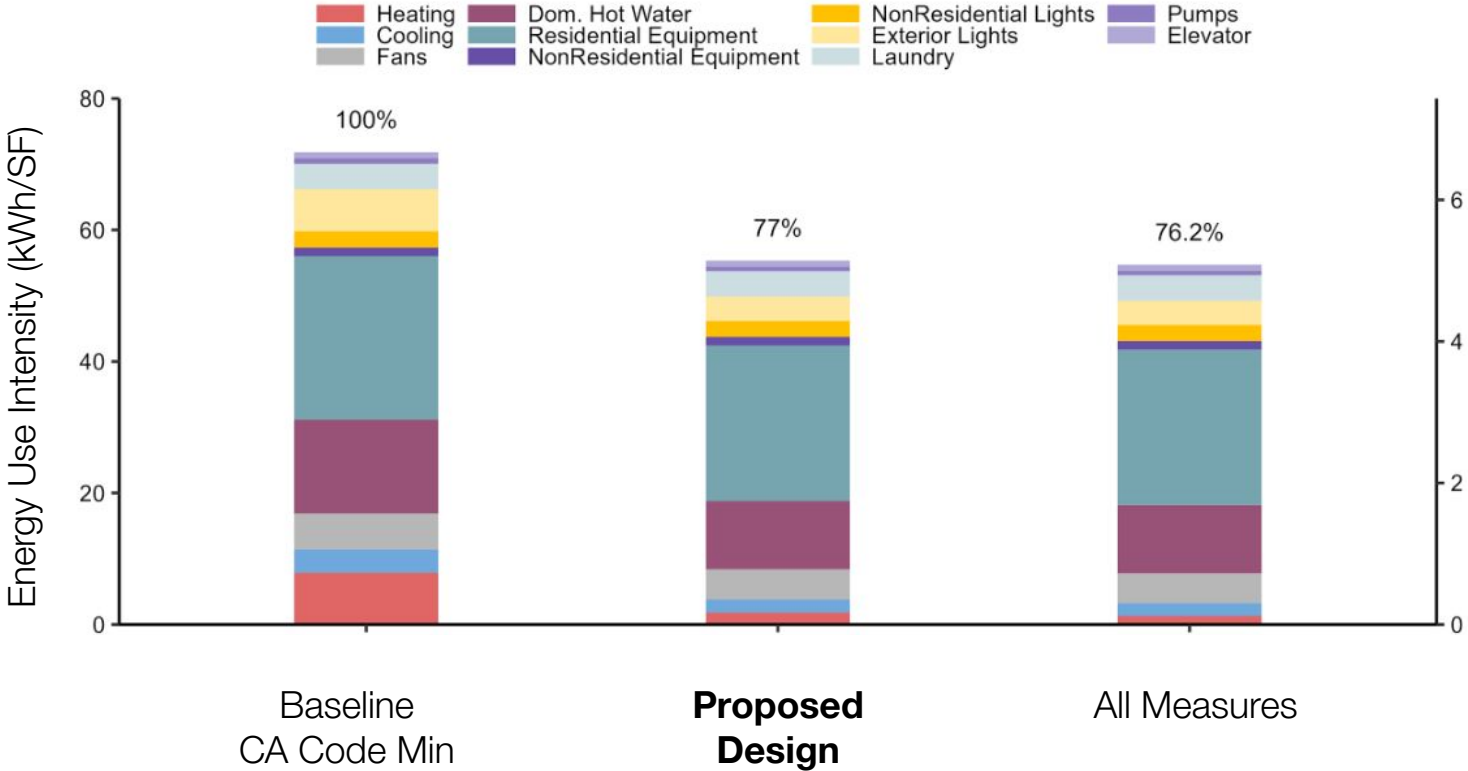
Innovations in exterior insulation



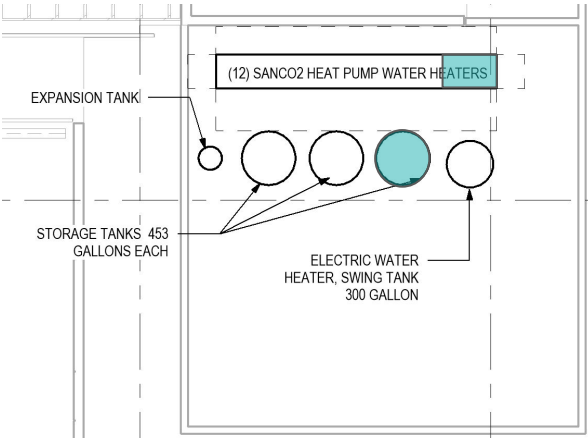
ZIPsystem™
R-SHEATHING



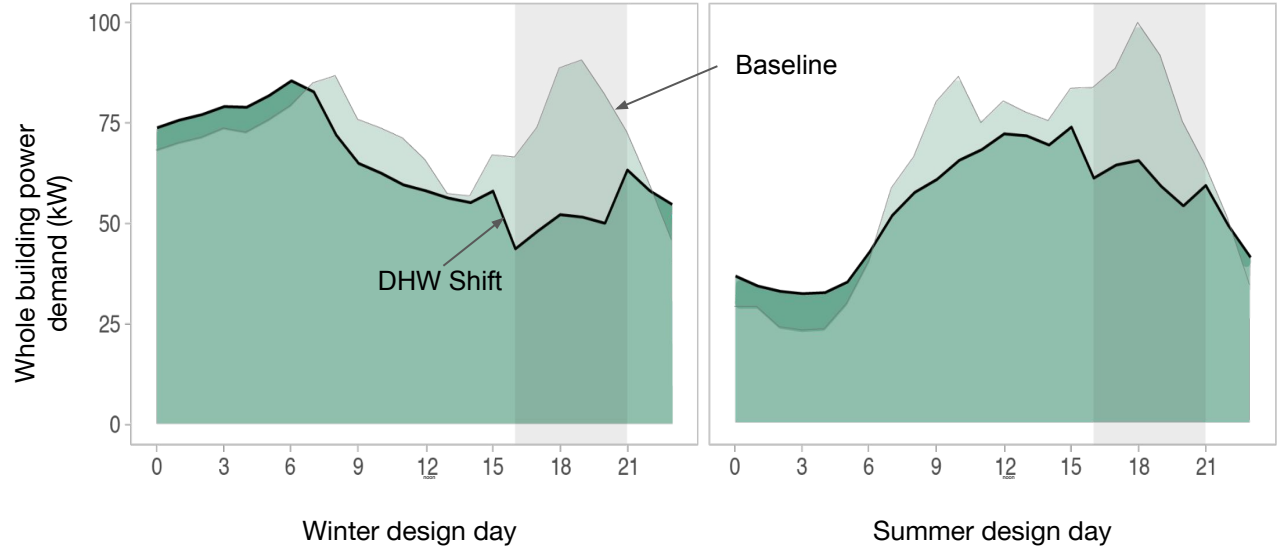
Energy Use Reduction



Domestic Hot Water | Thermal Storage



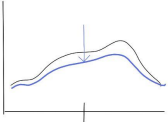
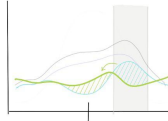
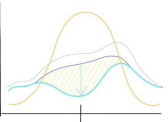
**Central SanCO2
Water Heater**



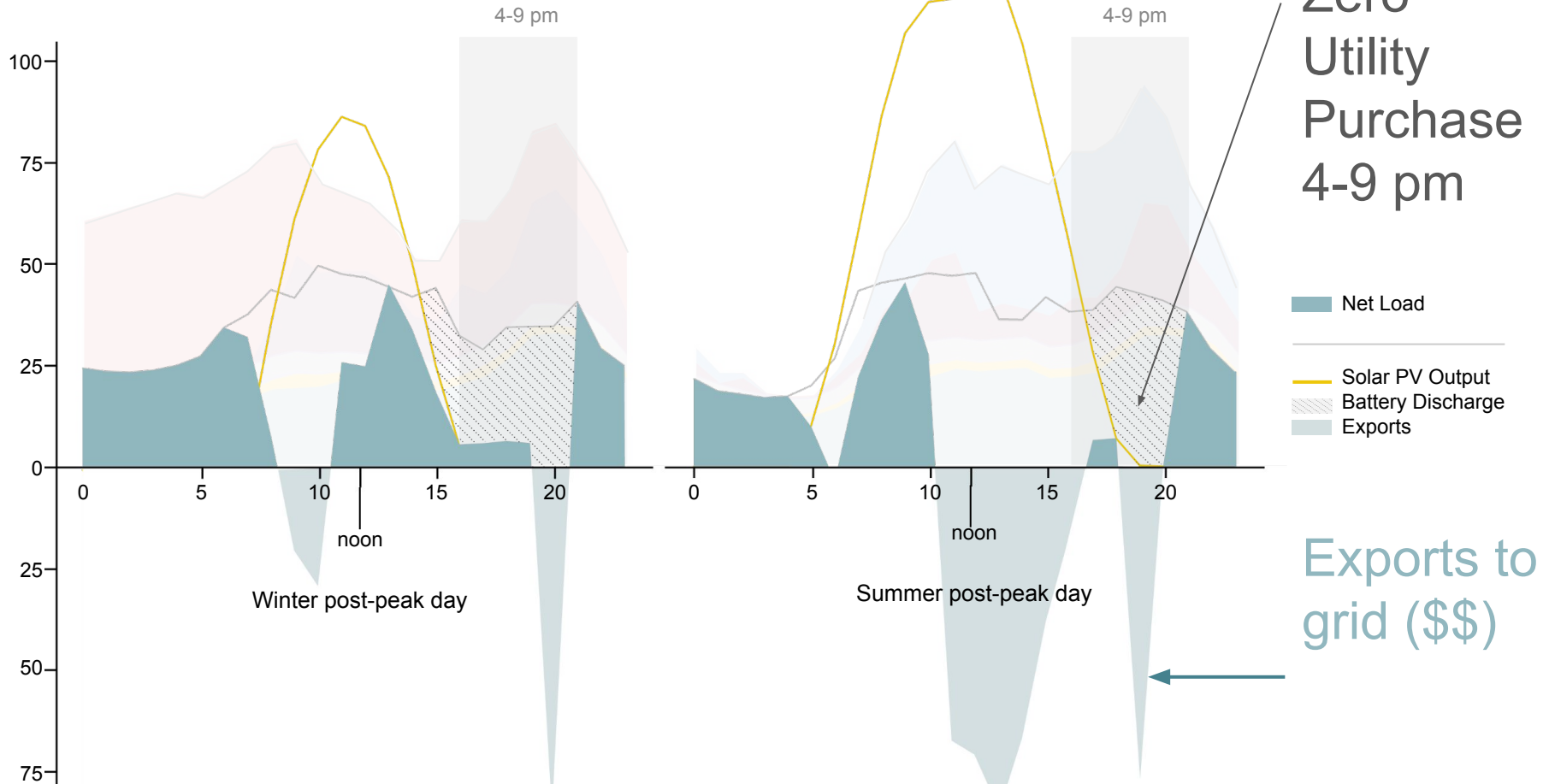
Baseline	Proposed
10 Sanden (2) 453 gal DHW tanks	12 Sanden (3) 453 gal DHW tanks

	Energy Cost Savings	First Cost Premium	Simple Payback (years)	Avoided Battery Cost
DHW Shifting w/ Added Storage	\$ 3,514	\$49,000	14	\$100,600

Load Shift at Roosevelt Village

Strategy	Portion of Annual 4-9pm Load Served	Approximate Incremental cost
	10%	+ \$250,000
Thermal Storage (hot water)	32%	+ \$50,000
	14%	+ ~ \$0
Peak Load Management <ul style="list-style-type: none"> ● Dynamic ventilation control ● Light dimming ● Ohm Connect ● Laundry incentives 		
	38%	+ \$2,000,000
171 kW Solar PV array + 268 kWh Battery Storage		
		\$50,000,000 Approx. Construction Budget

Proposed Design | Net Load with Solar PV & Battery Storage

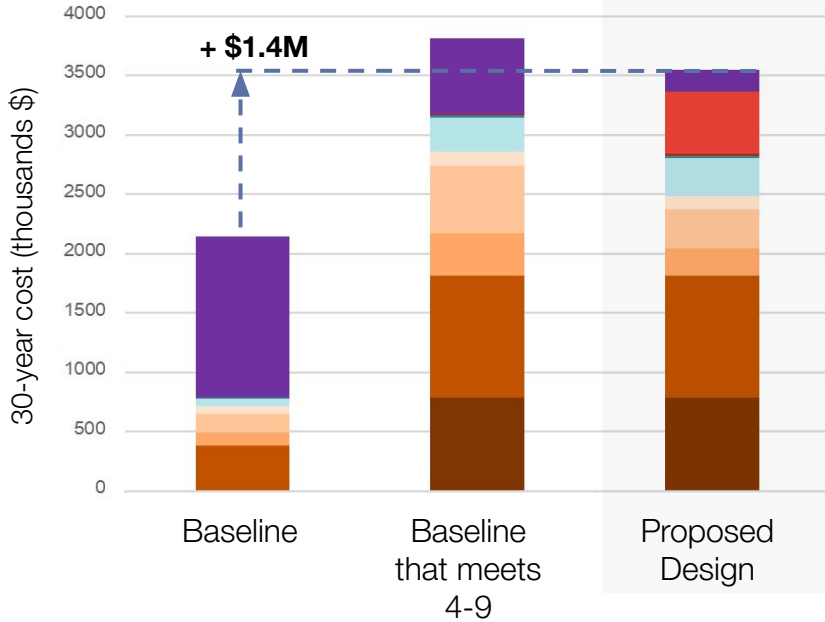


Financial Return | VNEM allocation of credits and bill savings

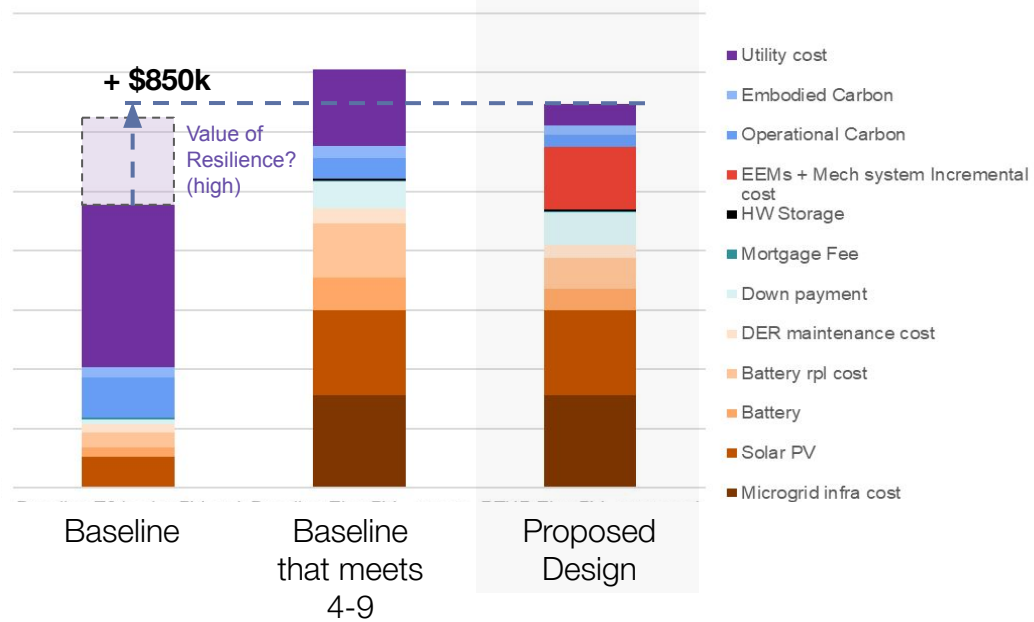
Res Export Allocation	Res Annual Bills	House Annual Bills	Avg Per Apt Annual Bills
0%	\$61,505	\$-55,310	\$831
50%	\$20,411	-\$11,483	\$275
63.1%	\$9,644	\$0	\$130
74.835%	0	\$10,286	0

← \$11/month

Cost Effectiveness | 30-year Net Present Value



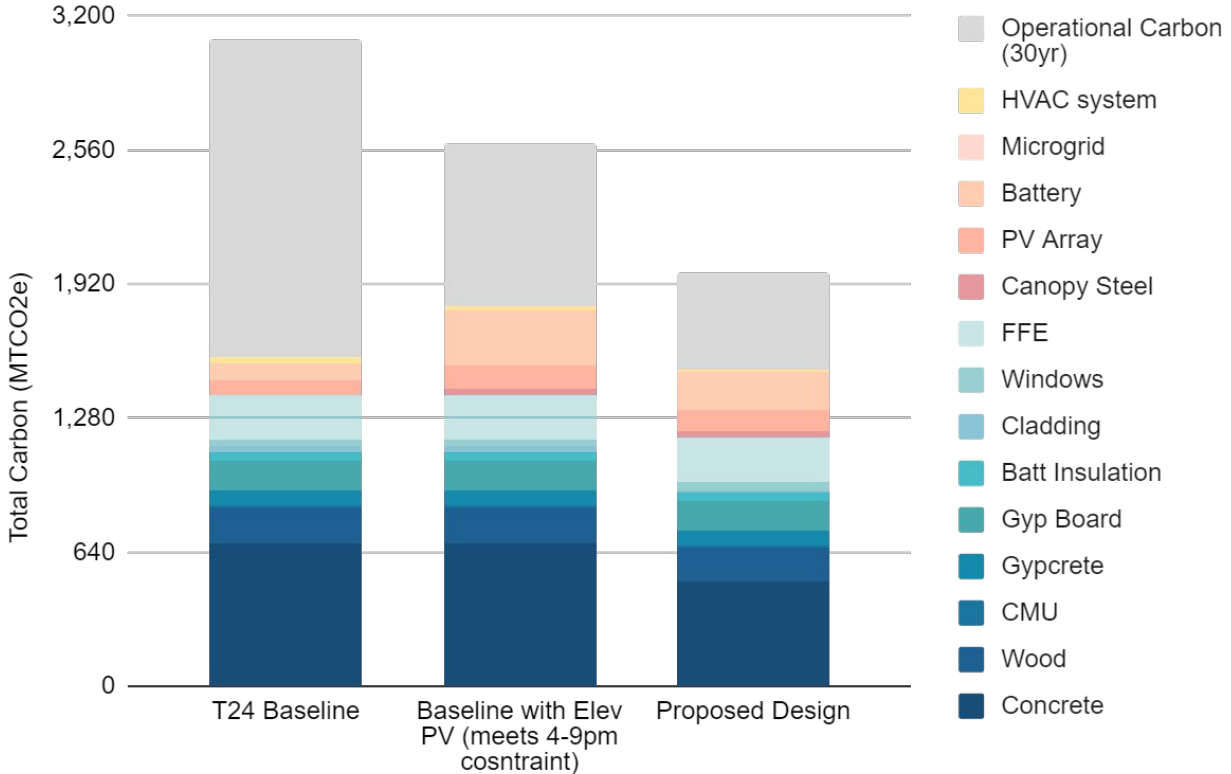
**Whole Building Life Cycle Cost
(30-year Net Present Value)**



Life Cycle Cost including Social Cost of Carbon & Value of Resilience (@\$190/ton)

- Utility cost
- Embodied Carbon
- Operational Carbon
- EEMs + Mech system Incremental cost
- HW Storage
- Mortgage Fee
- Down payment
- DER maintenance cost
- Battery rpl cost
- Battery
- Solar PV
- Microgrid infra cost

Total Carbon Comparison | 30-year embodied and operational emissions



70% Operational Carbon Reduction

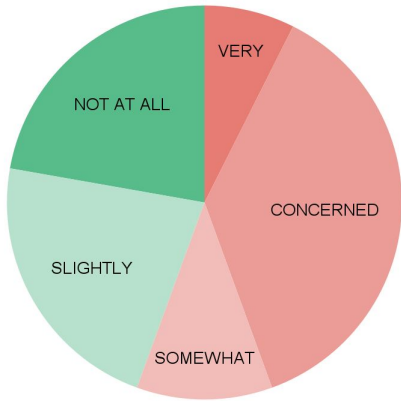
7% Net Embodied Carbon Reduction

Resident feedback | Resilience and outage concerns

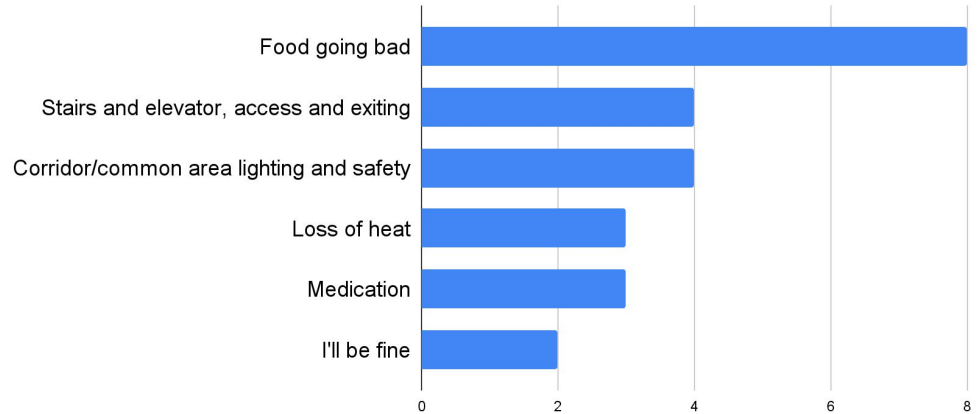


Resident feedback | Resilience and Outage Concerns

How concerned are you about power outages at home?



If the power went out, what would you be most concerned about? (open-ended responses)



“Visibility in the apartment and the hallways is a top priority for me”

“I was homeless for 10 years, I’ll be fine”

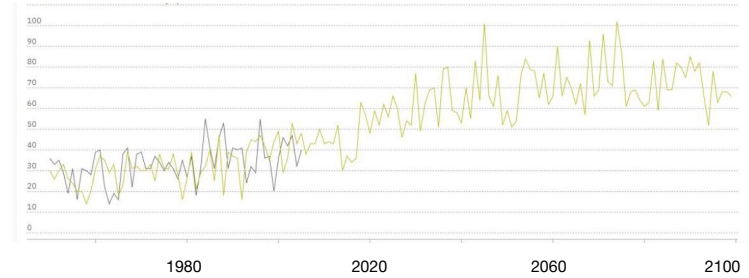
Date of interviews: January 2023

Total people interviewed: 27

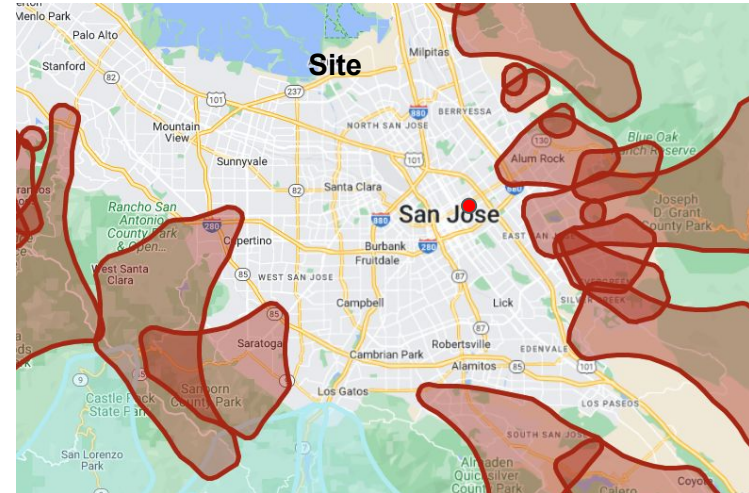
Grid Resilience | Most likely power failures

	Duration	Likelihood
Average outage (DOE data)	8 hrs	
Heat wave-related black-out (May include smoke)	1-3 hrs	1-5 a year
Winter storm	1-2 days	Once every 1-3 years
Major Earthquake	3-7 days	Once in next 30 years
Public Safety Power Shutoff	1-7 days	Not likely

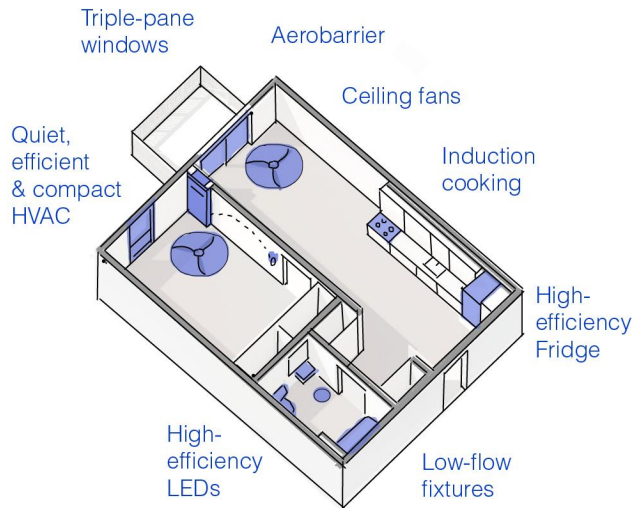
Number of Extreme Heat Days



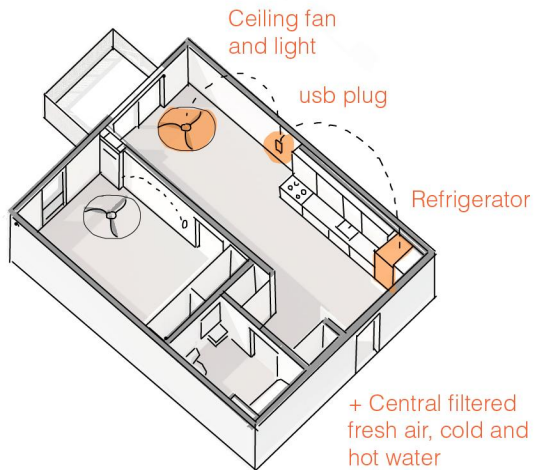
2019 PG&E Public Safety Power Shutoff



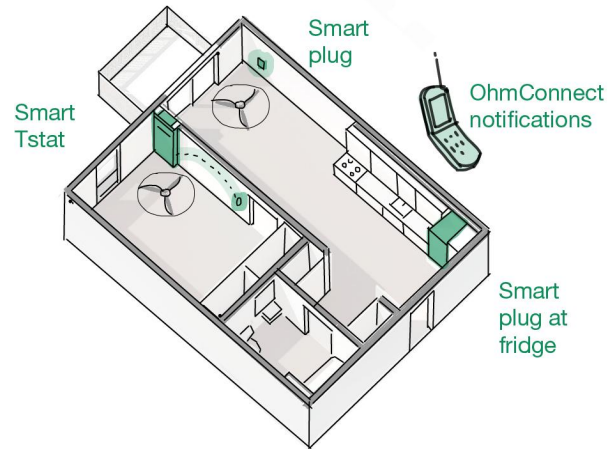
Apartment Design Features



Energy efficiency, Comfort

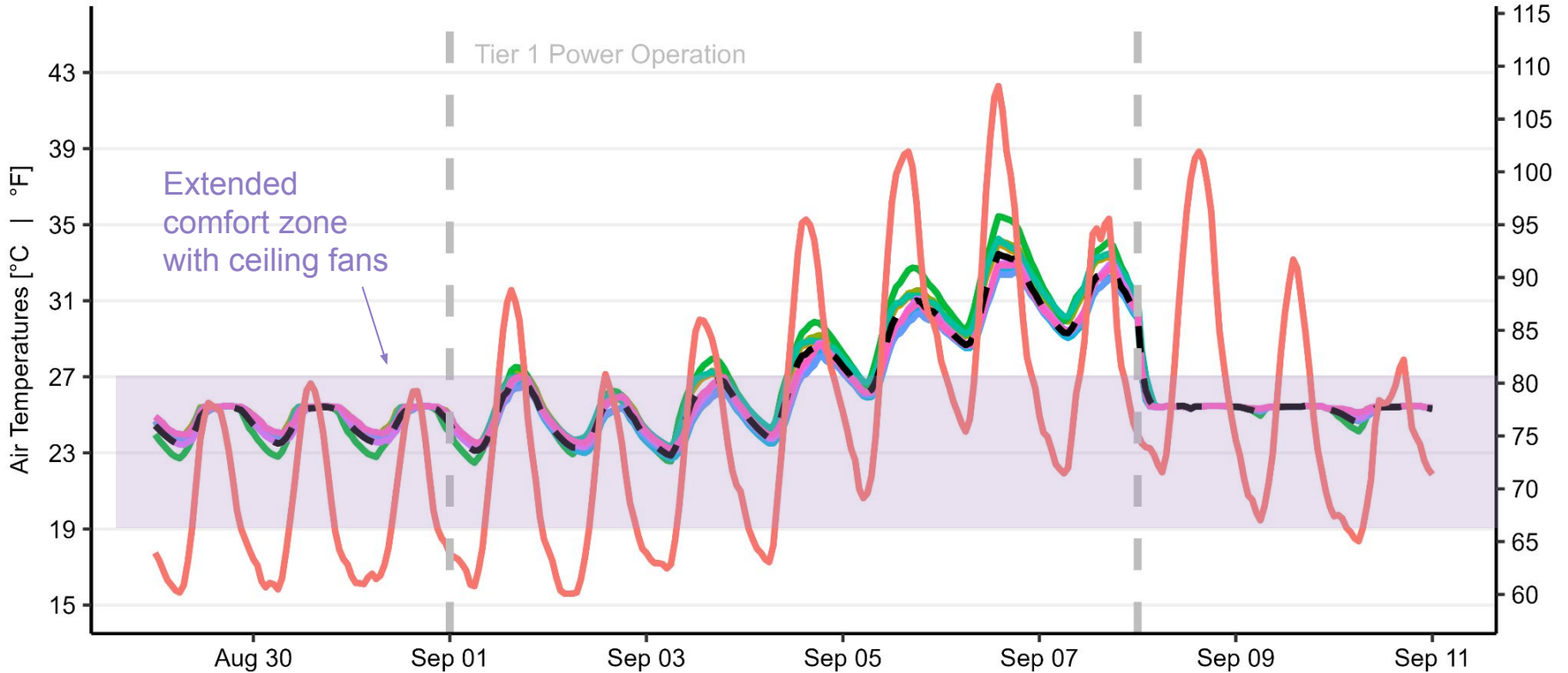


**Outage Mode
(services supported)**

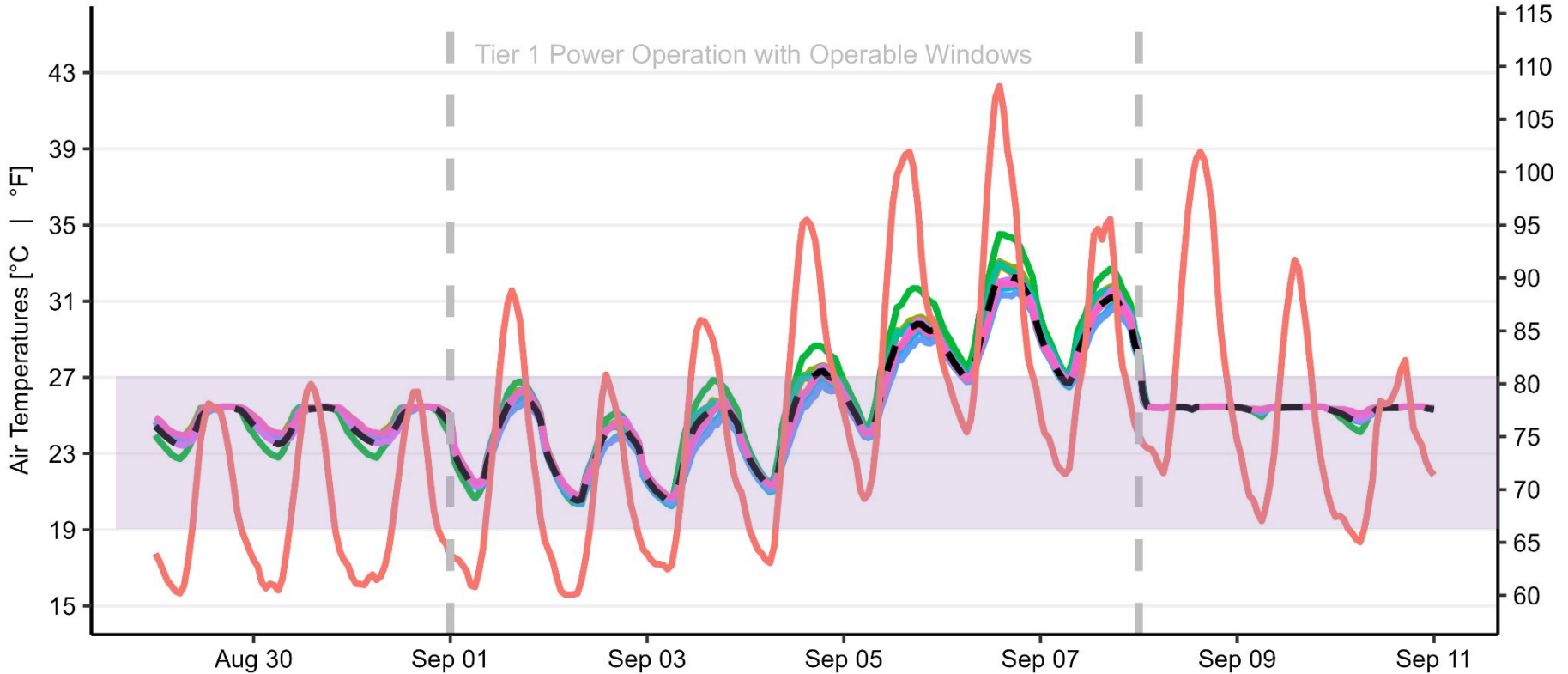


Conservation Mode

Indoor Temperatures | Proposed efficiency measures & Tier 1 back-up



Indoor Temperatures | Proposed EEM & Tier 1 back-up & Operable windows





Grid
Mode



Battery /
Conserve
Mode



Outage
Mode



Key Takeaways

1. Radically equitable grid responsive and resilient affordable housing:
 - a. Appears to maybe possibly **make sense from a societal perspective**
 - b. Adds something but not a lot to construction cost
2. **The recipe is pretty simple:**
 - (1) good passive design, (2) hot water load shift
 - (3) “efficiency first” and (4) virtual net metering
3. We need to look closely at the operational burden to housing providers and the **needs of each community**.
4. Federal funding is helpful, but several **policy barriers remain in the way**

