

Grid Integrated Buildings Decarb + Efficiency

Shawn Oram, PE

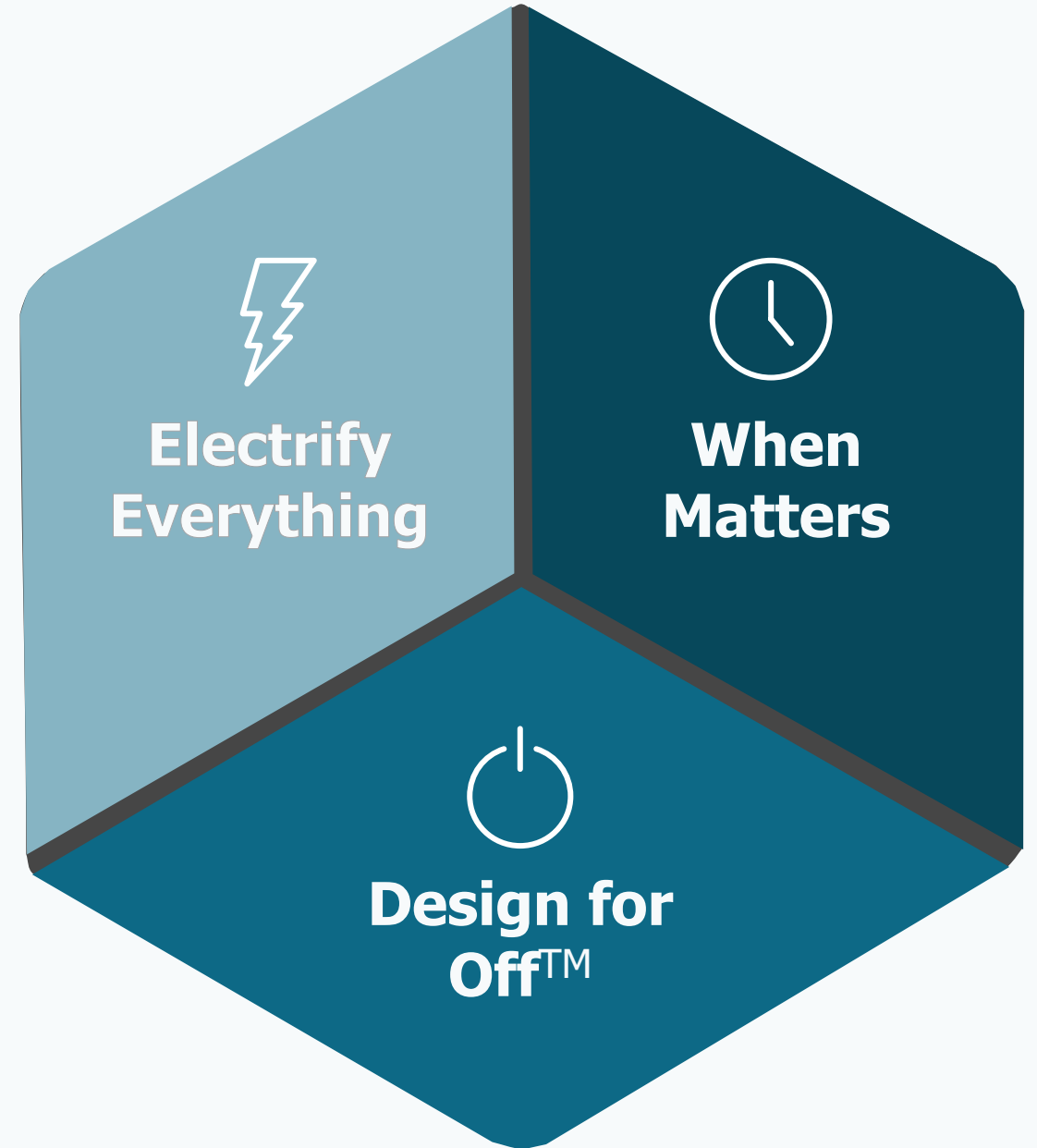
Principal, Design and Engineering

09/20/2023



Ecotope is...

+ A research and engineering firm providing leading-edge MEP solutions to decarbonize buildings locally, regionally, and nationally.



Our Design Approach



ELECTRIFY BUILDINGS

A building design approach that focuses on load reduction and smart building controls to reduce energy consumption by up to 50% over business-as-usual strategies.



DESIGN FOR OFF™

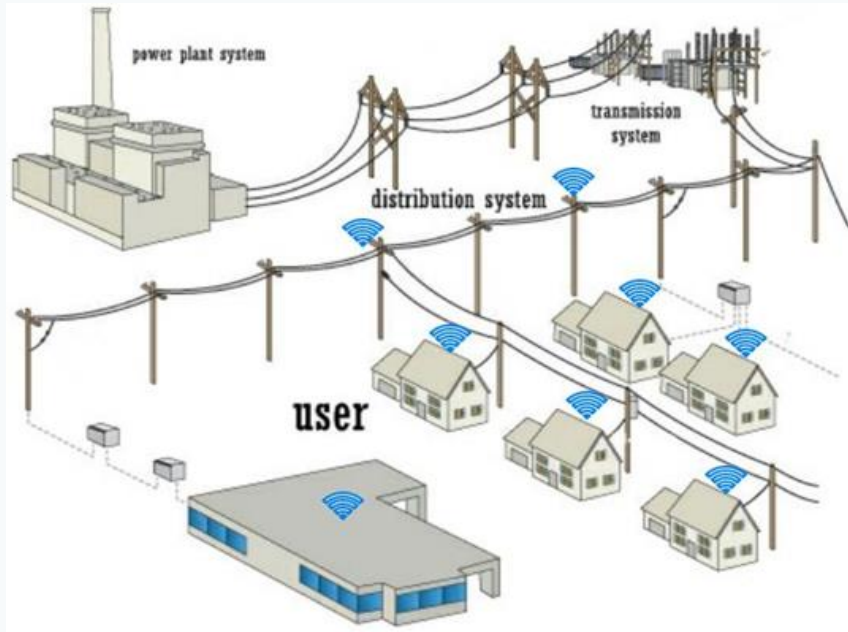
A focus on reducing future fossil fuel demands in buildings. All-electric buildings allow direct use of renewable energy.



WHEN MATTERS™

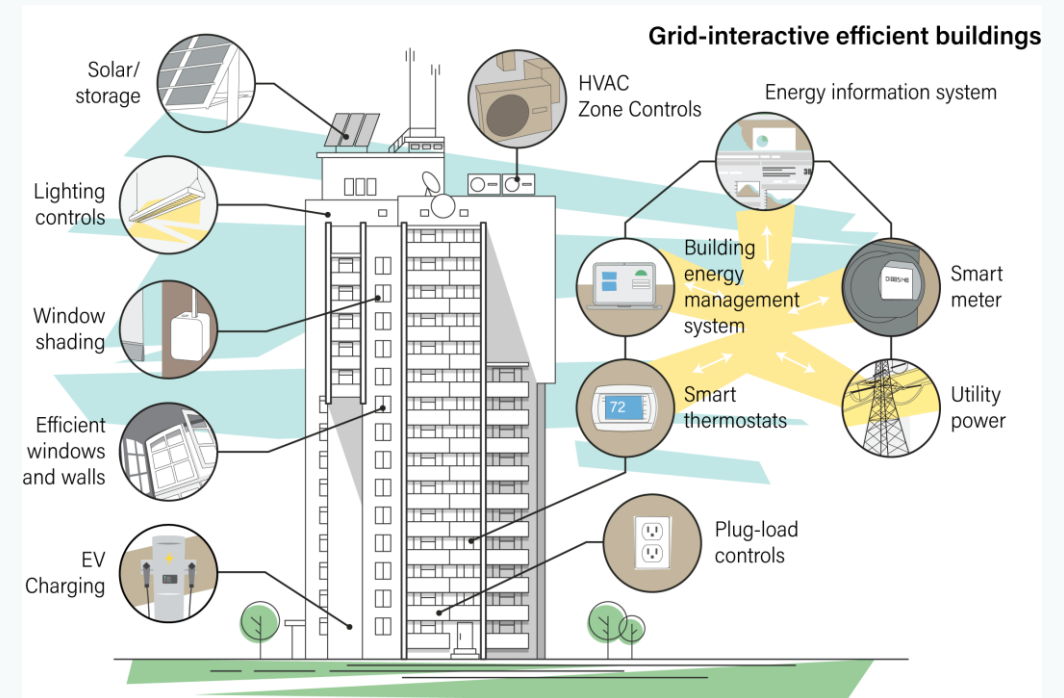
Important for buildings as electrification will create grid congestion and force time-of-use rates for peak-power events. Ecotope is focused on setting up building systems to shift away from peak times.

Utility scale grid modernization or efficiency + grid integration



\$\$\$

OR



Grid integrated
make room.

Learn from the Past?

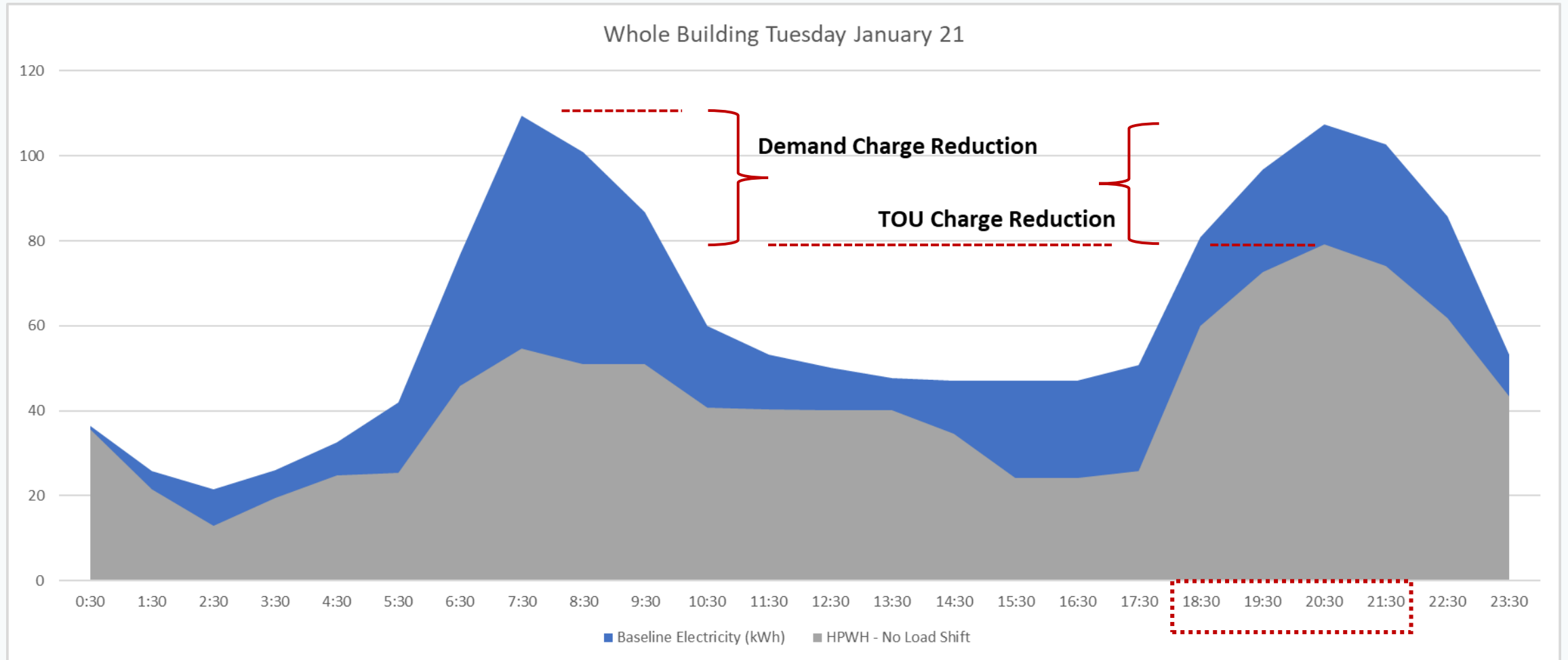


**WPPSS 2 – Nuclear Power WA
State 1983**

**Conservation was the cheaper
kwh, project was scrapped.**

MF whole building load shape w/CHPWH

One technology delivers 17% energy savings and 25%-40% peak demand reduction





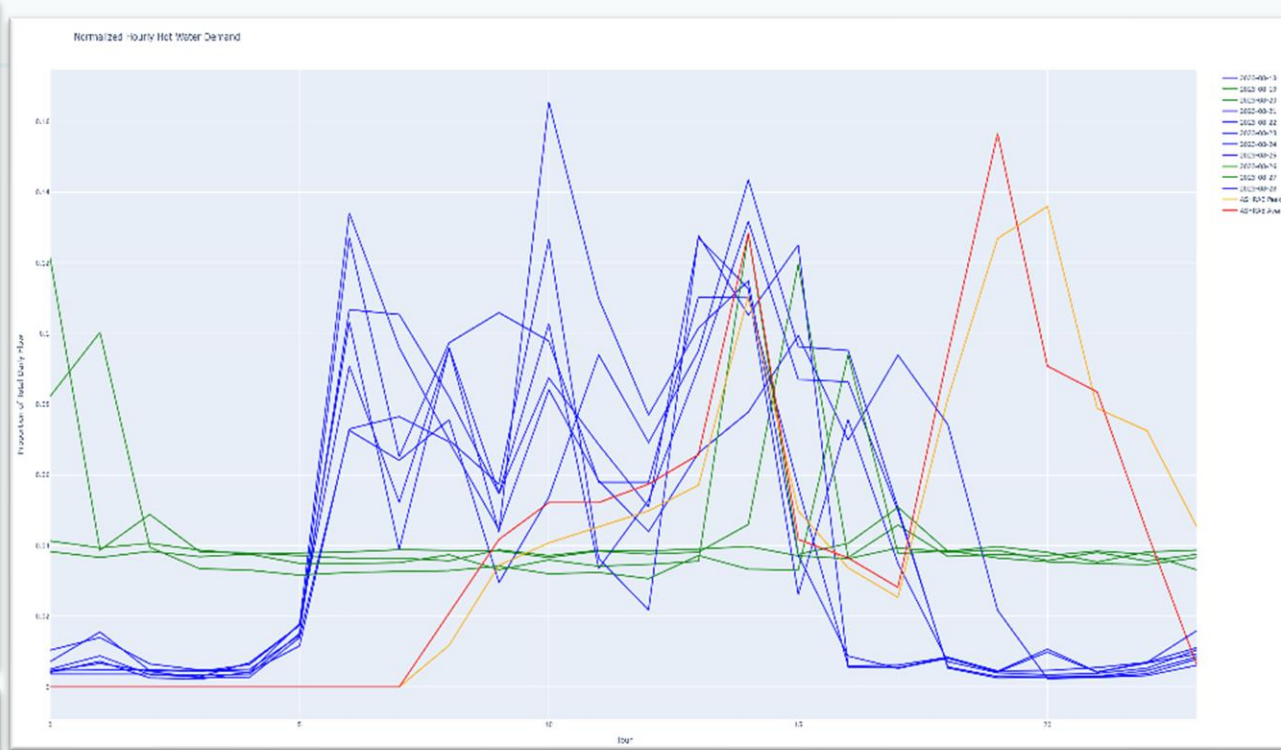
Decarb Case Studies



Big Tech Commercial Kitchen Decarb



Electrify Buildings
+ Design for Off
+ When Matters



500 Gallon Horizontal HWS tank



CJ3 Kitchen
San Jose, CA

Right sizing

SYSTEM	HEATING CAPACITY	TANK VOLUME	NOTES
EXISTING GAS	650,000 BTU/H	500 GAL	-
HPWH WITHOUT LOAD SHIFT	170,000 BTU/H	700 GAL	-
HPWH WITH LOAD SHIFT 4-9PM	250,000 BTU/H	1000 GAL	1
NOTES: 1. DESIGN IS SUFFICIENT TO MEET DEMAND BASED ON AVERAGE OF DATA PROVIDED. HOWEVER, CONSIDERING THE HIGHEST DAY DEMAND, THIS DESIGN WILL SUCCESSFULLY CAPTURE 80% OF LOAD SHIFT DAYS. TO MEET 95% OF LOAD SHIFTING DAYS 4-9PM, WE CAN INCREASE THE TANK VOLUME TO 1,400GAL.			

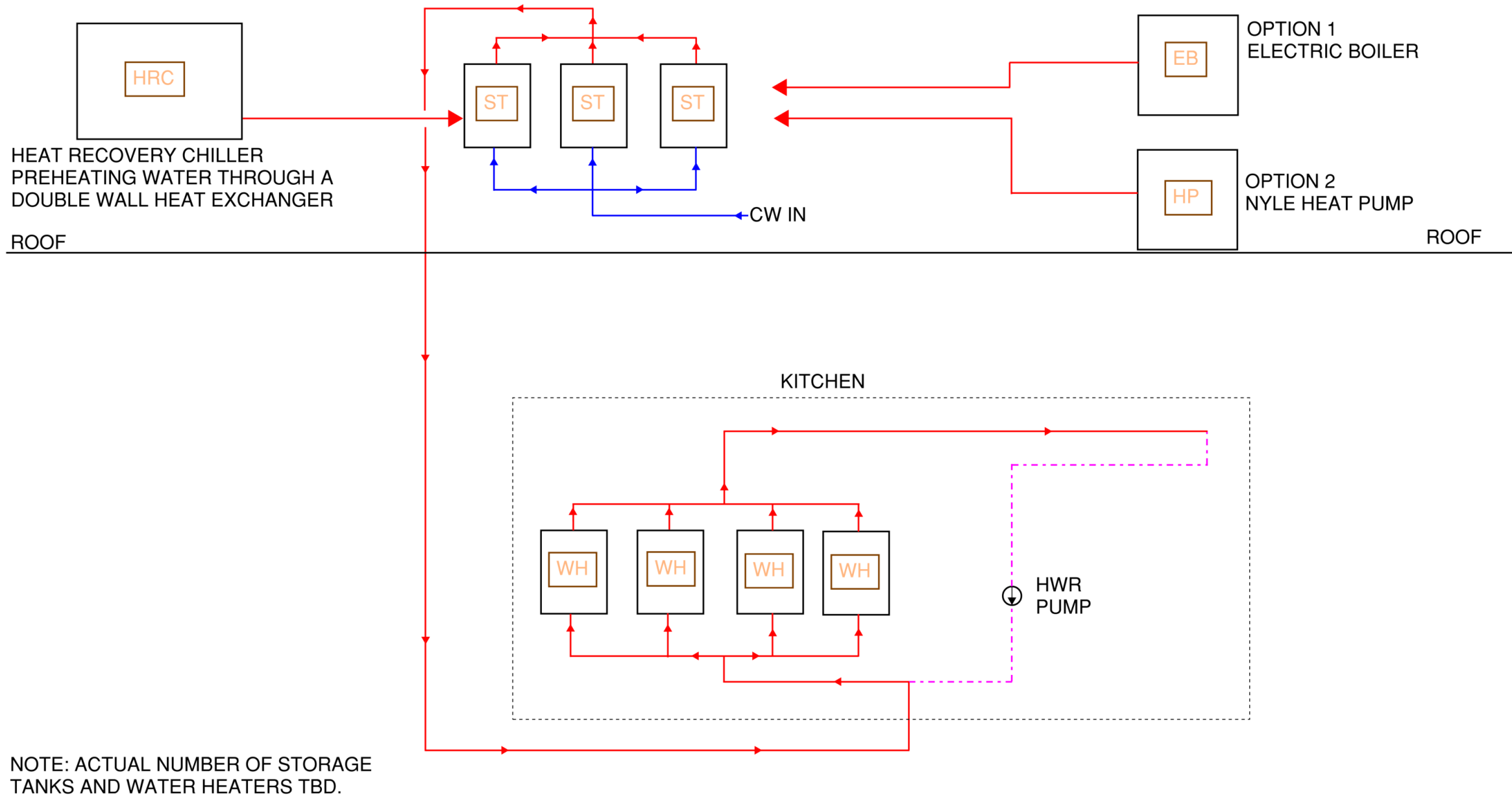
Ecosizer 2.0 – Custom Load Shapes

- **Like for Like HP replacement - 54 Tons**
- **Optimized sizing – 14 Tons**
- **Factor of 4 smaller capacity**



CJ3 Kitchen
San Jose, CA

Right sizing





Bayview Tower

An innovative skid-mounted CHPWH system brings high-efficiency and grid flexibility to existing affordable housing.



Electrify Buildings
+ Design for Off
+ When Matters



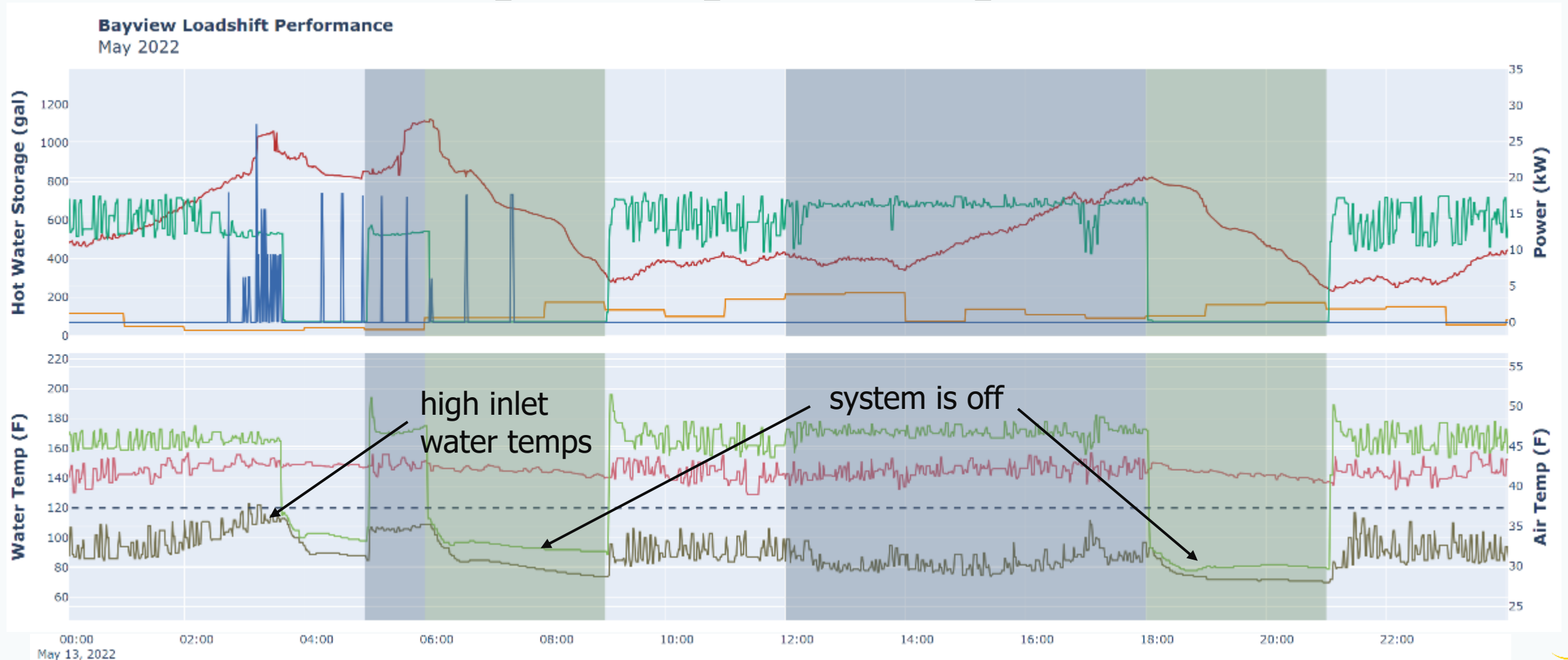
- + **Energy usage dropped from 230,000 to 95,000 kWh/yr.**
- + **Operates 3x more efficiently with a COP of 3.0**
- + **Uses carbon dioxide (CO₂) with a global warming potential of 1**
- + **Expected cost savings ~\$15,000/yr.**



Bayview Tower
Seattle, WA

Ideal system behavior

—heat pump temperatures





Sitka Public Library

**Making the shift
from fuel oil to
clean electricity**



**Electrify Buildings
+ Design for Off
+ When Matters**

EUI: 99 > 32 kBtu/sf/yr

Project Highlights

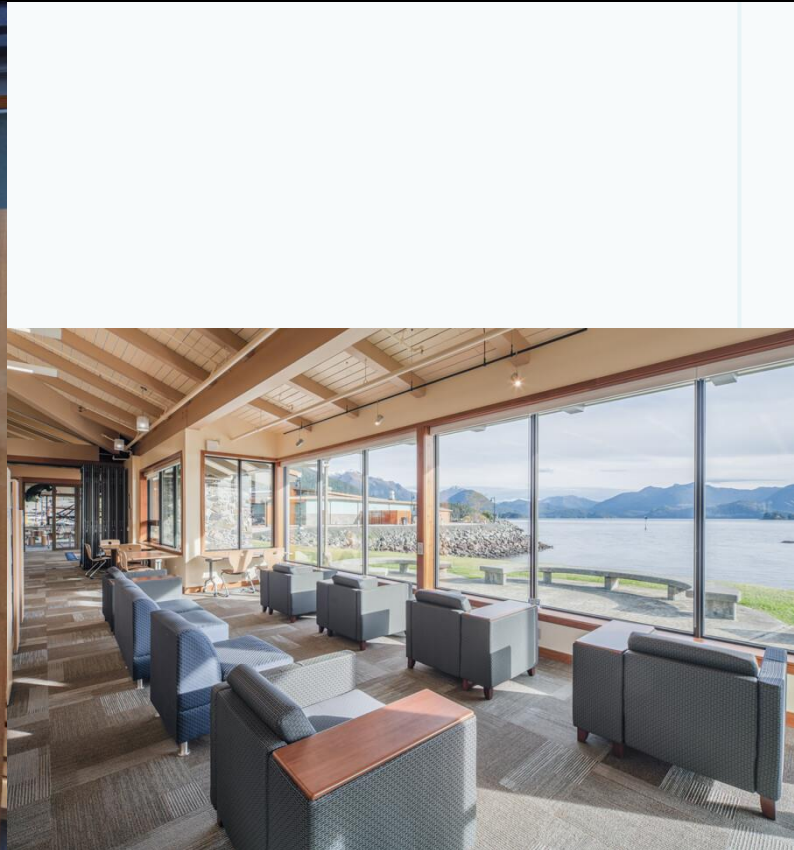
- + **Reno Added 50% more space and cut EUI by 2/3.**
- + **Super Insulation (4" Rigid)**
- + **Variable Refrigerant Flow Heat pump (VRF) Hydronic**
- + **Radiant floor heating**
- + **Very High Efficiency (VHE) Dedicated Outdoor Air System (DOAS)**
- + **Heat pump water heater server room sourced**

And...

- + **1st place, ASHRAE Puget Sound Chapter Technology Award, Existing, Commercial, 2020**

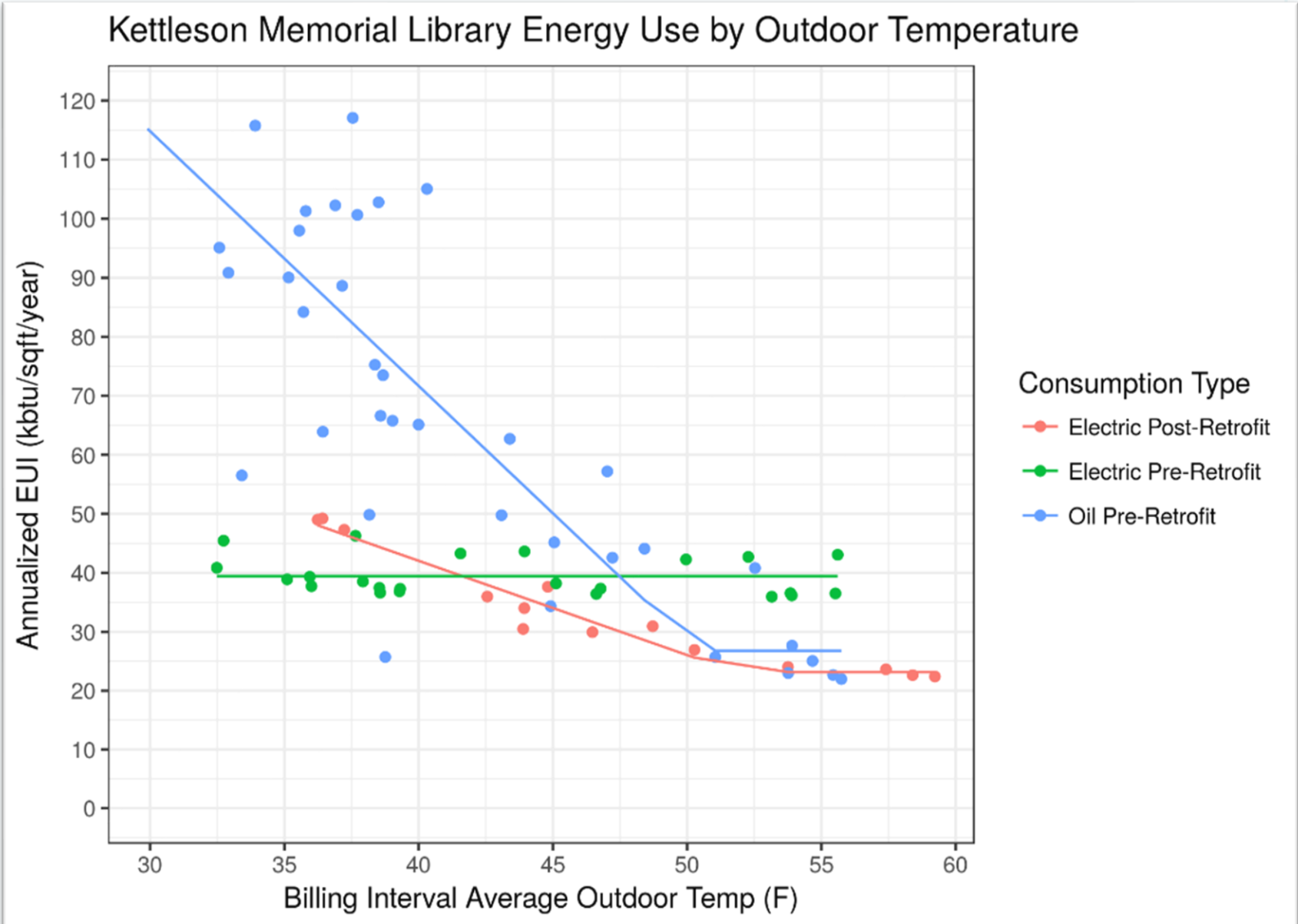


Sitka Public Library
Sitka, Alaska

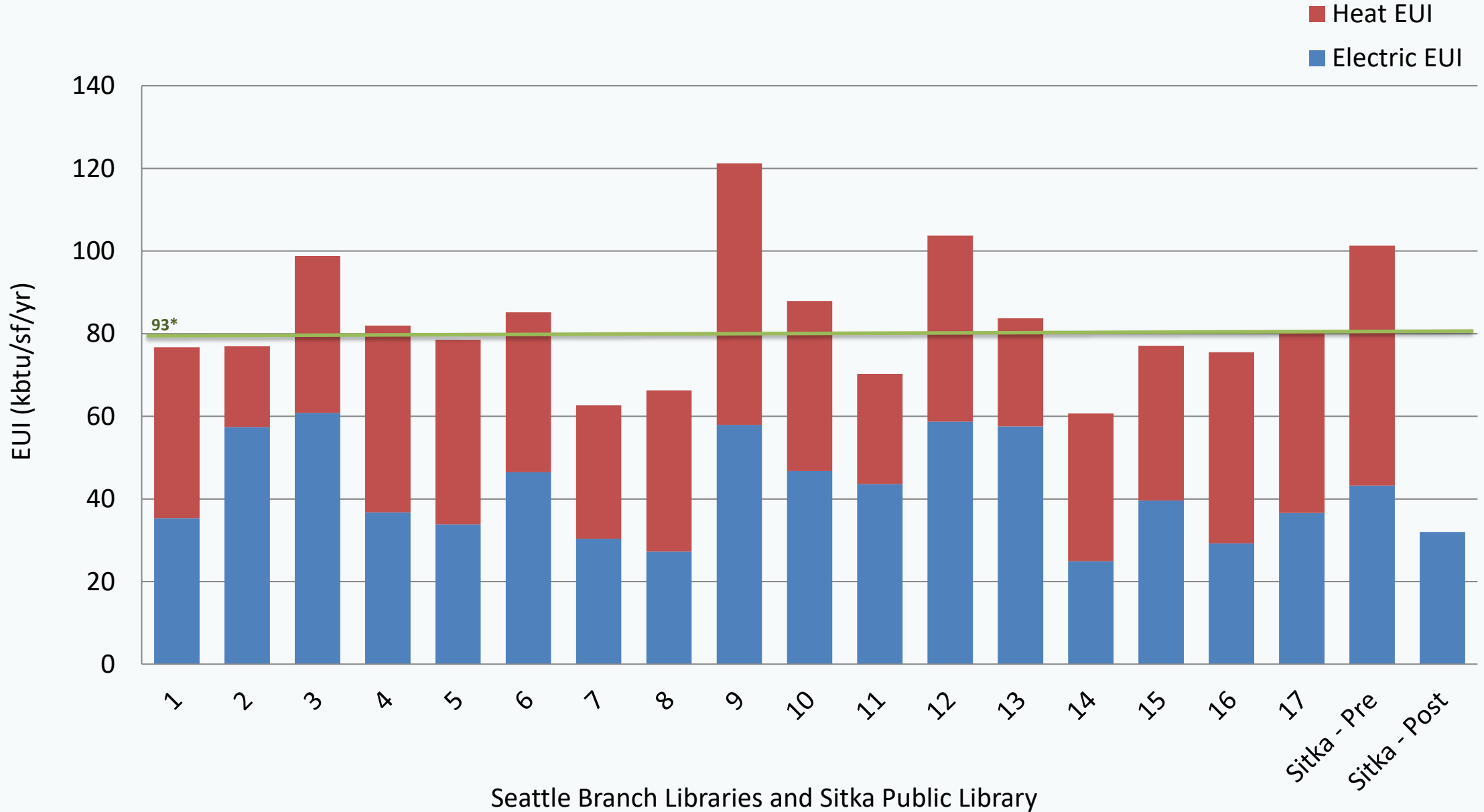


Change Point Analysis

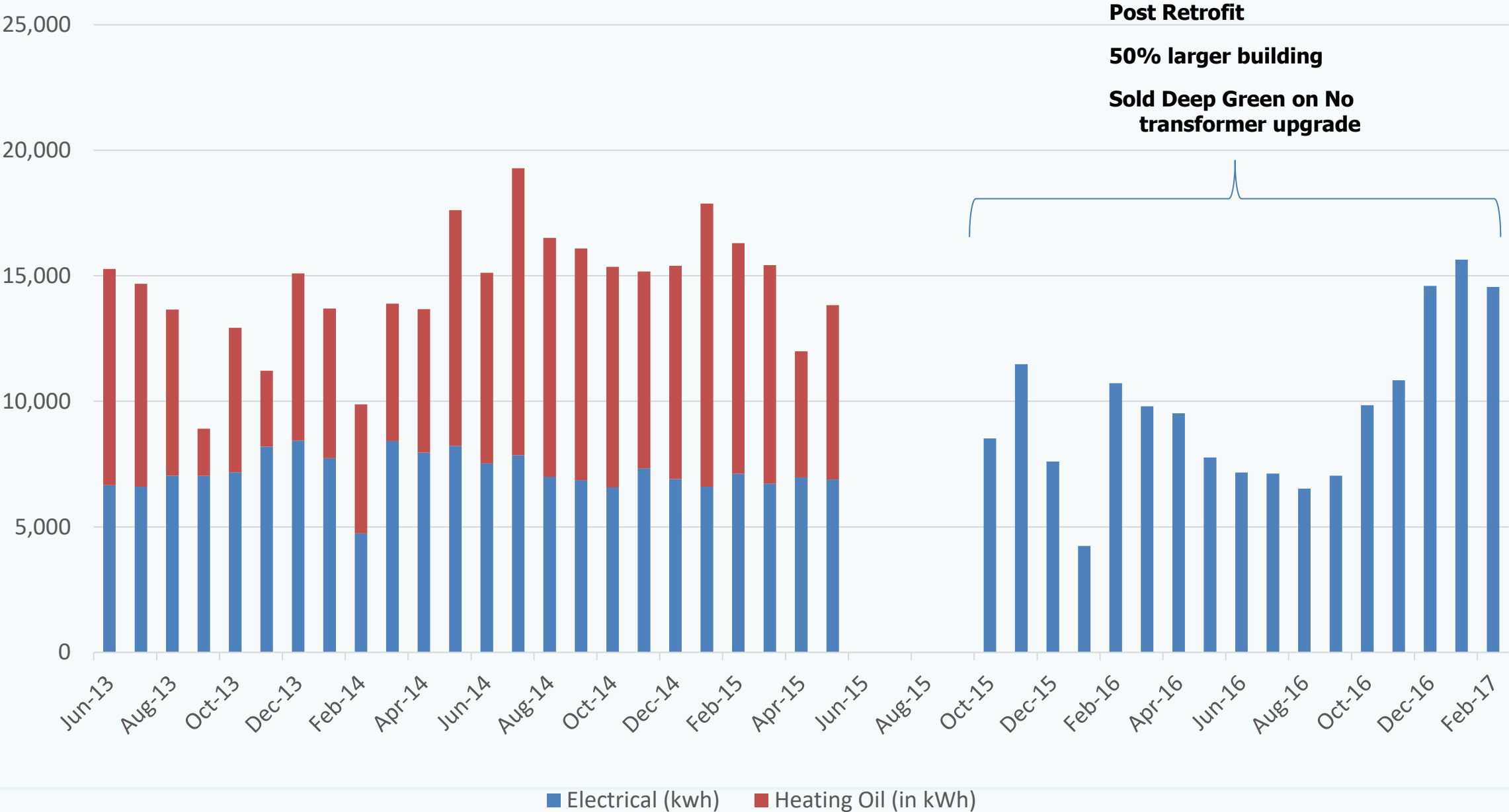
HDD Linear Regression Plot



Benchmark - Seattle Libraries (EUI avg - 81) and Sitka Public Library (EUI - 32)



Pre / Post Sitka Library Energy (kwh)
Pre - 8000 SF, Post 12,000 SF





King County International Airport

Decarb + Efficiency



Electrify Buildings
+ Design for Off
+ When Matters

EUI: 155 > 46 kBtu/sf/yr

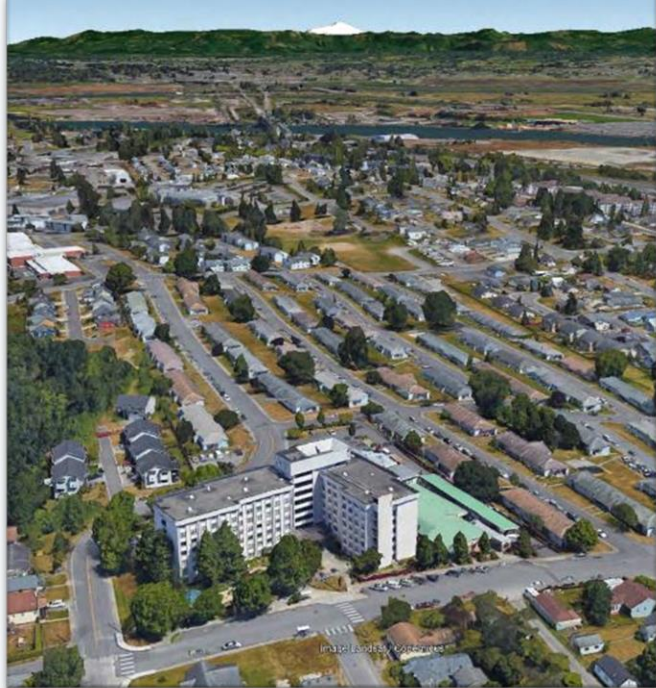
Project Highlights

- + **Variable refrigerant flow heat pump (VRF)**
- + **Energy recovery ventilator (ERV)**
- + **Dedicated outdoor air system (DOAS)**
- + **Fossil fuel usage for space heating was eliminated**
- + **Overall energy use was reduced by 70%**

And...

- + **2020 ASHRAE Chapter Technology Award, Commercial Buildings—Existing**





Aspirations:

1500 Units/12 Buildings

CO2 HPWH

CO2 Space Heat/Cool

Resiliency Microgrid

Solar PV

100% EV Coverage

V2G



ECOTOPE

Large Development Grid Integrated Community

Decarb+Efficiency



Electrify Buildings

+ Design for Off

+ When Matters

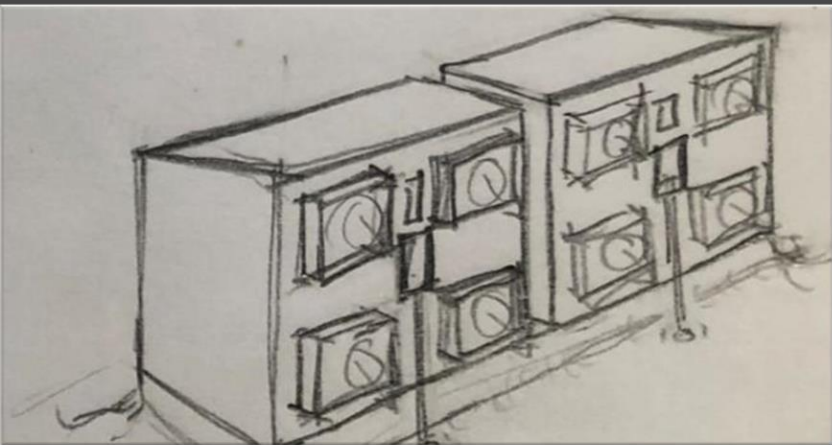
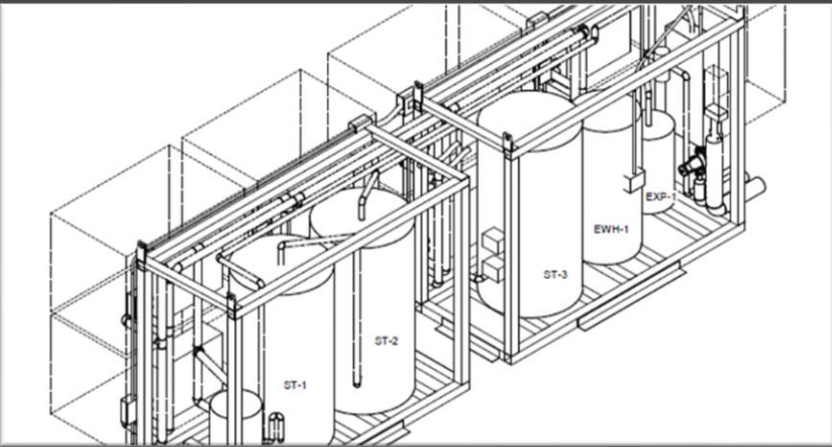
Pasadena 77 Unit Senior Living



50T > 8T Fix

WaterDrop Systems

+ Designed and developed by Ecotope and Small Planet Supply



Grid Integrated Buildings Decarb + Efficiency

Shawn Oram, PE

Principal, Design and Engineering

09/20/2023

