COMMERCIAL HEAT PUMP WATER HEATING:

THE WHY

Colin Grist, PE,
Ecotope, Inc.

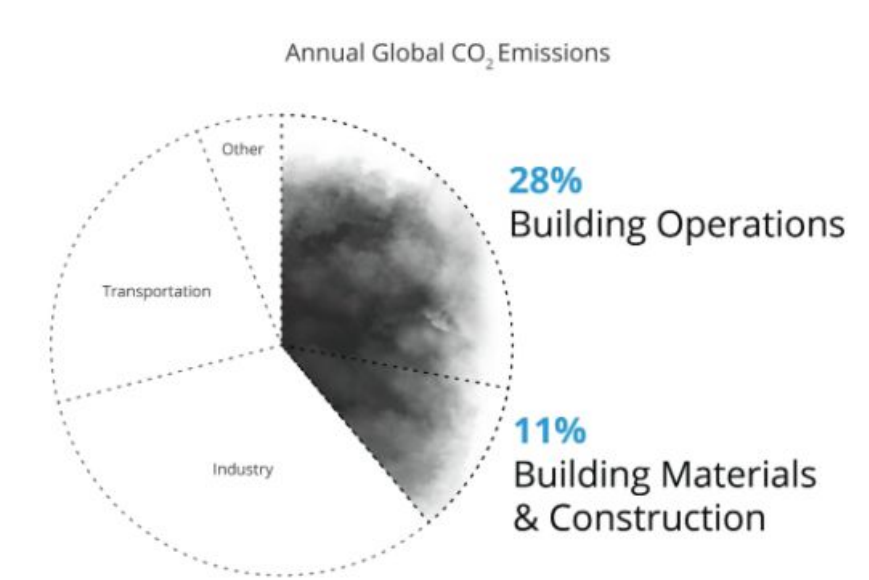
OBJECTIVES

- Global, Federal, and State Commitments
- Codes and Standards
- Advantages
- SCL Incentives

CLIMATE CHANGE IS REAL

Technologies reliant on gas **contribute to the climate crisis**

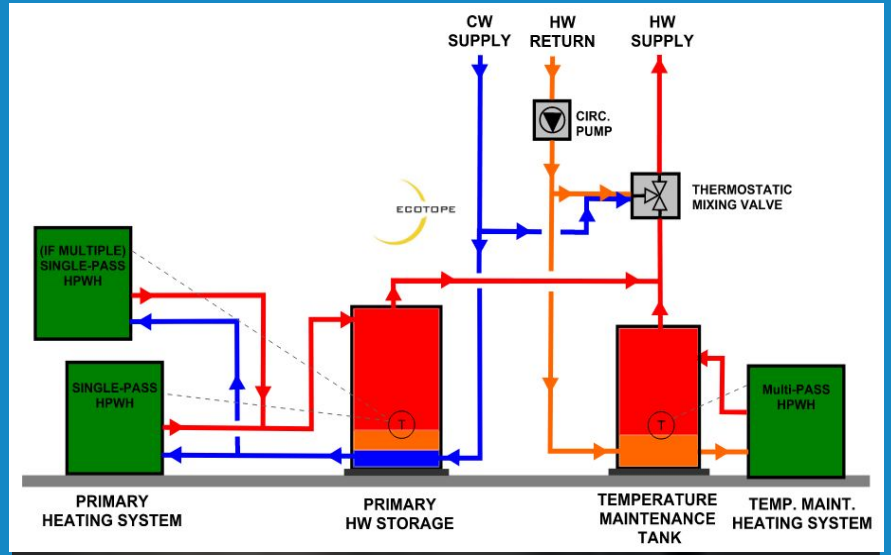
DECARBONIZATION AND ENERGY EFFICIENCY ARE KEY



~40% of annual CO2 emissions is from buildings

https://architecture2030.org/why-the-building-sector/

CHPWH IS PART OF THE SOLUTION



Low carbon technology

More energy efficient than electric resistance and gas water heating

GLOBAL, FEDERAL, AND STATE COMMITMENTS

GLOBAL POLICIES

Paris Climate Agreement

To reach global peaking of GHG emissions as soon as possible to be climate neutral by mid-century.

RE100

Group of 300+ international companies agreeing to switch to 100% renewables

The Climate Pledge

Group of 115+ companies that pledge to be net zero carbon by 2040

FEDERAL POLICIES

Goal: Reduce carbon emissions of US building stock 50% by 2035

Incentives for deep **retrofits**

Prioritize **low GWP** refrigerants

Target **zero net energy** building standards

Accelerate **building code** updates

New funding to adopt strict building codes and **train builders and inspectors**

WASHINGTON **POLICIES**

Shift

Shift from fossil fuels to heat pumps

Accelerate

Accelerate path to zero energy buildings

Reform

Reform programs and standards

Retrofit

Retrofit existing building stock

Deep Decarbonization Plan

Focus: High efficiency heat pumps for space and water heating

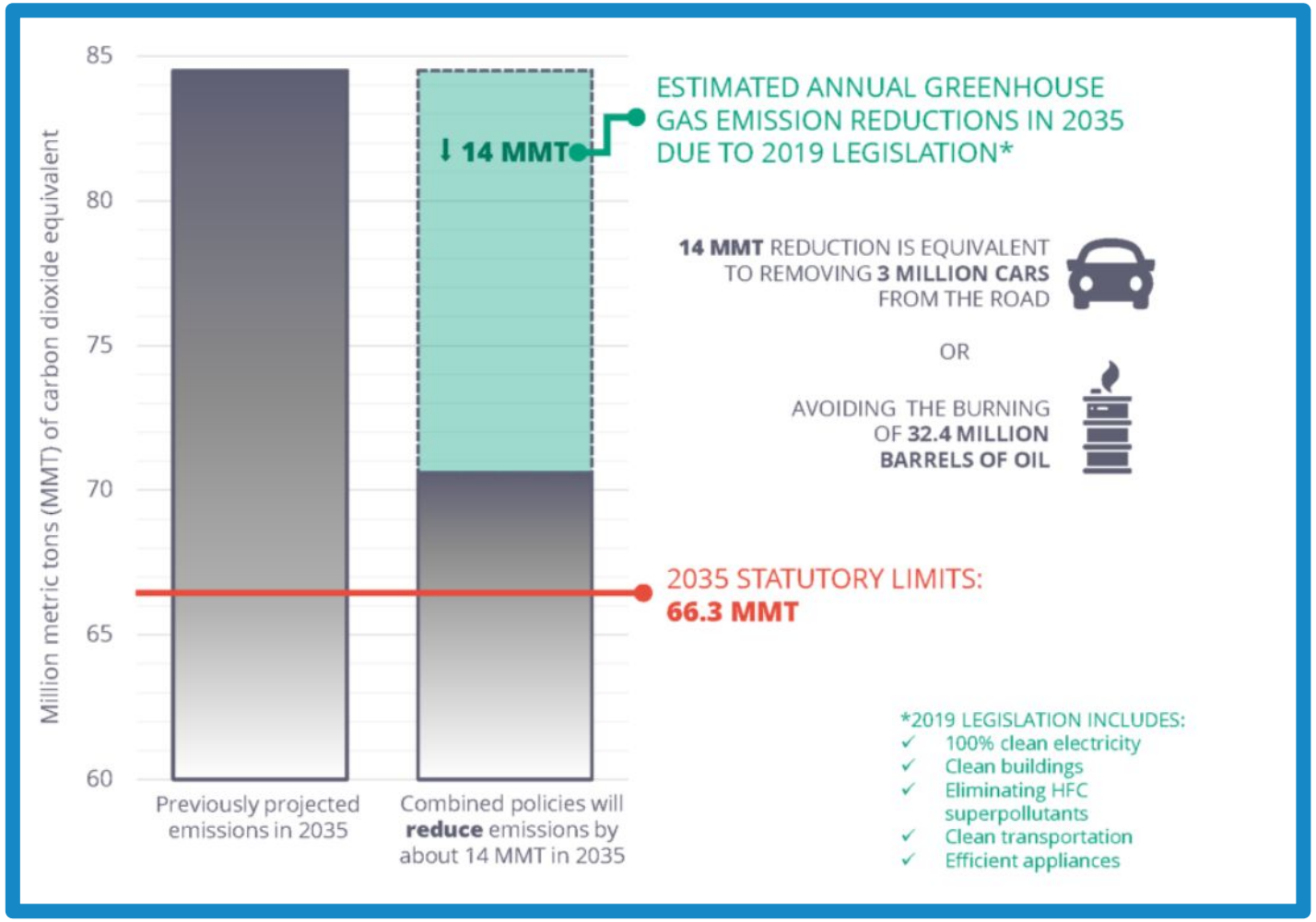
State Emissions Goals

- 40% below 1990 levels by 2030
- 70% below 1990 levels by 2040
- 95% below 1990 levels w/ net zero emissions by 2050

WASHINGTON **COMMITMENTS**

HB 1257 - Washington Clean Buildings Act for Existing Buildings

- Establishes Energy Standards for commercial buildings > 50k sq ft
- 2021 Early Adopter Efficiency Incentives
- Incentives available for large multifamily
- $75 million early action incentive fund available for qualified retrofit projects in 2021



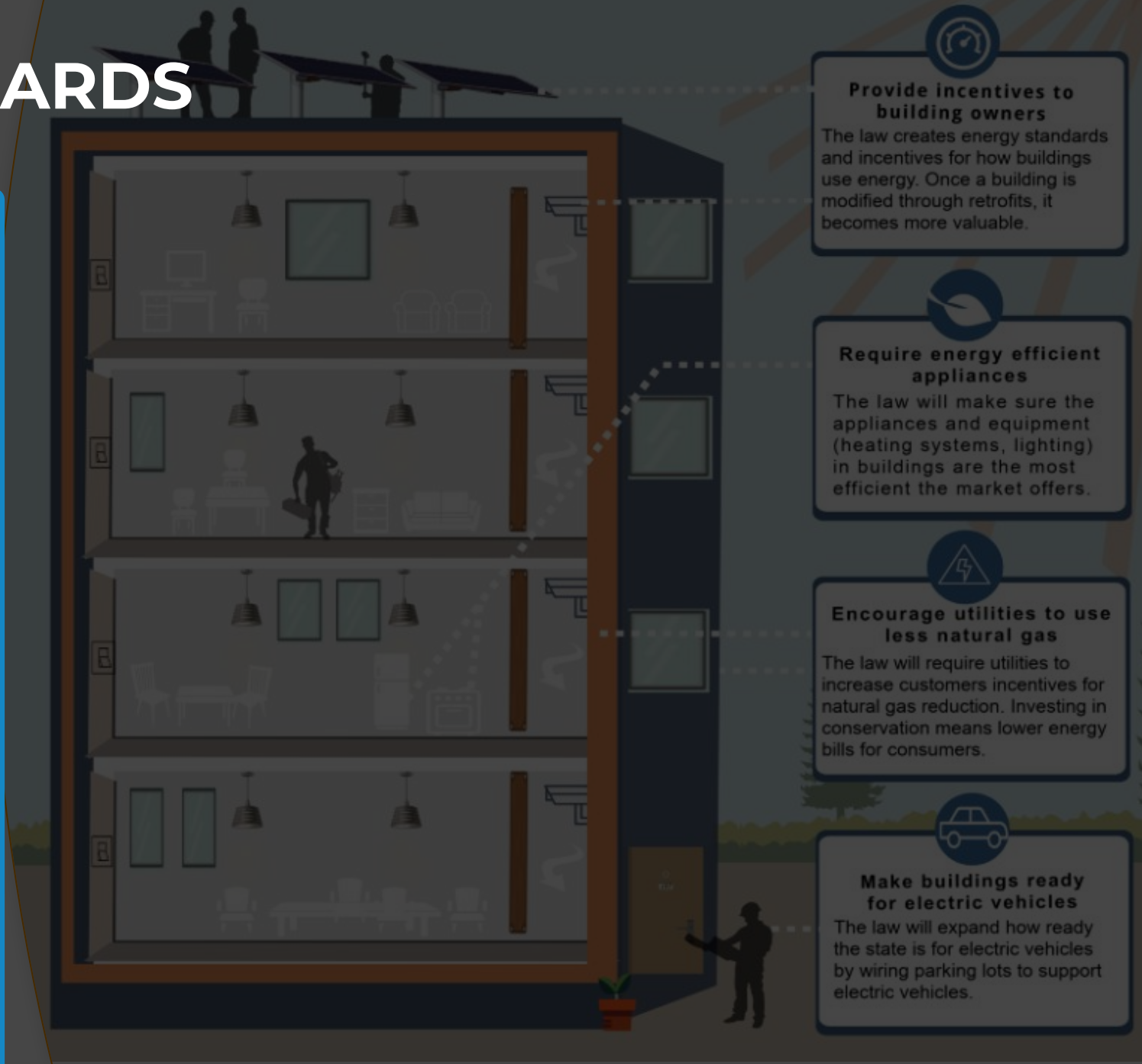
WASHINGTON CODES AND STANDARDS

WASHINGTON **STANDARDS**

HB 1444. Washington Appliance Efficiency Standards

Appliances must meet minimum efficiency performance levels

CHPWHs meet the minimum efficiency performance levels



WASHINGTON **ENERGY CODE**

Demonstrate that buildings meet **efficiency points** for new construction

Central HPWH systems awarded all eligible points

Easiest compliance option for **new construction** permitting and operations

Provide incentives to building owners
The law creates energy standards and incentives for how buildings use energy. Once a building is modified through retrofits, it becomes more valuable.

Require energy efficient appliances
The law will make sure the appliances and equipment (heating systems, lighting) in buildings are the most efficient the market offers.

Encourage utilities to use less natural gas
The law will require utilities to increase customers incentives for natural gas reduction. Investing in conservation means lower energy bills for consumers.

Make buildings ready for electric vehicles
The law will expand how ready the state is for electric vehicles by wiring parking lots to support electric vehicles.

SEATTLE ENERGY CODE

Goals

- Eliminate carbon emissions
- Decrease unnecessary electricity use

SEATTLE COMMERCIAL ENERGY CODE

C404.2.3 Group R-1 and R-2 occupancies w/ central service water heating systems.

Service hot water shall be provided by an air-source heat pump water heating system, not fossil fuel or electric resistance.

R-1 and R-2

Multifamily greater than 3 stories
Any Hotel/Motel

ADVANTAGES OF CHPWHs

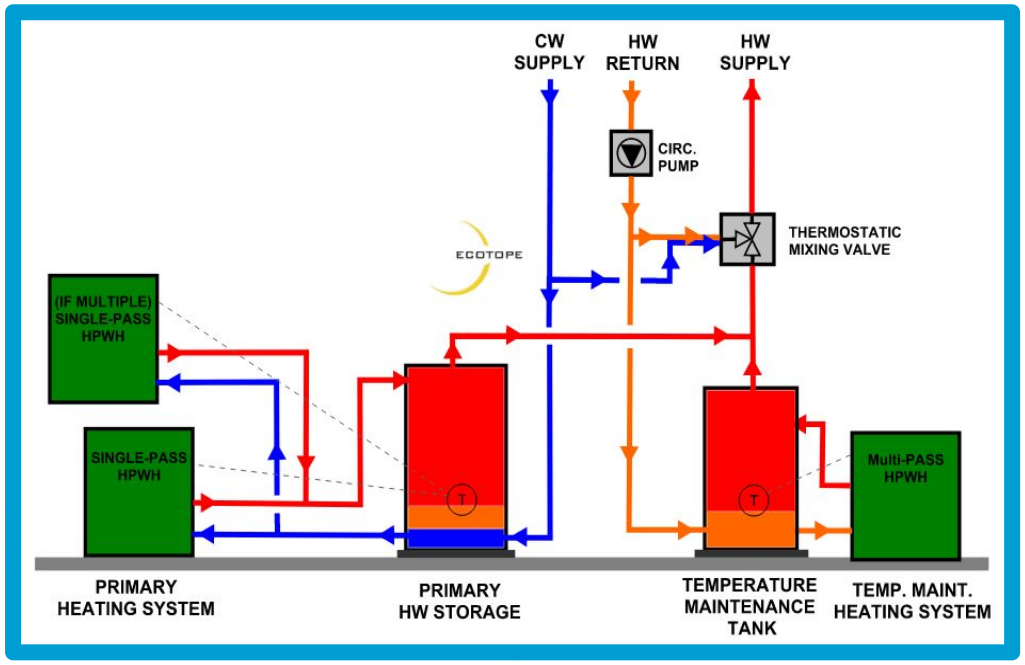
- Climate-friendly technology
- Proven performance
- Lower Operating Costs
- Grid Flexibility
- Simple Implementation
- Addresses demand for sustainable housing

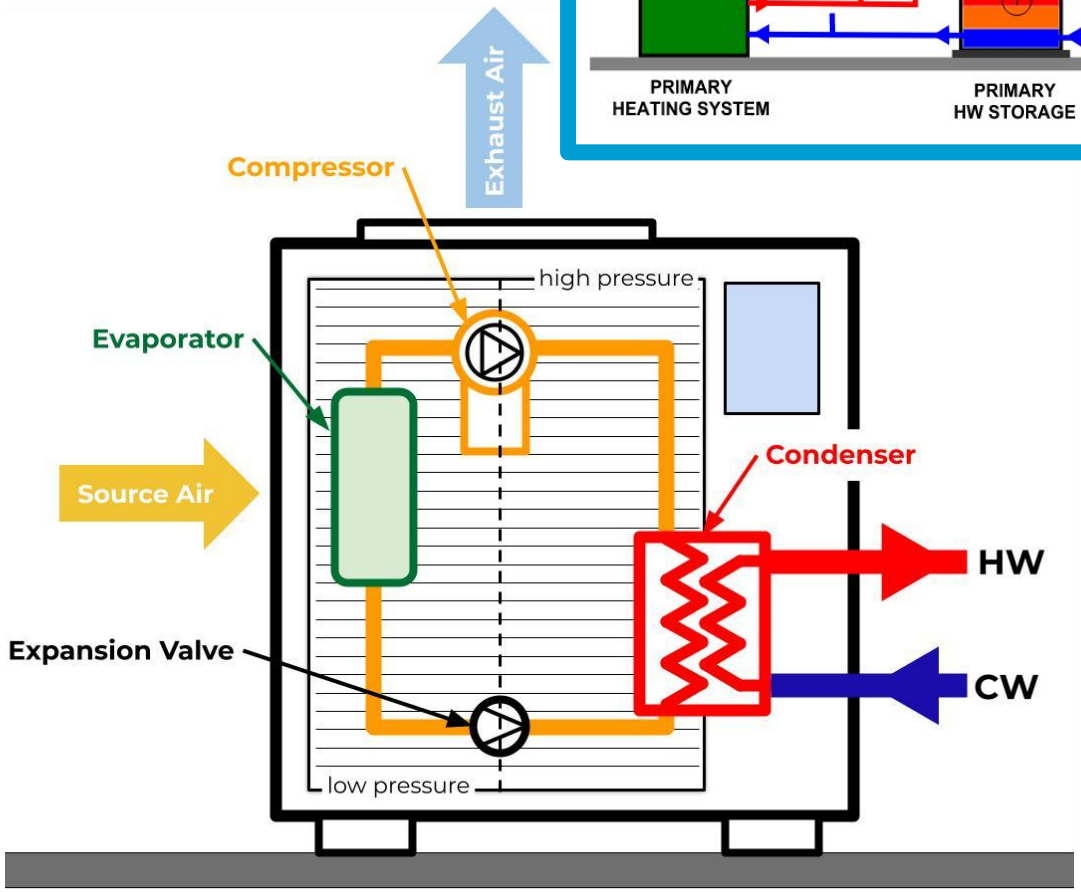
CLIMATE FRIENDLY TECHNOLOGY

Move Heat > Generate Heat

Utilizes low global warming potential refrigerants

More efficient than central gas or electric heating



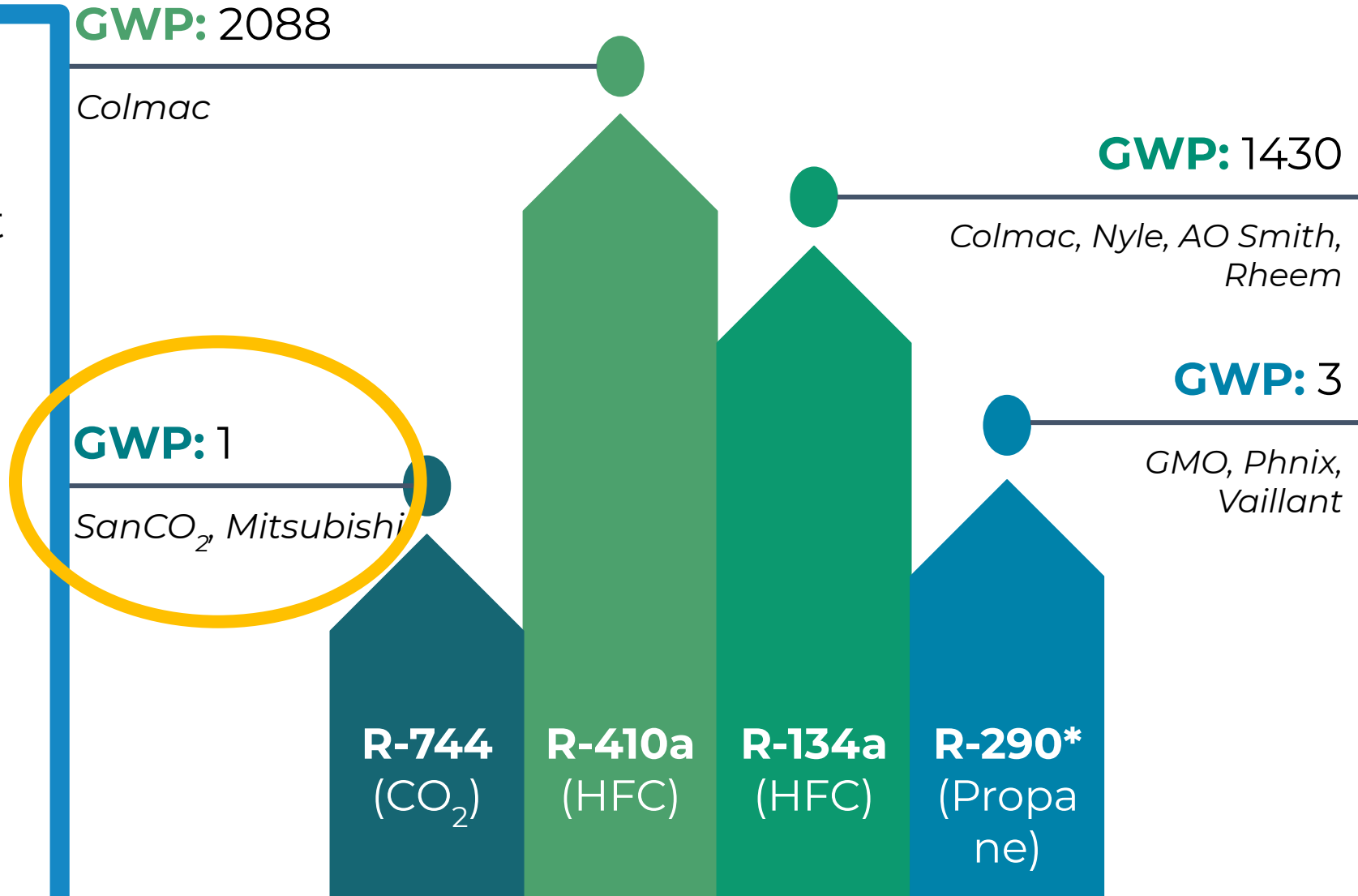


CLIMATE FRIENDLY TECHNOLOGY

Move Heat > Generate Heat

Utilizes low global warming potential refrigerants (that is what we want!)

More efficient than central gas or electric heating



CLIMATE FRIENDLY TECHNOLOGY

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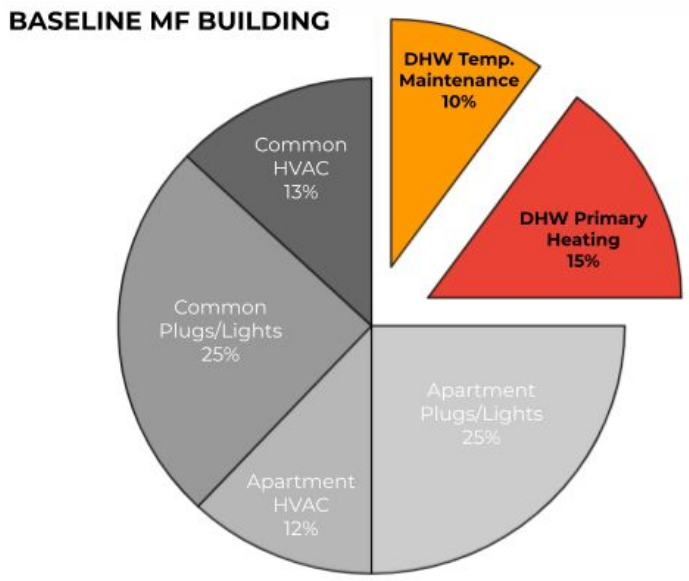
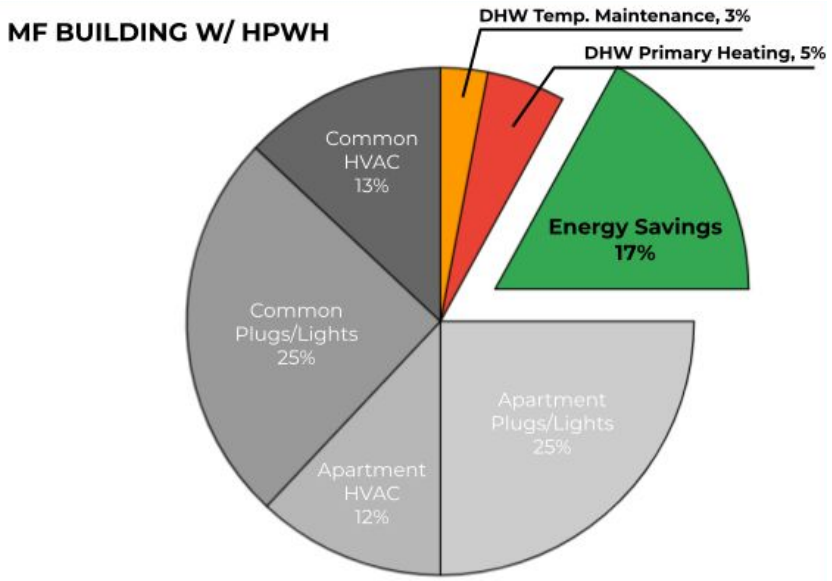




DEMONSTRATED **PROVEN PERFORMANCE**

10 years of experience, **over 100 projects**

⅔ reduction in energy usage for domestic water heating

15-18% reduction in overall building energy use


Sunset Electric Apartments, Seattle WA

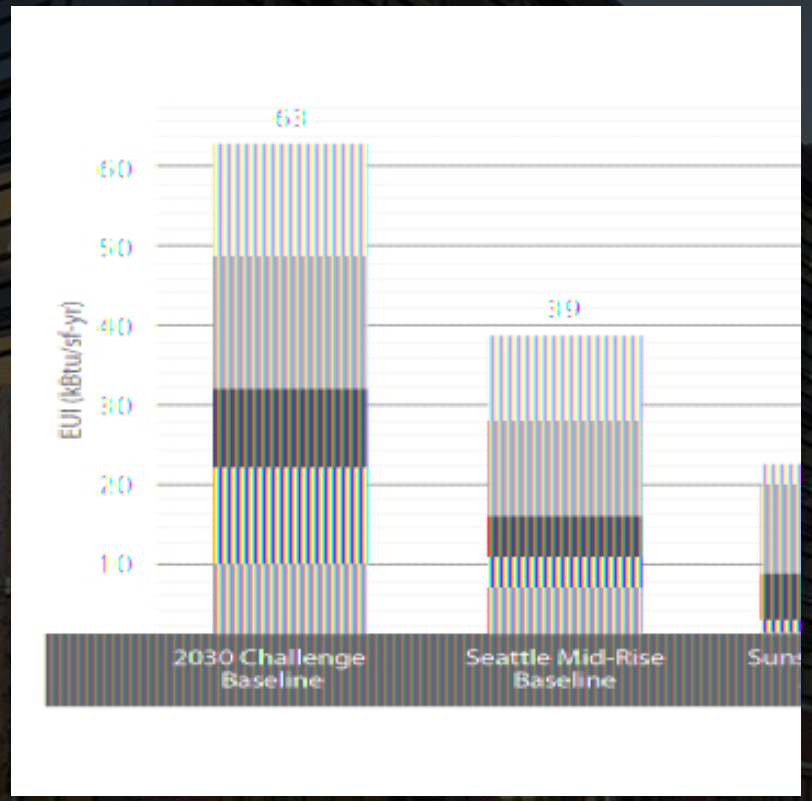

Stream Belmont Apartments, Seattle WA

SUNSET ELECTRIC

5 floors apartments over 1 floor retail over 1.5 levels of parking

92 residential apartments

Central 134a air-source heat pump water heaters in parking garage

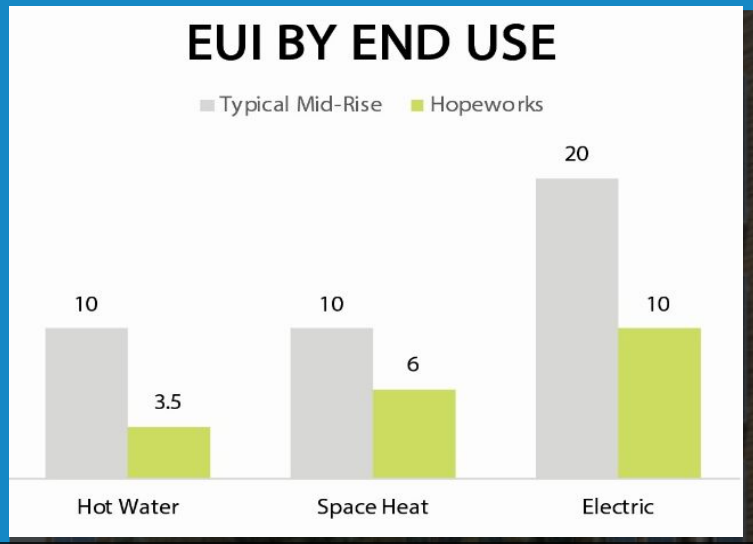


70% Reduction in DHW Energy

EUI= Energy Use Intensity

Energy Use/ Total Building Area

HOPEWORKS STATION



75% Reduction in DHW Energy

3 floors of apartments over 1 floor retail and 1 level parking

65 low-income apartments for formerly homeless population

Semi-distributed CO2 HPWH on roof

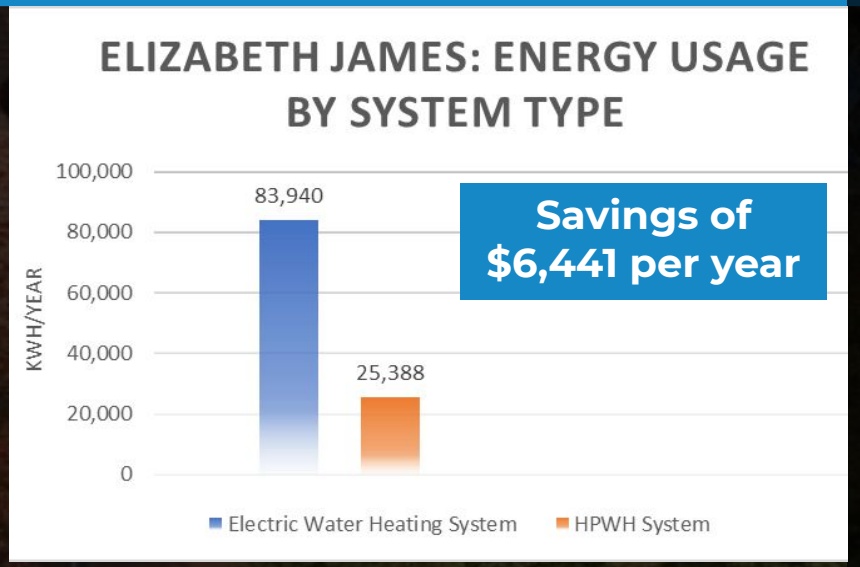
New construction

ELIZABETH JAMES

60 senior facility low-income units

4 CO2 Sanden Units (retrofit)

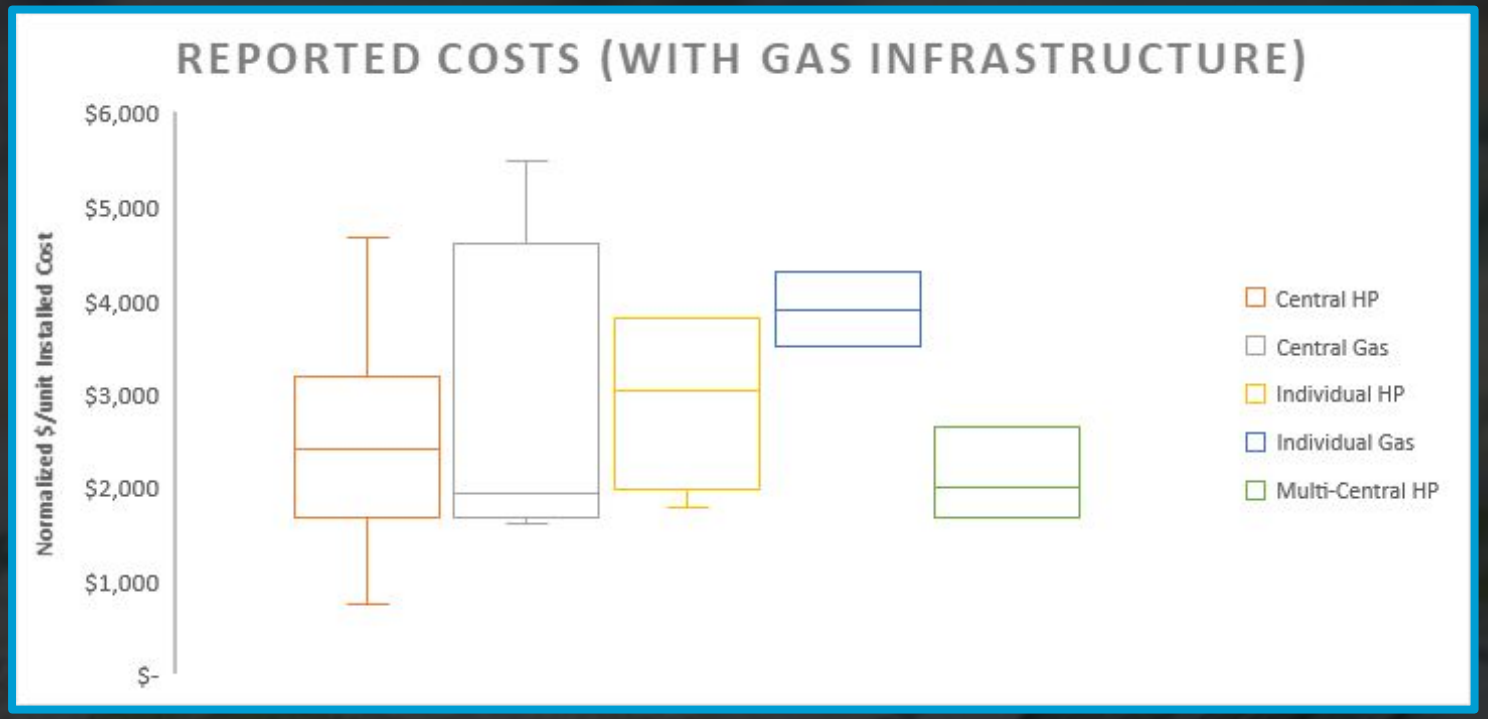
Zero GHG emissions

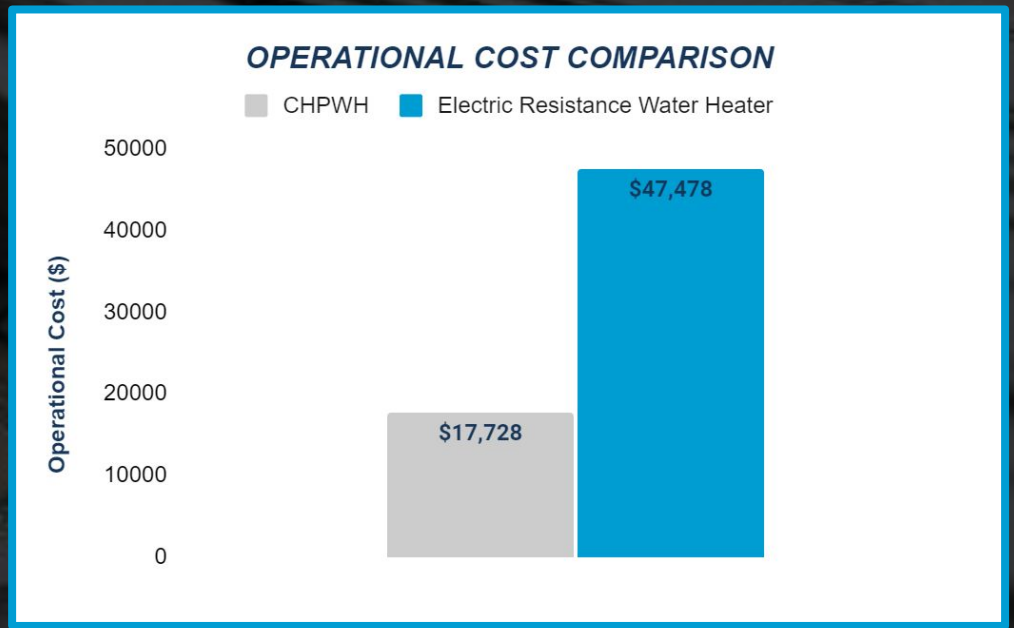


70% Reduction in DHW Energy

Cost Comparison

Lower Operational Cost Compared to ER Water Heaters



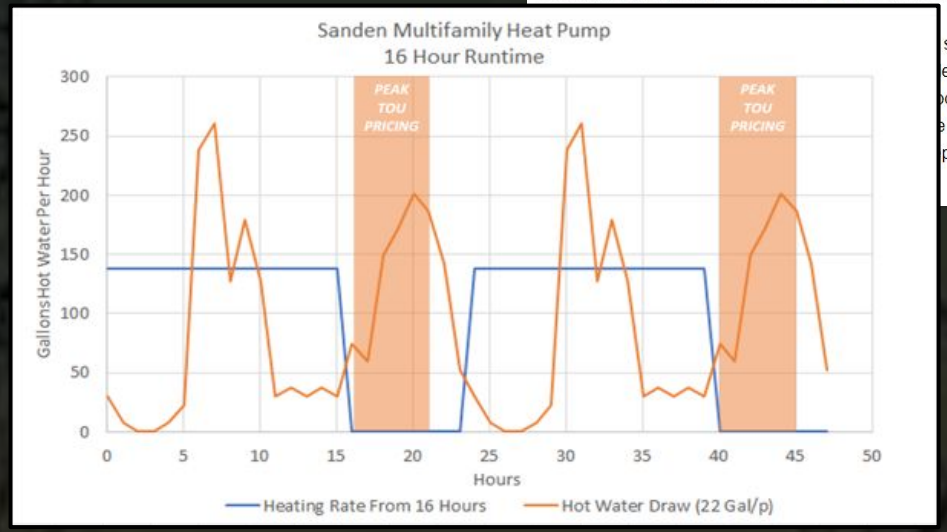


Neutral operational cost compared to gas

GRID FLEXIBILITY

TOU rates are coming!

CHPWHs are capable of load shift



Regional Study of
CTA-2045 Enabled Water Heaters

Raw data files are now available to download

The electric grid and the people who operate it are facing changes at a pace unprecedented since the days when Tesla and Edison fought over whether AC or DC electricity would be distributed. One thing is certain: renewable energy from wind and solar is here to stay as energy resources for the grid. Not only are these resources cost-competitive at scale with conventional power plants, but more importantly: customers, at least on the West Coast, overwhelmingly support renewable energy as a source they expect utilities to provide.

solar resources will have large amounts of excess energy when the
ectric storage to support the hours when neither wind nor solar energy
ods of excess renewables is a zero-cost measure, and appliances with
e end-state. When readers think "storage," they might think electric
pt of hot water heaters as "storage" and the ability to shift electric

Many HPWHs are capable of grid connectivity

ANSI/CTA-2045 module allows grid connectivity

DEMAND FOR SUSTAINABLE HOUSING

Market Differentiator

"Multifamily is on the cusp of some fairly substantial changes being driven by policy."

-Multihousing News

https://www.multihousingnews.com/post/innovations-in-energy-efficient-apartments/

CBRE + streetsense.

MULTIFAMILY

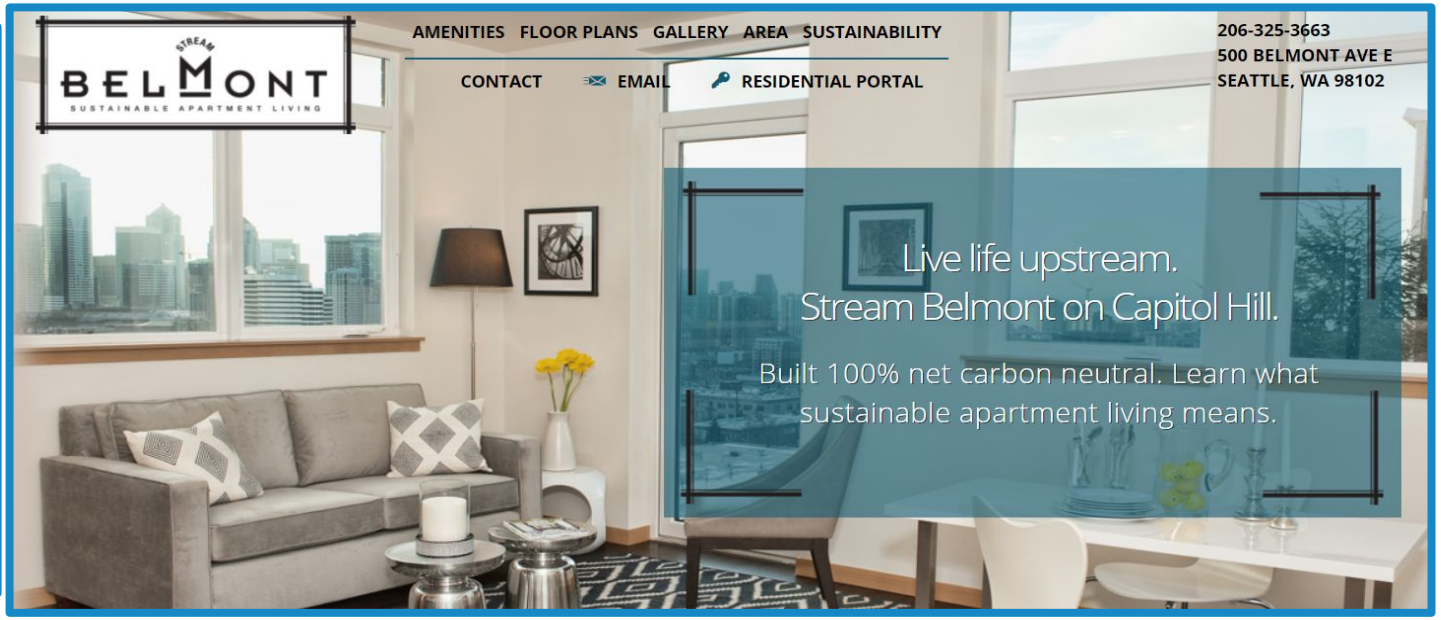
INNOVATION WATCH

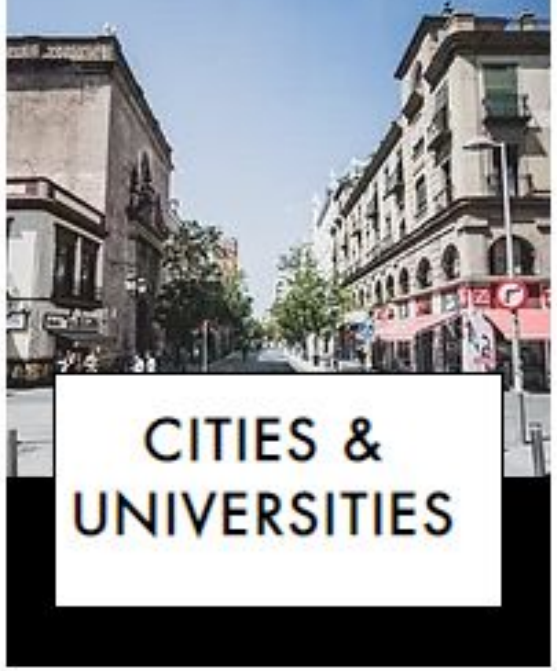
https://www.cbre.us/research-and-reports/Multifamily-Innovation-Watch

DEMAND FOR SUSTAINABLE HOUSING

Stream Belmont Apartments

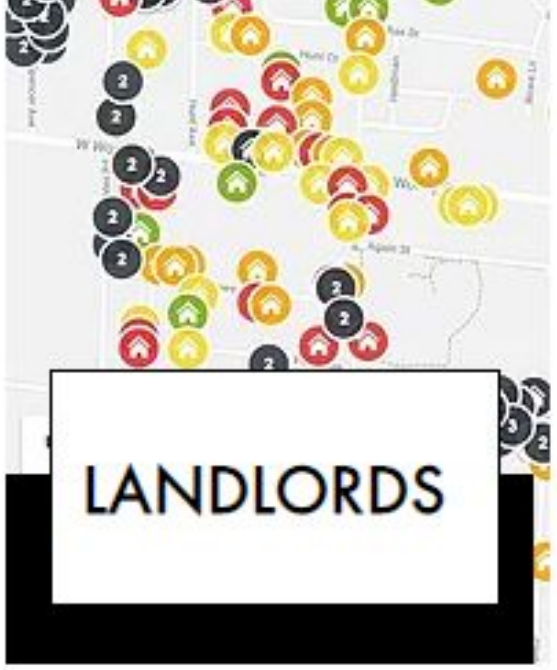
Energy efficiency and low carbon are in the sales pitch!





CITIES & UNIVERSITIES

TENANTS



LANDLORDS

UTILITIES

MISSION

RentLab's mission is to drive efficiency, sustainability, and affordability in rental housing using data transparency and customized community analytics.

rentlab

1234 MAIN STREET | ANYTOWN, ST | 00001 | 3 BED | 2 BATH

ADD PROPERTY DATA

Smart Living Score 45

Good To Know ✓ Recycling available ✗ High utility costs ✗ Inadequate insulation

Smart Living Features

Home Performance Participant	✗
Recycling service provided	★ ☆ ☆ ☆ ☆
Affordability	☆ ☆ ☆ ☆ ☆
Living space per person	★ ★ ★ ★ ★
Renewable energy	☆ ☆ ☆ ☆ ☆
Transparency	★ ★ ★ ☆ ☆

Accessibility

Walk Score® 81

Transit Score® 50

Bike Score™ 59

Average Monthly Costs *(per bedroom)*

THIS UNIT
$80

COLUMBIA AVERAGE
$62

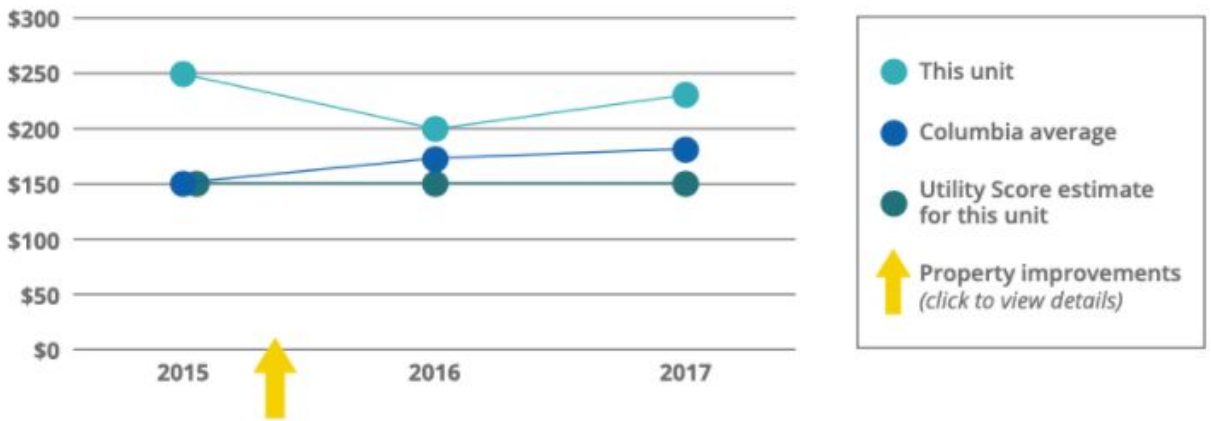
UTILITY SCORE ESTIMATE
$90

Efficiency Score

6/10

The Efficiency Score estimates home energy use, and is shown on a one-to-ten scale where a ten represents the most efficient homes.

Average Monthly Costs Over Time *(per bedroom)*



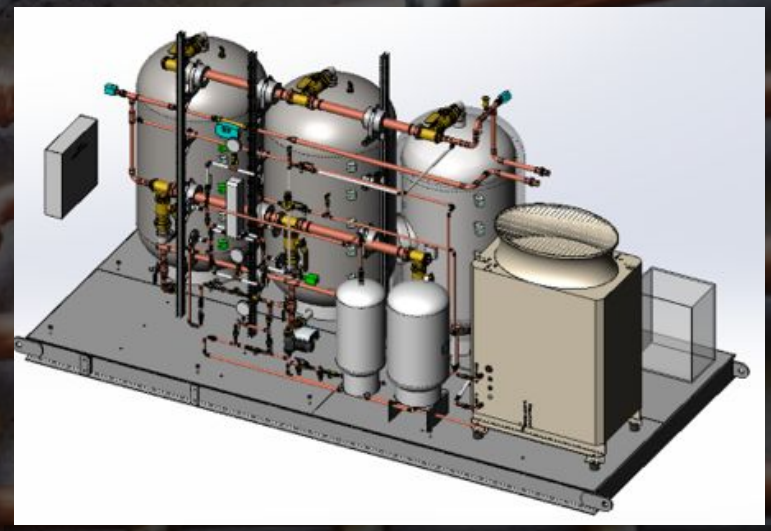
SIMPLE IMPLEMENTATION: **MARKET DELIVERY**

Custom Engineered System

All the pieces are separate and come from multiple distributors and/or manufacturers.

Fully Specified Built-up System

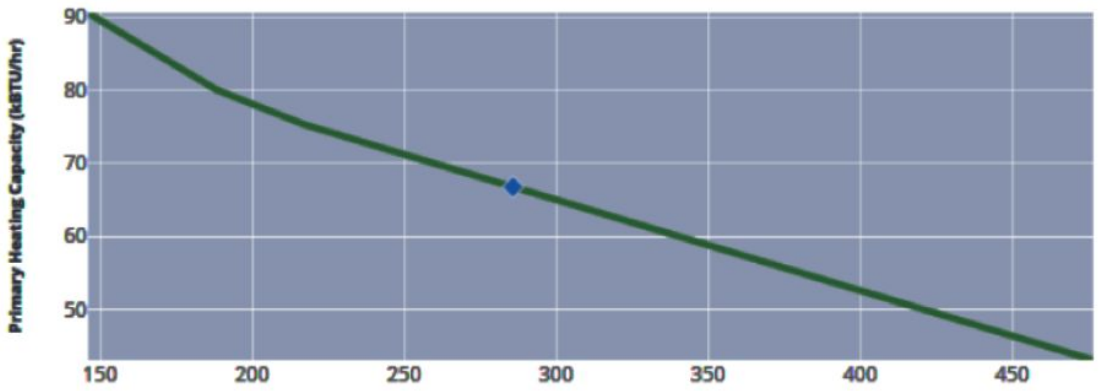
All the pieces are separate but come from a single distributor or manufacturer.



Fully Packaged/Skid

Everything assembled in a single package.

SIMPLE IMPLEMENTATION: **ECOSIZER**



Primary System Size, Storage: 286 Gal, Capacity: 66.8 kBTU/hr

THIS SYSTEM WAS SIZED FOR

Occupancy
60.0 People

Apartments
30.0 Units

Daily Hot Water Usage
25.0 Gallons per Day per Person

Total Hot Water
1500 Gallons per Day

Tank Volume
285 Gallons

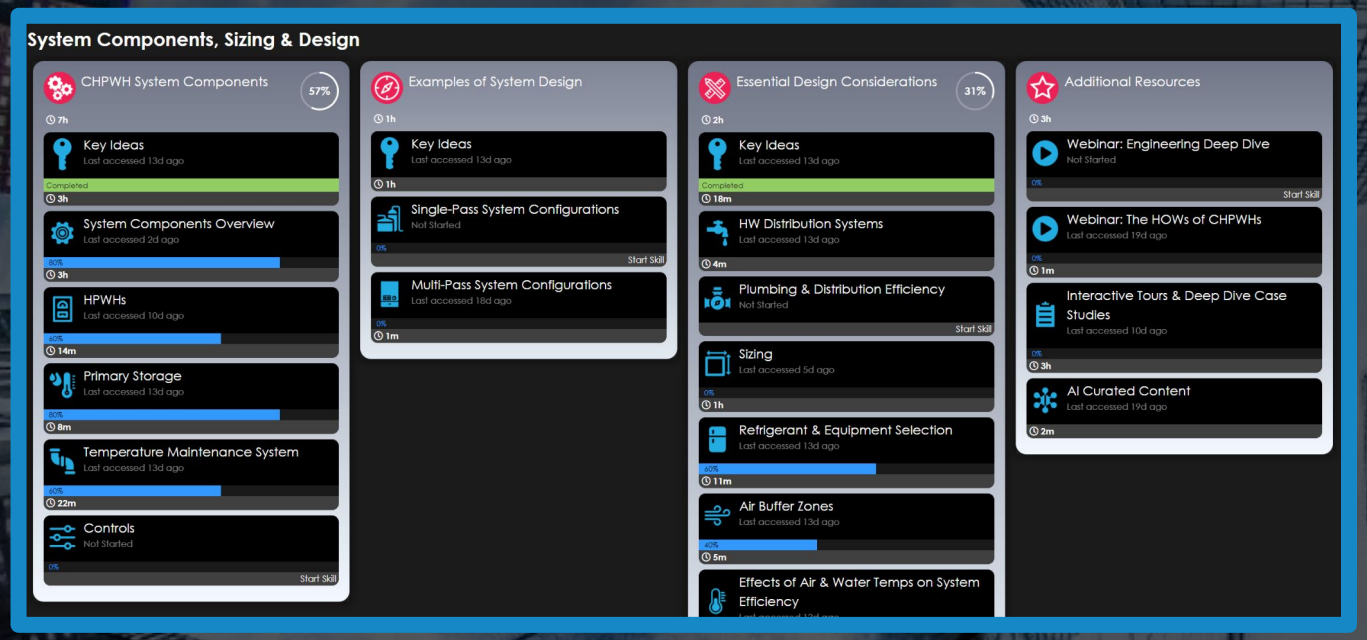
Heating Capacity
66.8 kBTU/hr

Swing Tank Volume
80 Gallons

Swing Resistance Element
4.7 kW · **15.9** kBTU/hr

https://ecosizer.ecotope.com

SIMPLE IMPLEMENTATION: **EDUCATION MODULES**



Online On-demand CHPWH Educational Modules

- Technical Overview of CHPWH
- System Components, Sizing and Design
- Operations and Maintenance
- Installation of CHPWHs in New Construction
- Measurement & Verification for CHPWHs
- The WHY of CHPWHs: An Overview
- Manufacturer Training and Resources
- Code Compliance training

ADVANTAGES **RECAP**

10 years of proven performance

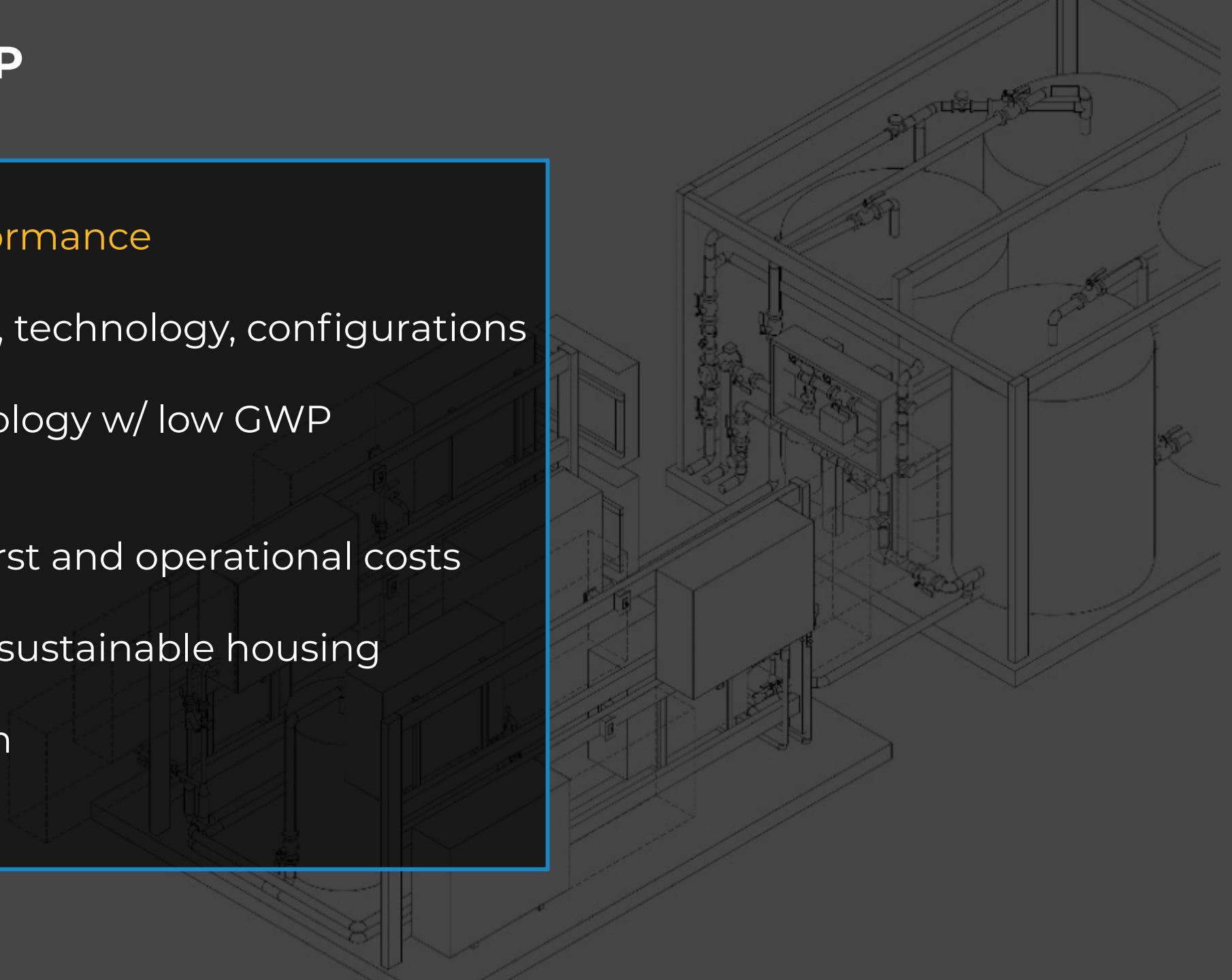
Multiple building types, technology, configurations

Climate-friendly technology w/ low GWP refrigerants

Comparable or lower first and operational costs

Addresses demand for sustainable housing

Simple Implementation



SEATTLE CITY LIGHT INCENTIVES

SCL **INCENTIVES**

C-HPWH Water Heating Incentives

Measure	Incentive Rate	Eligibility	Baseline Assumption	Custom Calcs?
Commercial Retrofit & New Construction				
Heat Pump Water Heaters - Single or Multi-pass systems	*$0.24/kWh*	*Must be central systems, Commercial only*	*Existing for retrofit, Code for new Construction*	*Y*
Multifamily New Construction				
Centralized Heat Pump Water Heaters COP >2	*$350 per living unit*	*Central System COP>2*	*Code*	*Y*
Centralized Heat Pump Water Heaters CO_2	*$500 per living unit*	*Central System COP>2, CO_2 as Working fluid*	*Code*	*Y*

CHPWHs ARE NEEDED NOW BECAUSE…

Societal shifts are driving clean and efficient technology

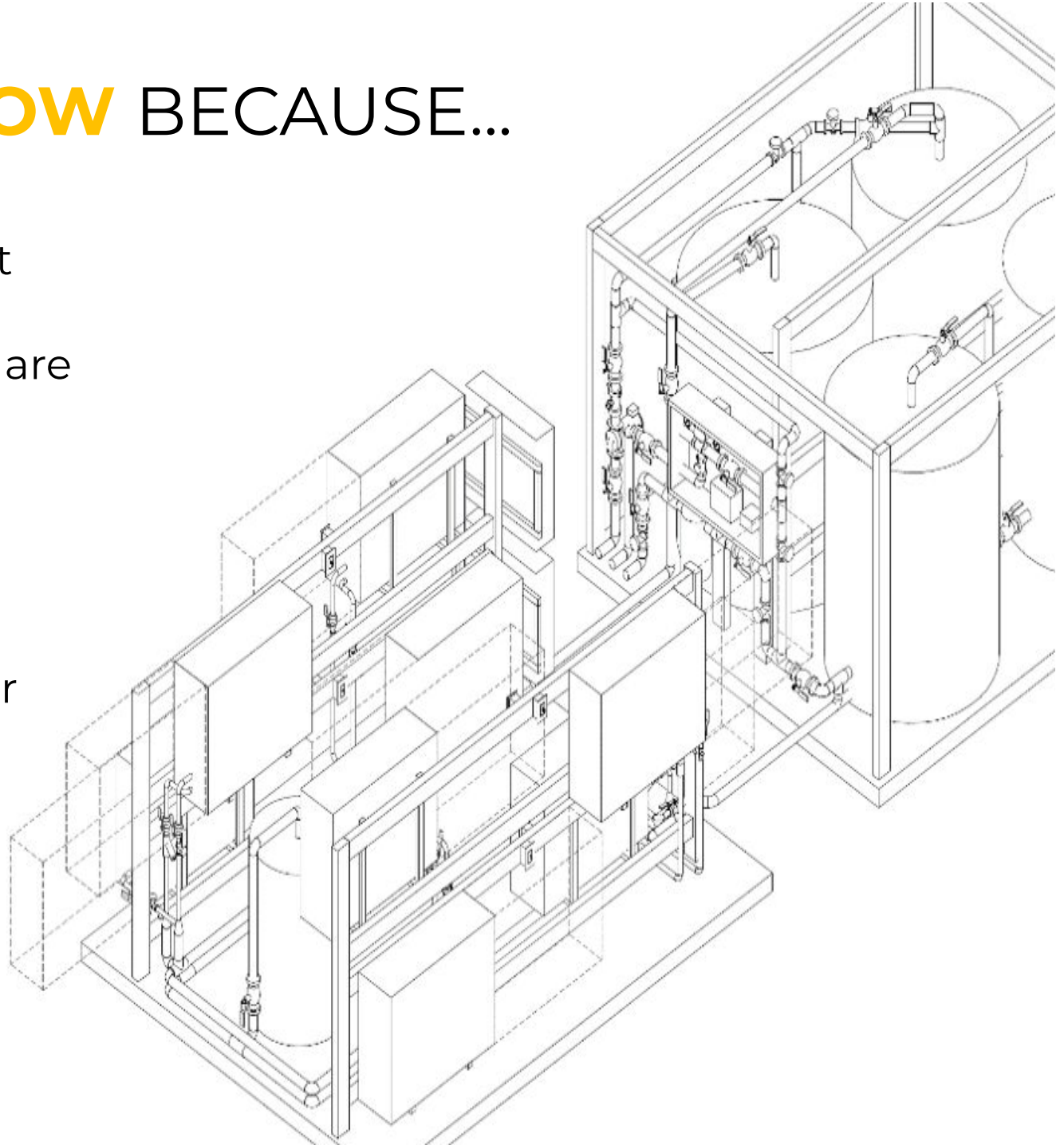
- Federal, state, local policies and codes are requiring clean and efficient electric technologies

Unique **value propositions** exist

- Exceptional proven performance
- Climate-friendly technologies
- Lower operating costs and equivalent or lower first costs
- Market differentiation

Investing now makes sense

- Significant **incentives** exist through SCL for CO2 refrigerant systems or systems with a COP >2



ADDITIONAL **RESOURCES**

Seattle Energy Code 2018

Advanced Water Heating Specification v.8.0

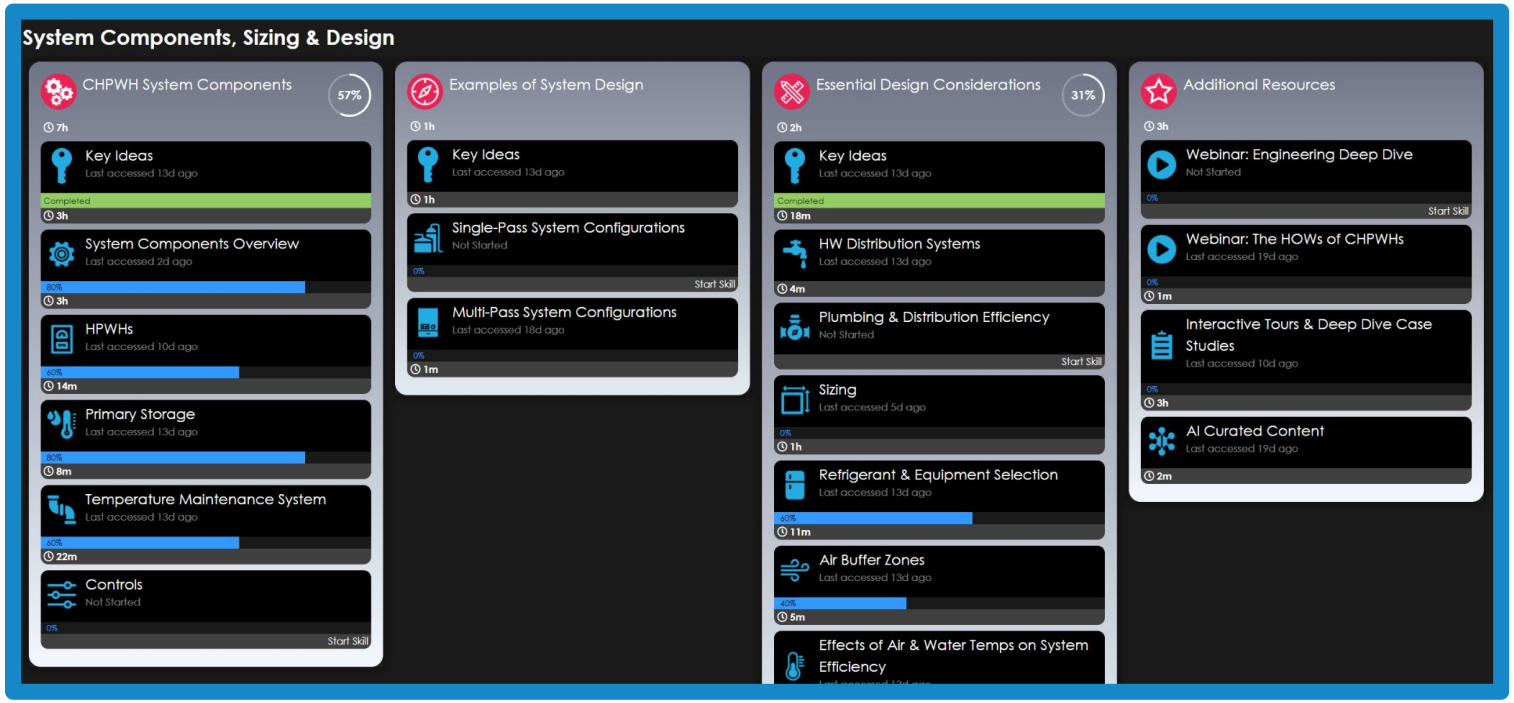
Ecosizer

Washington Governor's Deep Decarb Plan

RentLab

ECOTOPE

UPCOMING **TRAINING & RESOURCES**



Upcoming Instructor-led sessions with SCL:

- October 11 & 13: CHPWH Engineering Deep Dive
- Oct 26, Nov 3, Nov 10, Nov 17: CHPWH Design, Maintenance and Operations

Coming in November!

Access to fully online, on-demand CHPHW educational modules:

- CHPWH: Technical Overview
- System Components, Sizing and Design
- CHPWH: Design, Maintenance and Operations
- CHPWH: Measurement & Verification
- CHPWH Manufacturer Training & Resources
- CHPWH: Installation in New Construction
- Why Commercial HPWHs

lighting design lab

Seattle City Light

To host a training session, or for access to online CHPWH educational modules, contact:
Lauren Bhaskar, Engineering Training Manager,
LBHASKAR@DRINTL.COM

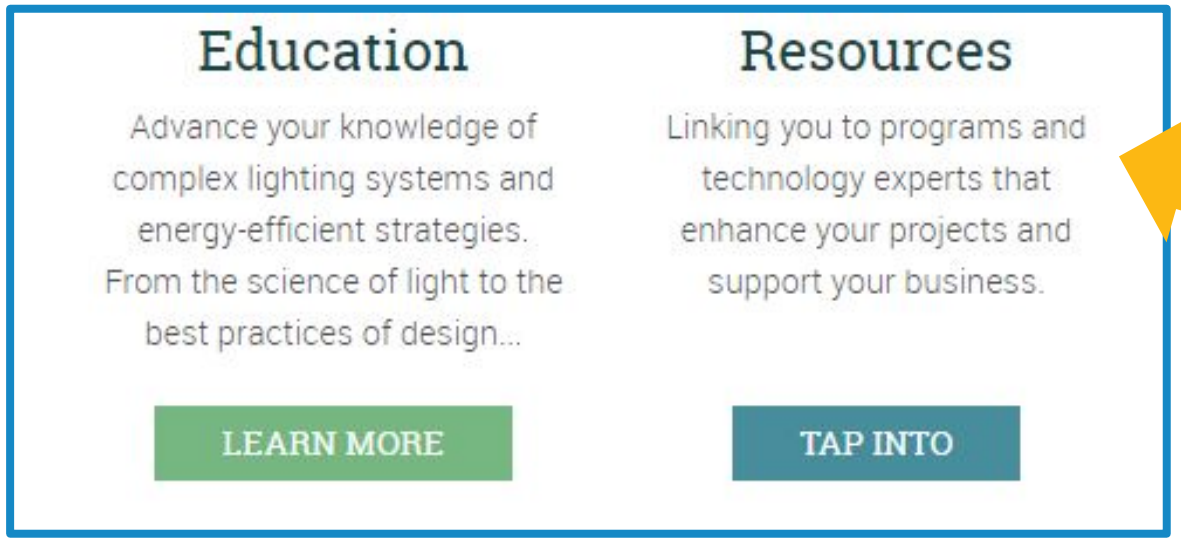
D+R LEARN

ECOTOPE

CLICK - CALL- **CONNECT**

Armando Berdiel Chavez, M.Eng., LC.
206-475-2722
armando.berdiel@seattle.gov

Visit Us Online

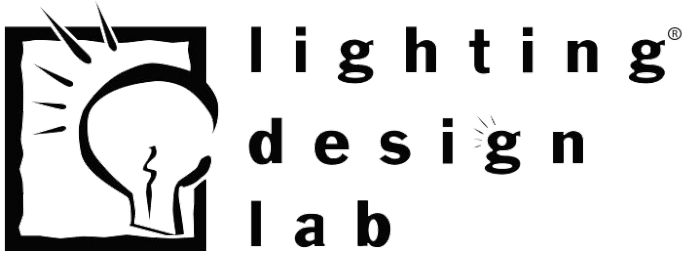


OR

Email Us

lightingdesignlab@seattle.gov

Todays slide deck will be posted here!



Thank You to our Collaborators