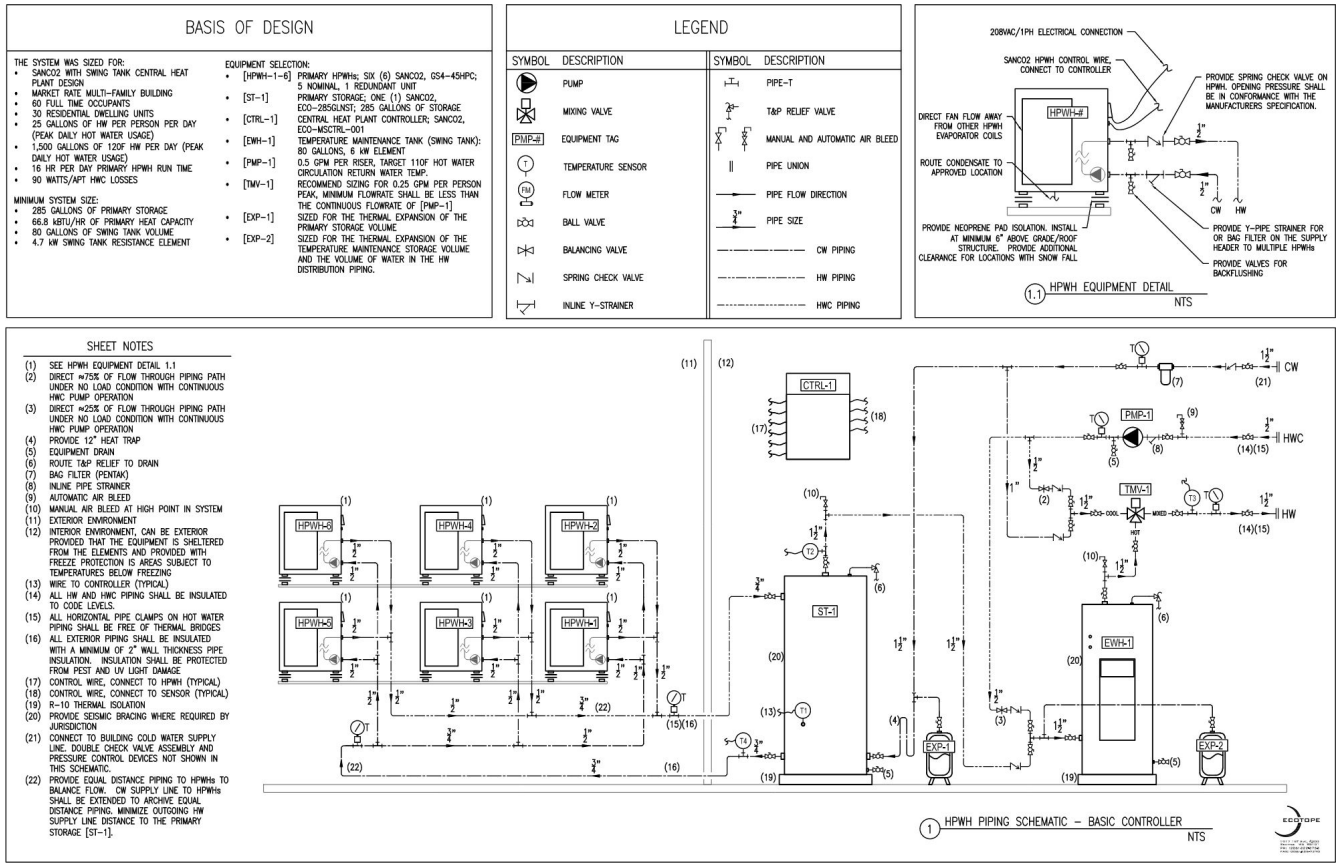
HOW TO SELECT AND DESIGN A COMMERCIAL HEAT PUMP WATER HEATING SYSTEM

Evan Green, Research Engineer
Ecotope, Inc.



OBJECTIVES

- Building Types and Applications
- Commercial HPWH system components
- Key Design Considerations
- Seattle Code Updates

BUILDING TYPES AND APPLICATIONS

IDEAL BUILDING **TYPES FOR CHPWHs**

Low-Rise 4-20 Units

Mid-Rise 5-400 Units, <7 floors

High-Rise 100-500, Units >7 floors

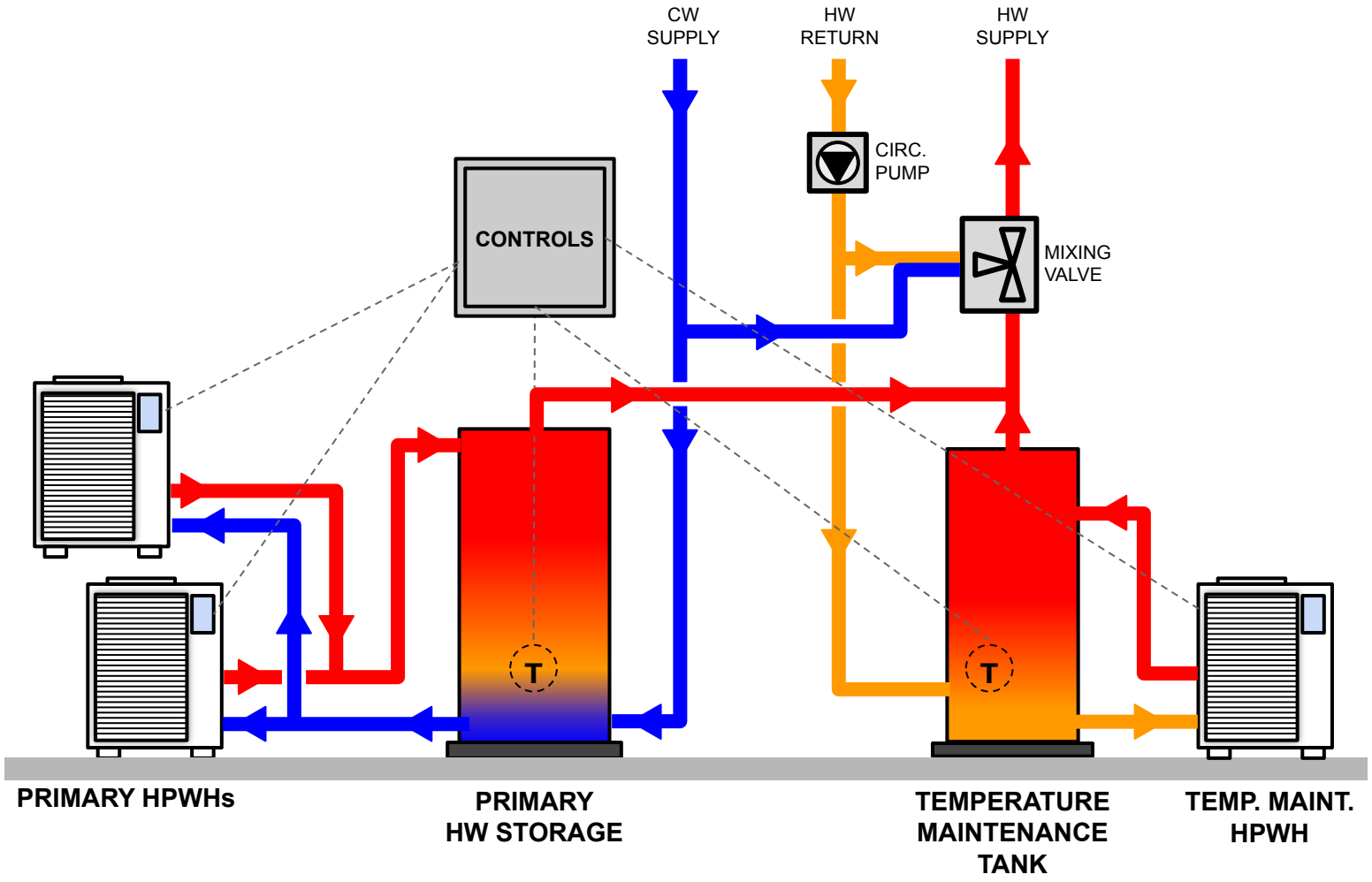
OTHER BUILDING TYPES **IDEAL FOR CHPWHs**

- Hospitality
- Residential
- Health Care
- Fire Stations
- Libraries
- Schools
- Offices
- Police Stations

CHPWH SYSTEM COMPONENTS

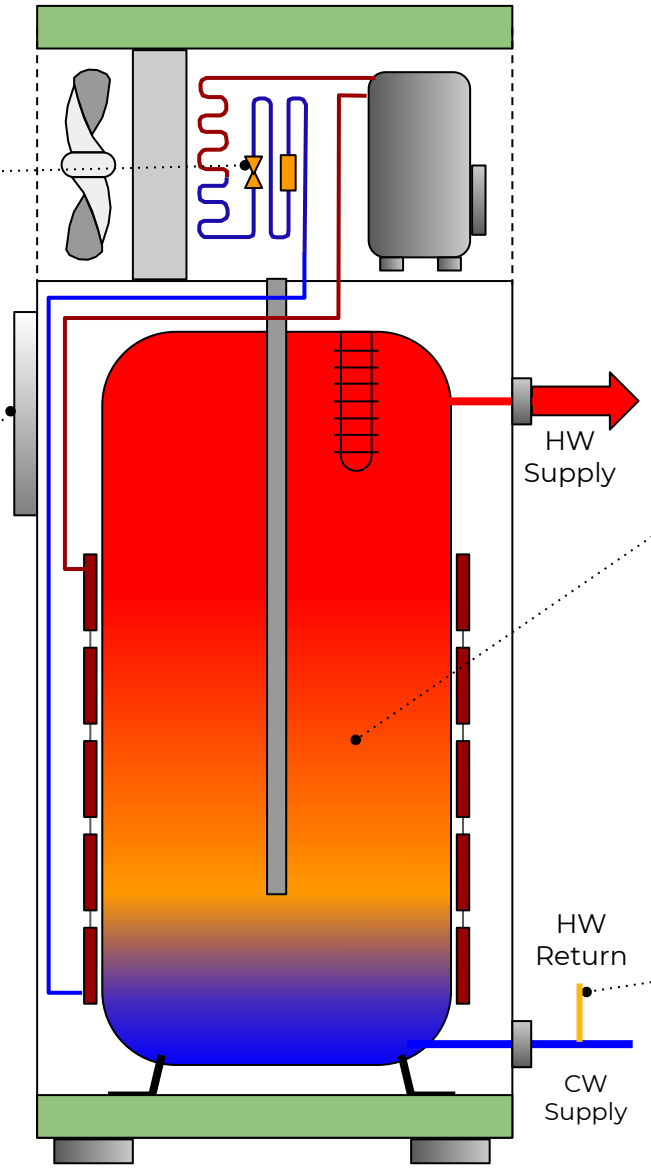
and how they interact

FOUR **CHPWH SYSTEM COMPONENTS**

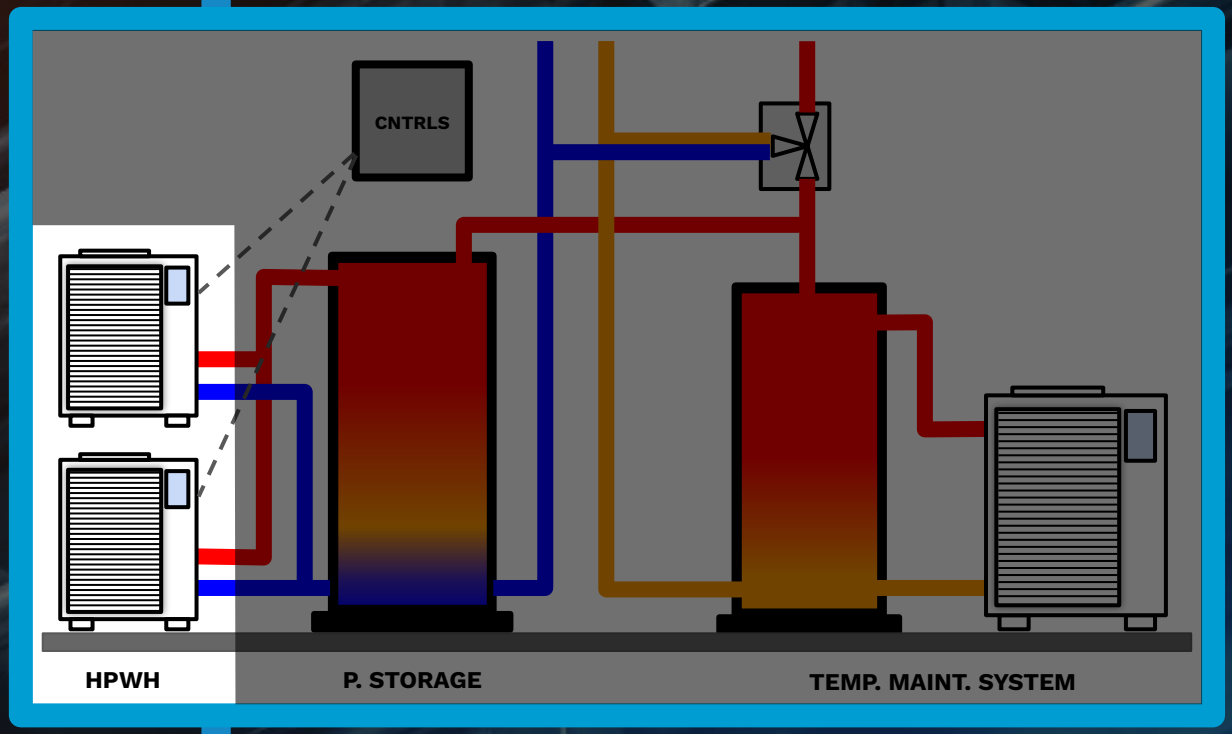


- Primary heat pump water heater (HPWH)
- Primary HW storage tank
- Temperature maintenance system
- Controls

HOW DOES IT COMPARE?



COMPONENTS:
HPWH

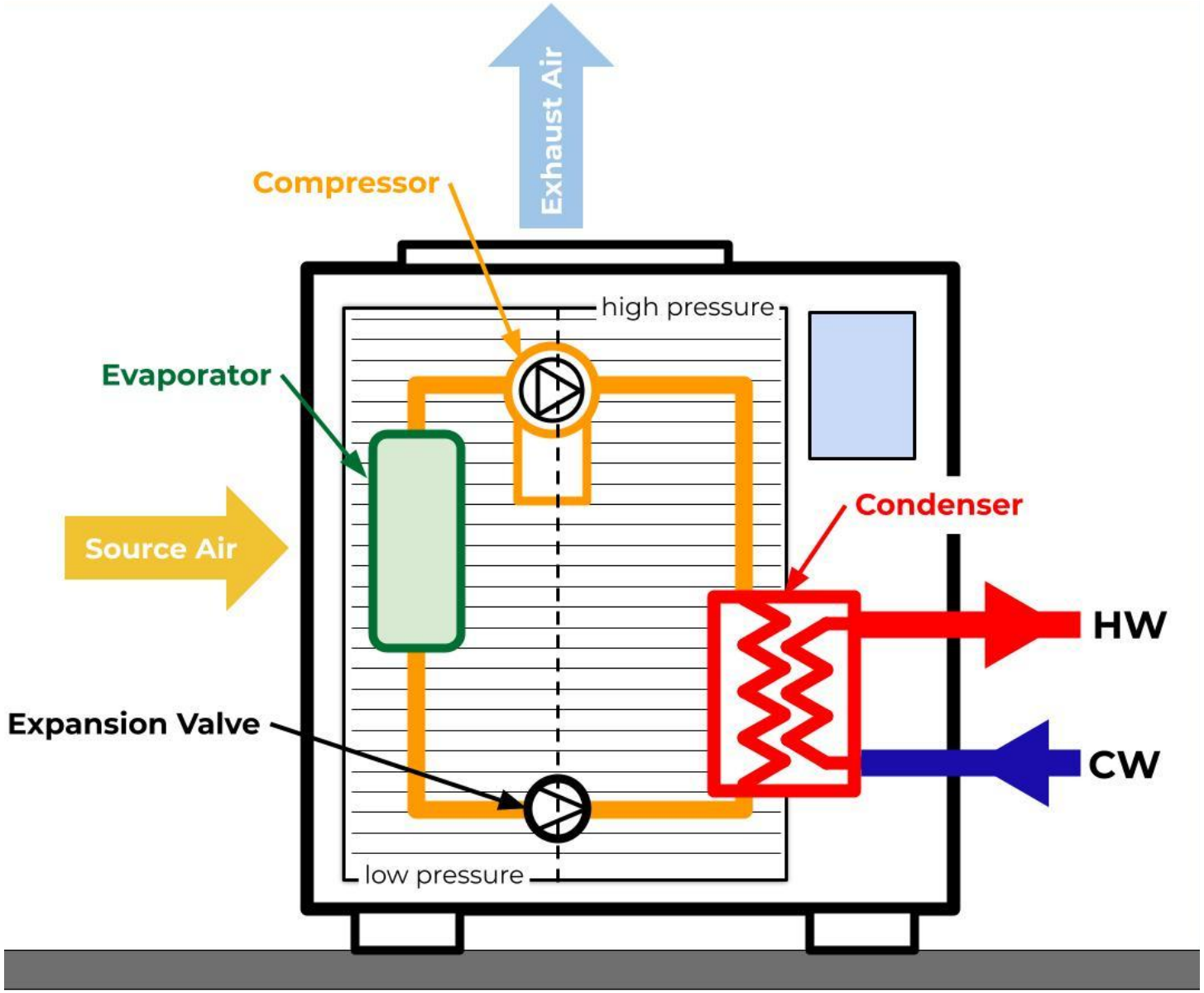


HOW **HEAT PUMPS** WORK

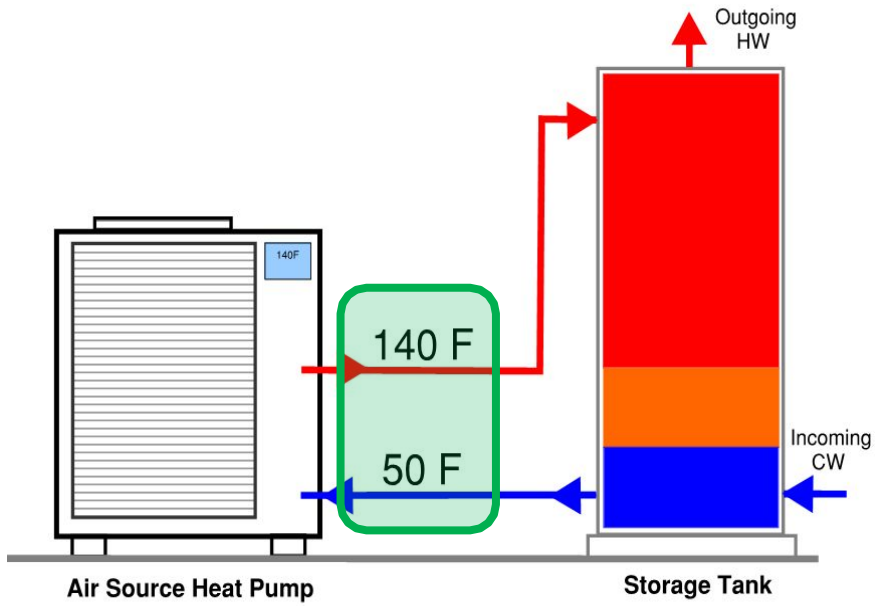
Move Heat > Generate Heat

Extract heat from air source and put that heat into water

More efficient than central gas or electric heating

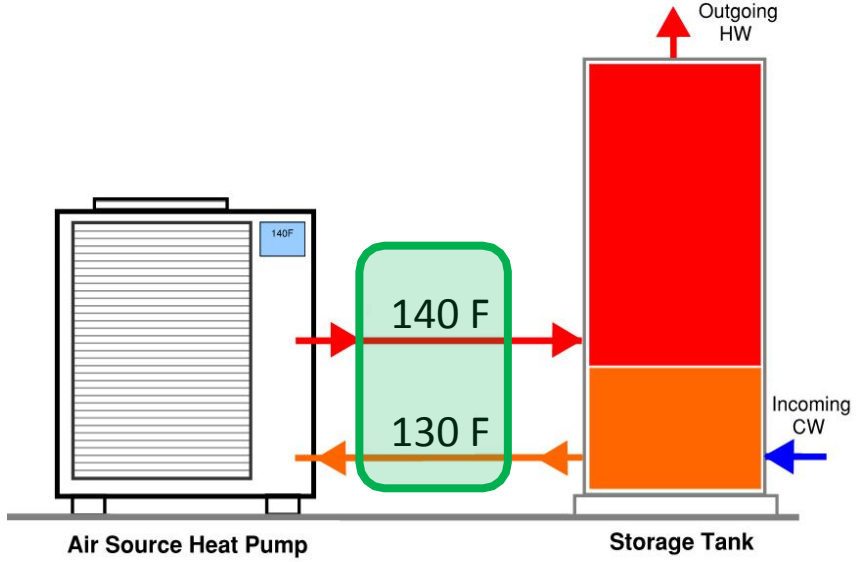


TWO TYPES OF **HEATING CYCLES**



SINGLE-PASS

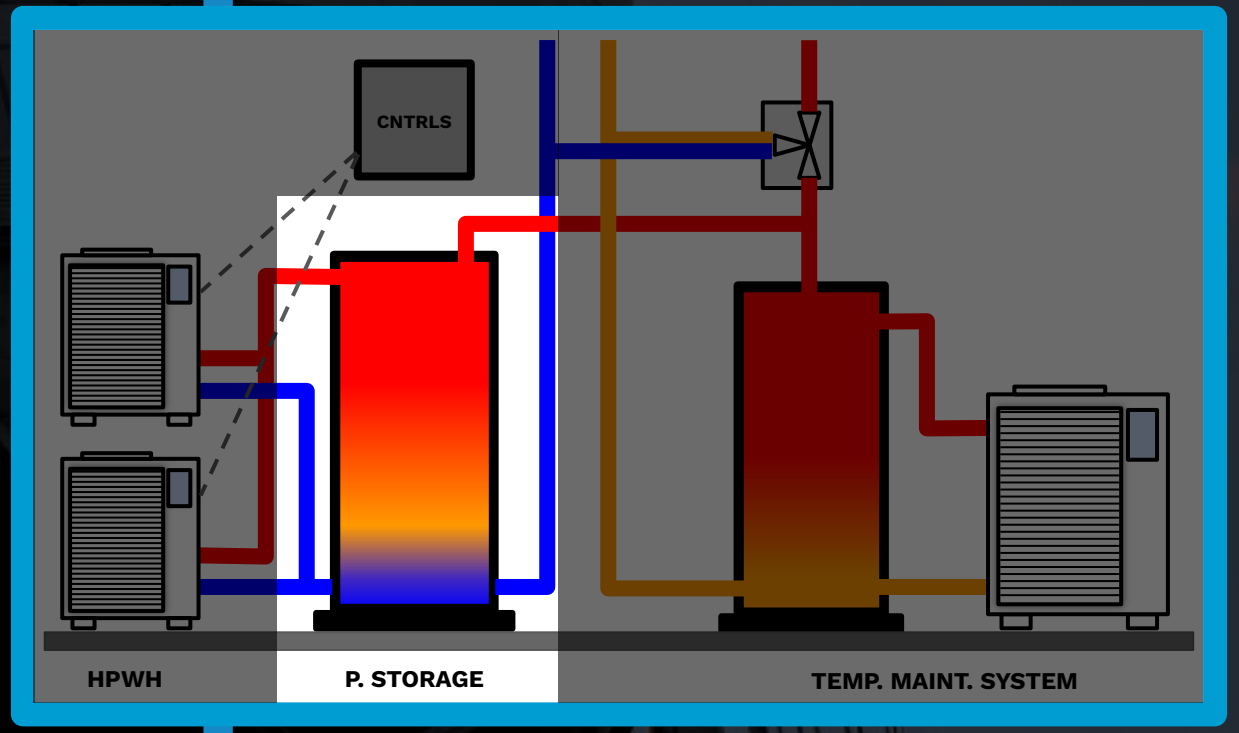
Heats water to working temp. in single pass
(*usually for primary heating load*)



MULTI-PASS

Heats water to working temp. in multiple passes
(*typical of temperature maintenance systems*)

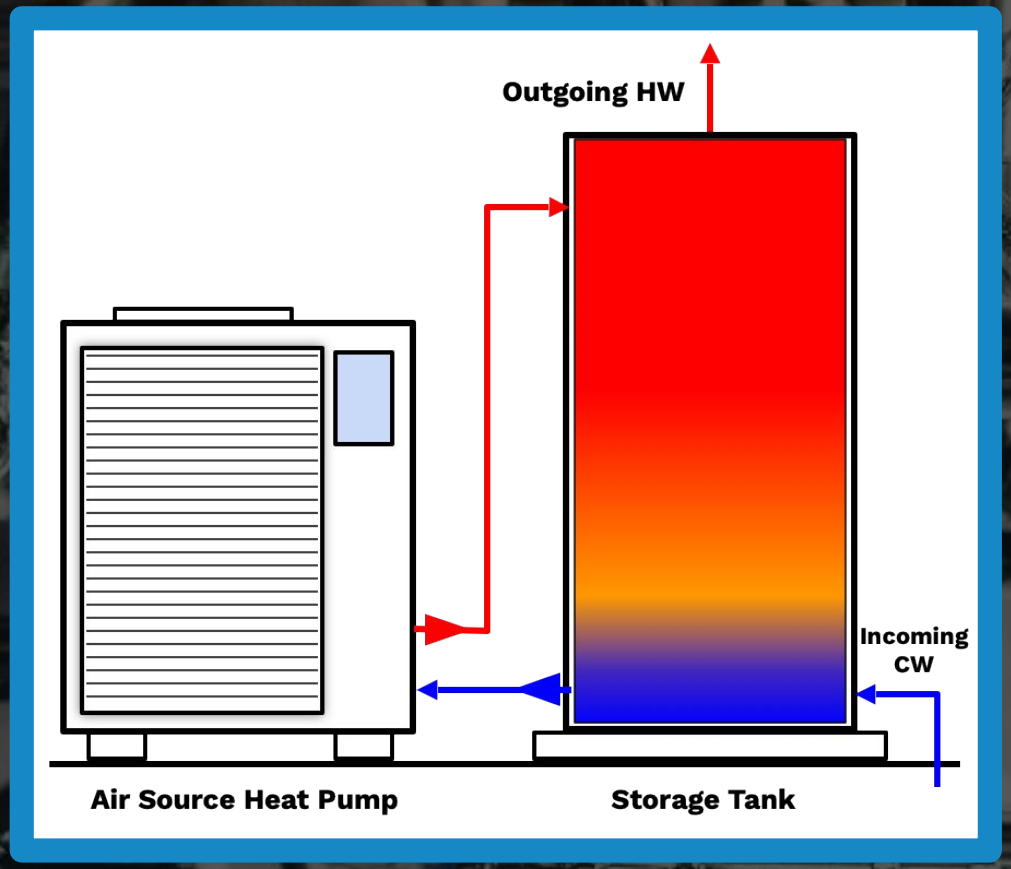
COMPONENTS:
PRIMARY STORAGE

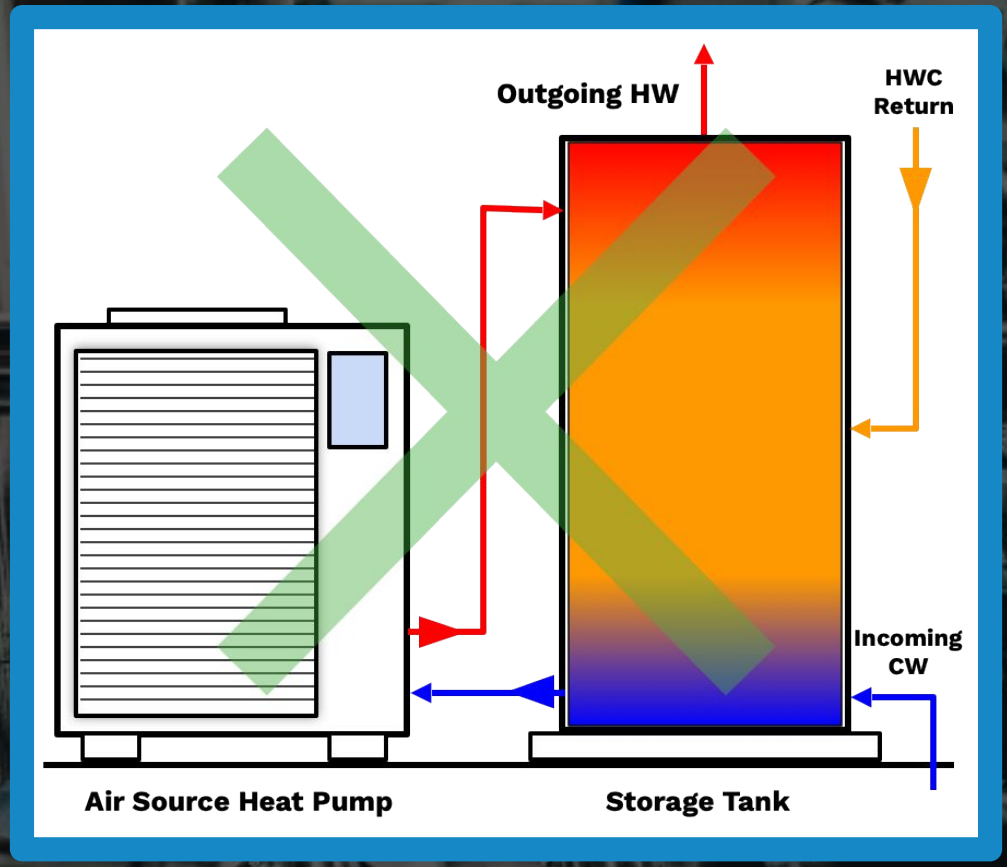


PRIMARY **STORAGE TANK(S)**

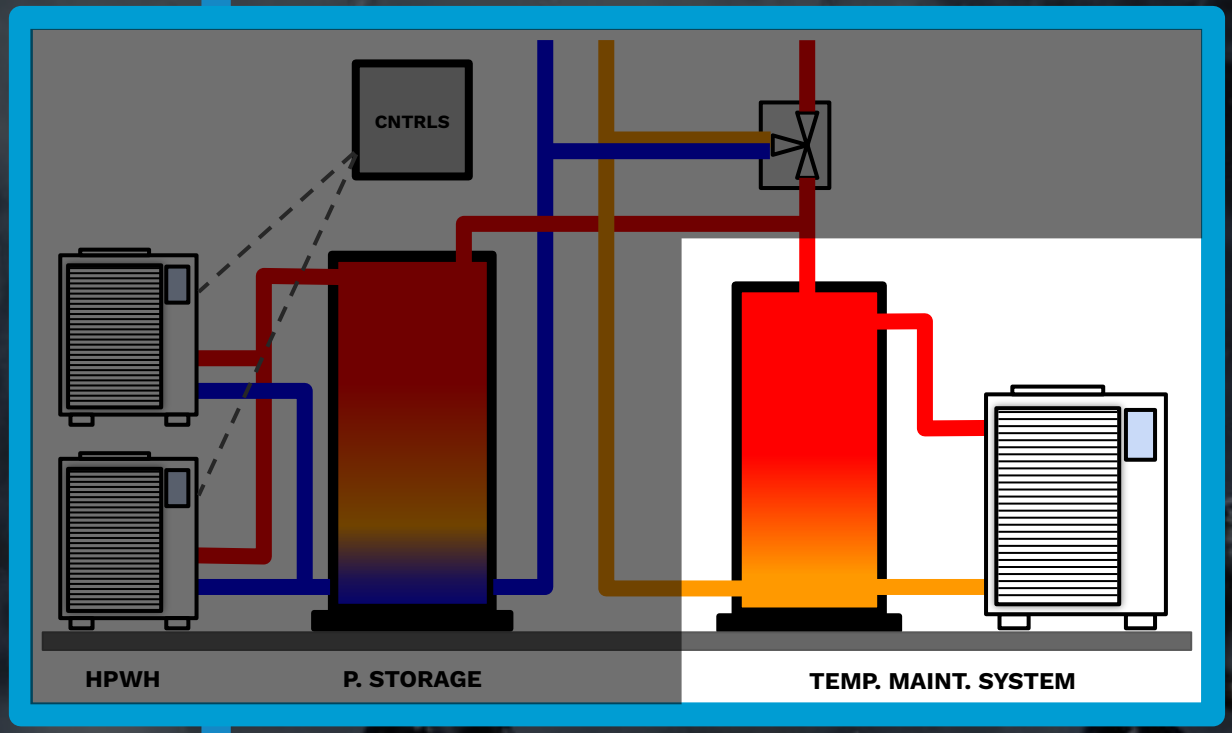
A BATTERY BANK

PRIMARY STORAGE: **THERMAL STRATIFICATION = GREATER EFFICIENCY**



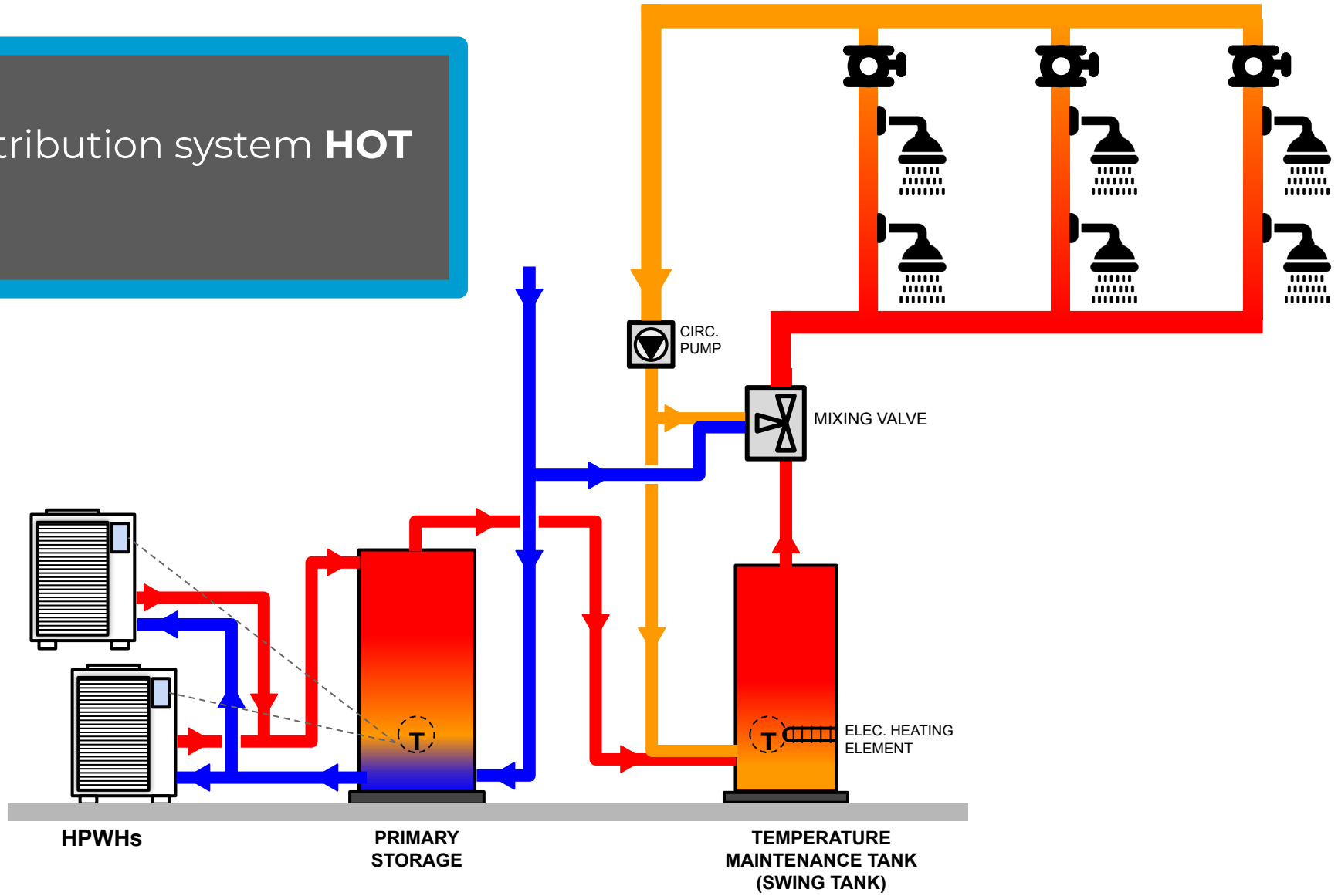


COMPONENTS:
TEMPERATURE MAINTENANCE



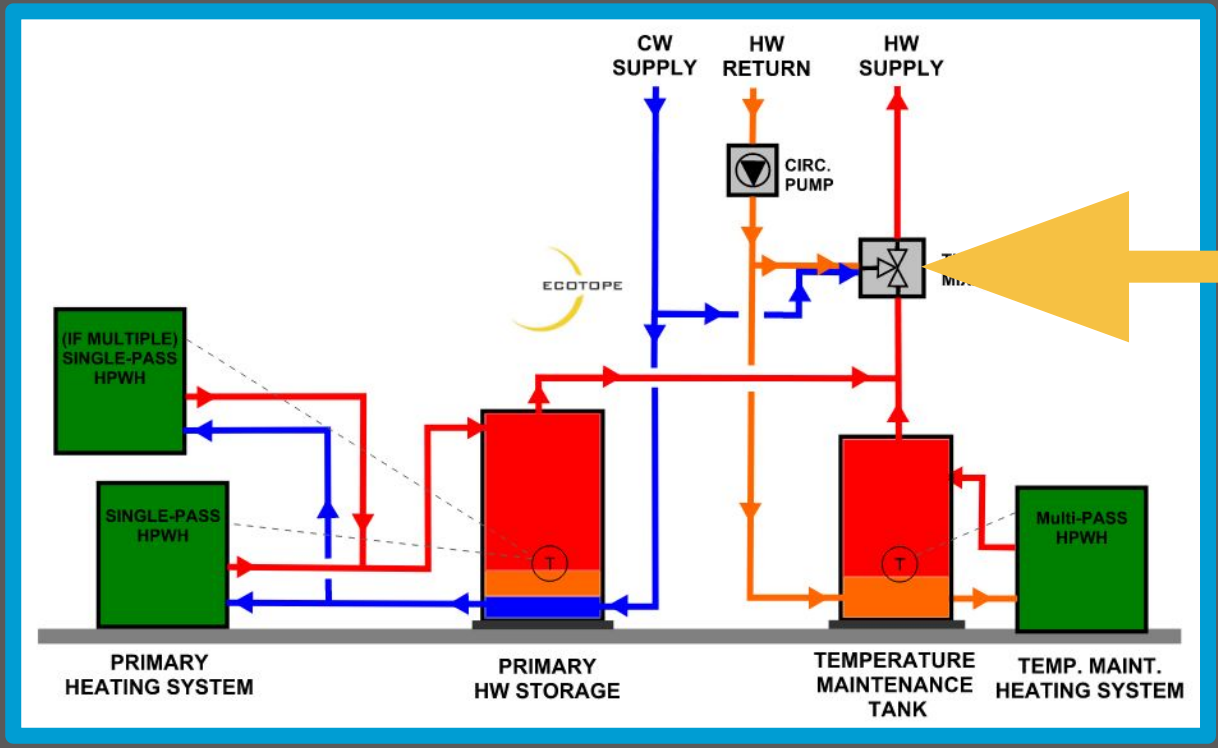
TEMPERATURE MAINTENANCE **SYSTEM**

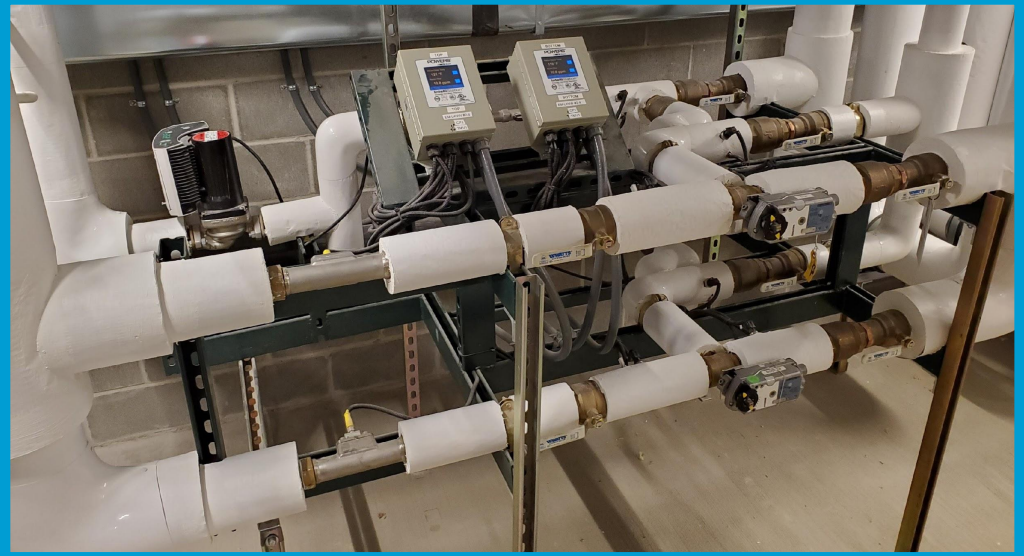
Keeping the water in the distribution system **HOT**

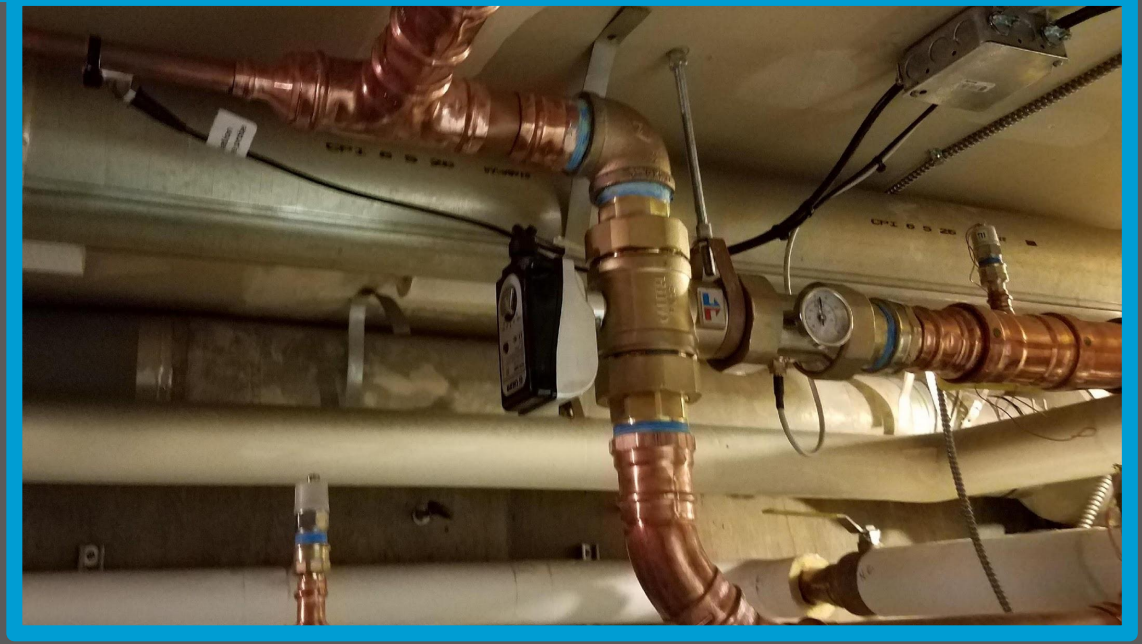


TEMPERATURE MAINTENANCE SYSTEM: THERMOSTATIC MIXING VALVE

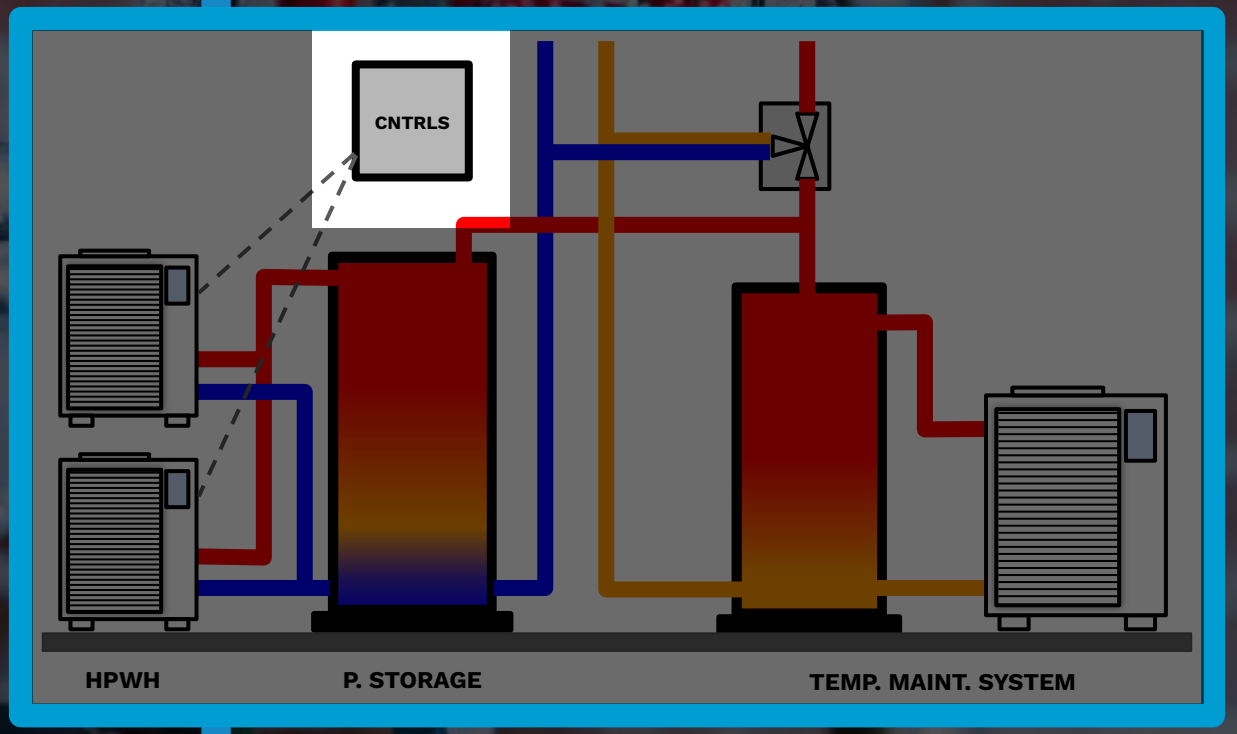
Provides hot water delivery **temperature control**







COMPONENTS:
CONTROLS



CONTROLS **OPTIONS**

Equipment communicates through **CONTROLS** to fulfill design intent.

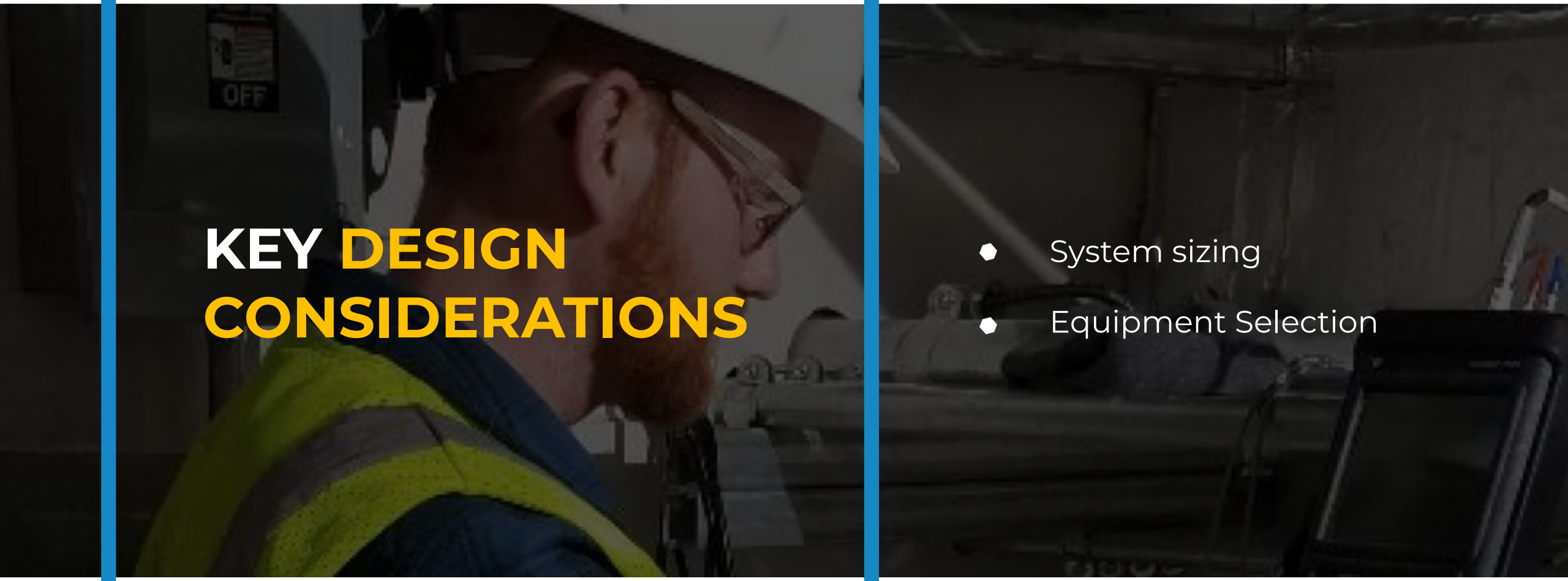

External Controls

Internal Controls

RECAP:

CHPWH COMPONENTS:

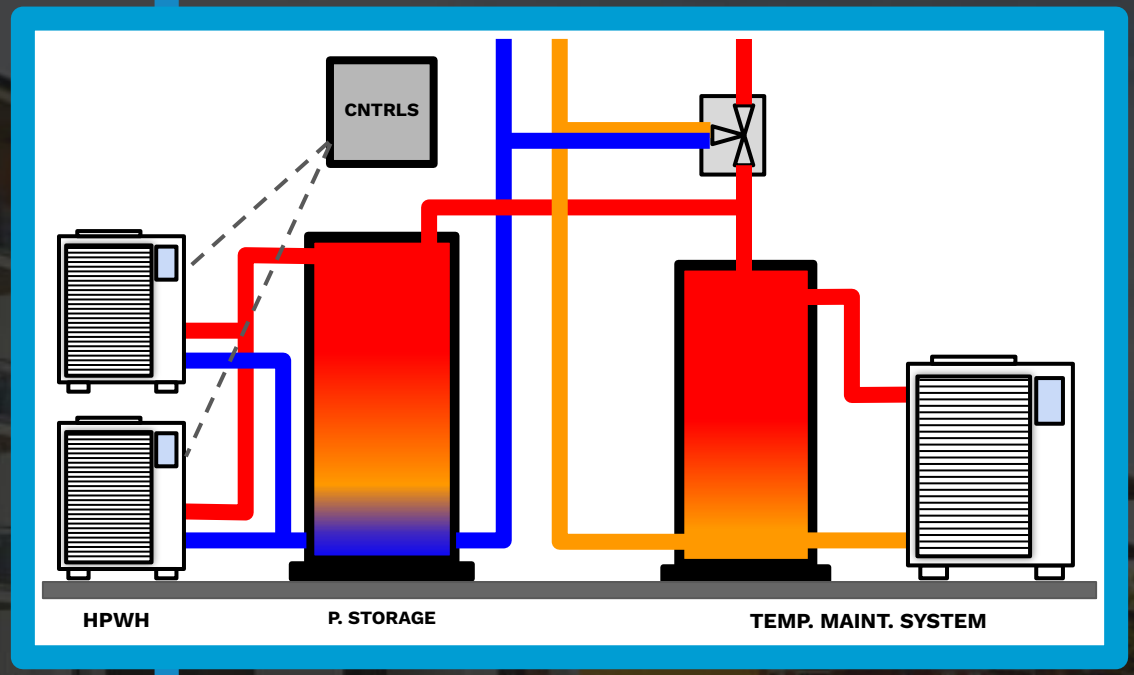
- Heat pump
- Primary storage tank
- Temperature maintenance system
- Controls



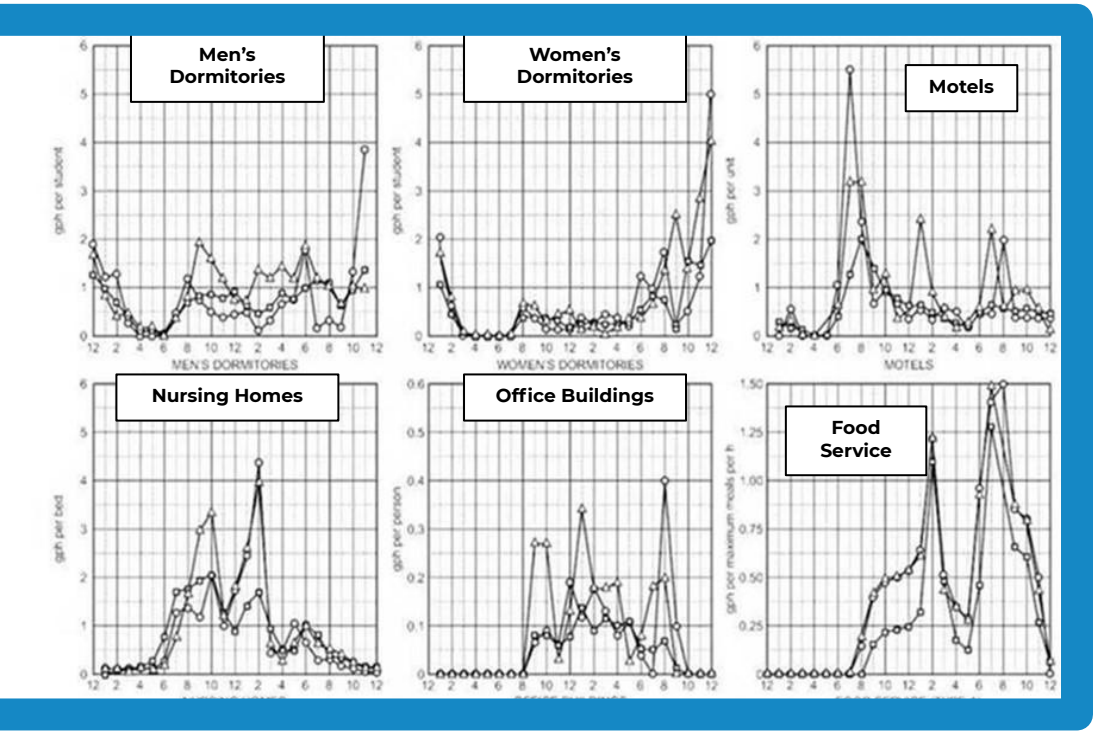
KEY DESIGN CONSIDERATIONS

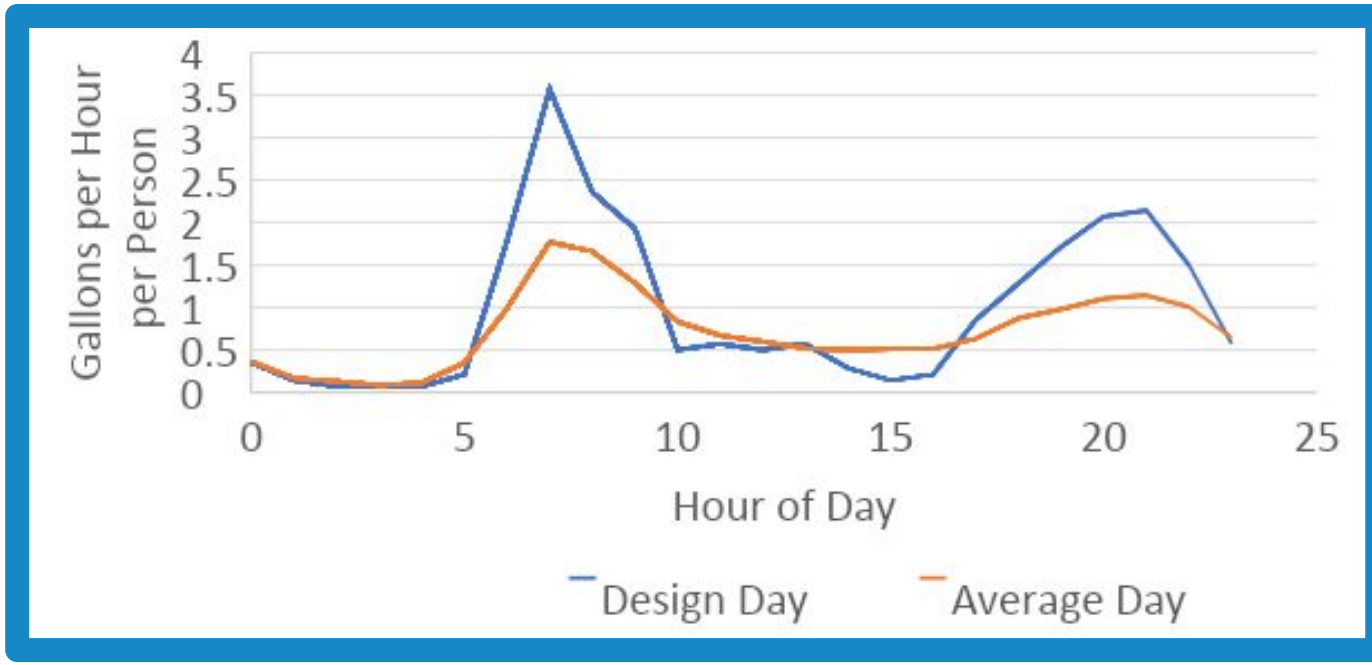
- System sizing
- Equipment Selection

HW SYSTEM DESIGN: SIZING



PREDICT DOMESTIC HOT WATER LOAD

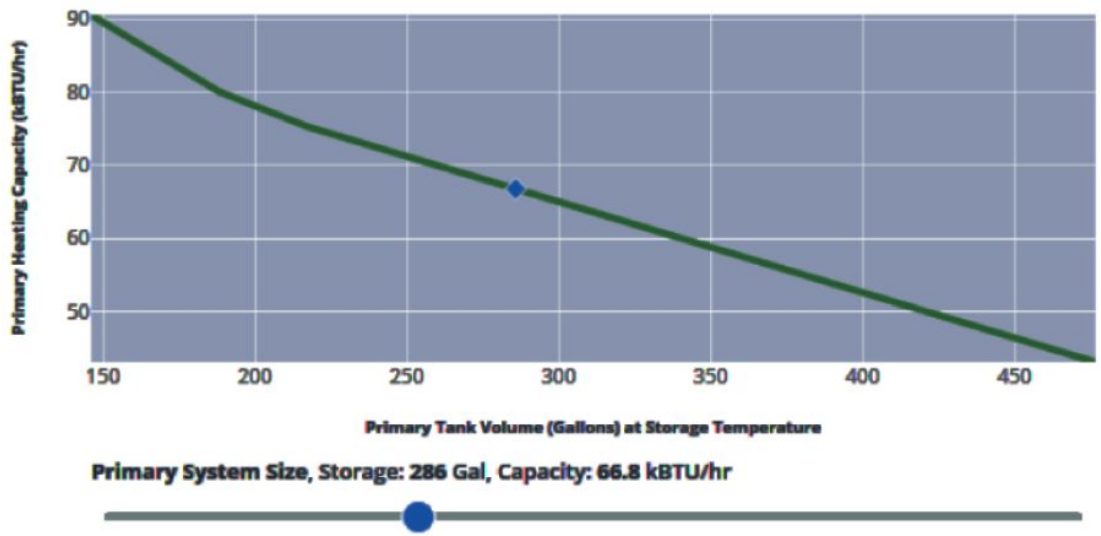




Hot water load defined by

- Number of Occupants
- Occupant Hot Water Usage
- Building Type

ECOSIZER IS A TOOL USED TO SIZE CHPWH SYSTEMS



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

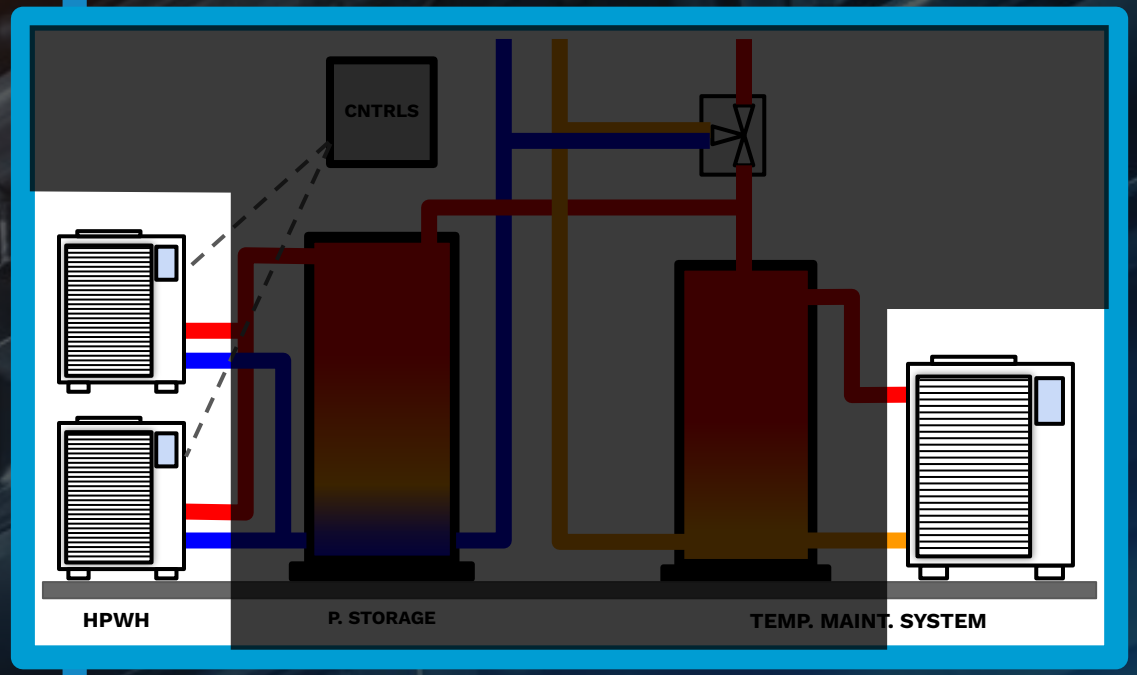
Heating Capacity
66.8 kBTU/hr

Swing Tank Volume
80 Gallons

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

ecosizer.Ecotope.com

HW SYSTEM DESIGN:
EQUIPMENT SELECTION



AVAILABLE PRODUCTS

Mitsubishi

$SanCO_2$

Colmac

Nyle

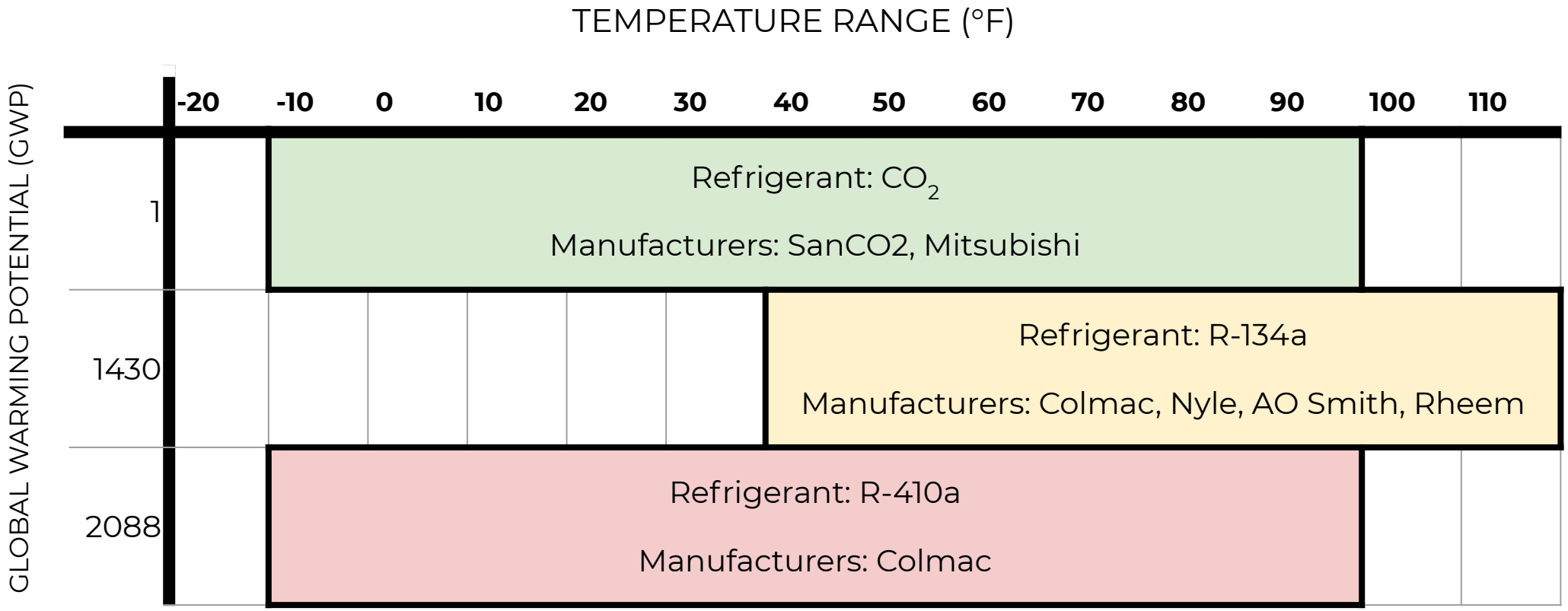
Rheem

AO Smith

DID YOU KNOW?

A **CHPWH system** serves 5 or more **dwelling units** or **commercial loads** requiring 120 gallons or more of storage volume**.**

EQUIPMENT SELECTION | **REFRIGERANTS**



EQUIPMENT SELECTION: **AVAILABLE PRODUCTS**

AO Smith

(2.5 ton)

Rheem

(> 1 ton)

Multi-Pass Unitary

Residential/Small Commercial

R-134a

$SanCO_2$

(1.25 ton)

Mitsubishi

(10 ton)

Single-Pass

CO_2/R-744

Colmac

(10 - 30 ton)

Nyle

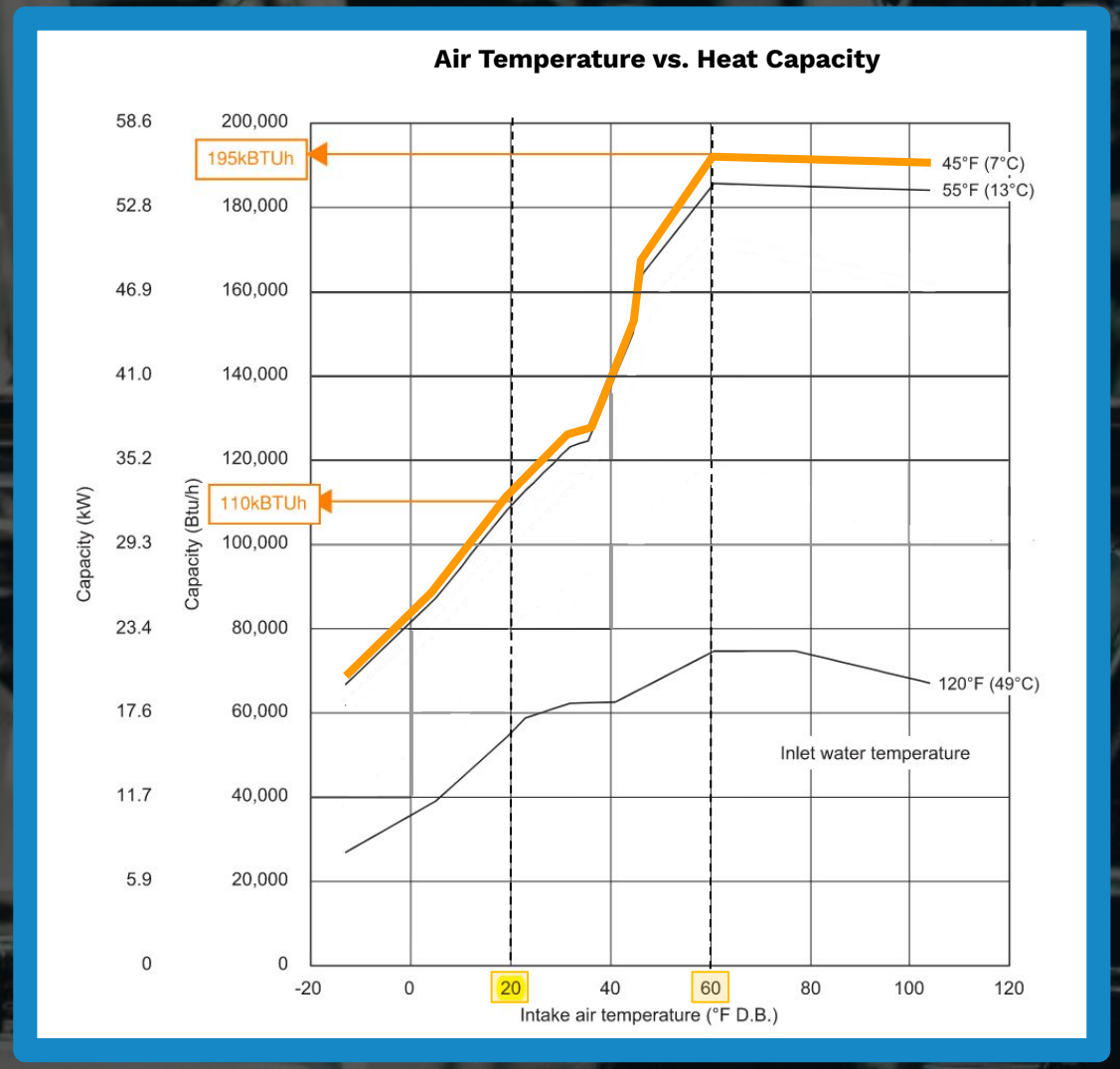
(10 - 30 ton)

Single- or Multi-Pass

R-134a

EQUIPMENT SELECTION | HEAT CAPACITY

R134a



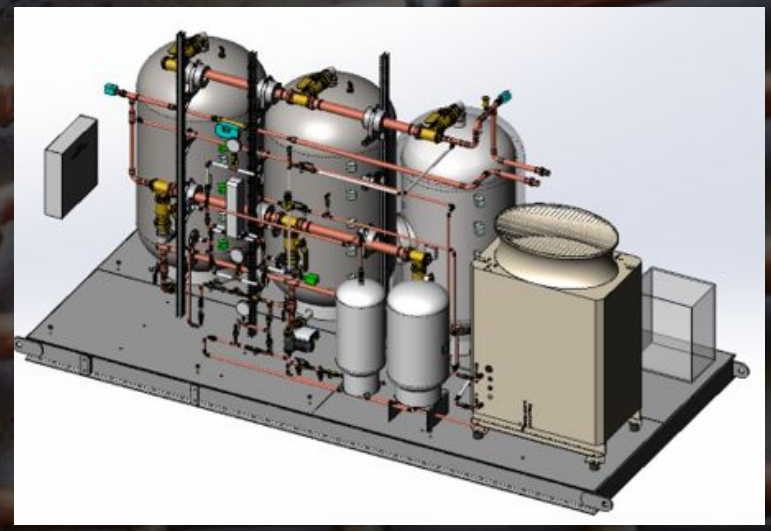
EQUIPMENT SELECTION: **MARKET DELIVERY**

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 distributors or manufacturer.



Fully Packaged/Skid

Everything assembled in a single package.

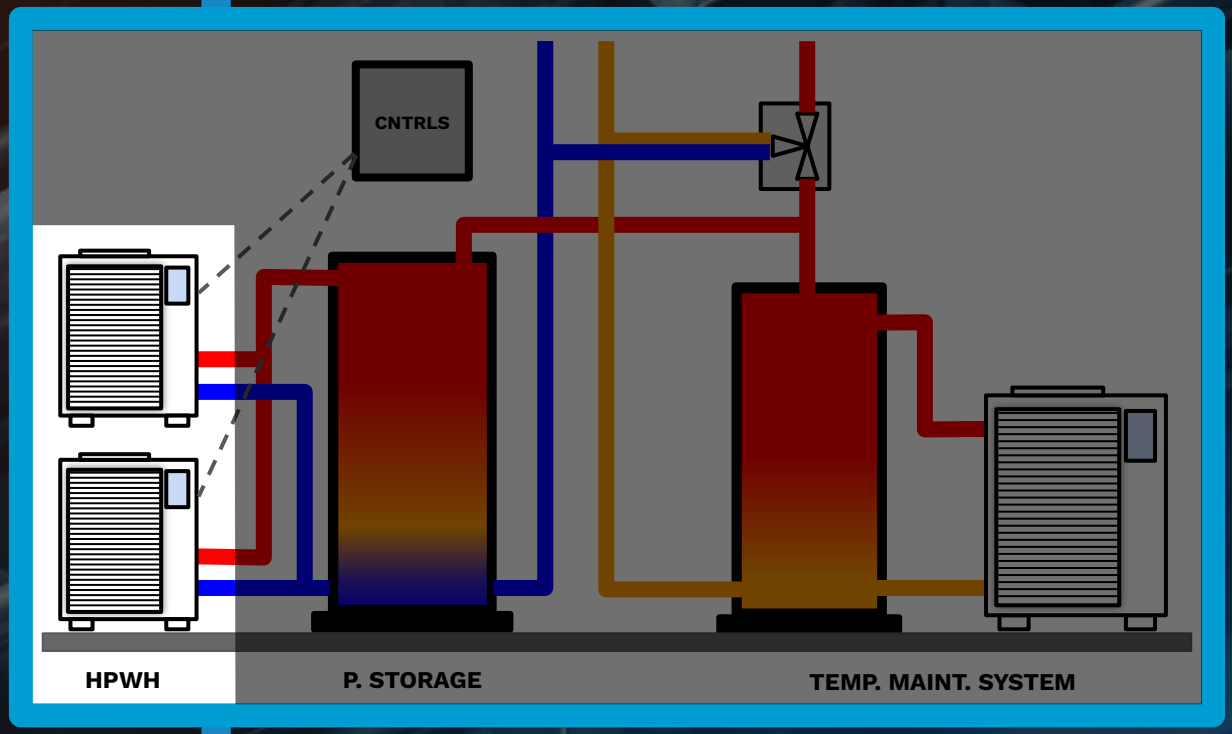
SEATTLE ENERGY CODE UPDATES

HPWH

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
Hotel/motel



OTHER SEATTLE ENERGY CODE UPDATES

OTHER UPDATES APPLY TO THE FOLLOWING:

PRIMARY STORAGE

TEMPERATURE MAINTENANCE

ALARMS

SIZING

RESOURCE: SDCI TIP DOCUMENT

ADDITIONAL **RESOURCES**

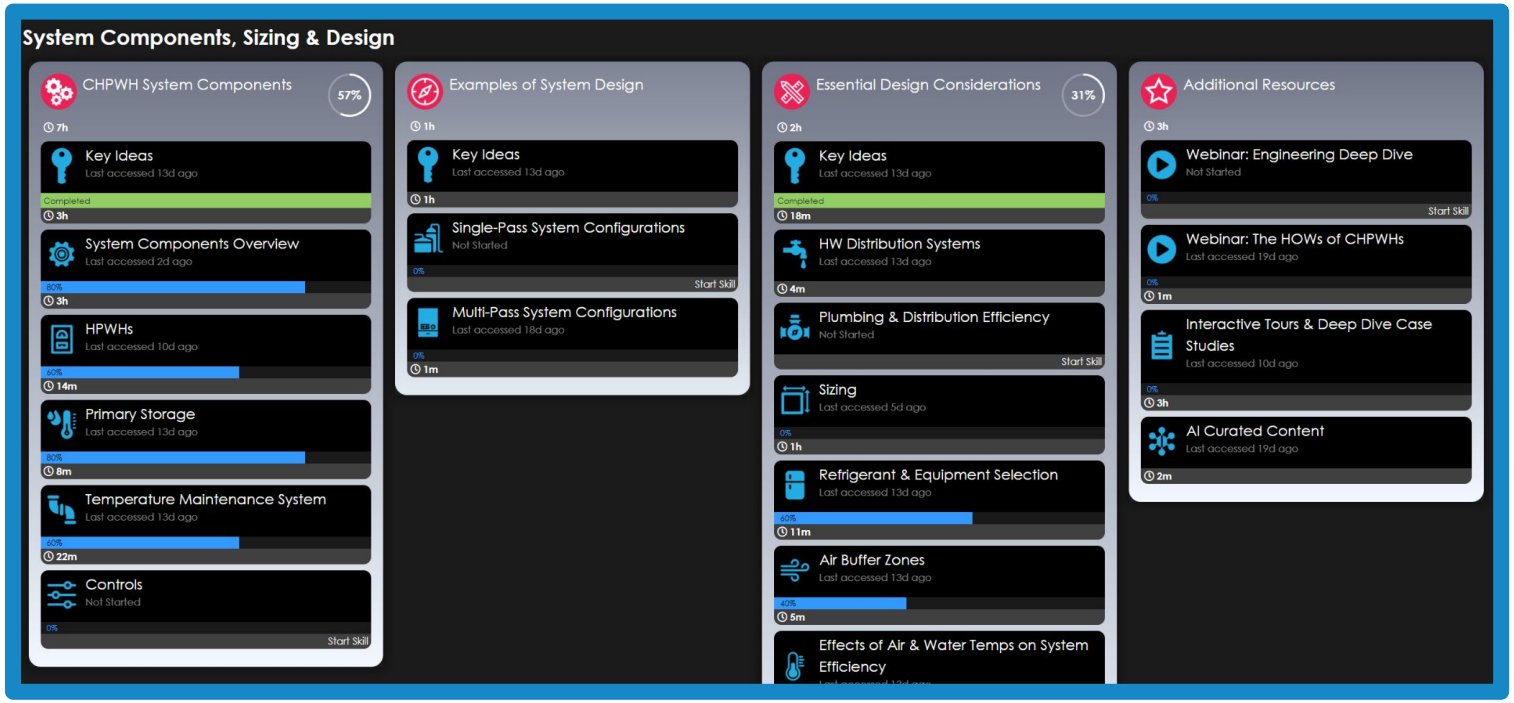
Seattle Energy Code 2018

Advanced Water Heating Specification v.8.0

Ecosizer

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**

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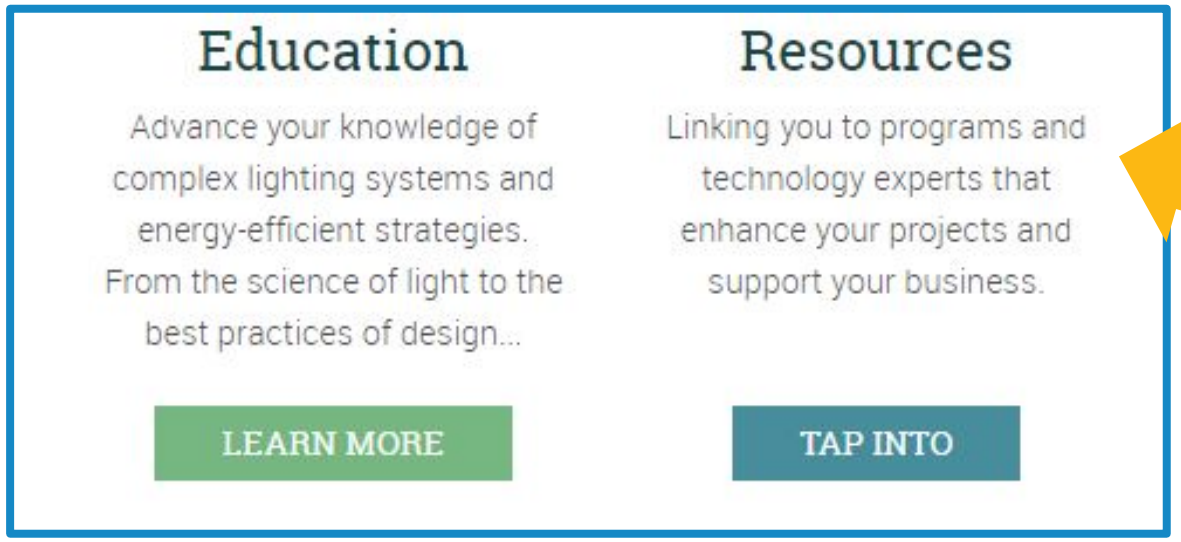
Visit Us Online

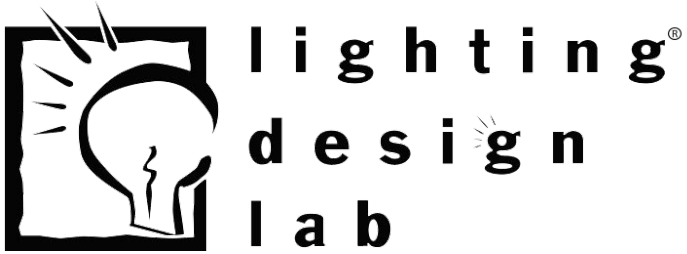


OR

Email Us

lightingdesignlab@seattle.gov

Todays slide deck will be posted here!



Thank You to our Collaborators