Emerging Technologies

Central HPWH Work Group

October 20, 2020

Agenda

- What's New?
- Market rate adoptions survey
  - https://www.surveymonkey.com/r/ET_CHPWH
- Ecosizer1.0 Overview and Demonstration
- Central HPWHWG Vision, Roadmap, 2021 workplan
- End of year funds

What's New

- New projects
  - Technology and location
- New collaboration opportunities
- New code, policies or rulemakings
- New products

Market Adoption

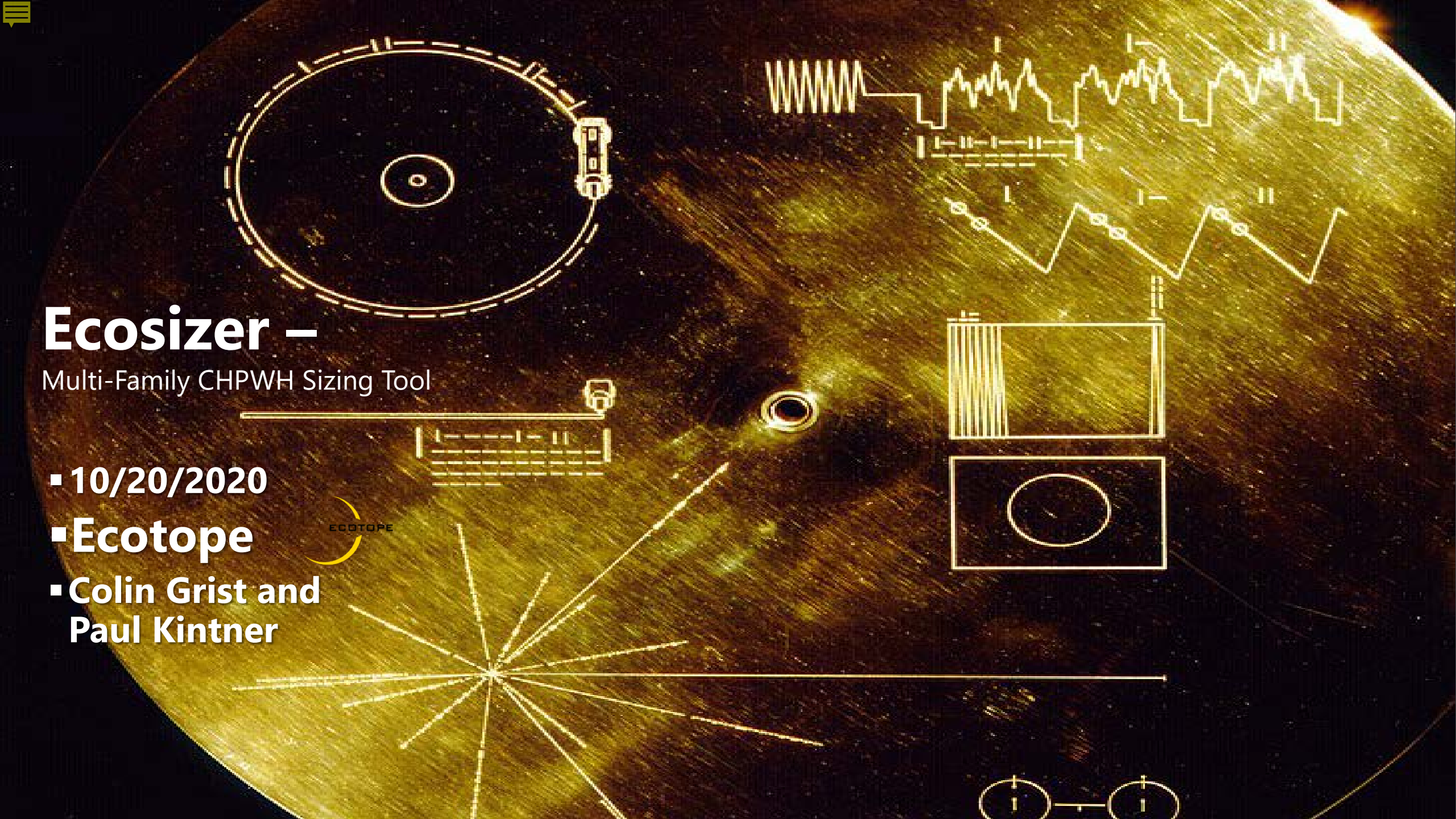
Bonneville POWER ADMINISTRATION

ECOTOPE

CHPWH Market Adoption Survey

https://www.surveymonkey.com/r/ET_CHPWH

Market data is hard to come by for new technologies. By surveying industry experts currently engaged in the development and deployment of heat pump water heater technologies, we seek to gain a better understanding of market adoption rates and potential. We believe your expertise and input is critical. The collective perspective of this group will help us more clearly understand the rate the market is progressing. The survey focuses on the market adoption of commercial-scale heat pump water heater technologies, not residential-scale equipment.



Ecosizer –

Multi-Family CHPWH Sizing Tool

- 10/20/2020
- **Ecotope**
- Colin Grist and Paul Kintner

Why do we need a sizing tool?

What are we designing to?

Ecosizer Method for sizing.

How to use the Ecosizer.

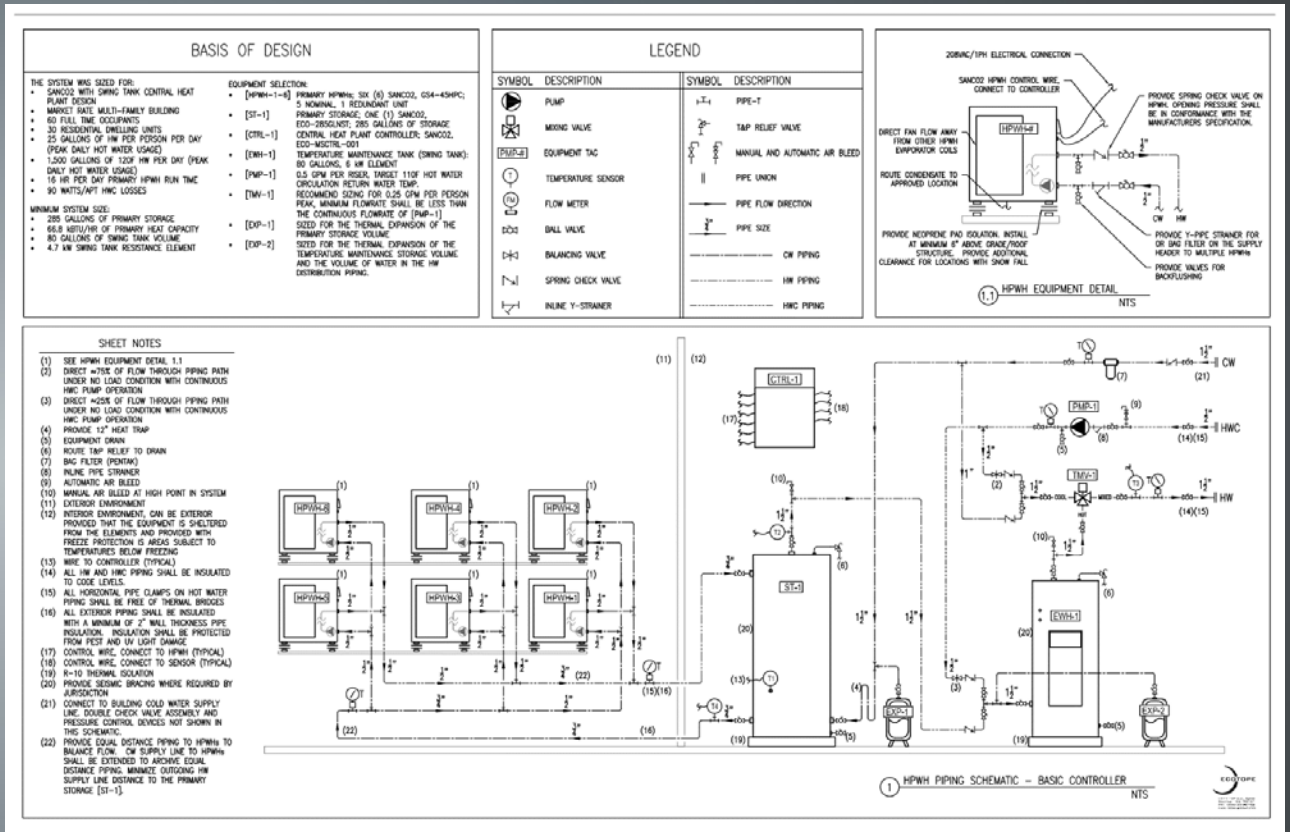
Previous Sizing and Equipment Selection

55 Tons
1,000 Gallons

5 Tons
520 Gallons

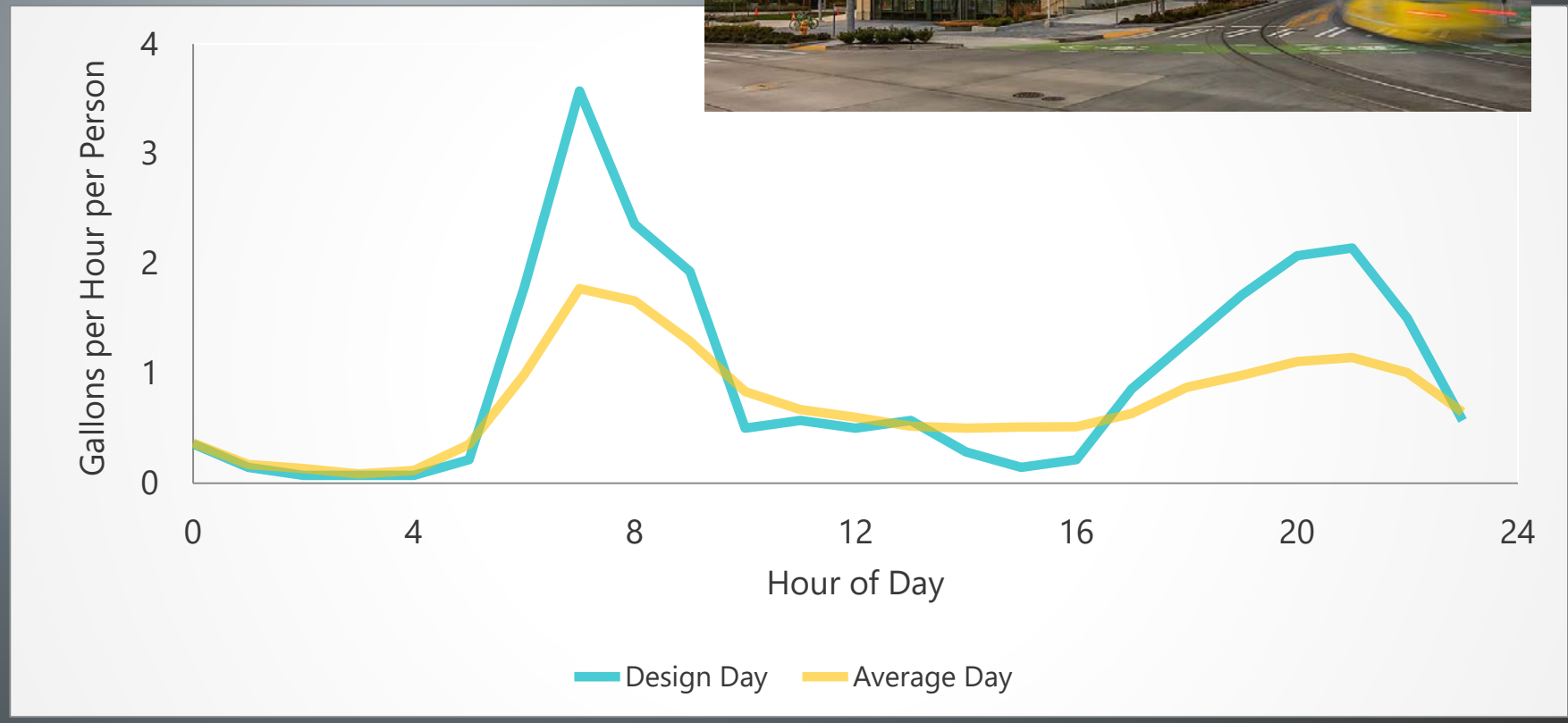
GOALS

- Standardize method for all
  - Remove the mystery behind getting a size from manufacturers
- Standardize schematics
- Education → Change is hard

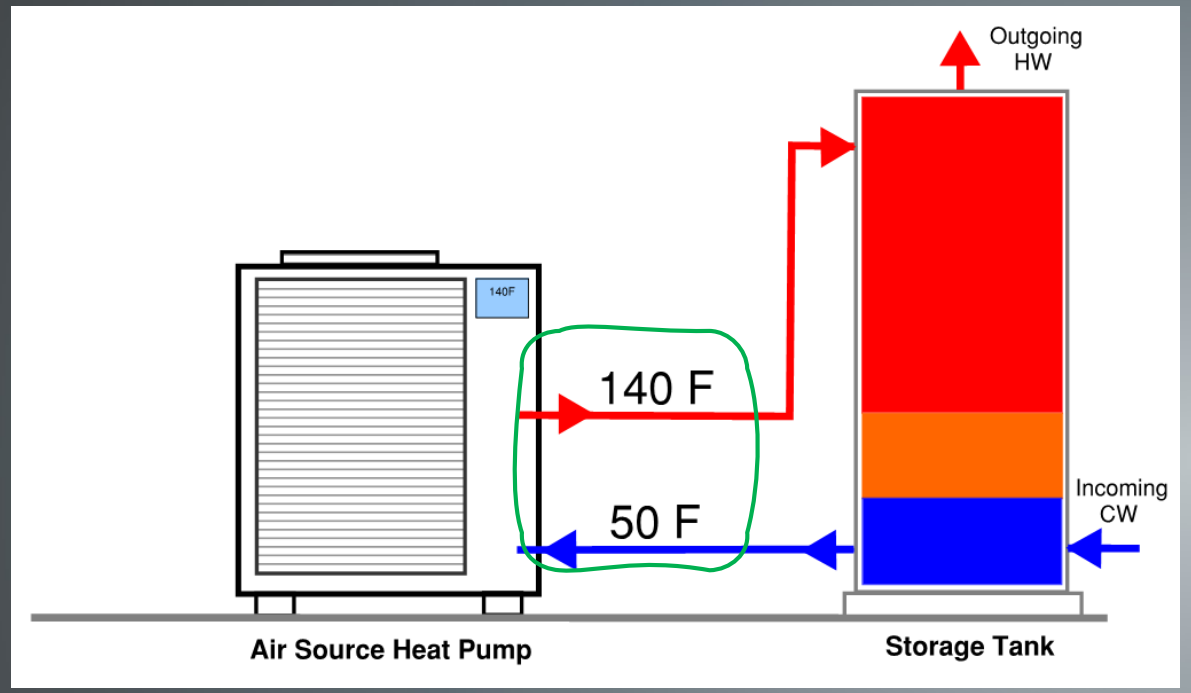


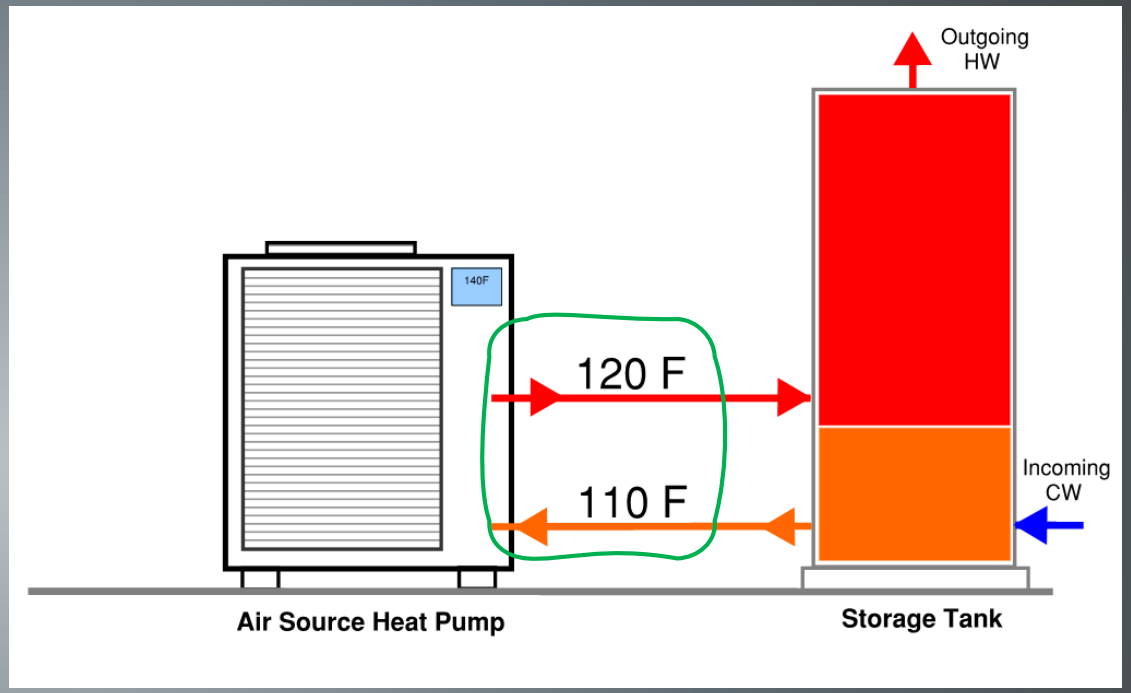
Domestic Hot Water Load

- Hot water load defined by:
  - the number of occupants
  - how much hot water they use
- At the Design Conditions (cool temperatures)



All Heat Pumps Are Not The Same





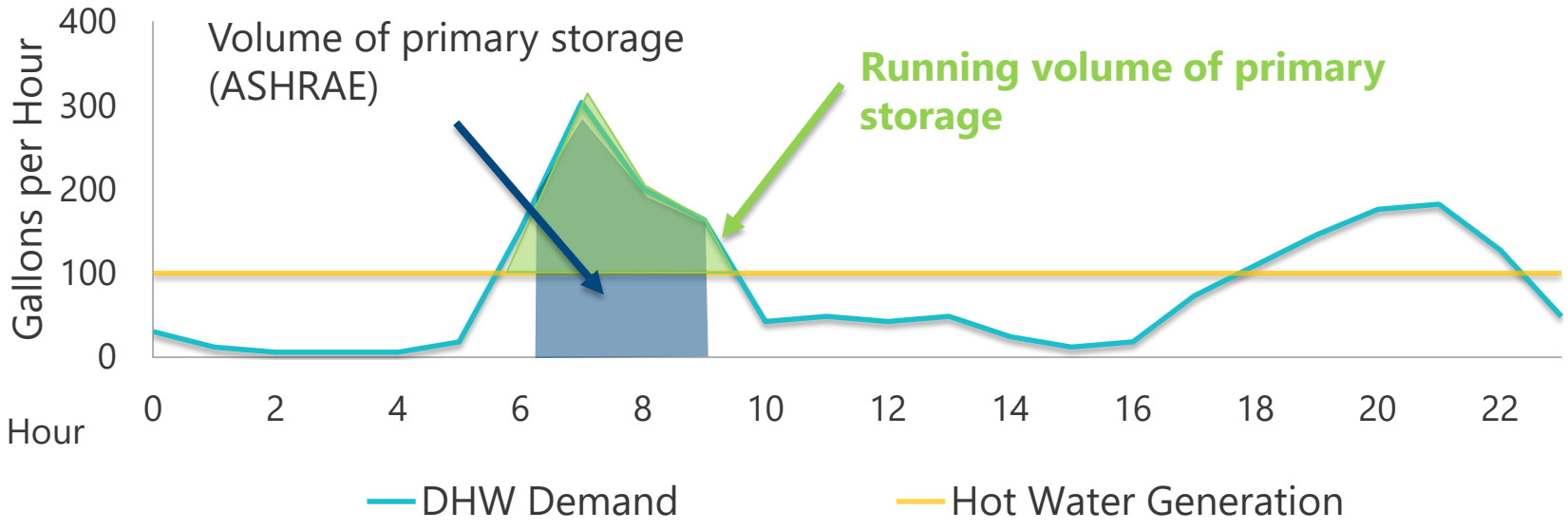
Single Pass

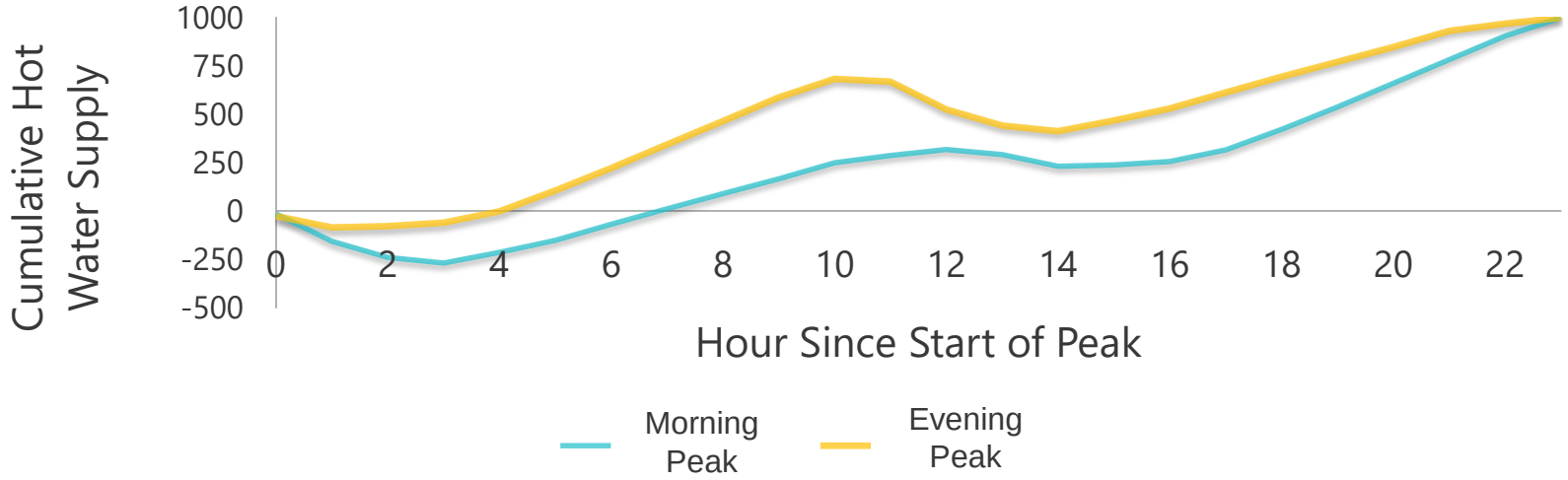
Heats water to working temp in single pass

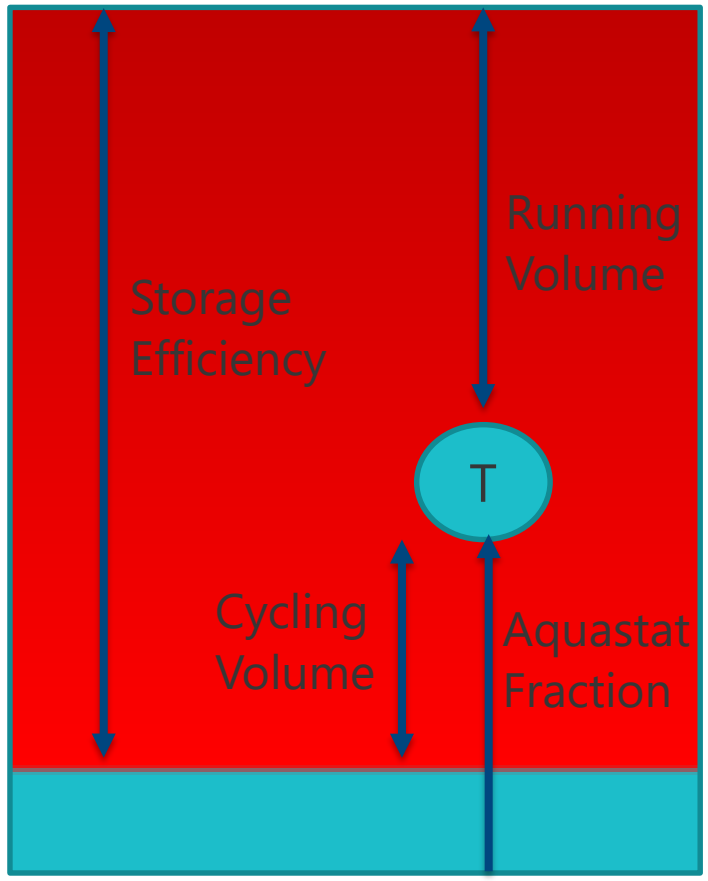
Multi-Pass

Heats water to working temp in multiple passes

ECOSIZER METHOD



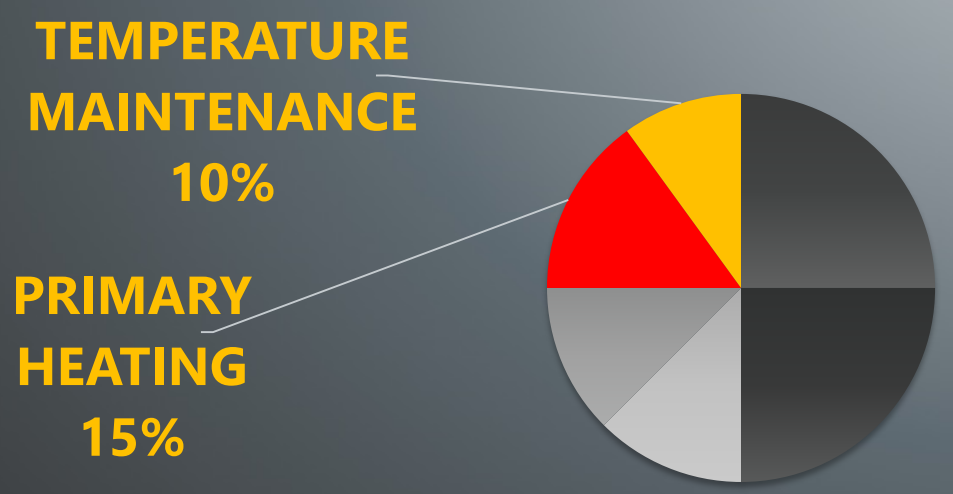


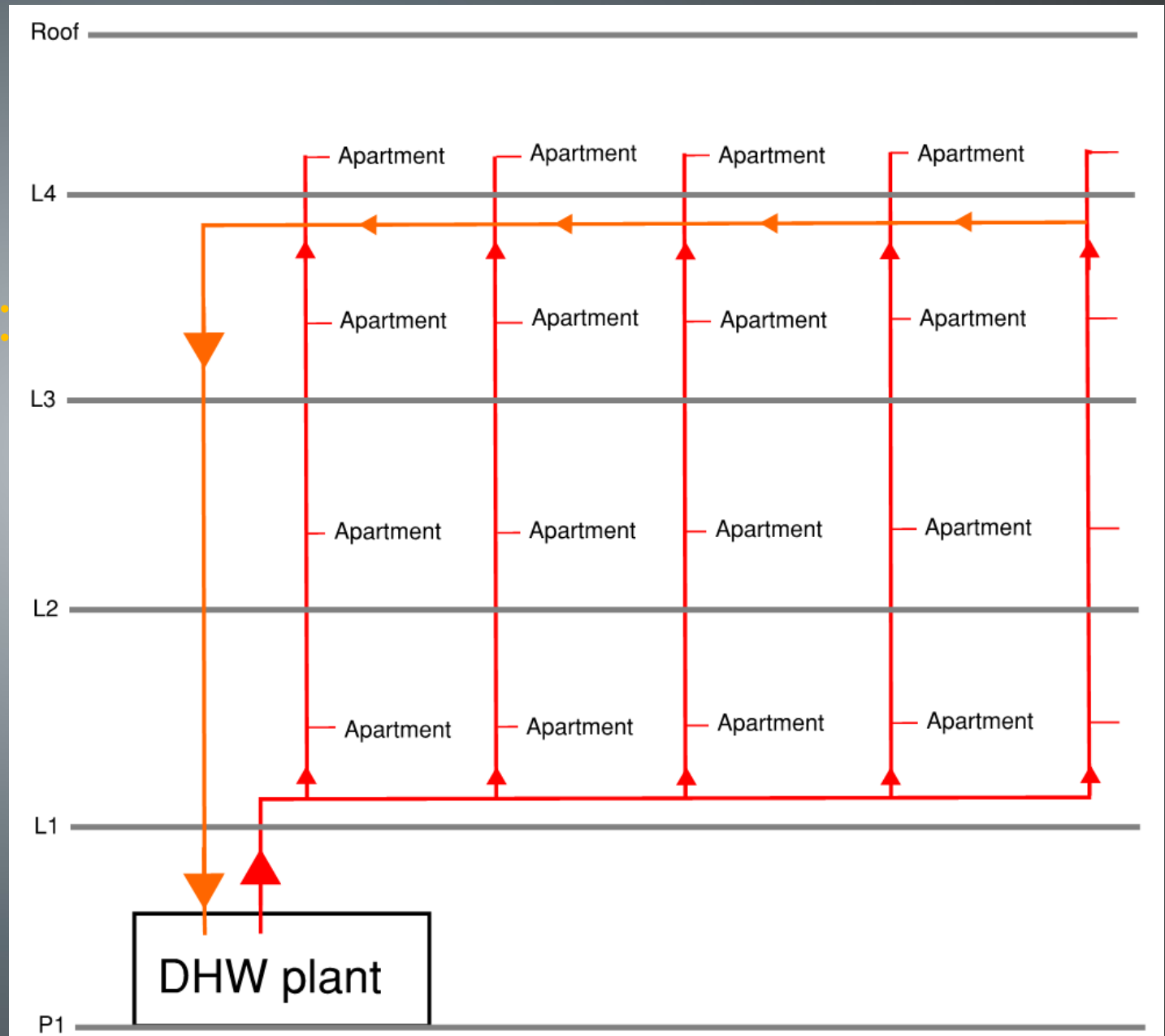


Idealized Hot Water Storage Tank

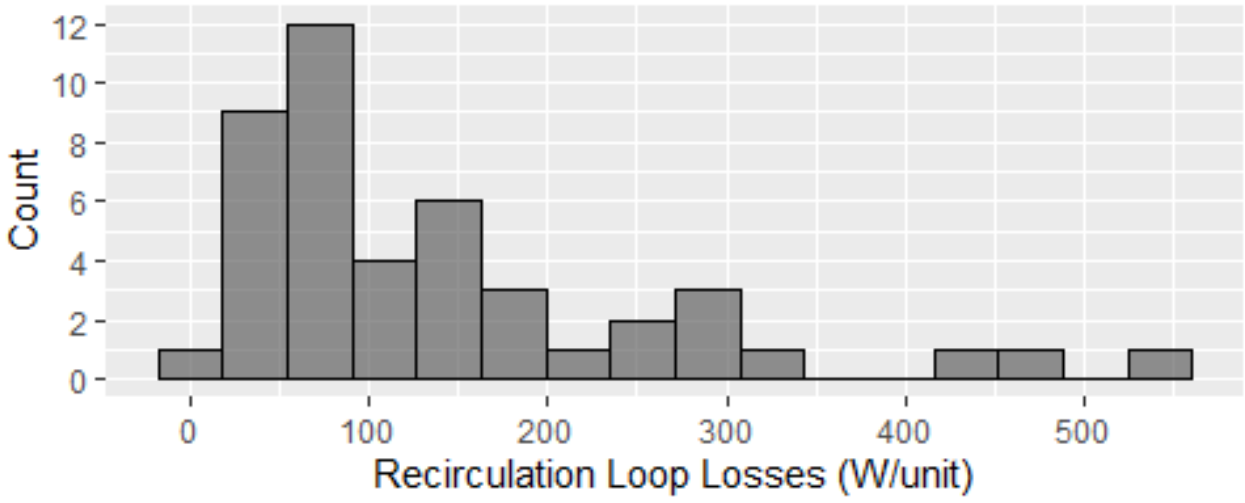
TWO DISTINCT LOADS

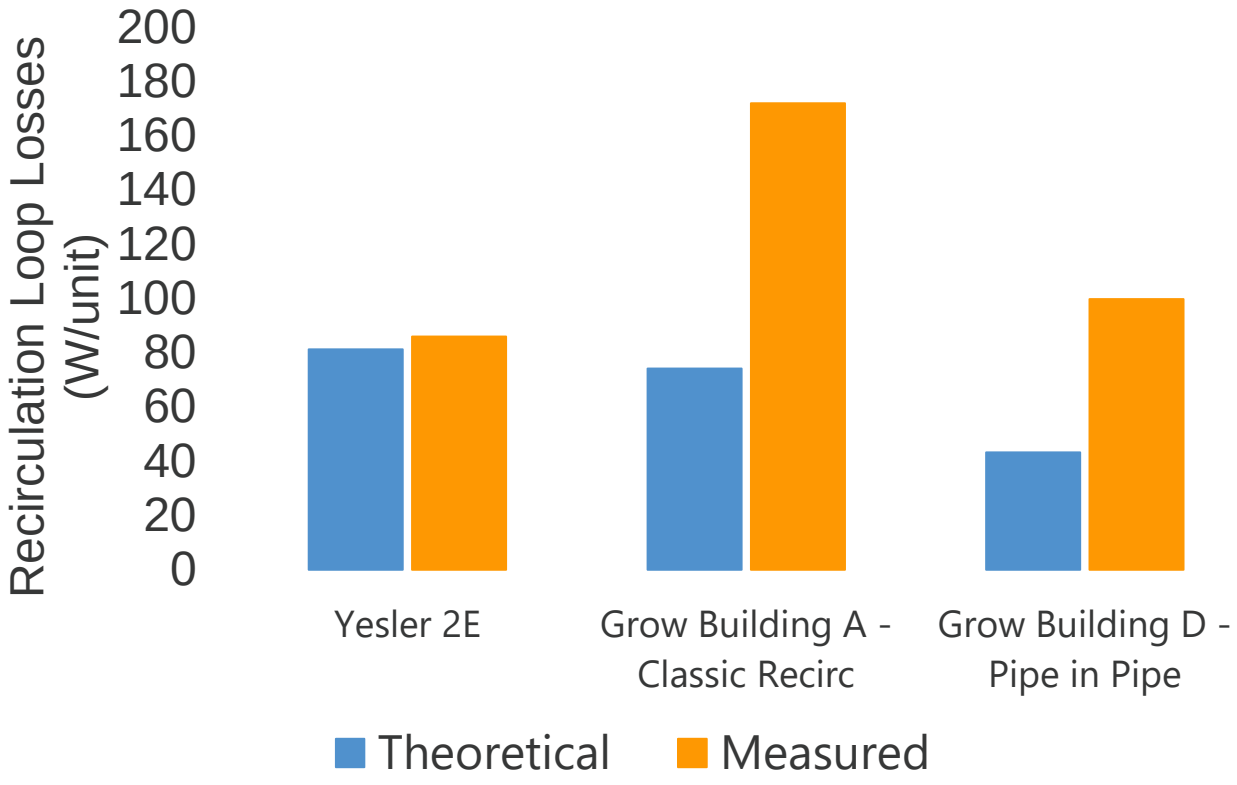
- Primary Heating:
  - Heating water for use
  - Making cold water hot
- Temperature Maintenance:
  - Reheating water due to energy losses in the distribution system
  - Keeping hot water hot





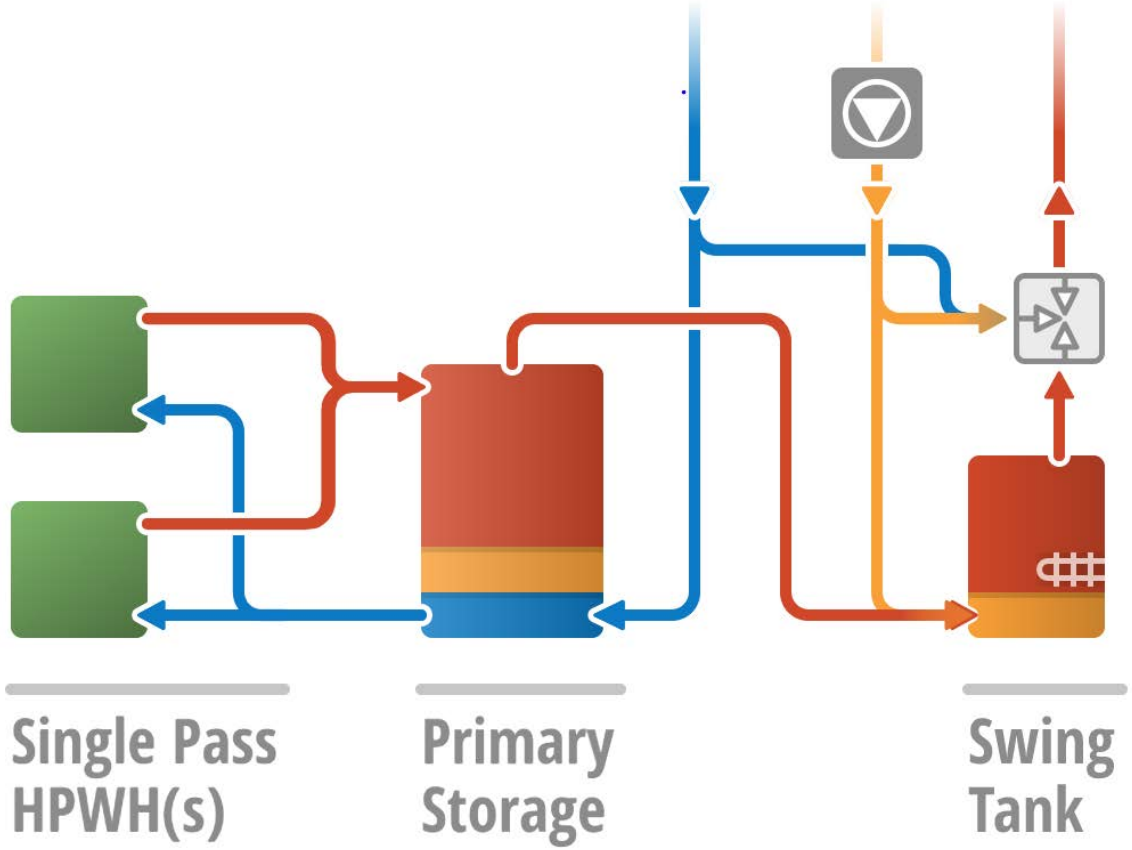
TEMPERATURE MAINTENANCE LOAD

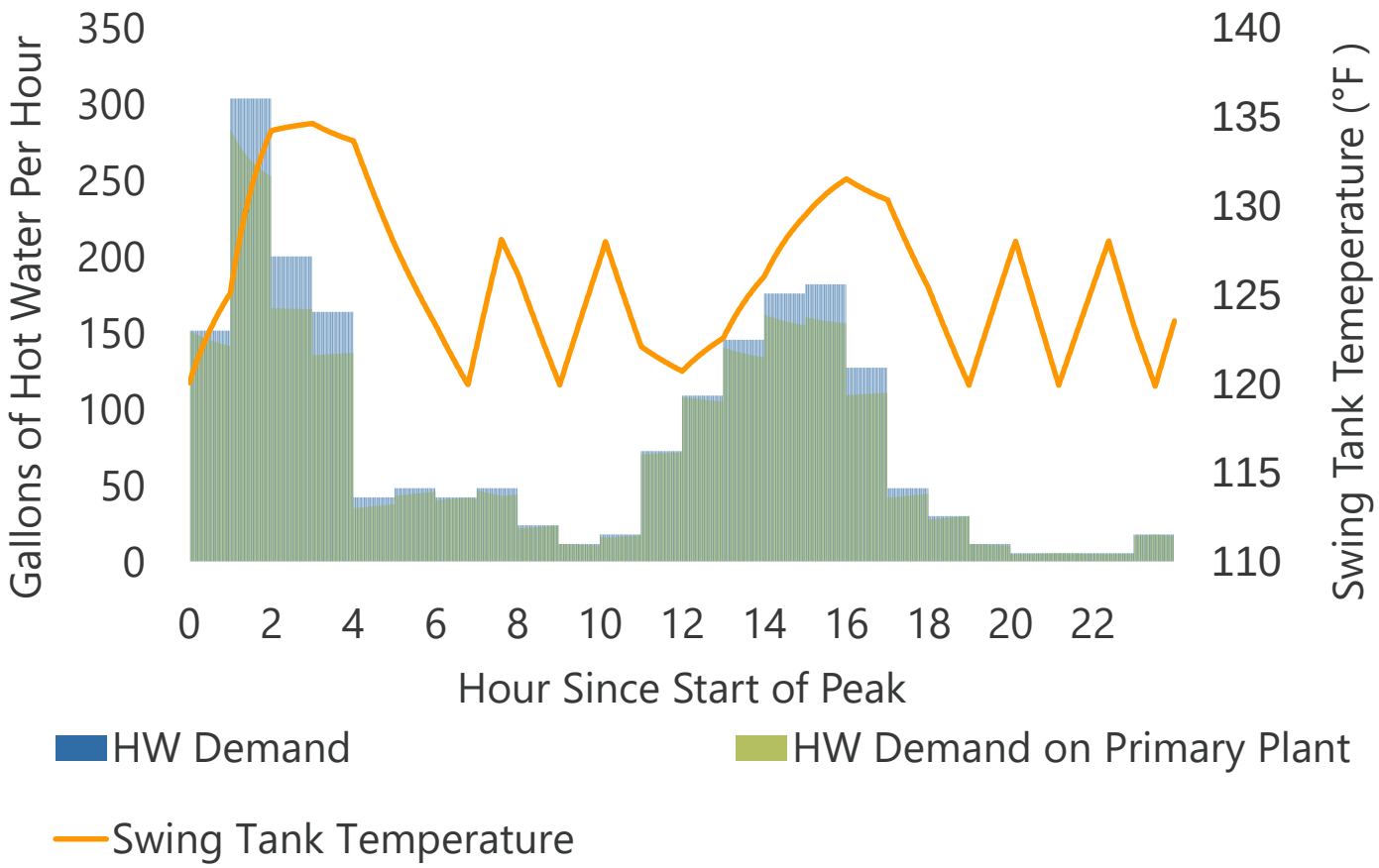




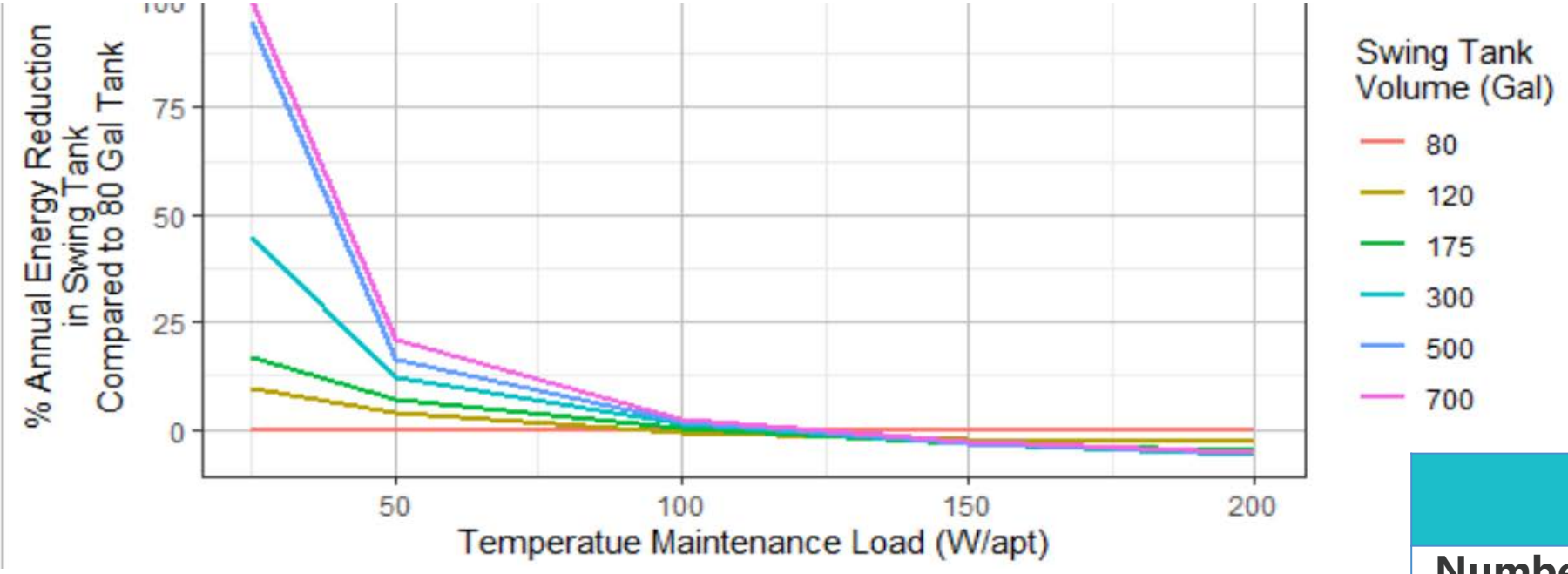
- 45 measured buildings show variance
- Theoretical calculation doesn't match measured values
- Seattle multi-family is typically around 50 – 100 W/apt

SWING TANK


Single Pass HPWH(s)
Primary Storage
Swing Tank


Gallons of Hot Water Per Hour
350
300
250
200
150
100
50
0
140
135
130
125
120
115
110
Swing Tank Temeperature (°F)
0 2 4 6 8 10 12 14 16 18 20 22
Hour Since Start of Peak
HW Demand
HW Demand on Primary Plant
Swing Tank Temperature

SWING TANK

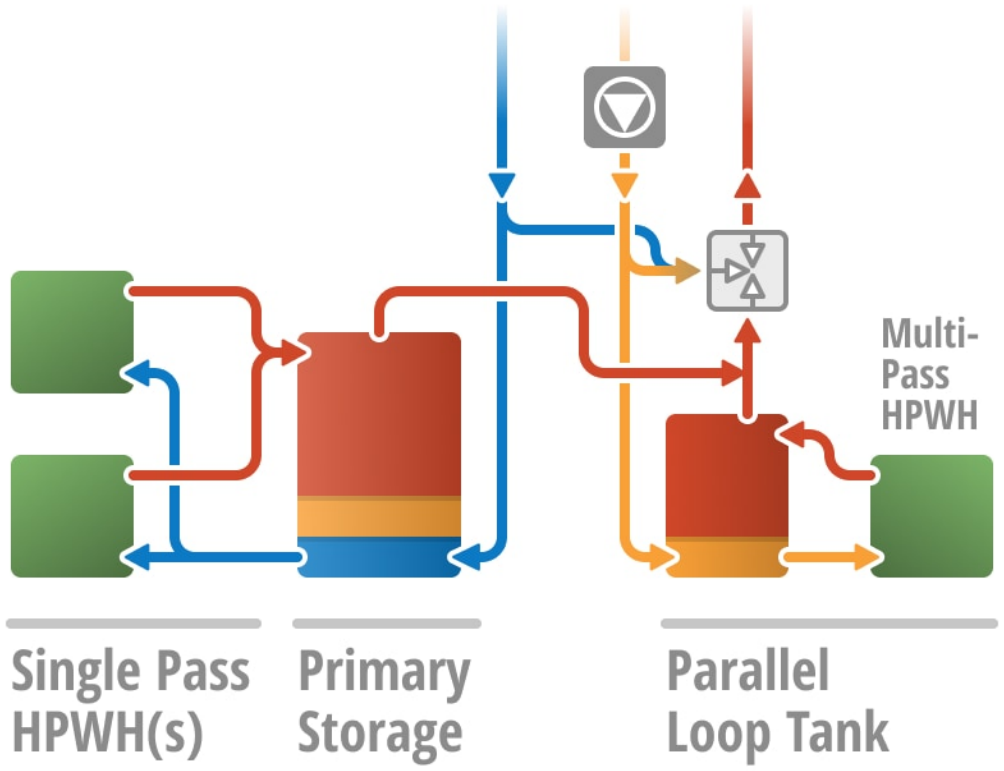


- Annual simulation of swing tank suggests the increasing the volume of the tank is not very effective at average temperature maintenance loads (~100 W/apt)

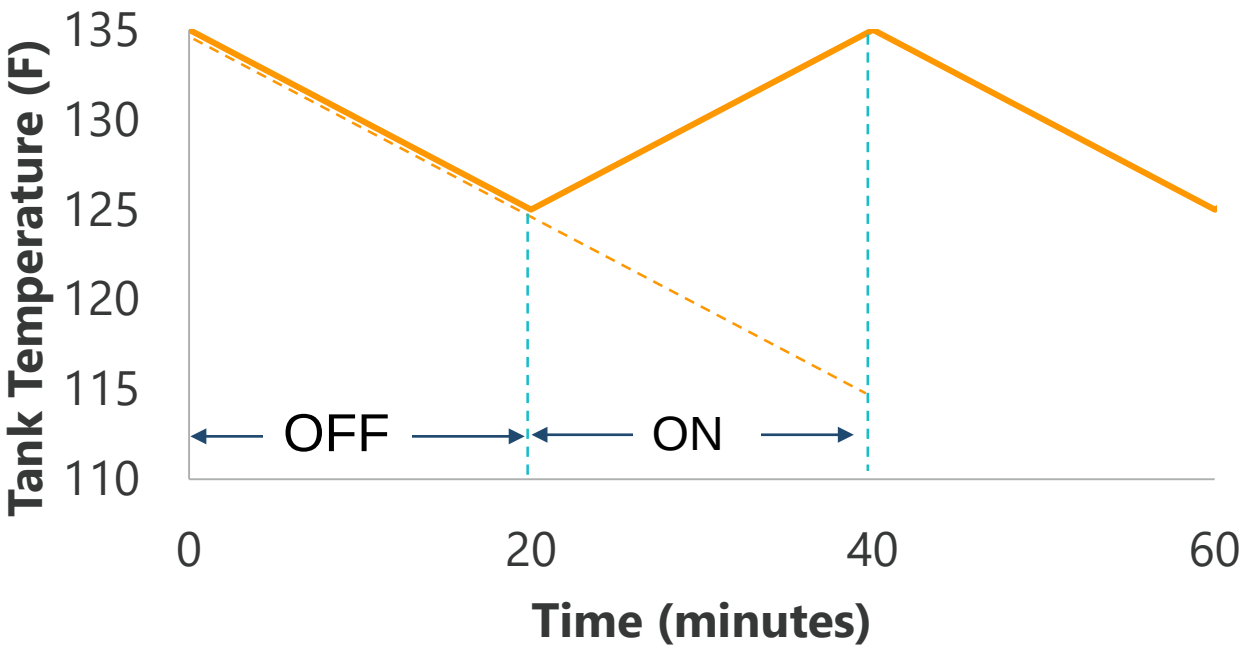
- Annually offsetting ~50 W/apt

	Swing Tank Volume (Gallons)	
Number of Apartments	Ecosizer	Title 24
0 - 12	80	80
13 - 24	80	96
24 - 48	80	168
49 - 96	120 - 300	288
> 96	120 - 300	480

PARALLEL TANK



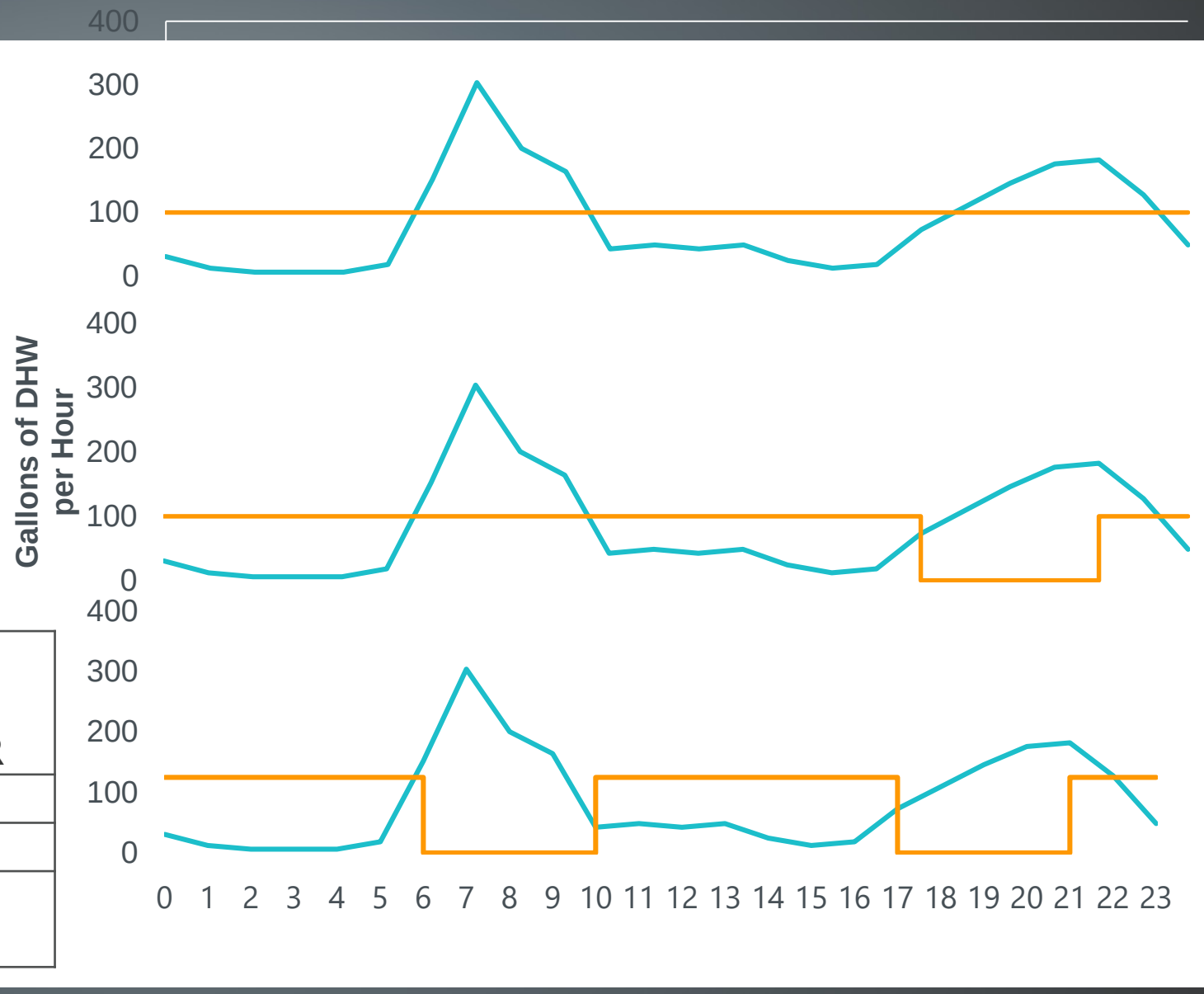
- Constant temperature maintenance load
- Design to cycle
  - On period greater than 20 minutes to prevent short cycling.



LOAD SHIFTING

- Same methodology but hot water generation rate goes to zero
  - Checks that it has enough recovery for the whole after the event
- Expand storage volume, but still trades off with heating capacity
- Comparison
  - 100 people, 2000 gallons per day
  - HPWH size to run 20 hours

Scenario	Sized Volume (Gallons)	Heating Capacity kBTU/HR
No Load Shift	530	83
5PM to 9PM	700	83
6AM to 10AM and 5PM to 9PM	950	104



Electrifying water heating is a major decarbonization strategy for multifamily buildings.

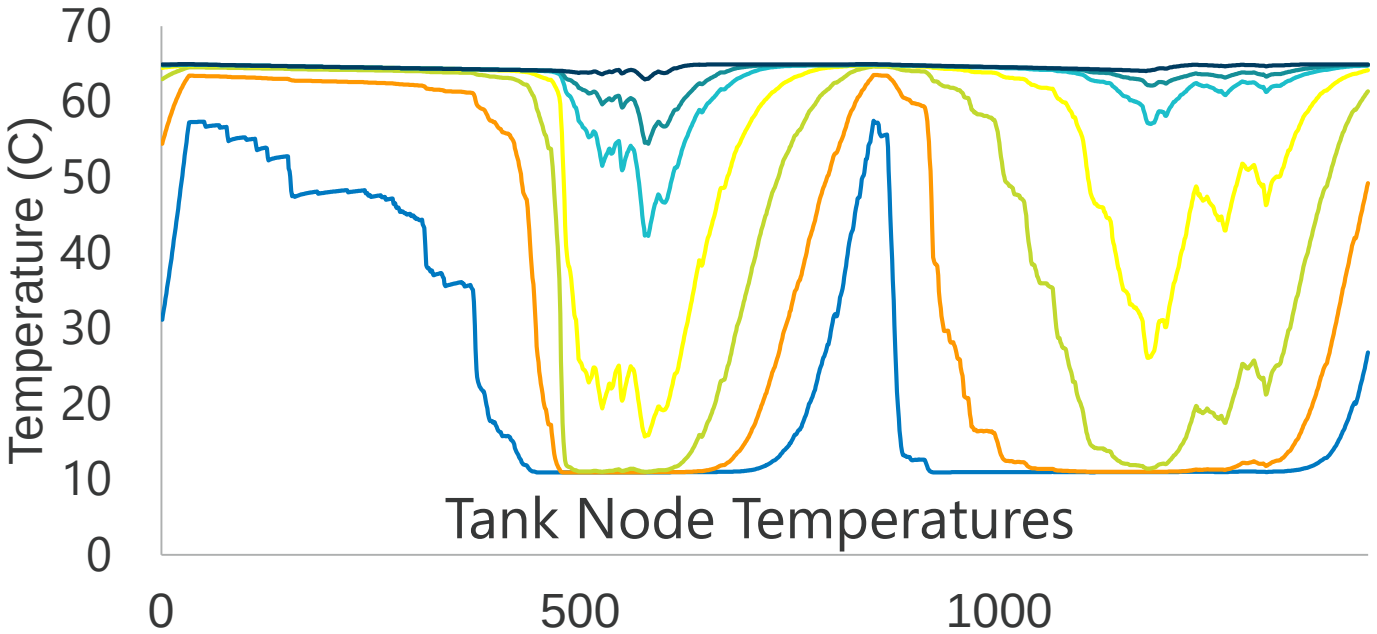
The Ecosizer is a free tool for sizing central water heating systems based on heat pump water heaters (HPWHs) in multifamily buildings. The tool is designed to support the building industry to adopt HPWHs to improve energy efficiency and reduce greenhouse gas emissions. The Ecosizer is also intended to provide educational information on central HPWH system designs to other stakeholders, for example energy efficiency and building decarbonization advocates, program administrators and implementors, building science researchers, manufacturers, and policy makers.

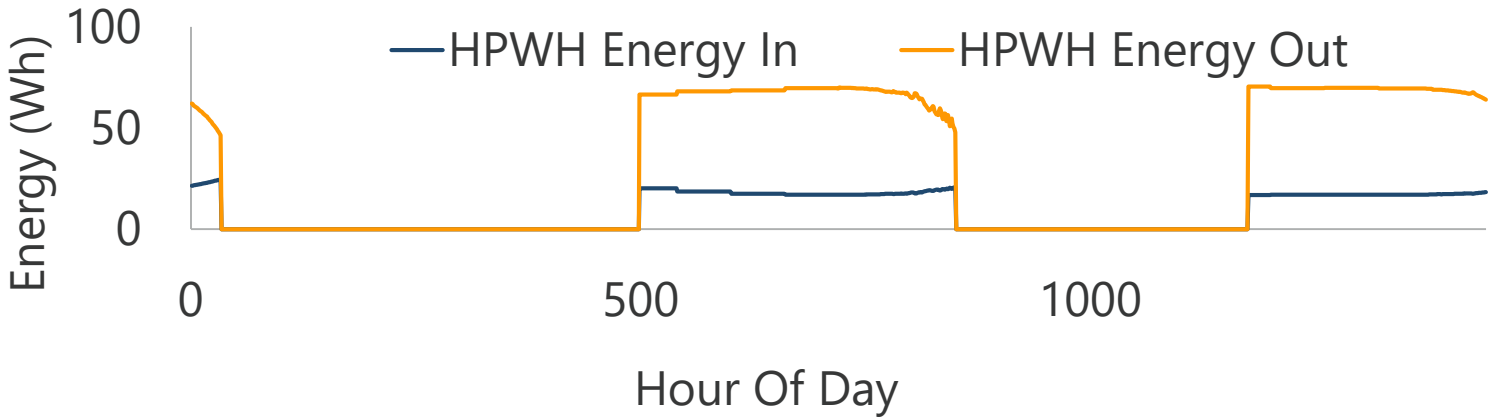
HOW TO USE THIS TOOL

1. Identify weather conditions (cold water temperature and ambient temperature) on the design day, which is usually the coldest day of the year.
2. Select a HPWH technology and identify its temperature setpoint limitations. Consider its potential performance limitations under winter design conditions.
3. Provide input method and values to determine design-day hot water demand.
4. Provide the storage, delivery, and incoming water temperature settings for your system.
5. Select the configuration for the temperature maintenance system.
6. Revise default values for advanced inputs, if needed.
7. Click “Size Your System” to obtain minimum sizing results and the Primary Sizing Curve.
8. Select the actual HPWH heating capacity according to performance characteristics of the selected HPWH technology. Use the Primary Sizing Curve to find the minimum storage volume based on the actual HPWH design-day heating capacity. Alternatively, select a storage volume first and use the Primary Sizing Curve to find the corresponding HPWH output capacity needed to meet the design-day hot water demand.

WHAT'S NEXT? ECOSIM

- What users are asking for
  - Equipment selection of different available technologies
  - Accounting for temperature dependent HPWH performance and defrost by modeling with location-based weather files
- Bring in HPWHsim and yearly analysis
  - Conduct energy performance and sizing analysis.
  - Easily compare multiple scenarios and trade-offs between tank sizes and HPWHs





THANK YOU

Paul Kintner paul@ecotope.com
Colin Grist colin@ecotope.com

ECOTOPE

FUNDERS

SOUTHERN CALIFORNIA EDISON®
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INPUT

2050 PARTNERS

ZYD ENERGY

VISION for ROADMAP

High performance Central HPWHs are standard practice in new construction in 90% of US (in 5 years?) (MF?)

Develop a funded 24-month plan/roadmap to develop framework for all new CHPWH systems being non-fossil

OPPORTUNITIES - END STATE

CODES/INCENTIVES

1. Sticks. Codes etc require or encourage HPWH
2. Carrots. Utility programs/community-based choice aggregators provide incentives … cost-effective

PROVEN PRODUCTS AVAILABLE

1. Collaborative process that encourages and proves proven systems
2. Local suppliers readily have plug-n-play systems available

MARKET KNOWS & DESIRES PRODUCT

1. Market actors know how to design, install and commission systems
2. Market actors are aware and desire the systems

ACTIVITIES / INTERVENTIONS

1.Advanced Water Heater Spec is available

2. Comment on new codes

3. Develop Model Code

4. Develop Model Incentive Program

5. Credits for modeled systems performance

6. Assist others in development of incentive program EE, Decarb, Grid Interaction

7. Model gas ban

8. Model cost-effective designs for modeled codes

1. 4-5 proven plug-n-play systems
2. Supply chain is trained
3. TIM knowledge development system

1. Designers/Architects (market actors) are trained and choose to install systems
2. Trades are trained and are comfortable installing systems
3.Operators trained and operations and can optimize the system for performance and load flexibility

High Performance: Low GWP (<700) High Average System Efficiency (C0Psys~3) Grid Responsive

Sample 2021 Work Plan

	TODAY	Desired State	GAPS	REMEDIES	1-6 Months	6-12 Months	12-18 Months	18-24 Months
Products	Product 1 Sanden Multifamily Package	Plug-and-play series of packages for different sized blgs **w and w/o load shift**	1. Controls integration. 2. Training program. 3. Widespread distribution and marketing plan.	1) Create standardized controls package. 2) Produce online training materials (train the trainers). 3) Expand distribution and marketing	1) Application testing for basic controller. 2) technical content and support for development of online training.Objective Statement 3) Develop a funded 24-month plan/roadmap to develop framework for all new HP systems being non-fossil	1) Demonstrate ability of 3rd party engineer to deliver fully integrated system with only support from online training materials and Small Planet Supply.	1) Applications Testing of advanced controller. 2) Applications testing of skid-mounted system.	1) Demonstration project with skid-mounted system with advanced controller set-up for grid integration.
	Product 2 Mitsubishi QAHV Package	Plug-and-play series of packages for different sized blgs **w load shift**	1. Standardized package. 2. Controls integration. 3. Training program.	1) Create standardized component and controls package. 2) Produce training materials (train the trainers).	1) Application testing for full package. 2) Demonstration project at Bayview.	1) M&V study of Bayview performance. 2) second demonstration project in CA - Lassen Apartments. 3) Applications testing of load shift potential at Bayview. 4) Develop materials to train the trainers.	1) Demonstration project and M&V of fully integrated package for new construction in project in Seattle (Yesler 6.6?)	
	Product 3							

Next Steps

ASK:

- Does this seem about right?
- Join team and contribute expertise or interests
  - Continue vision development
  - Develop workplan

Emerging Technologies

End of Year funds

- Several project that need funding
  - Training
  - Spec development
  - Market assessment
  - Needs assessment
  - … other priority items?