



SANCO₂ 
Hot water, naturally.



zehnder
always
around you



Commercial Representatives

- Co2 Heat Pump Pioneer
- Established in 2010 to promote a business model anchored in climate crisis. Solutions as “viable market opportunity”.
- Passive House Specialists
- 10 years of “firsts” – Including SanCO2.

Multi Partner – Multiyear Application Study



Ken Eklund – Washington State University



2019 HPWH Training →

AVAILABLE PRODUCTS

A commercial heat pump water heater (CHPWH) system serves more than four dwelling units or commercial loads needing a total of 120 gallons or more of storage volume and/or more than 6 kW of input power. These systems can be unitary or split systems, built up or fully packaged, and can be configured in several different ways.

Below is a table that displays the range of HPWHs available on the US market and some of their specifications. This is not an exhaustive list but includes those products that have engaged with the Technology Innovation Model (TIM) or the Advanced Water Heater Specification Qualified Products List and have field-verified system COP.



	Various Residential Integrated Units	SanCO ₂	AO Smith	Mitsubishi	Colmac	Nyle	SanCO ₂ WaterDrop	Origin by Steffes
Size	> 1 ton	1.25 tons	2.5 tons	10 tons	10 - 30 tons	10 - 30 tons	varies	varies
Market delivery	unitary	split	unitary	split	split	split	fully packaged	fully packaged
System design	multi pass	single pass	multi pass	single pass	single or multi pass	single or multi pass	single pass	single pass
COP	3.0 - 4.0 (UEF)	2.8 - 5.5	4.2	3.0 - 4.0	4.0 - 4.4	3.0 - 5.0	2.8 - 5.5	3.0 - 4.0
Refrigerant	R-134a	CO ₂ / R-744	R-134a	CO ₂ / R-744	R-134a	R-134a	CO ₂ / R-744	CO ₂ / R-744
Minimum ambient air temperature	~45 °F	-20 °F	45 °F	-15 °F	40 °F	40 °F	-20 °F	-15 °F
Maximum ambient air temperature	~120 °F	104 °F	110 °F	110 °F	110 °F	120 °F	110 °F	110 °F
Maximum outlet water temperature	145 °F	149 °F	150 °F	165 °F	160 °F	160 °F	149 °F	165 °F

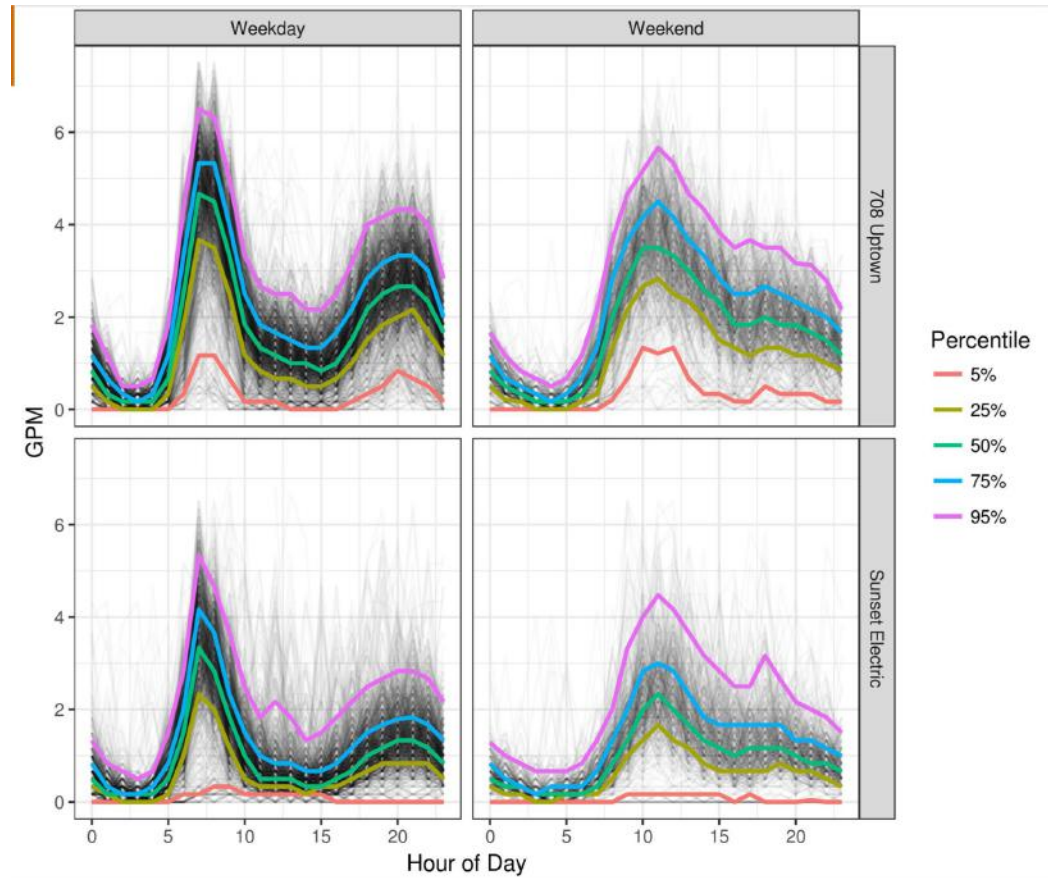


The Shift

Moving to heat pump DHW - Is moving from **Recovery** to **Storage**

The Load

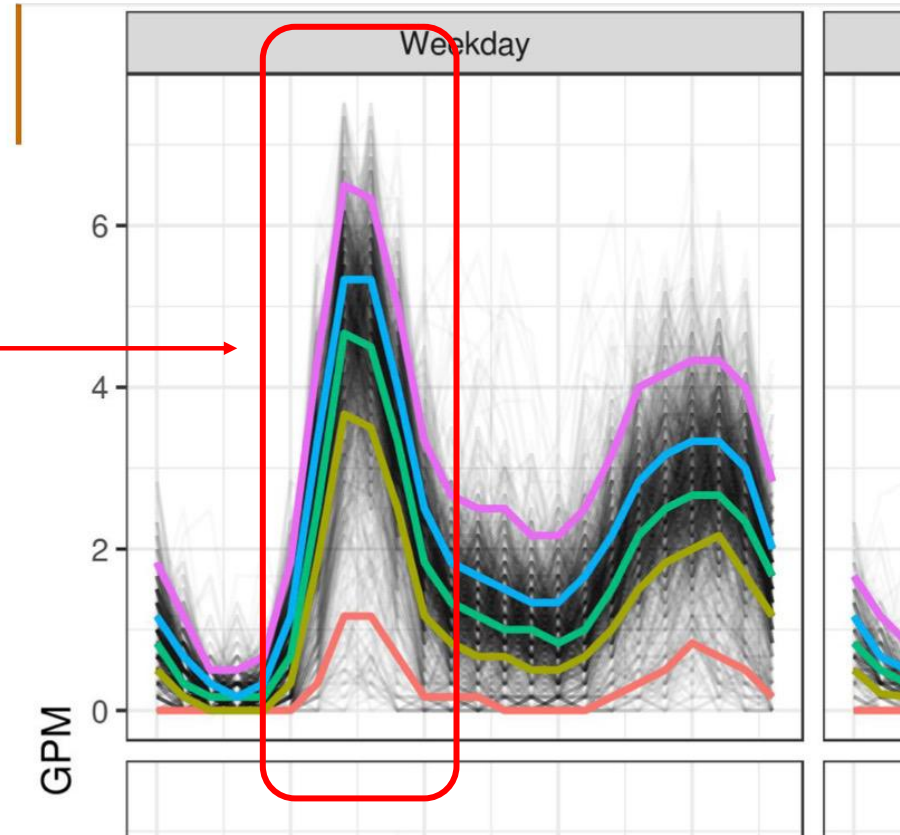
- These are two residential apartment buildings in Seattle WA.
- Normally the gas boiler would be sized to meet the peak flow with very little storage.
- Then there would be the tendency to oversize. Just a little...
- Boilers have high recovery capacity.



Courtesy of Ecotope

Heat Pump Strategy

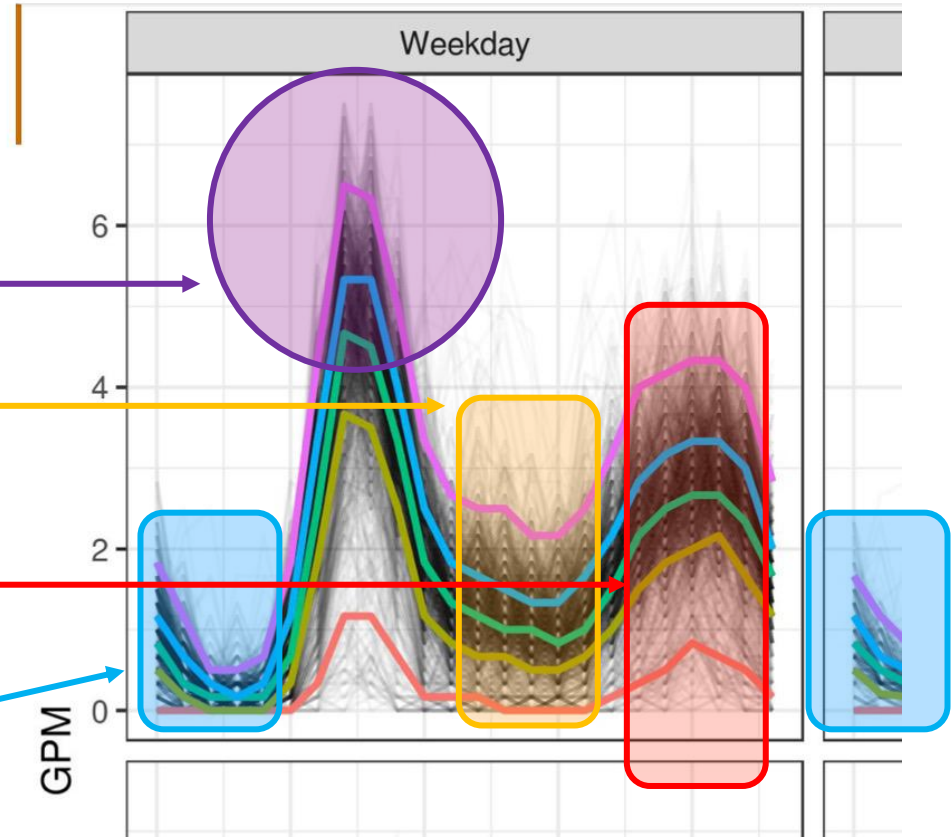
- Build storage ahead of draw.
- Size storage to meet the peak loads. In residential buildings this is the morning peak.
- Heat pump capacity is sized to recover the peak in 4 to 8 hours. The recovery rate is developed by load patterns, renewable energy strategy, and equipment utilizations.



Courtesy of Ecotope

Load Shape

- Morning draw served by storage
- Daytime recovery rebuilds storage.
- Evening Draw takes some storage
- Overnight recovers storage.



Courtesy of Ecotope



The nature of CO₂

Super Critical – Super Good

Why We Like CO2

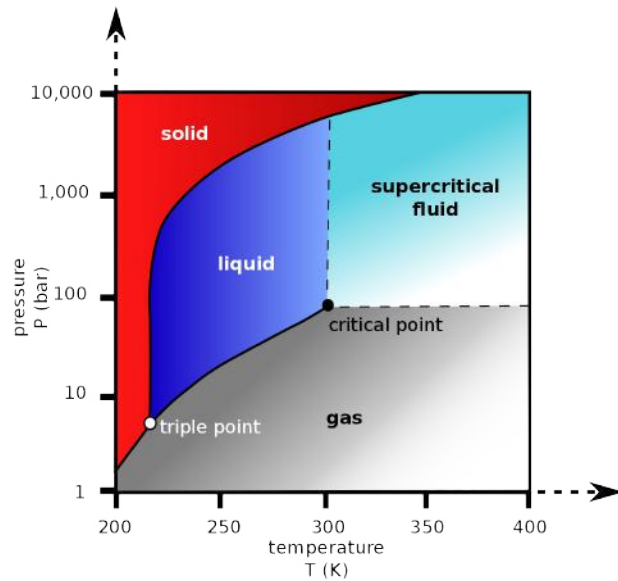
- Minimal Global Warming, approx. 1/1500th compared to “normal” refrigerants
- Non ozone depleting, Safe & secure
- It’s gets hot and crazy under pressure

	Refrigerant	ODP	GWP	Toxicity	Flammability	Notes
Fluorocarbon refrigerant	R134a	0	1,430	No	No	Refrigeration & HPWH
	R410A	0	2,086	No	No	HP, AC & HPWH
	R407C	0	1,800	No	No	HP & AC
Natural refrigerants	CO₂	0	1	No	No	
	Propane Gas	0	20	No	Yes	Flammable
	NH3 Ammonia	0	<1	Yes	Yes	Plume Study required

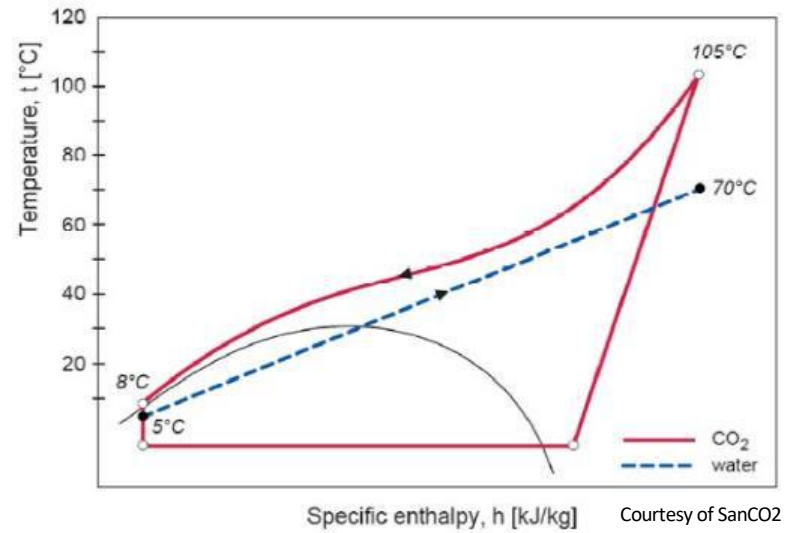
Courtesy of SanCO2

No Phase Change Means More COP

Super Critical Fluid will drop the heat quickly as pressure is released.



Heat drops from the gas/fluid onto the water with no phase change energy



CO2 Works in the Cold

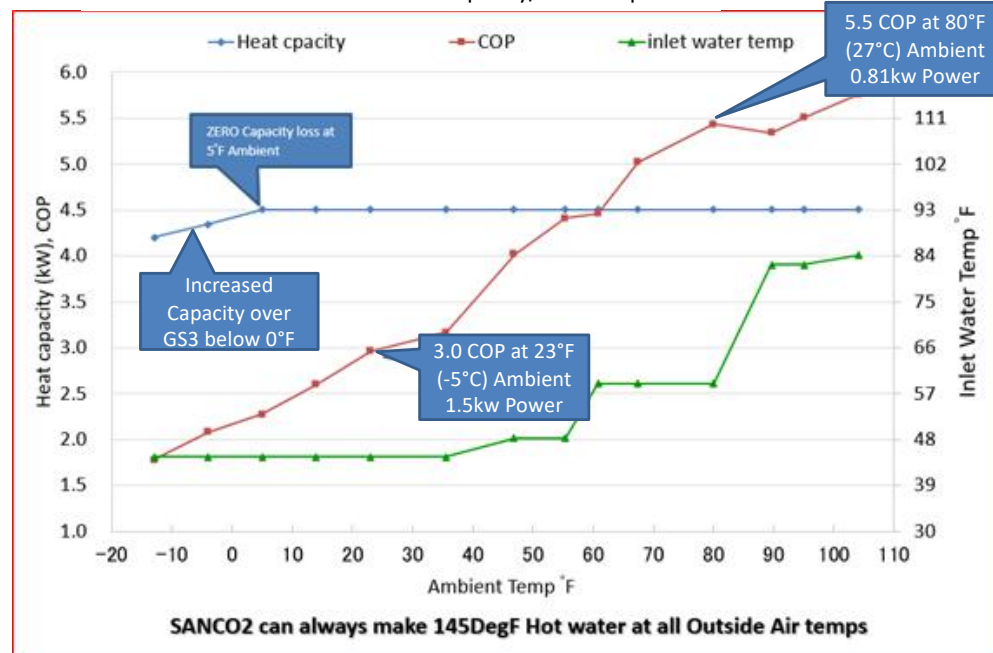
- 5.5 COP at 26C
- 4.5 COP at 15C
- 3.1 COP at freezing!
- 1.75 COP at -25C

Based on inverter driven compressor, fan, & water pump and a double wall heat exchanger.

GS4-45HPC COP



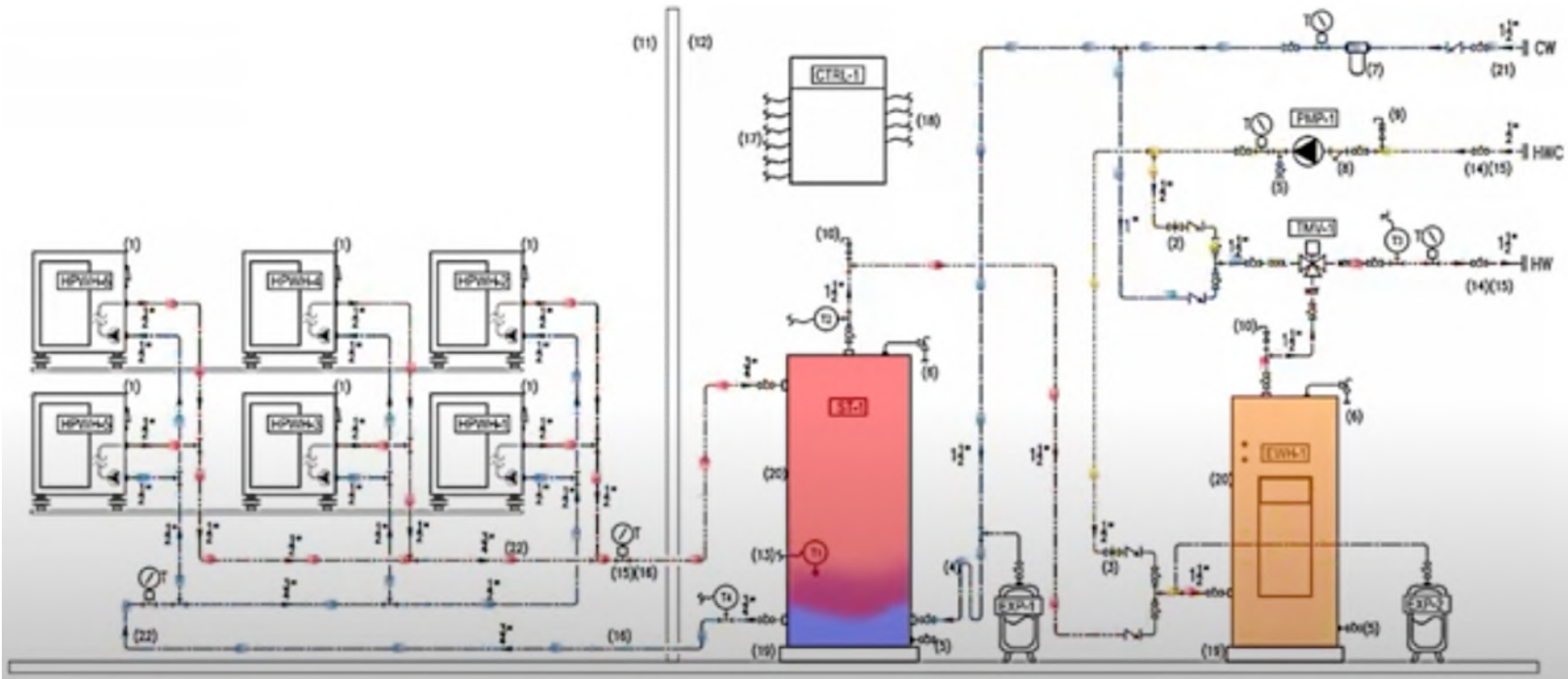
COP is defined as the ratio of Capacity/Power Input



Heat Pumps

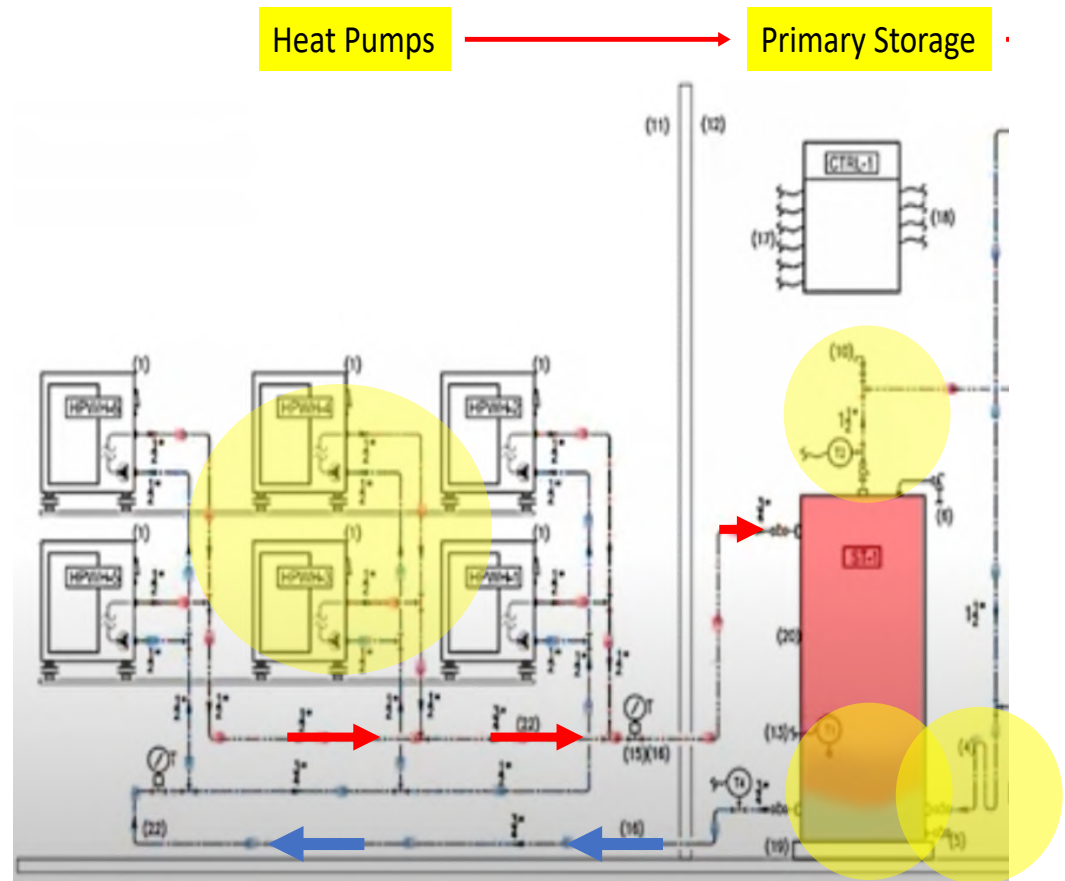
Primary Storage

Swing Tank



Breaking into Functions

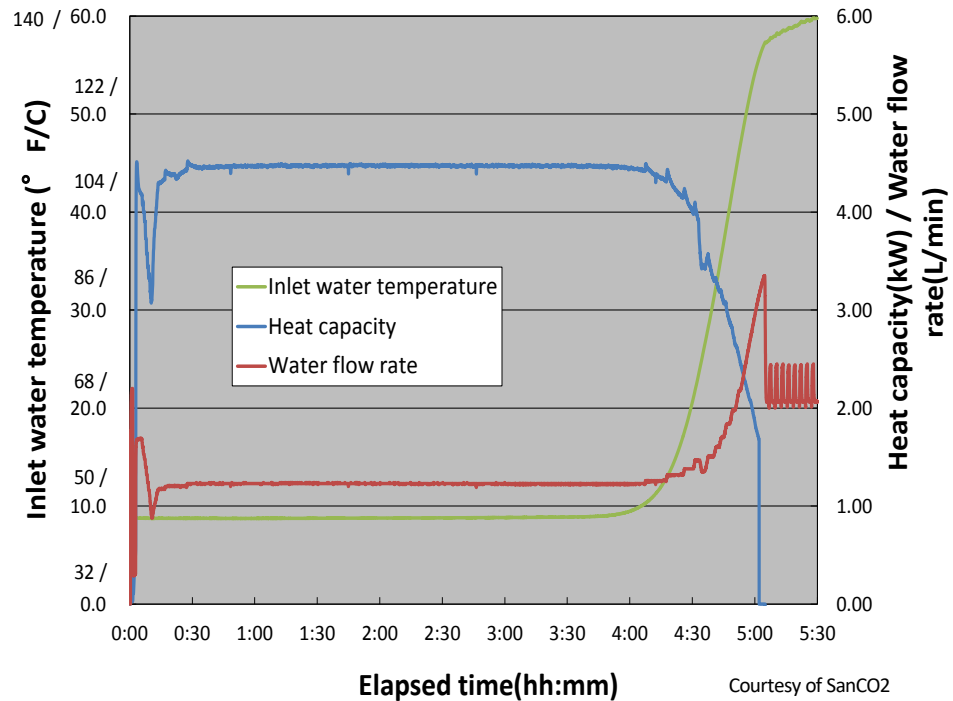
- The primary storage tank(s) are stratified
- The cold municipal water is piped into the bottom of the primary storage tank(s)
- Heat pump(s) take cold water from the bottom of primary storage tank(s) and provide the 100F lift in a single pass.
- The high temperature (150F-170F) is piped to the top of the primary storage tank(s)
- The hot DHW is piped from the top of the primary storage tank to the load.



CO2 Needs Cold Water

- CO2 Heat pumps loose both capacity and COP when return temperatures increase.
- As the inlet temperature increases, the delta T decreases.
- The water pump try's to compensate by speeding up the flow.
- The overall capacity is reduced as the entering water temperature increases.

Heating 83 Gallon tank from Cold

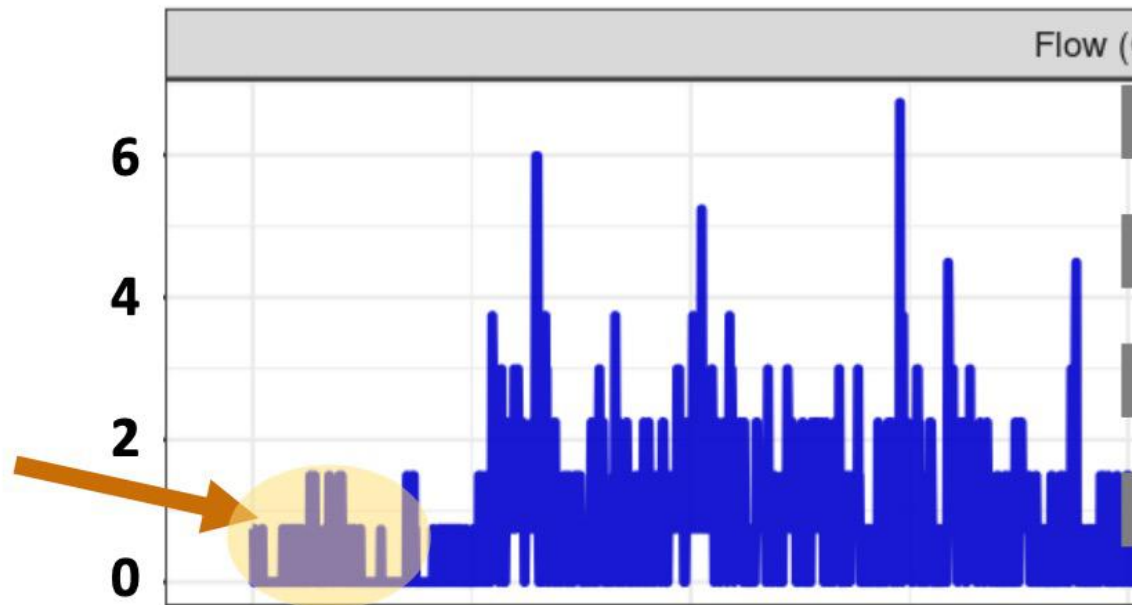


Courtesy of SanCO2

Recirculation loss

Happens overnight as the recirc loop pulls heat from the tank and loses it to the building

**Low
overnight
hot water
use**



Courtesy of Ecotope

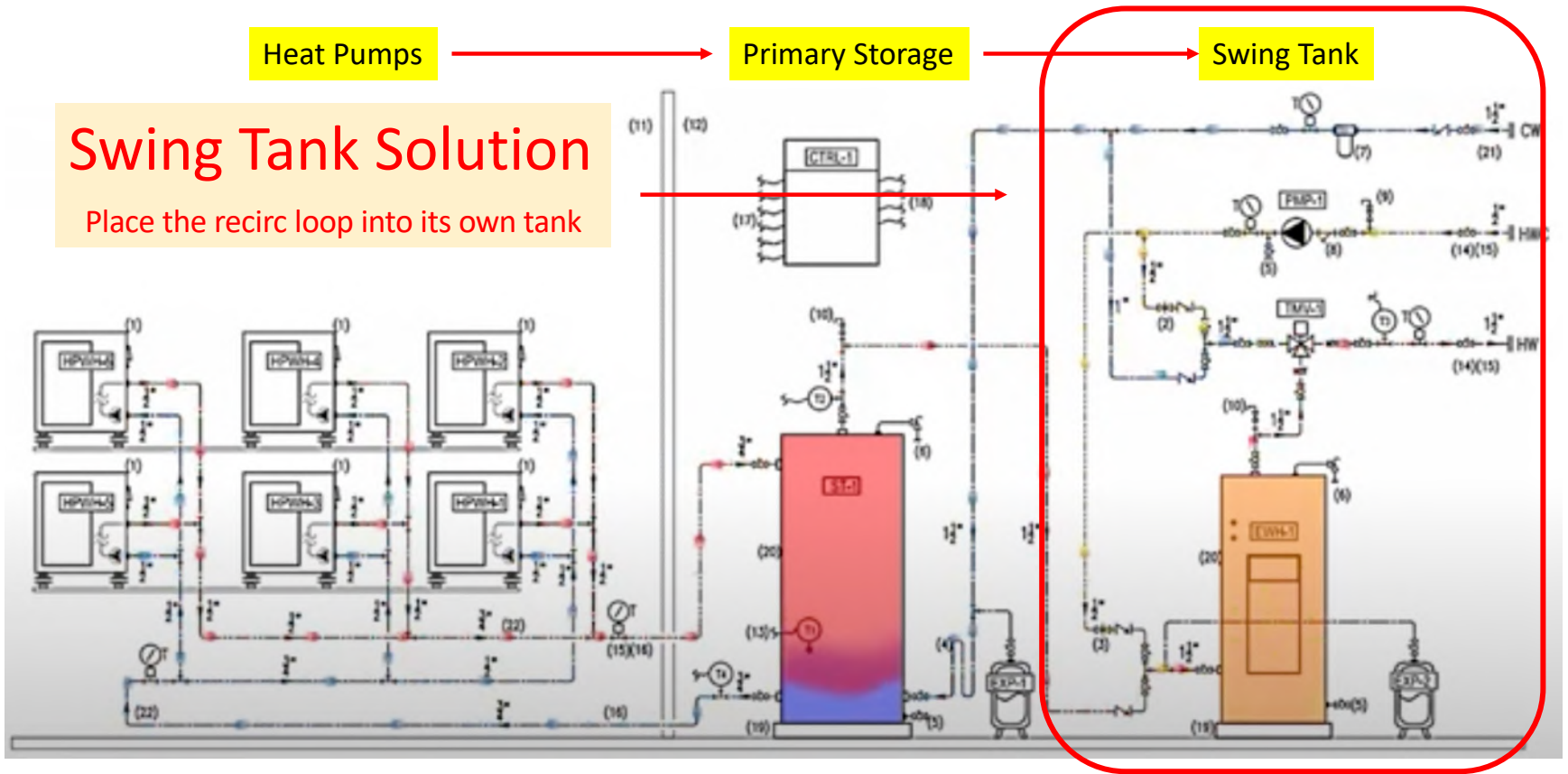
Heat Pumps

Primary Storage

Swing Tank

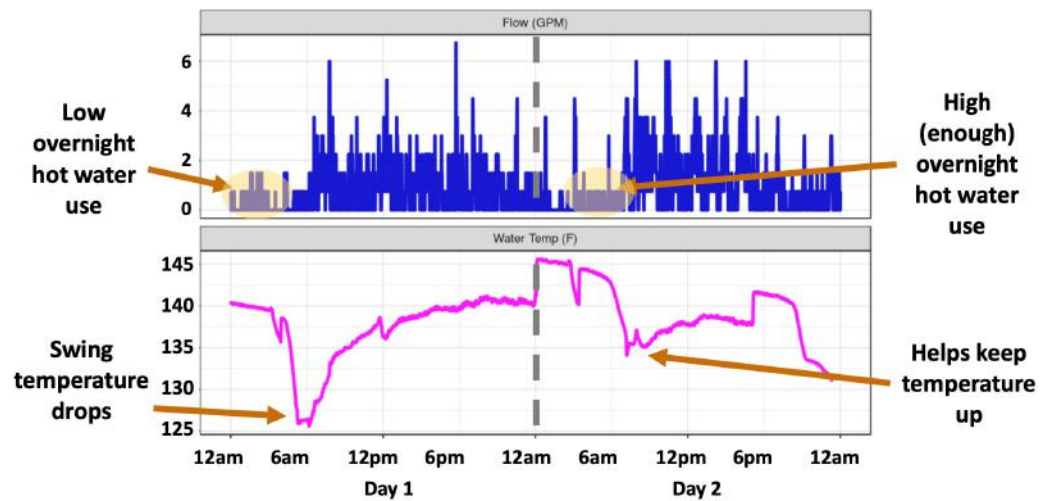
Swing Tank Solution

Place the recirc loop into its own tank



How it works

- Recirculation losses are isolated from primary storage
- Overnight tank temperature can often cool below set point (120F)
- Add electric resistance to provide a short lift back to set point.
- Can also use a multi-pass heat pump.

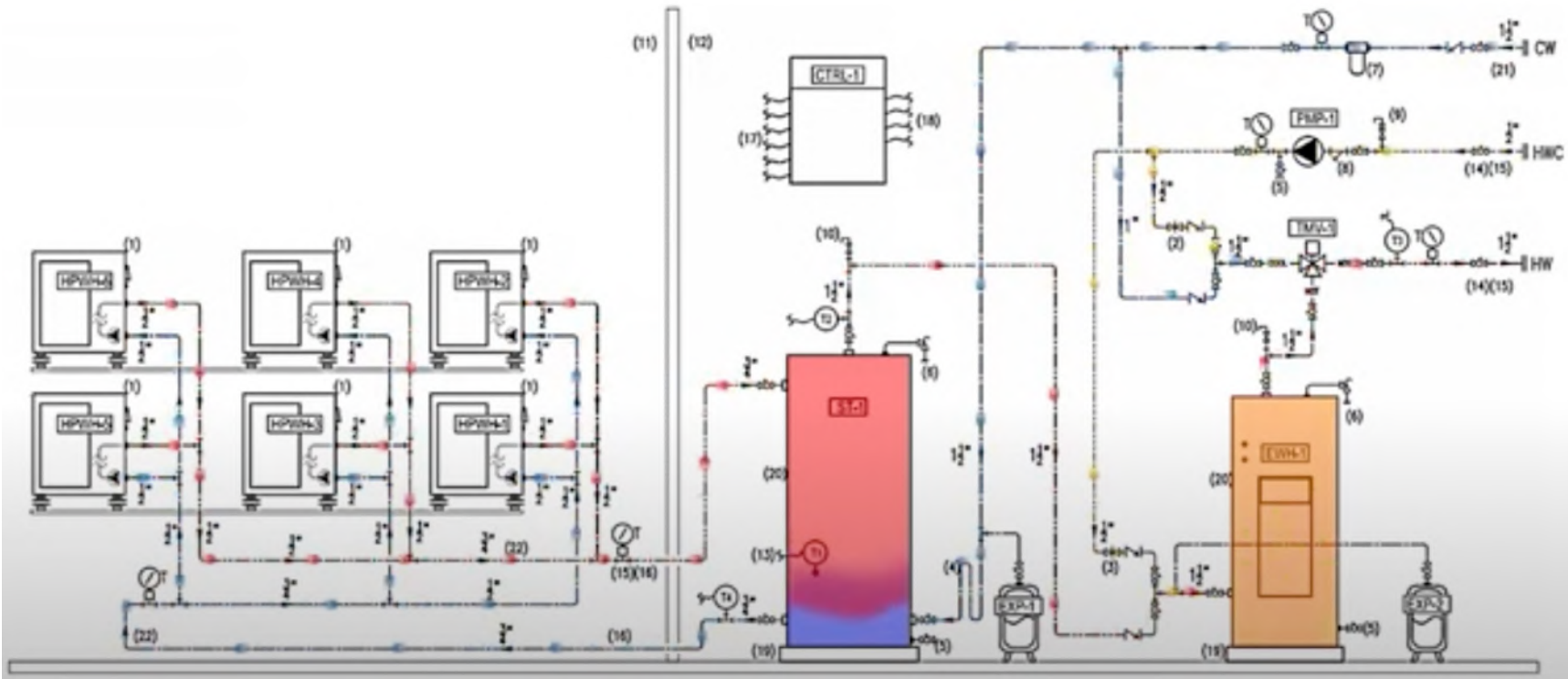


Courtesy of Ecotope

Heat Pumps

Primary Storage

Swing Tank



Control & Visibility

The WaterDrop Controller Functions: Basic, Communication Package, BMS, Full M&V.





Sizing a Building

New tools!

The Ecosizer

<https://ecosizer.ecotope.com/sizer/>

ECOSIZER

[Size Your System](#)

[Glossary](#)

[Documentation](#)

[FAQ](#)

[About](#)



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.

[MORE INFORMATION](#) 

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.

Occupancy Inputs



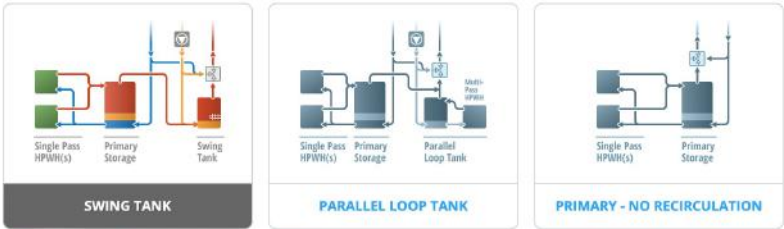
Water Temperatures

TOTAL PEOPLE & APARTMENTS		APARTMENT SIZE & OCCUPANCY RATES	
	Number of Apartments	Occupancy Rate	Peak Gallons per Day per Person
		ASHRAE Market Rate	Ecotope Market Rate with Low Flow Fixtures
Studio	50	1.49	1 <input type="range" value="25"/> 49
1 Bedroom	0	1.93	1 <input type="range" value="25"/> 49
2 Bedroom	0	2.39	1 <input type="range" value="25"/> 49
3 Bedroom	0	2.84	1 <input type="range" value="25"/> 49
4 Bedroom	0	3.29	1 <input type="range" value="25"/> 49
5 Bedroom	0	3.74	1 <input type="range" value="25"/> 49

Water Temperature

Design Cold: °F
 Supply: °F
 Hot Storage: °F

Temperature Maintenance System



- Primary plant with a temperature maintenance plant in series
- Primary plant with a temperature maintenance plant in parallel
- Just the primary plant without a temperature maintenance load

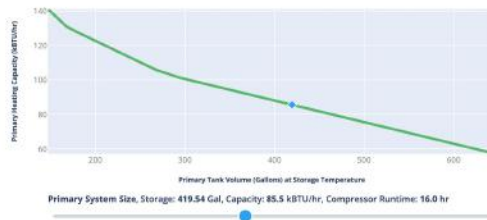
Results



Results

The graph below represents the trade off between storage volume and heating capacity. The Ecosizer method result is the green curve in the graph. The system sized from user inputs is the blue diamond. Users should pick any point above the green curve to determine their system sizing. Use the slider bar below the plot to select a different size system.

Primary Sizing Curve



RECOMMENDATIONS

The recommended minimum heating capacity shown below is the **minimum** needed average output capacity of the selected equipment at the design cold air temperature in your climate zone. Note that you must also account for manufacturer specific defrost penalty.

Primary Storage

Swing Tank

Tank Volume ⓘ
420.00 Gallons

Swing Tank Volume ⓘ
120 - 300 Gallons

CA Title 24 Swing Tank Volume ⓘ
288 Gallons

Heating Capacity ⓘ
85.50 kBtu/hr

Swing Resistance Element ⓘ
8.7 kW - 29.9 kBtu/hr

THIS SYSTEM WAS SIZED FOR

Occupancy

74.5 People

Apartments

50.0 Units

Daily Hot Water Usage

25.0 Gallons per Day per Person

Total Hot Water

1,862.50 Gallons per Day

Recirculation Loop

Heat Loss

100.0 Watts per Apartment

Details

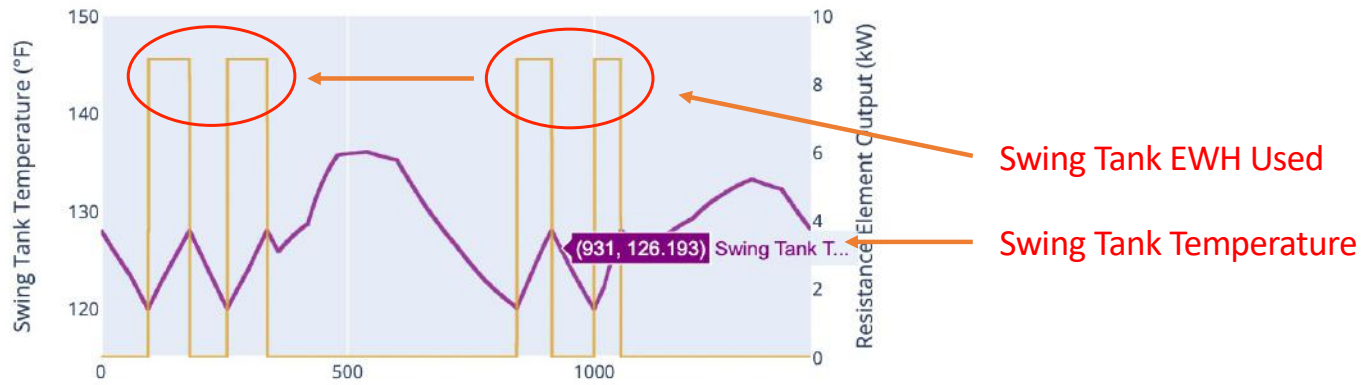
SAVE RESULTS TO PDF

SEND US YOUR FEEDBACK

Heat Pump Capacity



Hot Water Simulation





Deliveries

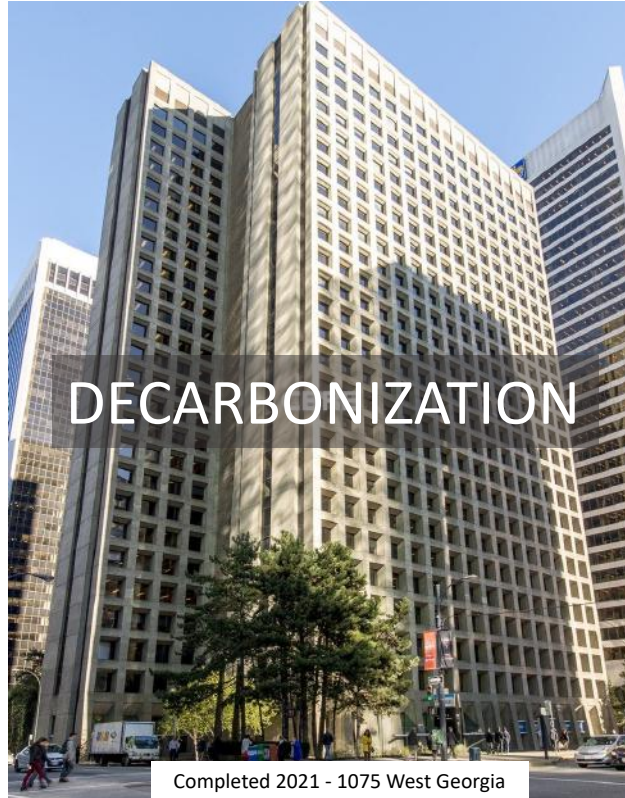
Parts, Pumps and Skids



10 Heat Pumps



1 BMS Controller



DECARBONIZATION

Completed 2021 - 1075 West Georgia
ST Vancouver BC

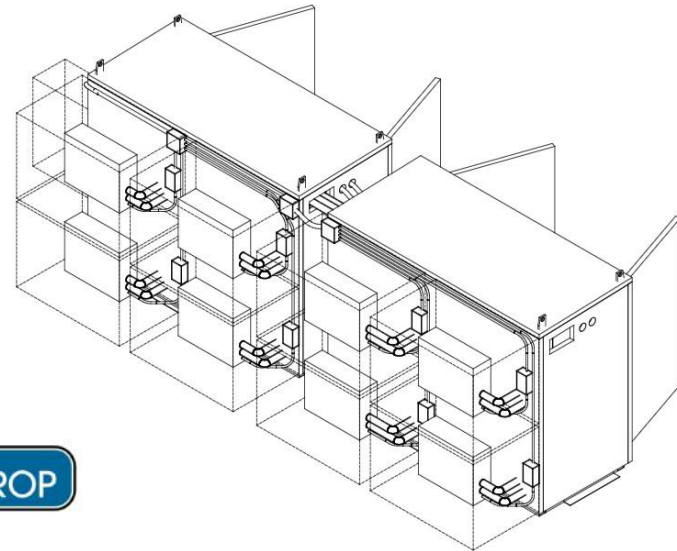
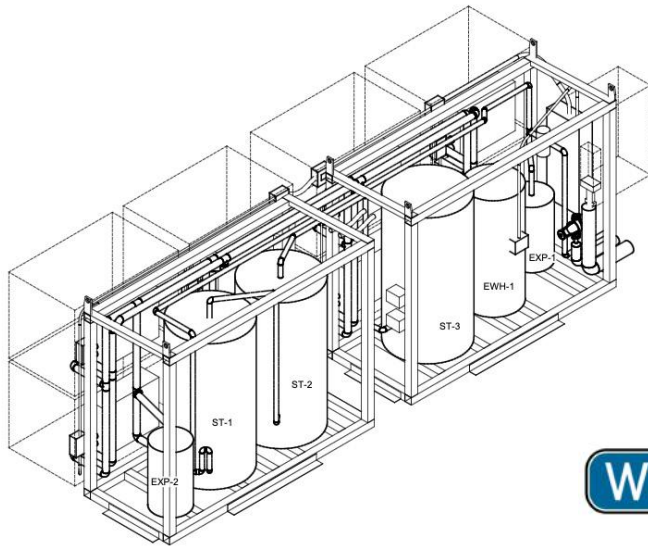


Existing Buildings

- Custom sizing to fit building
- Site assembled using a wide range of tank sizes – 119 to 505 Gallon.
- Drop in ready heat pump piping design.
- Drop in ready primary & swing tank piping design.
- Standard or custom controller package is plug and play ready.
- Bidder & installer training
- Full start-up service

Factory Assembled

WaterDrop Fully Functioning Plant. - Just add water.



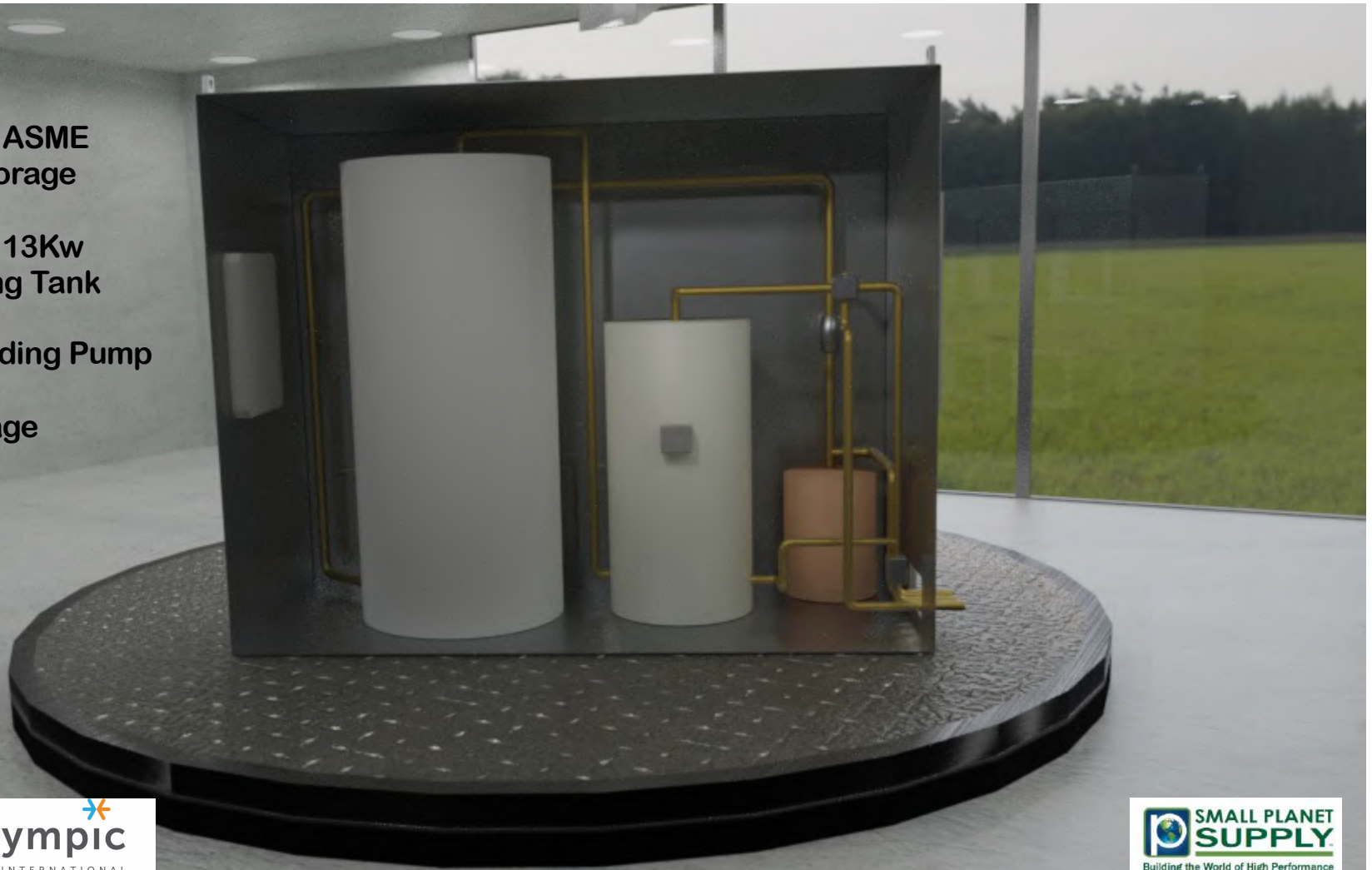


27Kw Capacity

**Single Pass Lift to 150F
Master Staging Controller
Low Ambient Operation**



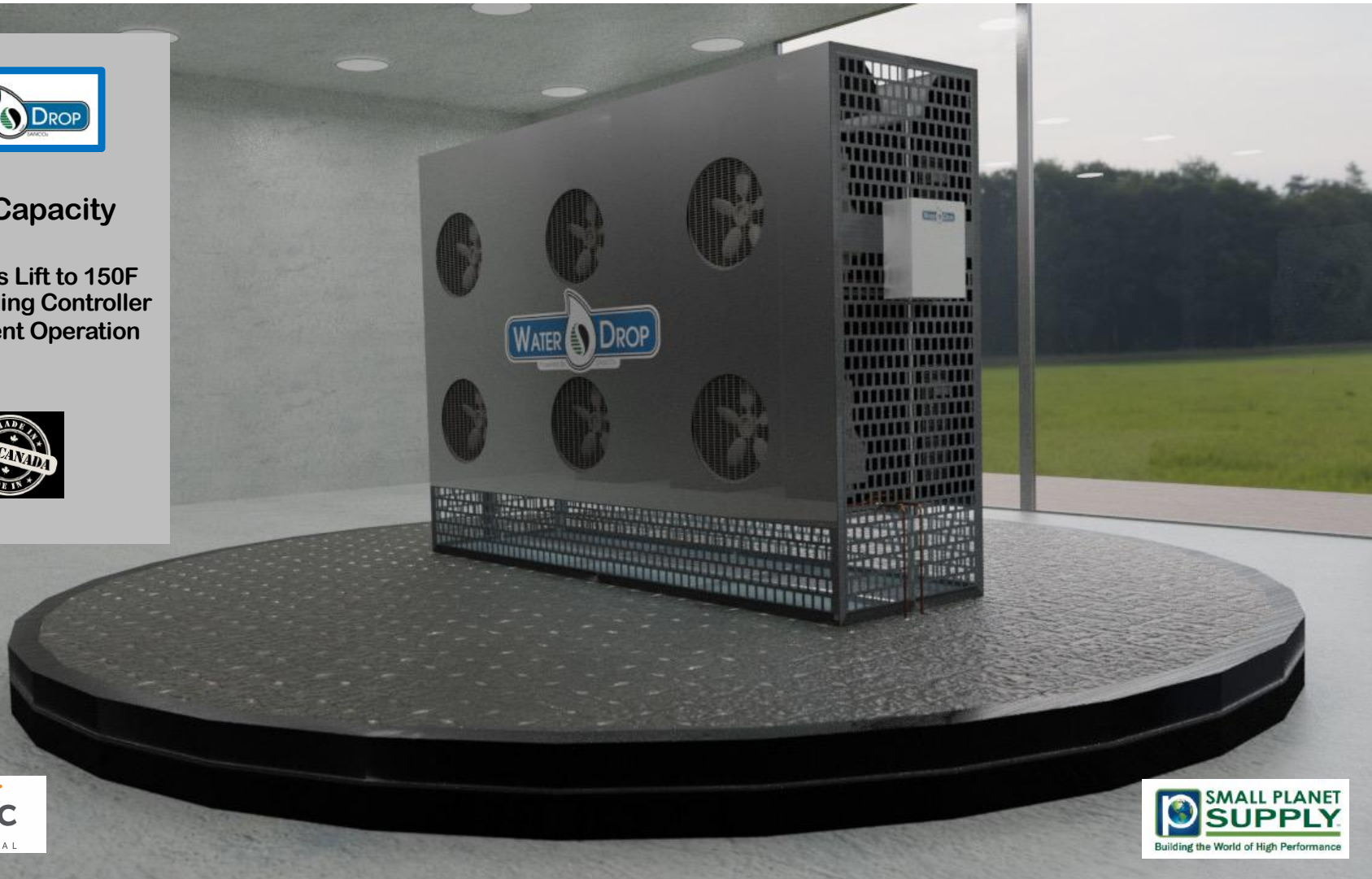
- ✓ 505 Gallon ASME Primary Storage
- ✓ 119 Gallon 13Kw ASME Swing Tank
- ✓ TMV & Building Pump
- ✓ M&V Package Available





54Kw Capacity

**Single Pass Lift to 150F
Master Staging Controller
Low Ambient Operation**



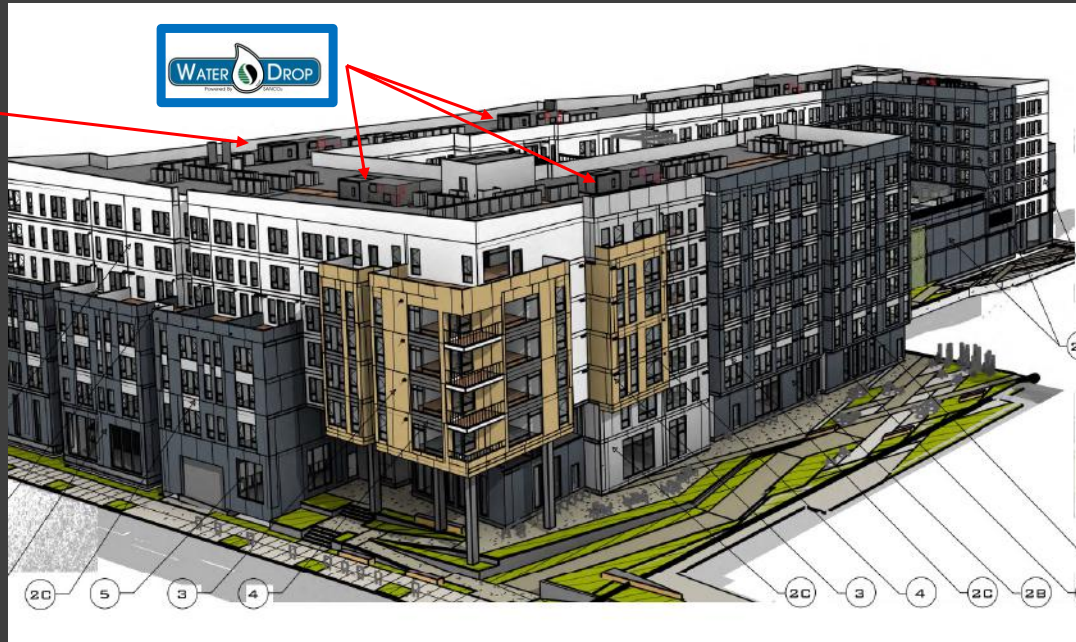


Big Buildings

Zone out and keep it tight



Break it into zones



- Compact distribution systems use less pump energy
- Shorter runs have less loss with a smaller swing tank lifts
- Multiple plants offer better security and lower power drops.



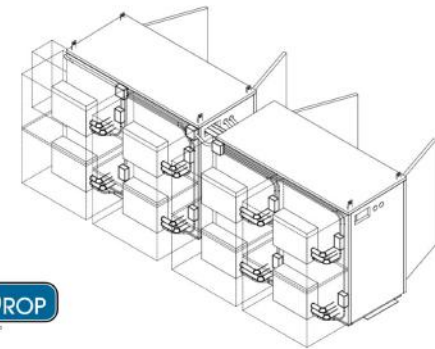
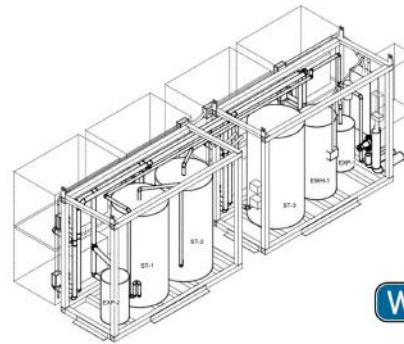
- Supported System
- Ecosizer System Sizing
- “Drop In” Design
- Factory Assembled
- All Major Components
- System Pricing
- Bidder & Installer Training
- Factory Startup Service
- Warranty on Factory Skids

Locally supported by...



olympic

INTERNATIONAL





Questions about WaterDrop?

Contact Albert Rooks

albert@smallplanetsupply.com

Want more information about
Small Planet Supply?

www.smallplanetsupply.com

or visit our warehouse

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