



# Sustainability Decathlon - Domestic Hot Water for a Sustainable ADU

Designed by Hydro-Sol: Mahnoor Fatima, Makala Maydwell, Chiara Marie Duran, Miguel Romero Cruz, Jiahao Ma  
Sponsored by Professor Mark Walter

DHW for a Sustainable ADU is a design project for Sustainability Decathlon (OCSD23), which is a design-and-build competition held in Orange County focused on sustainable housing.

## Objective

Provide hot water to a solar-powered home that addresses climate change and California's housing needs.

## Challenge

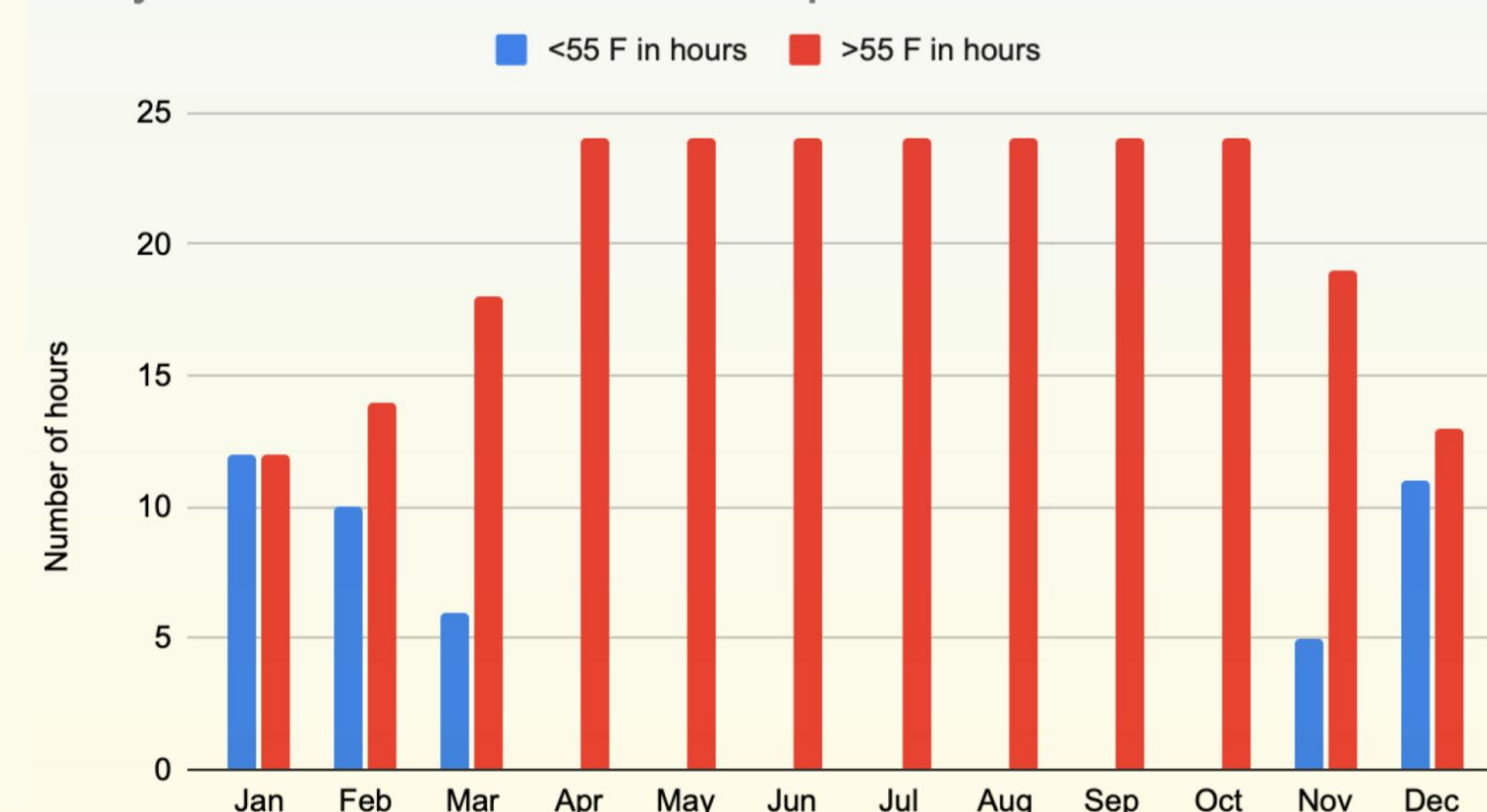
Design a water heating system that is ultra-efficient, affordable and reduces overall household water usage.

## Temperature Analysis

Using the average monthly temperatures in Irvine, CA it was estimated how often any solar backup would need to run and what the highest temperature difference would need to be heated.

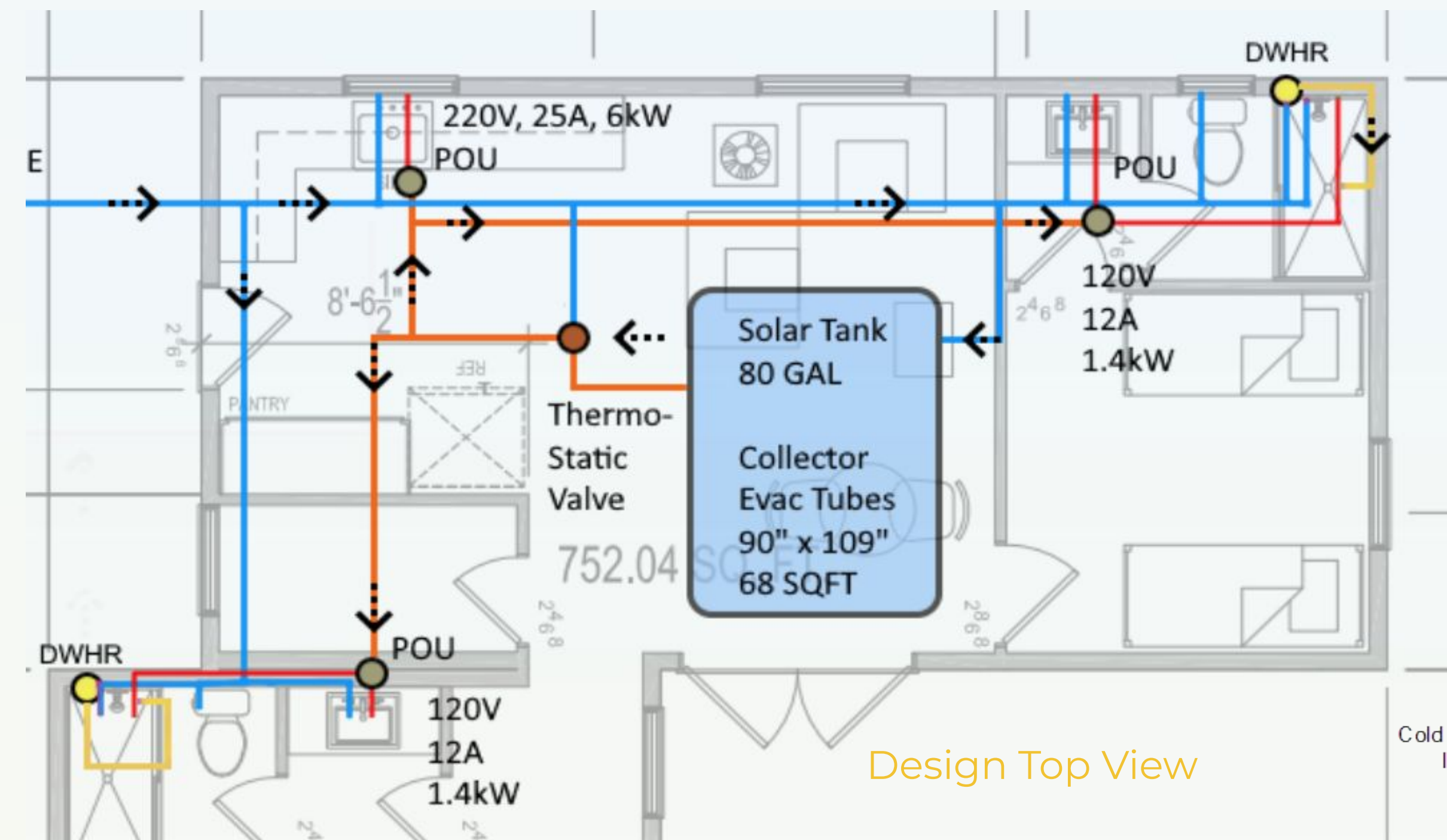
- $\Delta T$  max = 60°F
- Highest backup needs = 50% in Jan
- 75% of the year solar can supply

Daily Breakdown of Ambient Temperature in Irvine



Temperature Analysis

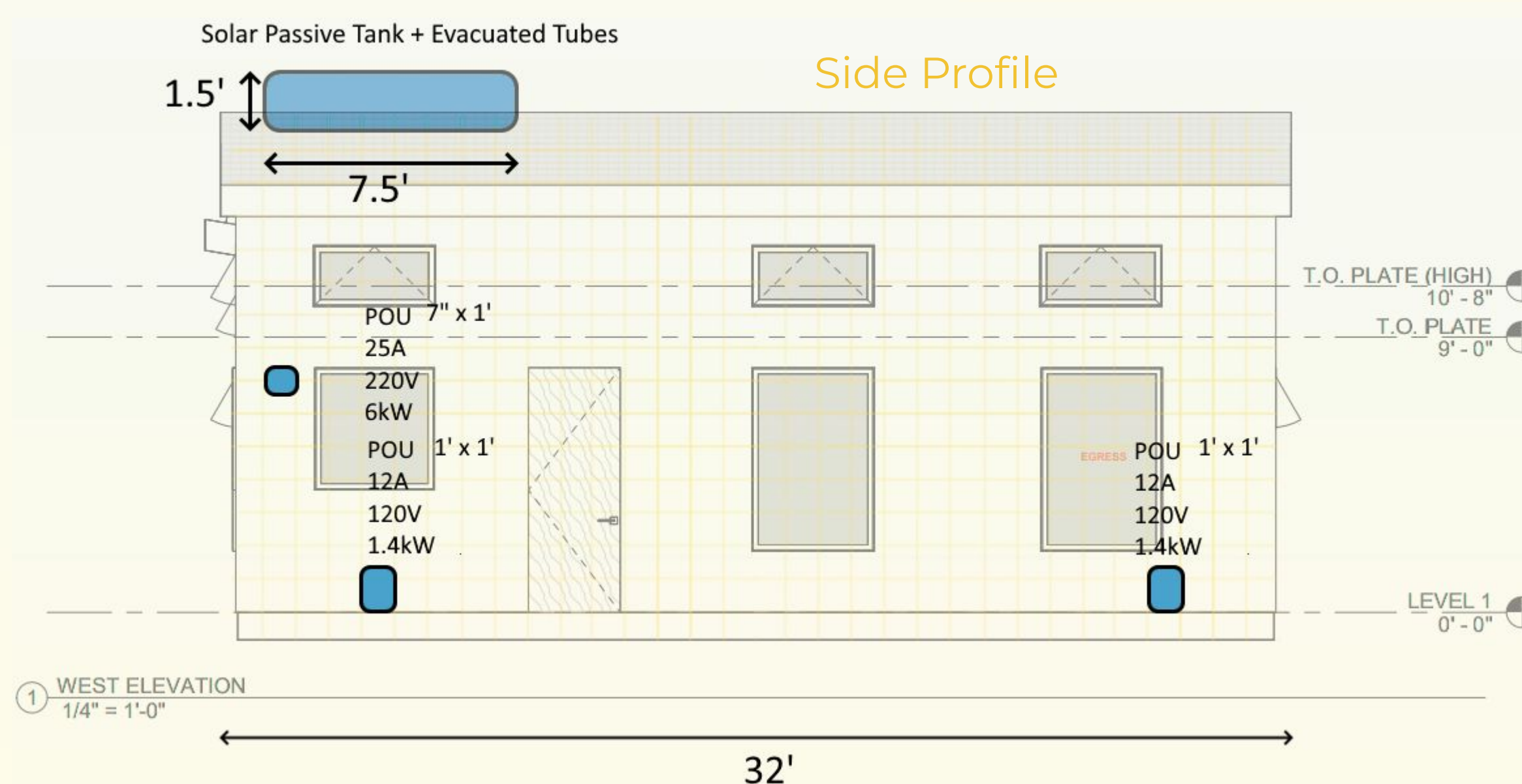
## Design Solution



## Solution

- Solar Thermal Collector
- Water Storage Tank
- Passive Water Heating System
- Backup
- Drain Water Heat Recovery

% of Day Backup Needed



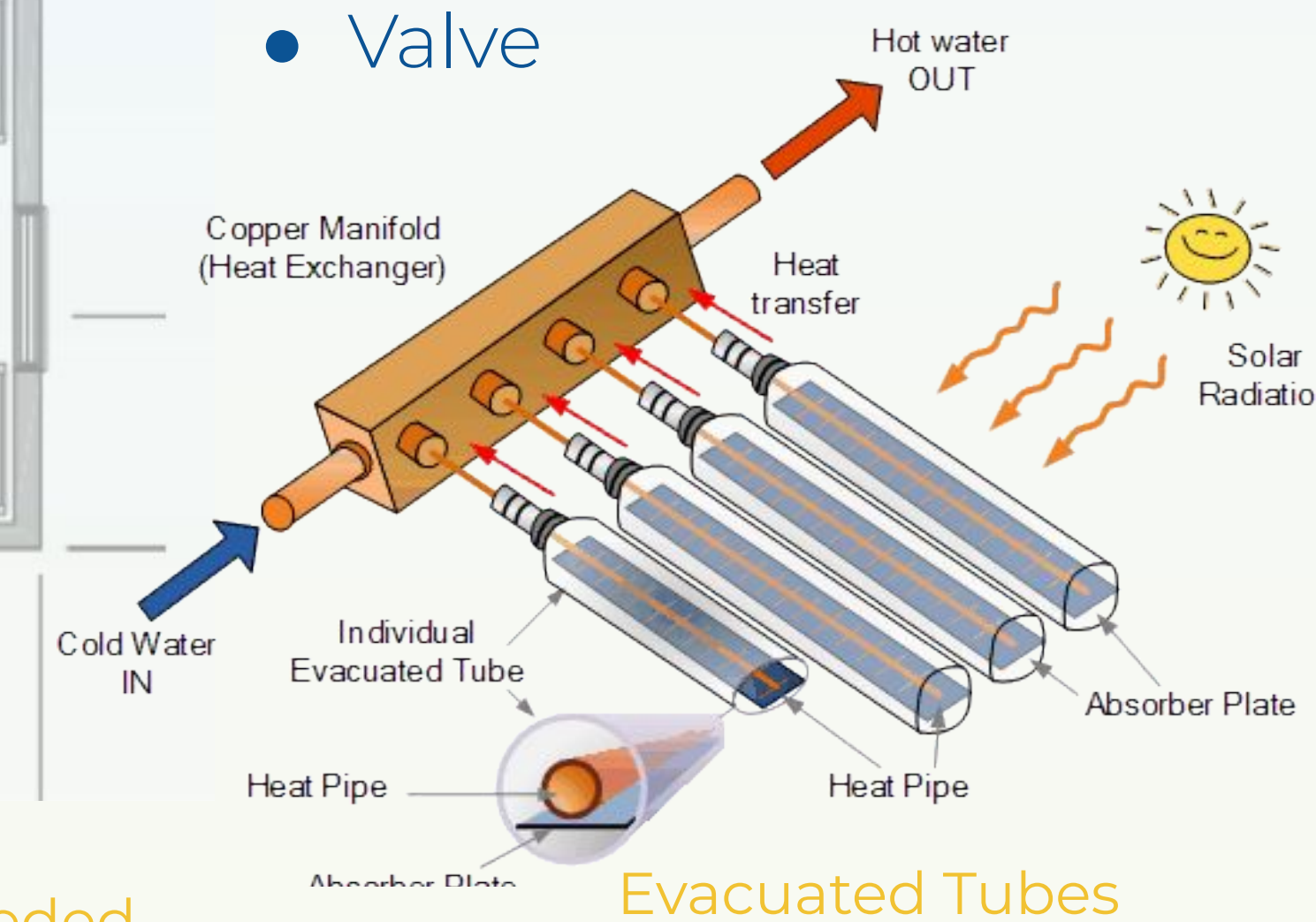
## Components

- Passive Solar Kit
- Evacuated Tubes
- 80 G Tank
- 3 Point of Use
- DWHR
- Valve

Solar Kit



Ecomini6 POU

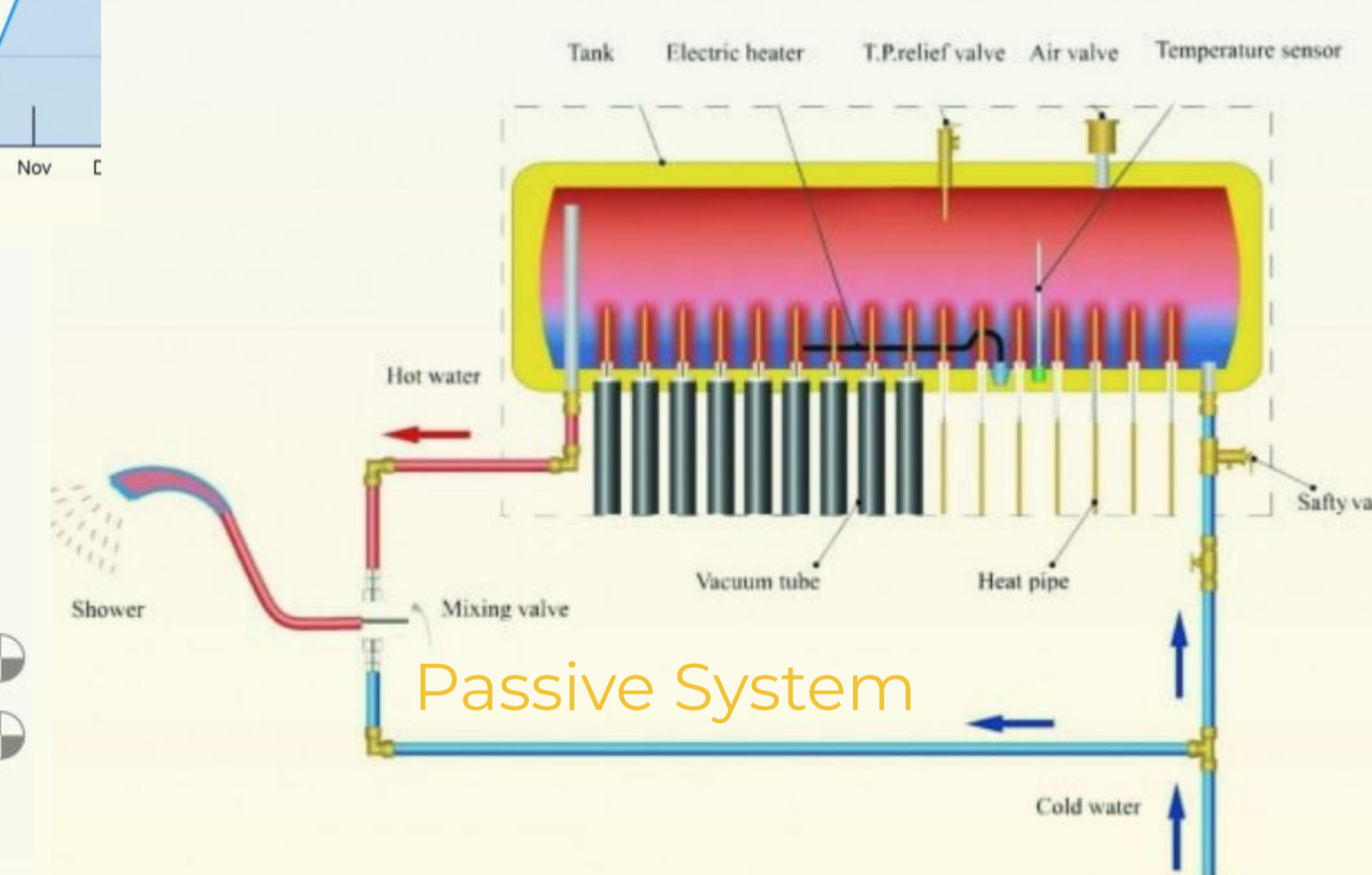


Valve

Rheem POU

## Passive System

- Works on convection
- No pump needed



## Hardware Performance

- Energy efficient
- Cost effective
- Sustainable
- Spatially aware-only on roof

## Analysis

Total Initial Cost	\$5,409.94
Power (kW)	N/A + 1.44 + 6
Storage Space Needed	Roof
Total POU	2x - ECOMINI6 1x - RHEEM 6
Hourly Cost	\$3.82
*Yearly Cost	\$902.31

## Future Improvements

- Want to utilize DWHR (direct water heat recovery) so that heat is not wasted when water goes down the drain

## Safety

- Scalding risks
- Bacteria growth due to lukewarm water (can lead to Legionnaires' Disease)

**Acknowledgements** Our team would like to thank the following people for making this project possible:  
OCC for partnering on Sustainable ADU project with UCI, hosting team meetings and providing the floor plan.  
UCI Department of Aerospace & Mechanical Engineering and Professor Mark Walter for providing this amazing opportunity.  
The UCSD Jacobs School of Engineering Team for poster format inspiration.

## References

<https://www.sunmaxxsolar.com/product/thermopower-vts-30-tube-80g-thermosyphon-solar-hot-water-kit-with-heat-pipes/>  
<https://www.cnet.com/home/smart-home/how-to-adjust-the-temperature-of-your-water-heater/>  
[https://www.researchgate.net/publication/257051305\\_Experimental\\_investigation\\_of\\_the\\_performance\\_of\\_five\\_types\\_of\\_solar\\_collectors.](https://www.researchgate.net/publication/257051305_Experimental_investigation_of_the_performance_of_five_types_of_solar_collectors.)