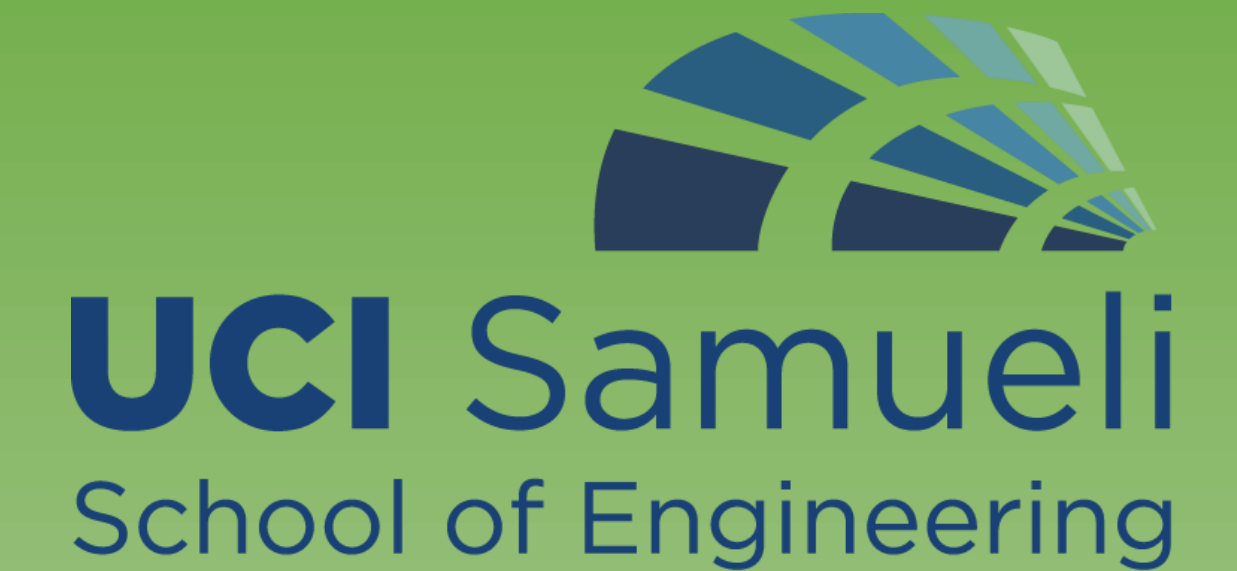


Advisor: Derek Dunn-Rankin
Project Manager: David Baltazar
Team Members: Alex Masamitsu
 Cameron Colley
 Enpei Wu
 Jianan Qu
 Yiyi Wang
 Anthony Ruiz

Solar Water Heating System



Innovation

Although solar water heating is far from replacing gas as a heating mechanism, it can still be combined with current gas heating systems to increase its efficiency. By creating a passive solar water heating system that preheats hot water, we can reduce the amount of water wasted during water heating time, saving both time and money for homeowners, while also addressing the drought in California.

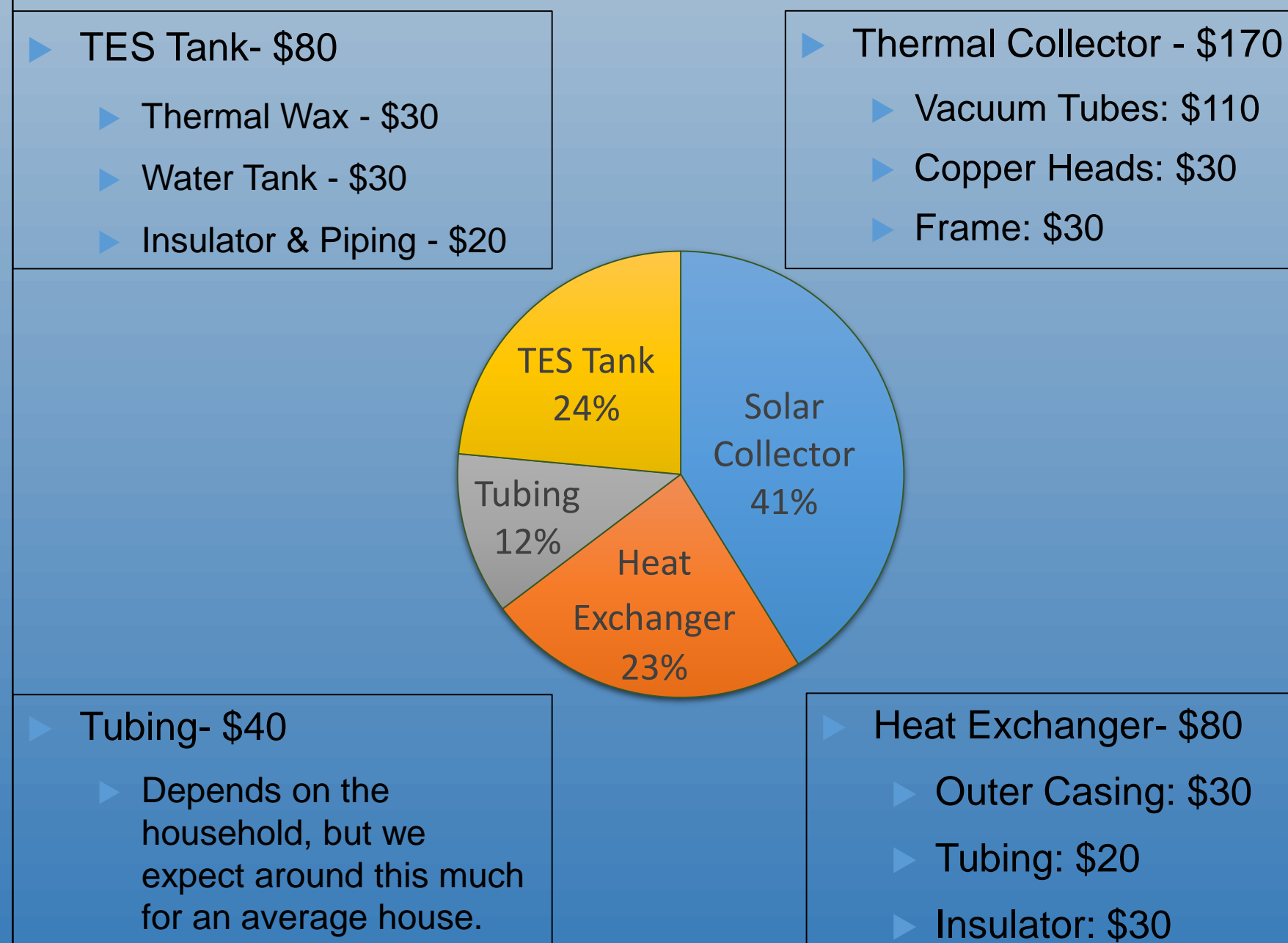
Current Status

We are finishing up the solar thermal collector. We finished the reports explaining our choices in materials and designs (working fluid, vacuum tube over piping, frame material, etc.). We are finalizing the frame design for the collector, ordering the vacuum tubes, and manufacturing the manifold.

Next Steps

After manufacturing the parts of the solar thermal collector, we will assemble the complete solar thermal collector. A solar thermal collector testing group will test the performance of the collector by recording the average temperatures of the working fluid at different times, seeing if the design satisfies building codes, and test the installation. Another group will begin designing the Thermal Energy Storage (TES) tank by researching different types of phase change materials and designing the interior of the tank, taking into account the working fluid path and the phase change material placement.

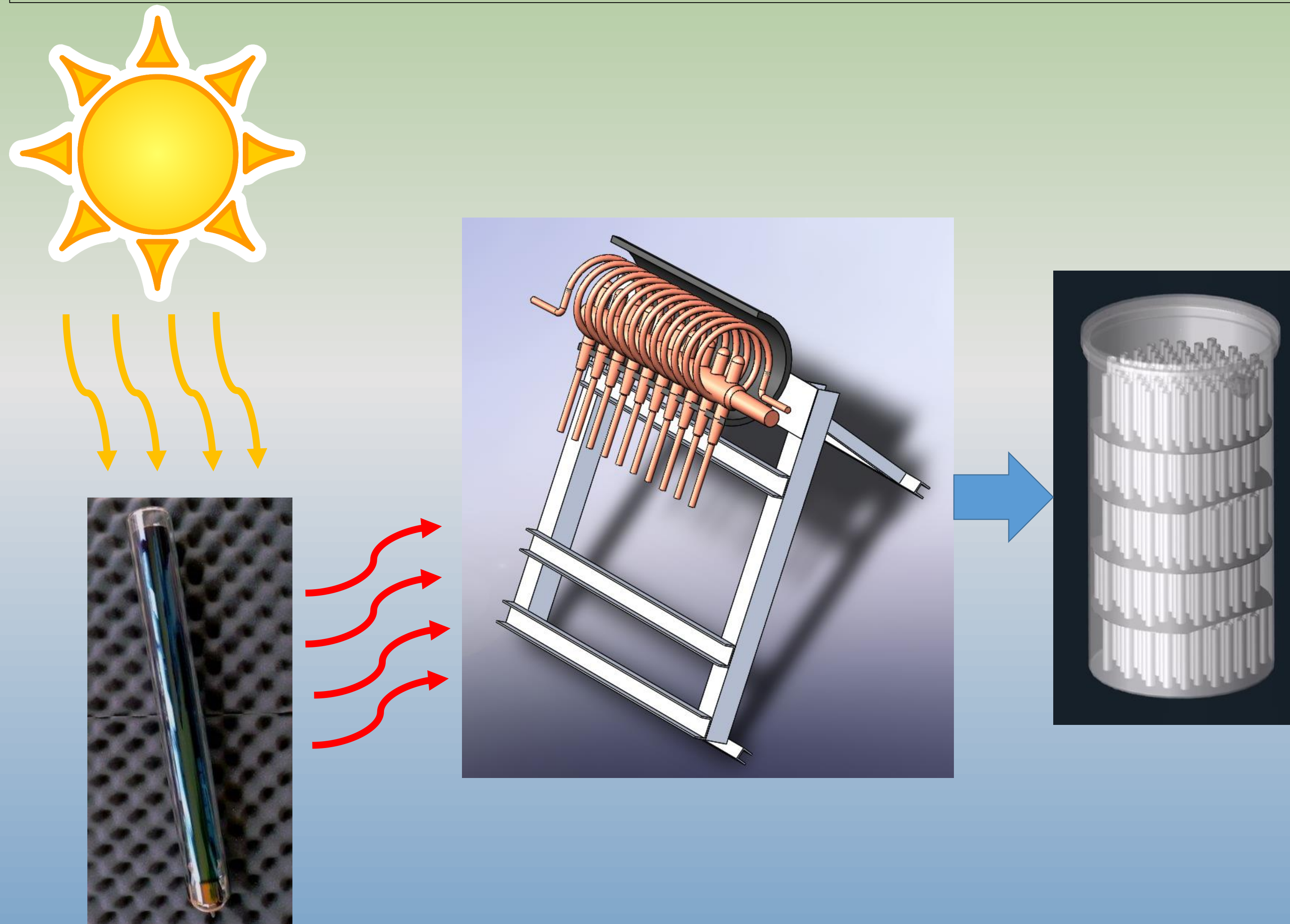
Budget Breakdown



Background

Many households waste water while waiting for it to heat up. Studies show that an average household of four will waste about 10 gallons a day waiting for their water to heat up in the shower and sinks.

California has the most potential to capitalize on solar energy. And while solar electric integration is expanding, solar water heating is not. The reason for this is that gas heating is already cheap and efficient enough as is. Thus, we are developing a commercial device not with the intention of saving on heating bills, but with water bills.



Goal

Create a solar water heating system that can passively preheat a household's water to reduce the amount of wasted water made when waiting for water to heat up. As a commercial device, we need to make it smaller and lighter (so as not to interfere with other solar systems a house might already have), but also cost-efficient, in terms of both labor and money.

Objectives/Requirements

- Weight of the Solar Collector:** In order to meet building codes and be eligible for government subsidiaries, the solar thermal collector must not be over a certain weight.
- Size of the Solar Collector:** Must be big enough to absorb enough heat from sunlight, but small enough to not interfere with current/future solar systems (Solar Panels)
- Temperatures of the Working Fluid:** We need to preheat the water to about 120°F. During the day, we should aim for a higher temperature, since there is more sun/heat. At night, we should have a lower temperature, but not too low since we will have a Thermal Energy Storage Tank (TES)
- Working Temperatures:** Need to ensure working fluid doesn't freeze or boil in average California temperatures.
- Maintenance:** Aim to make it on par, if not better, than solar water heating systems that are on the market.
- Total Cost:** Need to keep low to appeal to customers. Make it lower than current solar water heating systems. Also keep it low enough so people can buy multiple units.

September 2016	October 2016	November 2016	December 2016	January 2017	February 2017	March 2017	April 2017	May 2017
Solar Collector Design frame and manifold	Solar Collector Purchase parts and assemble	Solar Collector Test the performance	TES Tank Finalize tank design & wax	TES Tank Test the performance	Combination Test installation and performance	Combination Combine TES with solar collector	Combination Redesign/Move to heat exchanger	Combination Redesign/Move to heat exchanger

Objectives	Goals	Current
Weight of Solar Collector	40 lbs	37 lbs
Size of Solar Collector	36" x 36" x 10"	28" x 40" x 10"
Working Fluid Temp (Day)	150 °F	133°F
Working Fluid Temp (Night)	105°F	N/A
Water After Preheating	120°F	N/A
Working Temperatures	-10°F - 220°F	18°F - 213°F
Maintenance Times	5-6 Years	N/A
Total Cost	<\$1000	\$600-\$700