Solar water heating for university residences

Heating water is a substantial portion of domestic energy costs, regardless of whether we are considering a single family dwelling or a large university residence. There are commercial solutions for heating water that are sized appropriately for serving apartments and single homes. Direct thermal systems, where water flows through either flat-panel or vacuum-tube solar heat collectors, have a reasonable track record in SA and were (briefly) subsidised in an effort to reduce demand on the electrical grid. These systems need specific geyser tanks, which can accommodate the piping to direct water to the collector panel. There are newer systems that use photo-voltaic (PV) panels to generate DC electricity, that directly drive a heating element in an ordinary geyser tank, which do not require any additional piping from the geyser to the roof exposed to sunshine. These Direct PV geyser heating systems have much lower capital costs that PV-inverter-battery systems, as the inverter and battery are not necessary.

This project will consider the hot water demand (volume and time-of-use) for several UCT student residences The roof tops of these residences will need to be investigated for pitch angle and compass orientation, which affect the power that can be collected by either PV or thermal panels. This information will be combined in a model that determines how much of the hot water demand for the residence can be offset using either Direct PV or thermal collector systems for the geysers, incorporating imperfect weather conditions and time-of-use not aligning with peak solar generation. The cost savings derived from solar water heating may then analysed against the capital outlay for an appropriately sized system to determine payback periods and long term financial gain.

Model constraints and variables

- Operational parameters (heating water/no AC supply)
- Project boundaries (eg; no battery or inverter)
- Model environment (uct rez, seasonal)

Parameters of the model

The model must operate within certain parameters, the nature of these parameters aligns with the aim of the project resulting in the model achieving the goal of the project which is to effectively implement solar water heating in university residences.

The operational parameters will be set for different scenarios trying to make the model dynamic for every outcome. The parameters that will be kept constant..

- Residences are at maximum capacity
- Every student takes two 4 minute showers per day
- They shower over/ at the same time every season ()

Parameters that change are the

- Ambient temperature of the water in the different seasons

- The temperature that is sufficiently “hot”

Project boundaries

- No inverter
- No AC voltage conversion
- No battery

Model environment

- Dimensions
- Angle
- Geyser systems
- Water produced will differ for each res.