

# Solar Desiccant Air Conditioning

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## Motivation

- Create a solar air conditioner to be used in home.
- Many homes have a potential to use with panels on their rooftops especially with the southern California climate.
- Harness environmentally friendly source of energy.
- Easy to use and affordable at one time investment.

## Solar Air Conditioning System Operation

### Air Cycle:

- The solar a/c system does not have a compression cycle which reduces energy consumption.
- Water and water vapor from the air are manipulated.
- Outside air is processed through a desiccant wheel which removes the moisture from the air. This process reduces the air's enthalpy and wet bulb temperature.
- This air with a reduced relative humidity is passed through a humidification cycle that cools the air further and increases the humidity to a comfortable level.
- To recover the absorptive properties of the desiccant wheel, solar heated water goes through a water to air heat exchanger to dry away moisture.



### Water Cycle:

- Water is circulated through a solar heat collector.
- The heated water flows through the radiator. To minimize heat loss, the connections and pipe length from the solar collector are minimized.
- The water is stored in a 5 gallon tank and circulated by a pump connected to the system before the solar heat collector.

## Solar Collector Heating

- Donated Sun Maxx 10 evacuated tube solar collector system.
- Can deliver 18,000 BTU of heating a day.
- Uses glass evacuated tubes with a manifold on top of the solar collector.
- Capture light from all angles.
- Larger aperture area results in higher solar efficiency.



## Cooling

- We chose the open cycle desiccant cooling method for A/c.
- This includes dehumidification of hot air by a desiccant.
- Desiccant cooling is an open heat driven cycle, which uses a desiccant (silica gel) wheel and thermal wheel in tandem to achieve both cooling and dehumidification.
- Design is based on adsorption chiller system.
- The desiccant wheel dries out the air to increase efficiency. Air is cooled in the heat recovery wheel.
- Heat is transferred through contact between the air and rotor material. Cooled further through evaporation humidification.
- Solar power used to heat the air to dry out desiccant wheel.

## Testing Procedure

- PVC piping is used to transport the water through the collector, through the heat exchanger, then to a storage tank.
- The water system runs for around 30 minutes or until the temperature levels out.
- The fans are then turned on and the wheels begin to turn so they will contact both streams of air.
- The inlet and outlet temperatures and humidity levels are measured.



## Testing Results

- We set up a test box so that we could test what temperature and humidity level changes occur through the heat exchanger.
- We have a fan set up on one side to remove the hot air when it passes through the heat exchanger. With this set up, we experienced a temperature increase and a humidity level decrease. This is also expected for the air passing through the desiccant wheel.

	Temperature (F)	Humidity (%)
30 Minutes		
Inlet	78	43
Outlet	83	38
40 Minutes		
Inlet	75	47
Outlet	85	32