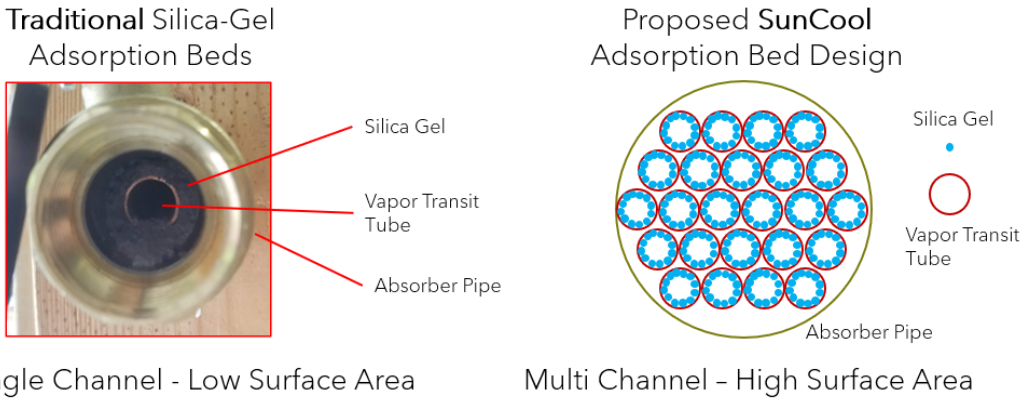
Technical Assistance Request

SunCool – Solar thermal air conditioner

Brief project overview: The purpose of the SunCool project is to use solar energy to drive an adsorption refrigeration cycle and generate low-grade cooling air for the purpose of residential and industrial air conditioning. The main driver of the system is solar energy, which is used to drive the thermodynamics of desorption from the main adsorbent bed, situated within the solar receiver.




The SunCool project / concept seeks to test out and optimize key components of the system:

- Adsorption Bed Optimization
    - Testing of different adhesives under multiple heat / cool thermal cycles to test for performance and degradation (life time)
    - Optimum vapor transit tube size / count for maximum effectiveness & maximum cost effectiveness
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- Concentrating Solar Power

    - This field is highly researched, however a selection by an experienced team member needs to be placed once the final adsorption design is made.
- Condenser
    - Another highly researched component. This should have some additional cursory investigation into conventional AC methods and integration with mass-manufactured parts for cost reduction.
- Evaporator
    - Specific to the different applications, this needs to be optimized for the minimum viable product at each potential site: commercial, residential, disaster relief. Highly likely that the solution will be the same form factor in different sizes.
- Coefficient of Performance (COP)
    - This measures the efficiency of the system in general. A laboratory is needed with a constant and controlled heat source to simulate the sun and eliminate environmental variables in order to measure this properly. A high COP will make this product very cost effective and competitive.

The main investigative path at this time is silica gel and water as the adsorbent / refrigerant pair. Water is in many ways an ideal refrigerant due to its high latent heat of vaporization and environmentally friendly qualities, but like any refrigerant, it has its downsides, specifically with working at very low vacuum temperatures and being very difficult, if not impossible, to cool below the freezing point.

The project seeks technical assistance in the following areas:

- **Laboratory benchtop space with access to a high-power vacuum pump and plumbing expertise to set up the benchtop optimization experiment**
- **Technical manufacturing assistance for fabrication of the high surface area adsorbent bed prototype**
- **Sunlight simulation facility to test total system efficiency and choose optimum solar concentrator design.**
- **Assistance from student researchers or general assistants to run the experiments**
- **Flammable gas handling expertise in the case of switching to a different adsorbent pair (i.e. calcium chloride / ammonia, carbon / methanol, etc.) for further performance gains in this specific system setup.**