

## **SP25.13: Passive Cooling for Buildings and Data Centers**

### **Overview**

Cooling buildings and data centers are becoming a major load on the power sectors due to increased ambient temperatures, especially in the sustained heating loads encountered across the southwest. The increased temperatures are due to human-caused global warming, and powering the cooling loads to regulate against the warming is further contributing to root problem. This research project is to evaluate the performance of a new coating technology that can cool a surface below ambient temperatures through radiative phenomena. Specifically, the coating can radiate at spectral wavelengths not absorbed by greenhouse gases in the atmosphere. Said differently, these materials can radiate through the "atmospheric window". Prior undergraduate students built a heat exchanger test rig that is now located on the NAU Yuma campus. The test rig includes three hydronic loop heat exchangers coated with a black opaque paint, white reflective paint, and passive radiative coatings from a manufacturer developing the materials. Students can collect temperature and irradiance data from these heat exchangers to determine the amount of heating/cooling collected by a flowing water line (hydronic loop) to determine the heat gain or heat rejection from the different surfaces.

### **What the student will DO and LEARN**

Students will collect temperature and irradiance data under variable flow rates and outdoor conditions (outdoor air temperature, cloud cover and time of day). They will learn how to analyze this data and describe convective and radiative heat transfer phenomena. The work is expected to be communicated in an Building Technology American society of mechanical engineers journal and conference, ideally during the Summer 2025. As such, there will be the deliverable of technical writing and presentation with careful guidance from the instructor.

### **Additional benefits**

Professional and technical communication. Learning the theory of experiments. Professional opportunity to network with company collaborators who have not yet funded the work.

### **Additional qualifications**

The test rig is at NAU Yuma. We prefer the work to be carried out by this subset of the NAU student body.

### **Time commitment**

6 hrs/week for 30 weeks