

FLORIDA STATE UNIVERSITY
Multi-Generation Capable Solar Thermal Technologies

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Description: The objective of the proposed research is to develop and demonstrate small-scale solar thermal technologies that can be used separately, in conjunction with one another, or with existing waste heat producers, thus improving the overall system efficiency.

The development of an indoor solar simulator capable of providing and sustaining 1 kW/m² over an area of 10 m².

The development of a Rankine cycle-based solar concentrating system that is capable of producing at least 2 kW of electricity adaptation and integration of small-scale absorption-based refrigeration systems that can employ the waste heat from the aforementioned Rankine system.

Integration of existing membrane distillation technology for waste heat recovery from either, or both, of the above-mentioned technologies.

Demonstration of a multi-generation system that combines all of the above-mentioned technologies.

Budget: \$544,226

Progress Summary

Over the past six months, the solar simulator has been ordered and partially constructed. A frame for the array is built out of 80/20 extruded aluminum. Power supplies and control circuits allow the lights to be controlled to a desired constant power. Figure 1 shows the 3-lamp or 4-lamp arrangement of the array exists which is being used to find a better alignment for the final system to achieve the best approximation of the sun's characteristics.



FIGURE 1. LAMP ARRAYS. (left) 3-lamp (right) 4-lamp

Figure 2 shows preliminary results of the 3-lamp array for 2kW arc lamps. A pyrliometer is mounted on a traverse to allow measurement of intensity in a maximum of 2.4 meters by 1.2 meters (8'x4'). Figure 3 shows the traverse which is controlled by LabView to move and take measurements.

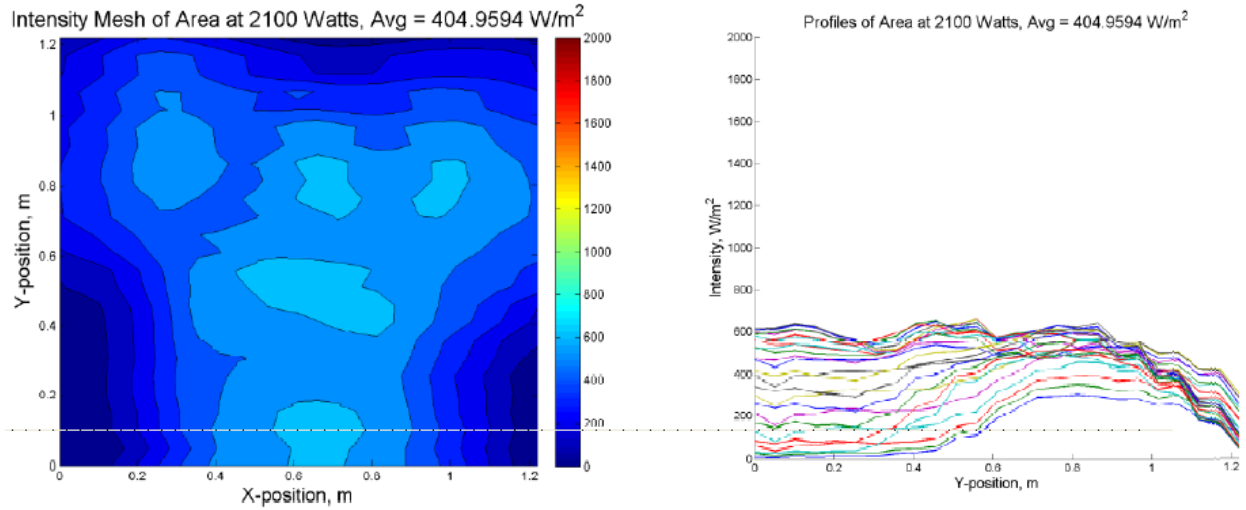


FIGURE 2. Light intensity for a 3-lamp array

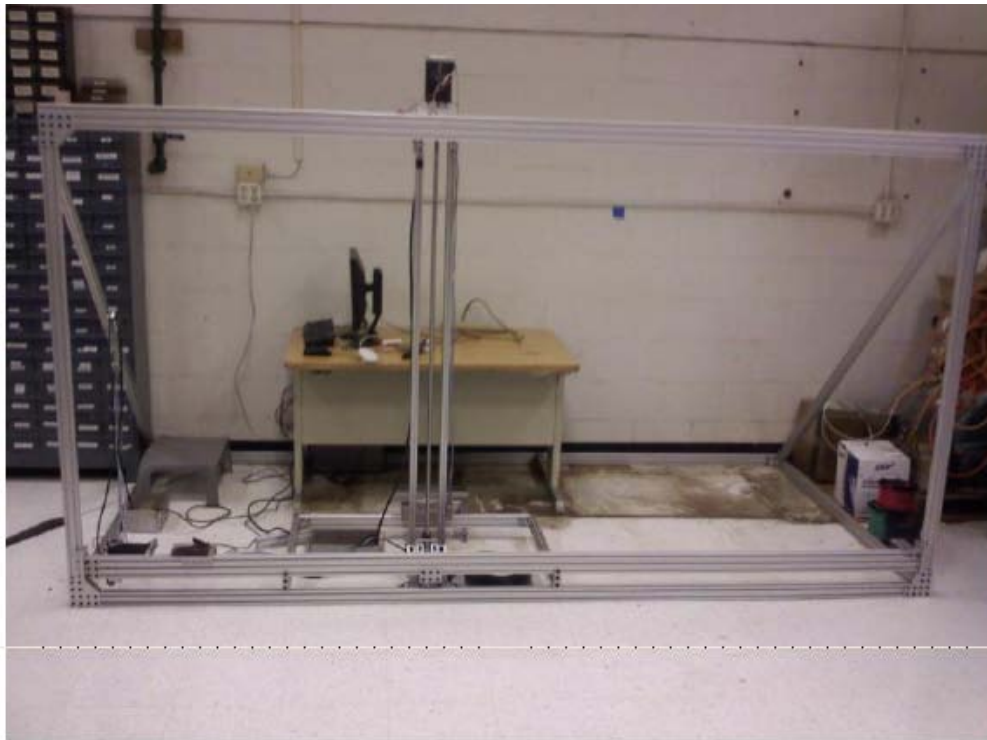


FIGURE 3. Pyrheliometer mounted on traverse.

Adjustments can be made geometrically to smooth out the intensity between the 3 lamps. The intensity can be increased by putting in a higher power bulb. 2.5kW bulbs have been purchased and are being integrated into the system. Once the final intensity distribution and lamp power is accepted, a final design of the system will be built using a total of 9 lamps.