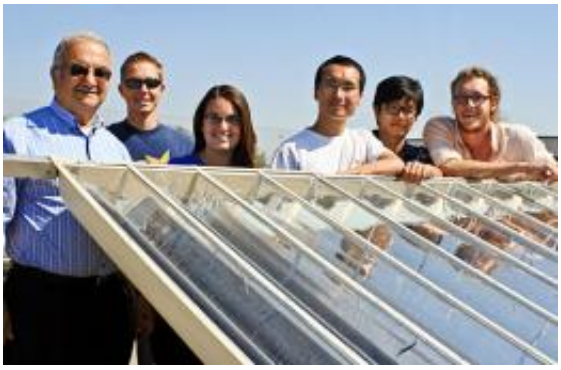
Researchers unveil innovative solar cooling project

September 30 2011



UC Merced professor Roland Winston (left) and a team of student researchers designed and developed a system of non-tracking solar thermal collectors.

Using solar thermal energy to power an air conditioning unit can be difficult and expensive. But a team of researchers at the University of California, Merced, have added a game-changing advance to the process that could make it much simpler, less costly and more effective.

UC Merced professor Roland Winston and his team of student researchers have designed and developed a system that gathers and concentrates sunlight onto specially made collector tubes. The heat generated can then be transformed using existing technology for cooling, heating and a number of other potential uses.

The key factor in their design is this: The collectors are entirely

stationary. Typically, solar collectors must move and track the sun to achieve optimal energy production, necessitating additional equipment that can be costly to install and complex to maintain.

The UC Merced design — called an External Compound Parabolic Concentrator (XCPC) — generates solar thermal efficiency of 60 percent at temperatures up to 400 F, achieving thermal performance previously seen only in tracking systems. And in contrast to tracking systems that work only on clear, sunny days, the UC Merced design can work in hazy conditions because it "sees" most of the sky, allowing collection of both direct and indirect sunlight.

Winston said other scientists and industry leaders have been skeptical regarding claims of the technology's performance and efficiency. So to demonstrate it, Winston's team installed a mobile office trailer at their facility at Castle in Atwater and are cooling the trailer using air conditioning powered by an array of 160 XCPCs in two parallel rows. The air conditioning used in the demonstration comes from a high-performance, double-effect absorption unit - a type that requires a significant heat source to generate cooling.

"We believe this is the first working system of its kind anywhere in the world," Winston said. "For any application that requires process heat, the XCPC system is potentially a very cost-effective way to reduce conventional fuel consumption and greenhouse gases. Its non-tracking design also enables it to be installed in any number of ways, including on rooftops and walls. You don't have this type of architectural flexibility with tracking thermal systems."

The students who were the backbone of this project have been led for the past two years by Heather Poiry, who is in the process of completing her master's degree in mechanical engineering at UC Merced while studying under Winston.

Poiry hopes the work she's put into the project can ultimately benefit businesses all over the world, but especially those in the San Joaquin Valley food processing industry, which could use solar thermal energy to offset the need to burn coal or oil for heat in their operations.

"Solar thermal technology can also have a very positive effect on air quality," Poiry said. "And I think being able to create this technology right here and know we can make an impact here in the Valley is very important to all of us."

The cooling project design and assembly were done by Winston, Poiry and a team that included more than 30 different students over the course of two years. Poiry said the students ranged from undergraduates to postdocs, and some were volunteers interested in learning about solar technology.

Provided by UC Merced