Solar Ovens in the Serengeti

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— Brian Thompson
Mechanical Engineering Professor

Engineering Seniors Help Sustain Tanzanian Resources

In many countries, sharing meals creates bonds among people. In May 2007, a team of MSU students witnessed this firsthand with the people of Tanzania thanks to a special kind of oven – one that cooks with the rays of the sun.

Capturing the sun to cook offers huge benefits to the health of the people and the environment of the country, says Judy Martin, founder of the nonprofit group Solar Circle.

In Tanzania, 92 percent of cooking is done with either wood or charcoal made from wood. Smoke from those fires has been known to cause serious upper respiratory illnesses, particularly in children who are exposed by staying close to the fires with their mothers.

"You can smell the country burning just walking down the street. Respiratory diseases are the second-highest killer of children in Tanzania," says Martin. Even gathering wood can be dangerous due to cuts from machetes used to hack through underbrush, and dangerous wildlife.

Cooking fires also contribute to the destruction of protected areas. Tanzania is the location of Mt. Kilimanjaro and a large part of the Serengeti plains, where people cut wood from protected forests for cooking.

To address these issues, Martin founded a group whose goal is to use solar energy as the primary means of cooking in Tanzania. Solar Circle is also working to create an in-country industry to produce and market solar ovens and sell them at around $20 U.S.

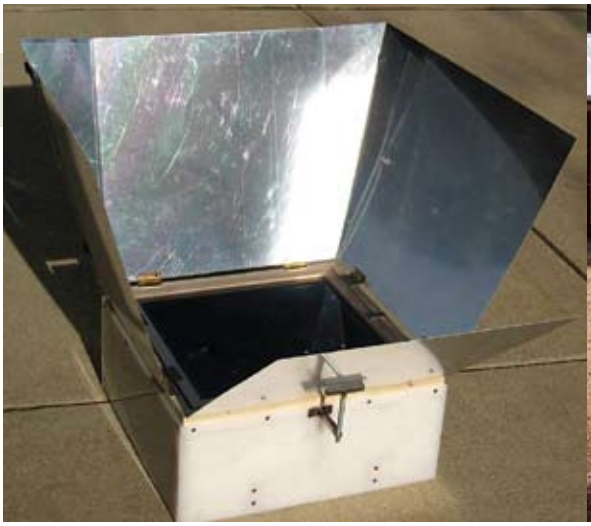
Brian Thompson, MSU professor of mechanical engineering, was running his department's senior engineering design project at the same time Solar Circle came into existence, and recognized the humanitarian program as a good fit for his students.

"The important thing is how we transform lives, and we should become more global as citizens. Since young people are involved, it's a great opportunity for MSU students and the people they benefit," says Thompson.

Nine engineering students designed, tested and built prototypes in the project's first year. Their designs use angled aluminum panels to reflect sunlight into an insulated box with a glass top. The glass top allows solar energy to enter, simultaneously preventing heat from escaping. The inside of the ovens can reach more than 260 degrees Fahrenheit (approximately 130 degrees Celsius), hot enough to boil water and cook food.

After designing the ovens, the students traveled with Martin and Craig Somerton, an associate professor of mechanical engineering and the team's faculty advisor, to Tanzania for spring break in 2007 to test their ovens, teach people about solar energy and learn about life there.

At a trade school in Ndanda, the team worked with local artisans to build the ovens.



"We were impressed with how skilled the staffs were at the schools. The students worked shoulder to shoulder with them and began to learn about another culture," says Somerton.

While students worked with the artisans, there was a lot of discussion and instruction going both ways. They learned from each other.

"The MSU students brought science into the cooking. They helped teach our people how to test the ovens with temperature gauges and instruments to measure sun intensity," Martin says.

"It was eye opening, especially for someone who has never left the country."

Andrew White
Graduate Student, Mechanical Engineering

With construction completed, the designs were tested in Masasi. "An official from the Department of Natural Resources visited the project," Somerton says. "He didn't speak any English but we still could look at the data together."

Students also participated in the second major focus of Solar Circle: education. They spent a day teaching at a girl's school in Masasi about how solar ovens work. Students used simple experiments that explained how the aluminum panels of the oven reflect sunlight, and how light is absorbed by an insulated box where the food is cooked. They left quite an impression at the school, Martin says. Even a year later, the children are still talking about it.

The Tanzanians also left an impression on the engineering students. "It was eye opening, especially for someone who has never left the country," says Andrew White, a graduate student in mechanical engineering.

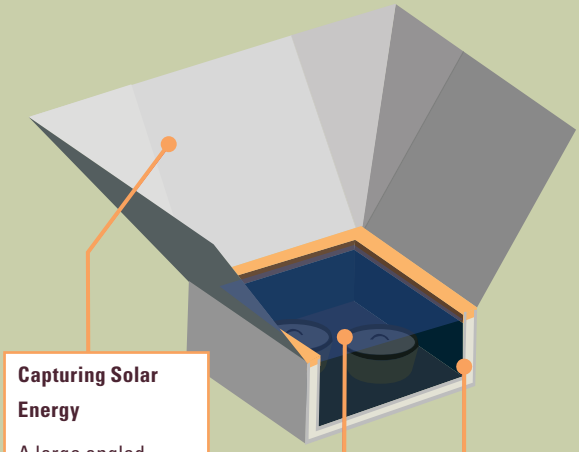
He was amazed by how happy the people were there, and hopes to return and work there again.

The next goal for the Solar Circle team is to devise a simpler design so they can make more ovens. "Someone once told me that 90 percent of the world's engineers work to improve the lives of 10 percent of the people. That means 90 percent of the people in the world are waiting for the engineers to teach them how to make the simple things," says Martin.

"That's what we need here–the 90 percent instructed by engineers so people can cook without burning the forests."

≈ Gordon Shetler

The Solar Oven: *How It Works*



Capturing Solar Energy
A large angled sheet of reflective anodized aluminum captures sunlight and reflects it into the oven.

Trapping Heat
Solar energy passes into the ovens where the black walls absorb it. Light passes through the glass top, but heat stays in.

Insulating the Interior
The oven is insulated with fiber from kapok, a local fruit. Rubber seals prevent heat from escaping.