Solar Cookers: A Safer, Cleaner Path to Global Food Security

by Esu Obu

Cooking with a parabolic solar cooker in Nepal, 2015
Photo credit: Julie Greene

Why Solar Cooking?

In many parts of the world, there is a heavy dependence on cooking using natural resources such as wood and fossil fuels.[1] With global pressure on energy demand from the latter, increasing prices hurt financially vulnerable populations the most. Additionally, the environmental impact of burning resources for energy is an increasing concern. Greenhouse gas and air pollution are just a couple detrimental examples. The sun offers an alternative energy source that is used as a means to cook food and pasteurize water for households.

About 2 billion people suffer from wood fuel shortage, poor urban families can spend as much as 50% of their income on cooking fuel, and 50,000 lives are lost on a daily basis to waterborne diseases.[2] Each year, close to 4 million people die prematurely from illness attributable to household air pollution such as those from stoves with solid fuels and kerosene.[3] Since 1987, Solar Cookers International (SCI) has been working around the world as a non-governmental, nonprofit organization to improve human and environmental health through solar thermal cooking technology. They seek to address the aforementioned issues plaguing “sun-rich, fuel-poor regions of Africa, Asia, the Pacific, and Latin America.”[4]

By prioritizing solar thermal energy for cooking, family income can be redirected for education, food, and health needs.[4] The time that could be devoted to education and/or implementing micro-enterprises is far too often spent on acquiring cooking fuel and on cooking. SCI believes that education of this system will empower and enable women and their communities to make strides in environmental, social and economic improvement.[4]

How Solar Cookers Work: Design is Key

Efforts to aid needy communities with maintenance of proper health and nutrition are crucial for survival, especially across food safety and sanitation efforts. SCI strives to achieve multiple levels of humanitarian efforts by influencing positive changes in public health and safety, the

environment and sustainability efforts, and economies through their commitment to impact policy, practice, and research and development efforts.[5] Farmers with a Vision (FWA) is another group working in Kenya that has benefited the community through distribution of solar cookers through local microcredit agencies that help members buy cookers ranging from $25-60. Educational efforts throughout the community have also contributed to reduction of deforestation by decreasing the use of firewood and paraffin for cooking.[6]

What is a solar cooker?

Solar cookers are appliances that harness the sun's energy to prepare all types of foods, from baked goods to meats and vegetables. Its generated heat also serves as a way to pasteurize water for safe drinking.

The fundamental processes in a solar cooker reflect that of optics and engineering principles: concentration (reflection or reflectance), absorption (attract or hold heat), and retention (maintaining heat).[6] Shiny materials such as silver, aluminum, or chromium are often shaped to reflect UV light to more efficiently accumulate and concentrate heat. Darker, thin materials are often chosen to absorb and evenly transfer heat, while insulation and covering is pertinent to retaining optimal heat temperatures throughout the cooking process.

Solar cookers are typically designed in three types: box (also called a solar oven), panel, and parabolic cookers (or curved concentrator cookers).[7] Solar ovens can be low-cost and simply built, with an outer wooden layer and inner insulating box layer that often contains aluminum and is covered with glass or plastic for direct sunlight to heat the oven up to 140 ºC.[7] Panel cookers use a flat panel to reflect and focus light, while also using a curved design to achieve a larger surface area of reflective material. Parabolic cookers, on the other hand, use the curved, bowl-shaped design to achieve high temperatures and faster cooking via direct, concentrated sunlight reflected in the pan.[7]

Despite the ingenuity of these products, there is a persisting need for the convenience that fueled cooking processes–like gas or electricity–can provide. Lack of sunlight and adverse weather conditions such as wind, rain, or overcast skies can cause challenges with solar cookers. In Busia, Kenya, resourcefulness in using insulated baskets to conserve heat with the lack of sunshine, or back-up charcoal and firewood stoves are some methods of combating the challenges associated with the solar cookers.[6]

Feeding Families, Saving the Planet

SCI has identified over four million solar cookers around the globe; they are estimated to be directly impacting over 14 million people and serving over 7.7 billion solar-cooked meals over the lifetime of the cookers while preventing approximately 5.8 million metric tons of carbon dioxide emissions in a year, which is equal to taking more than 1.25 million cars off the road according to the United States Environmental Protection Agency. Each solar cooker is improving the lives of families, and cumulatively, they have a tremendous impact. One solar cooker avoids using one ton of wood for cooking per year. Over 30 million metric tons of carbon dioxide emissions are estimated to be prevented over the lifetime of solar cookers. Depending on the capacity of the solar cooker, filtered water can be pasteurized in 1-4 hours.

Recent solar cooking initiatives in Kakuma Refugee Camp, Kenya have been supported by SCI since 2018. With SCI support, 234 solar cookers have been built by Kenyans, using local materials, for local use. These sturdy solar cookers are expected to last 15+ years each and feed households of up to 6 to 10 people, thus making over 17 million individual solar-cooked meals possible, based on 300 sunny days per year. Over 5,000 metric tons of carbon dioxide emissions are estimated to be avoided over the lifetime of the solar cookers. Over 93% of the participants in Kakuma currently report they use less fuel and families report they are saving money on fuel purchases.

Cooking challenges

- Solar cookers are a complementary cooking appliance; there is an unavoidable inability to successfully cook without sun.[1]
- Quantifying (per household) return on investment and economic benefits of using solar cookers (made from varying materials) may help solar cookers gain investor and consumer traction.[8]
- A hurdle associated with solar cookers is the low cooking speed[8] with some conditions/models.

References

1. Herez, A., Ramadan, & M., Khaled, M. (2018). Review on solar cooker systems: Economic and environmental study for different Lebanese scenarios. *Renewable and Sustainable Energy Rev*. 81(1), 421-432.
2. Solar Cookers International. (2004). *Solar Cookers - How to make, use and enjoy* (10th edition). Sacramento, CA: Solar Cookers International.
3. World Health Organization. (2022, November 28). Household air pollution.
4. Solar Cookers International. (2018). Solar Cookers International General Statement.
5. https://www.solarcookers.org/about.
6. Wanzala, J. (2017, April 10). Kenya learns to cook with solar power - even when the sun doesn't shine. Reuters.
7. Jharkand Renewable Energy Development Agency (JREDA). *Solar Thermal (Cooking System)*. https://www.jreda.com/Content/getHeadersMenuContents/155.
8. Omara, A.A.M., Abuelnuor, A.A.A., Mohammed, H.A., Habibi, D., Younis, O. (2020). Improving solar cooker performance using phase change materials: A comprehensive review. *Sol. Energy*. 207, 539-563.

About the author

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