Empowering Solar Energy to be at the Forefront of the Energy Crisis
SUSTECH Conference Student Poster Submission

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The Problem

Electricity is a crucial component of our daily lives. Without battery, energy storage, and power, our world would be deprived and I would not be able to type this abstract. Surprisingly though, something that we take so much for granted is something that 25% of the world's population does not have access to. Without access to electricity, children in developing countries have to use alternatives like kerosene to study at night. Currently, around 700 million people in Africa do not have access to electricity and around 200 million of those people use kerosene lamps as a source of light. Unfortunately, kerosene lamps are unhealthy for the human body and are polluting the environment. According to the World Health Organization, kerosene lamps produce pollutants like carbon monoxide and carcinogens gases which lead to indoor and outdoor pollution. As the World Health Organization reports, "Over 4 million people die prematurely from illness attributable to the household air pollution from cooking with solid fuels." This is serious; over 4 million people are dying each year due to air pollution from household activities of using solid fuels like kerosene; I believe student and professional leaders in IEEE can help solve this serious issue with solar energy. Specifically, what I hope to achieve in the next couple years is a powerful mini-grid that is affordable, efficient, and accessible.

The Solution

Mini-grids. The solution I imagine for the 25% of the people who are living without electricity is a powerful mini-grid. The mini-grid that I hope to build will be able to store up to 1,000 Watts, which is capable of heating a small electric stove, charging cellular devices, and providing electricity for lamps. The target consumers are the 3 billion people in developing countries that are using solid fuels to conduct daily activities. With this mini-grid, households will be able to conduct several activities without the use of kerosene lamps. Currently, the cost to provide a regular panel of 1,000 Watts might cost anywhere from around $1000 to $2000 dollars. Not only is this an unaffordable cost for low-income families in developing countries, there is also the problem of finding a convenient place to store this solar panel. Say the solar panel will currently cost families $1500 dollars—that is around 600 gallons of kerosene ($2.5 for a gallon of kerosene) households can buy. Currently, it takes an average of 12 gallons of kerosene per year to give off 5 hours of light a day—that is only $30 a year for kerosene lamps. If we are solely concerned with providing light for lamps, an estimate is that it might take around 10 to 20 years for families to see any cost savings. However, I believe there is incentive for the government to give subsidies for the solar panels because it reduces the amount of pollution emitted and cost of cleaning up that pollution.

Thus, I believe there is a need to focus on using nanostructured materials to create solar panels that are efficient and affordable. The materials that make up the solar panel are increasingly important. Nanowires can help retain some of the solar energy captured at a cheaper price. Currently, common materials for solar cells are crystalline silicon and cadmium telluride. Before the technology for nanostructured materials are fully developed, I think this product can try to use crystalline silicon because it is cheaper. However, the development of nanostructured materials and patterns to reduce the cost of solar cells is a promising field and I believe the technology for it will be available soon. Using this technology, I believe it is possible to reduce the surface area needed to efficiently absorb solar energy, reduce the cost of solar panels, and increase the capacity of energy storage.

The second part of my solution is developing an educational aspect to this program. I hope to send this mini-grid as a solar kit to developing countries and have engineers teach the families and children about renewable energy, how to build the kit, and STEM in general. The goal of this educational aspect is to empower families to children in the developing country to understand the product they are using and find ways to be innovators and improve the product to create more renewable energy sources. If this product is developed, I hope to partner with IEEE Smart Village to bring this technology to energy-deprived regions of the world.