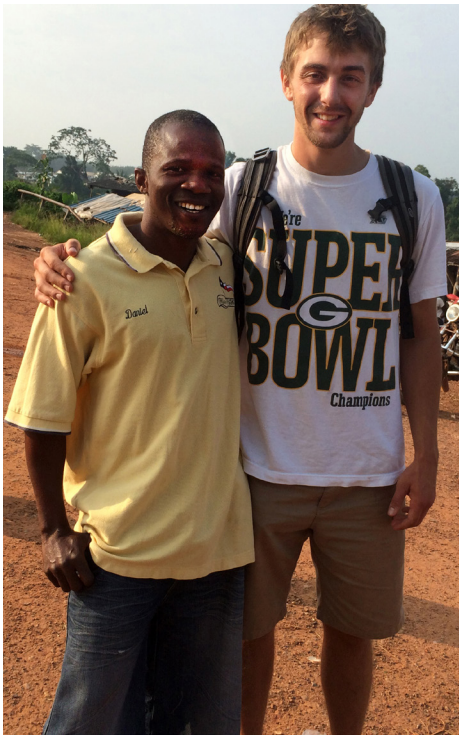

Powering Sub-Saharan Africa

INTRODUCTION

Access to electricity is critical for emerging countries to improve opportunities to work, learn, and thrive economically. In Sub-Saharan Africa, the problem is acute, with nearly 620 million people that do not have access to electricity. Those that do have access in both the rural and urban areas of this region rely on diesel fuel generators. In addition, the diesel generators used in these regions tend to be inefficient, and have little to no emissions control equipment. Therefore, diesel-powered generators produce significant pollution, contributing to both local health problems and global climate change.

DIESEL VS. SOLAR SYSTEM

To reduce the use of diesel fuel generators, efforts are underway to establish sustainable and renewable energy sources. The International Energy Agency estimates that by 2040, seventy percent of the rural electricity can be delivered by renewable energy sources.

Although sustainable energy systems are being installed in the region, there is a severe lack of technical expertise regarding the maintenance and repair of energy systems, resulting in inefficiencies and shortened system lifecycles. Without ensuring the productivity of new sustainable energy systems, the region will likely continue to rely on diesel fuel generators.

There are three viable options for pumping water in this region: 1) manual, 2) diesel generation, and 3) solar panels. To address the challenge of maintaining sustainable energy systems, the project team installed solar powered water pumps on the plantation of the Liberian Agricultural Company, a rubber plantation company in Liberia that is responsible for providing water to its 4,500 employees. The project team studied the use of the new solar system, and compared the environmental, social, and economic impact of installing diesel pumps, versus solar energy pumps.

ECONOMIC CONSIDERATIONS

Initial installation costs for a diesel pump are less than a solar pump, but diesel is more costly in the long run. Additionally, diesel prices are volatile in Liberia, making it difficult to effectively estimate and budget for costs. While the solar powered system is a larger upfront investment, the Liberian Agricultural Company understood it was ultimately a less expensive system, after comparing the life cycle costs of diesel and solar systems.

Another consideration is maintenance and operation costs of solar panels. The project team and the Liberian Agricultural Company developed three options for payment methods for electric use by the community, including:

1) Pay as you go -- charging customers for electricity used,
2) Community ownership of electric pumps, and
3) Leasing electric pumps – customers pay for water used monthly, and in addition, pay a small amount towards purchasing the solar system.

COMMUNITY INVOLVEMENT

Women in the Liberian Agricultural Company community spend a substantial amount of time collecting water for basic needs, such as drinking, cooking and cleaning. Ready access to water within homes would benefit women and families. However, improved access to water may lead to water intensive activities, increasing water use for non-essential purposes.

Community buy-in is essential to understand the need for continuing water conservation best practices, while increasing water access. It is important to fully understand local needs, communicate expectations for system performance, and engage the community, including both men and women, in ongoing operation of the solar system. Also, ensuring workers use the water pumps properly is critical.

To engage the community, the project team hosted a community meeting for workers, and the Liberian Agricultural Company management. The team emphasized that the solar system is designed to meet only basic needs, and water conservation practices should continue. A local high school graduate was trained to monitor the system performance. Communication protocols were established to relay performance information collected during monitoring to the project sponsors in the United States. This information was assessed by the project team and used to make necessary adjustments to the solar system.

CONCLUSION

Long-term maintenance of renewable energy systems is a critical component of increasing electrical use in Sub-Saharan Africa. Successful incorporation of social, economic and environmental concerns will increase the viability of renewable systems, as well as enhance community ownership and autonomy. While it is impossible to create a standard manual for successful project implementation, similar themes remain important. Each successful project can act as a case study to provide guidelines for future projects. The project team recommends that each project be tailored to the specific characteristics of community dynamics, geographic location, resource availability, ownership structures, and the political environment.

Water pump system powered by solar array for Cattle Barn Camp.

Josh Novacheck with boys from the Cattle Barn Camp.

PROJECT PARTICIPANTS

University of Michigan, Sustainability Without Borders, and the Liberian Agricultural Company

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READ MORE

- Full Project Report: "Use-Phase" Sustainability for Energy Development Projects, 2014
- Dow Masters and Professional Fellowship Project Reports

SUPPORT

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