

Zambia

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Beyond Solar recently completed its third project providing solar power in the developing world. In the eastern province of Zambia, Beyond Solar partnered with Dwankhozi Hope, a US based non-profit organization, to provide solar powered lighting in three separate rooms in a primary school, and the equipment and capacity to charge three laptop computers. Financing was provided in a joint effort by Beyond Solar and Dwankhozi Hope, and the personnel involved in the on-site installation were Moses Masala (Dwhankhozi Hope Project Manager), my friend Erik Thorbjornsen (an experienced engineer), and myself, Jeff Olshesky, a co-founder of Beyond Solar. While the planning of this project began months in advance, the actual time required to complete the project, after arriving in Zambia, was five days. By all measures, the project was a success, and this paper will describe the origins of the project, how it was executed, and possible future project opportunities within the area.

Background

Our mission to improve the quality of life through solar power still remains, but the methods we used in the most recent trip to the African country of Zambia marked a slight departure from our two previous projects completed in Orissa, India. Our earlier projects involved the distribution of pre-assembled solar powered lanterns to hundreds of families in multiple villages, while utilizing a hybrid micro-finance model that required the beneficiaries to pay for a portion the products they received. In Zambia, we installed solar panels on the roof of a school building to power lights and three laptop computers. This was done in a central location with minimal interaction with the families of the 600+ students at the school and we did not require any financial obligations from the school. Lastly, we partnered with another organization, Dwankhozi Hope.

Matt MacLean, one of the founders of Dwankhozi Hope, is a college friend of mine and we reconnected upon learning of our shared interest in doing development work in third world countries. Dwankhozi Hope's mission is to help one specific site without any restrictions on the type of development work, while Beyond Solar chooses to focus primarily on solar related projects but is more site-agnostic. Aside from those minor differences, we both shared tales of challenges, setbacks, reward, and the realization that much more can be done. One of the more demanding requirements of Beyond Solar's previous projects was developing a good relationship with a trustworthy local person or organization that could help navigate the confusing and often frustrating logistics of getting a project done in the third world. Matt and fellow Dwankhozi Hope board member Charles Masala have engaged Charles' brother Moses as a project manager, and the work the organization has completed over the years is a testament to the strength of the relationship. I had wanted to do work in Africa so when I learned about Dwankhozi's history of successful projects and their local support, partnering with them was a natural course of action.

Matt was able to provide a lot of details about the village which helped shape our project: over 600 children attended classes at the newly built school; many walked 3-5 kilometers, *one way*, to get there, and most of the children's families were subsistence farmers, meaning they did not have much disposable income as all of their time was spent growing food for consumption rather than commerce.

Beyond Solar's previous projects distributing solar lanterns in villages of 10-50 households had been a success because all of the residents were able to benefit, and due to the labor performed by the adults, they were able to make payments toward the lights, funded by the offset cost of kerosene and the longer working hours the lights afforded them. To distribute lights to the families of all 600 children would have been outside Beyond Solar's budget and we wanted to ensure our work wasn't limited to a few select households. As we continued to discuss the needs of the area and the realities of budget and time, Matt and I decided that the best utilization of solar power would be at the school in the form of light and power for electronics.

Project Preparation

With any development project of this type, flexibility is a must. After weeks of discussing how lighting would allow students to study at night and parents to attend adult literacy classes, and give teachers extra time to prepare lessons, Matt surprised me with the news that we had a laptop computer to give to the school as well. This was great news but also required an added level of planning in terms of solar power generation, power storage, and providing AC power for the laptop (the power you get when you plug into a socket), rather than the DC power for the lights that runs directly off the batteries (sort of like the lights in your car).

Having not installed an actual solar PV system, I wanted to understand the wiring as much as I could before I left. I purchased the three batteries, two charge controllers, the wiring, the switch, and 10 LED lights before leaving for Zambia. I figured if I could work out that system before departure in a controlled environment, in theory, the only thing I'd have left to do during the *real* installation would be to wire up the panels so that the batteries would get recharged. This proved to be a very valuable exercise as it made the actual installation much easier. Upon arrival, Moses took us to a reputable solar distributor, and we purchased the remaining equipment necessary to complete the project: 3 solar panels (too costly to ship or bring as luggage on the flight), 2 more batteries, racking equipment, and a few more tools. I was worried that sourcing the equipment in Zambia would be difficult, but due to Moses's experience as the owner of a construction company, he knew exactly what to get and where to get it.

Getting My Hands Dirty

The installation went quite smoothly, which I attribute to the planning done with Matt, Moses, and the help of friend Erik and my dad (who did not accompany me on the trip but helped with the "mock-up" system we put together before leaving), both of whom had much more experience with wiring electrical systems than me. The primary difficulties were assembling a platform install the wiring in the rafters, which consisted of a two desks put together and a 55 gallon oil drum set atop it. There was also the branch we had to set afire to burn out a wasp's nest before any of us would get to work. And the heat, about 95 degrees outside, was at least a good 10 degrees warmer under the aluminum roof where we were working. But occupational inconveniences aside, we worked for 2 days straight on wiring junction boxes, switches, and connections to the lights and at the end, the lights turned on and off, as expected. Moses had some of a few locals help with getting the panels on the roof, and somehow a welding tool materialized to help secure the panels to the rack, and the rack to the roof, to prevent theft. We had installed three panels on the roof, 2 of which were for lighting and the third to provide power for the laptop and other electronics. That third system required little in the way of wiring; we simply connected

an inverter to the batteries, and from there a standard surge protector power-strip. Like any outlet, the laptop plugged right in and began taking a charge. Later trips by members of the Dwankhozi team aim to supply Kindles or other tablet reading devices to access an unlimited amount of reading materials in a cost effective manner.

The first stage of the project was, without a doubt, a success. We were efficient in our time and purchasing of equipment. The real value of the project will be the second stage, when students, adults, and teachers are all able to expand their educational opportunities because of the lights and equipment we've provided. Moses will provide routine updates on the progress of the school district.

Conclusion and Next Steps

I mentioned earlier the differences between this project and previous projects Beyond Solar has done. One of the elements missing on this trip was the close interaction with families in the vilages; most of our work was done while school was out of session and we didn't have as much interaction with the people we were trying to help. Much has also been written about the effect of simply giving aid to a group rather than having them take more ownership in the aid they are receiving. Unfortunately, the demographics of this population did not permit even miniscule financial contributions from the beneficiaries.

To address some of these issues, Moses and I discussed what other ways solar could help the villagers and we began brainstorming some interesting ideas for the future. One potential project would be to install a small, roof-mounted solar lighting system in each of the neighboring villages. This would provide a "study room" for the students whose distant proximity from the central school prevents them from returning to the school in the evening. Another potential project that would bring income to the area would be a solar-powered water pump that could irrigate a cash crop such as cotton. These and many other potential projects would greatly improve the quality of life for the members of the Dwankhozi School District. The challenges to execute them will be difficult but equally rewarding as well.

The effort required to install a solar PV system was infinitely rewarding and brought to mind many of the conversations Matt and I have had about what is gained by those who actually do the work. In all of the projects Beyond Solar has completed, I feel as though the experience was as beneficial to me as it was the people I was working with. In this sense, Beyond Solar is formulating plans to involve students in America to participate and learn from the experience of working in a developing country.

Finally, the work that we have done is the direct result of those that support Beyond Solar and Dwankhozi Hope. Only through the help of our donors are we able to bring solar power to the villagers where we work. On behalf of Matt and his organization, and Beyond Solar, I want to express how grateful I am for the selfless contributions that have made this all possible.