

Photovoltaic Installation in Ecuador and The Amazon

David S. Mulder
California Polytechnic State University
San Luis Obispo, California

The Photovoltaic Installation in Ecuador and The Amazon is part of a collaborative effort between two major construction clubs at Cal Poly: NECA and MCAA. Four students, two from each club, traveled with two faculty to install photovoltaics for two different communities. The first project was a solar installation to provide fresh water for the community of Santa Rosa. Project number two, was a sixteen-panel installation in Shell, Ecuador for the non-profit Reach Beyond. The main goals of each project were to provide fresh water, and achieve net zero electrical consumption.

Key Words: NECA, MCAA, Photovoltaic, Solar

Introduction

This paper is to present the Electri International Student Passport Project done in December 2015. This was actually a two-part project in Shell, Ecuador and Santa Rosa, Amazon. The goals of this project were to provide the non-profit, Reach Beyond, net zero electricity consumption. The second project was to provide the community of Santa Rosa fresh water to all seventeen households. Reach Beyond is an international non-profit, with one of their offices located in Shell, Ecuador. They are a group of missionaries; whose original goal was to provide radio service to Latin American countries. The work involved two faculty, and four students from the Cal Poly National Electrical Contractors Association Student Chapter (NECA) and the Mechanical Contractors Association of America (MCAA). The student chapters got involved through achieving a grant, making all of the funding possible. The second project was a single panel system located in Santa Rosa, Amazon.

Background

Santa Rosa is located on the banks of the Rio Pastaza River in the Amazon. The seventeen-home community is completely off of the electrical grid. The goal of the project was to provide fresh water to each household in the community. The community had to walk over one mile to get fresh water, the bucket the water back. The fresh water comes from an underground spring. Reach Beyond led the student team to spearhead the project. The community reaches out to reach beyond, and asks for assistance. Reach Beyond then develops a plan for a project, and organizes the logistics. With the help of Cal Poly, Reach Beyond was able to develop the plan and logistics of this project.

Reach Beyond's main office in Ecuador is located in Shell. In addition to the office on the property, they also have a house. In Ecuador, the local electricity is very expensive. This was the original plan of the project, is to provide enough solar power to completely get Reach Beyond off the local

electricity grid. With the help of Cal Poly, Reach Beyond was successfully able to install a sixteen-panel system to their main office. This included photovoltaic panels, electrical panel, inverter, trenching, running conduit and final installations.

The Process of the Project

The process for this project was originally started in early 2015. It all started by Professor Lonny Simonian. He got students interested in an international project. To do this, we had to write a proposal to Electri International. After being shortlisted, two students, myself included, were flown to Chicago to present to the whole organization. After the presentation, we were voted on and successfully received a \$20,000 grant. This covered all student costs, domestic and international, and all materials involved. The next and largest part of this project was the preconstruction phase. This included the entire design, the budget, the schedule dealing with customs, the planning, and the logistics.

The first day we got there, we had to drive from Quito to Shell. This was a long and tiring drive. When in Shell, we had a half day of rest and flew to the jungle shortly after. This was the biggest culture shock of the whole trip. When flying into the jungle, there are no commercial planes. We had to have all of the materials with us in a small aircraft. When we landed, we had to walk the materials over a mile. When there, we set up camp and met all the residents of the community. The thing that makes this construction project different than other project I have done is the location. When in the jungle, there are no lights, no restrooms, no electricity, and no tools. If our project team had not brought all of the tools needed, there is not backup. We had to plan for everything, which made the preconstruction very difficult.

The first day of construction we split our group into two different teams. Parker Haerr, Lonny Simonian and myself were focused on the electrical side of the project. Paul Redden, Dhakshan Potuhera, and Tyler Pienado focused on the mechanical side of the project. The first thing we needed to do for the electrical side was construct the base for the panel. This was very difficult. In the amazon, the wood is very dense. It is nearly impossible to nail a nail into the wood. We broke countless drill bits, and bent to many nails. This was the first thing we had to overcome. The next task was to install the solar panel, and make the connections to the disconnect. With solar panels being powered by sunlight, they are always providing power. We had to come up with a way to make sure that we would not get shocked from the panel. The final solution was to cover the panel with palm tree leaves. This worked surprisingly well, and we made a safe connection. This was last thing we did for the day was make the final connection from the solar panel to the pump. This was the most rewarding part of the project. When water came out of the pump for the first time, it was remarkable to see. I don't know if I have ever seen so much joy in people.

The next part of the project was probably the most frustrating. The project had two 500-gallon water storage containers. The goal of this was to make sure that the community had water anytime of the day, or night. The most difficult part was the location of the gallons. They were on a water tower that stood over thirty feet in the air. Getting up was a difficult task, and working was hard at such a height. When all of the final connections were complete, the sun was down. The next day was our last in the jungle, we had to go to every individual house hold and make the final connections for each water pipe. One of the best photo's we captured was a little boy drinking

water out of the pipe for the first time. After about a half day, we left the jungle and went back to Shell.

The second part of our project was the installation of the sixteen-panel system for the Reach Beyond office. We started this work the day after we got back from the amazon. Our first task was to lay out the final design of the system. To do this, we had to drill through a metal roof and install multiple metal connection points for the panels. This was much harder than originally thought, to get all of the points in parallel was very difficult. One of the members of the Reach Beyond team was a welder, and made all of the final connection points.

The next phase was trenching for all of the conduit. While, in most construction projects it doesn't seem to matter if a one foot deep trench was needed be dug, but with the lack of resources we had it ended up being very difficult. I think I personally broke two shovels, and at least one pickaxe. We had to trench about 50-75 feet from the office, to the roof the panels were placed on. With multiple rocks, and a lot of gravel this took us nearly one day. We finally made it all the way through and laid the conduit.

The next task was completing the final connections to the disconnect switch. This included taking the direct current wire from the panels, running them in a conduit on the roof and landing them on the disconnect. We then had to come from the other side, heading towards the inverter and place all of the wire into the ceiling of the office. It was truly a group effort at this point. When working with a recessed ceiling after it has already been installed, it was very difficult. Unfortunately, not all of our solar panels arrived on time. We were only able to connect around half of the panels while we were there. Thankfully our contact in Ecuador was able to successfully install them about a month later.

New Knowledge and How to Apply

The first new knowledge I would like to point out was the fact that any of this was possible through Cal Poly. I would never have imagined that an opportunity of this scale would be possible, with all of the support we got as well.

Some other knowledge I gained on this was the difficulty of doing an actual project, and all of the logistics involved. From shipping, to planning, to traveling. There is a lot of work that I didn't think all the way through, until we needed it.

The obvious knowledge I gained on this trip was the installation of the solar system. Cal Poly's motto is 'learn by doing', and after doing a project like this, there is nothing better than working with your hands and getting real world experience.

The final thing I think that a lot of the members took away on this trip is the realization of how privileged we are here. I think a lot of people don't think about what it would be like to not be able to turn on your sink or shower and get water any time you need. It was truly an eye-opening experience for me, and changed the way I look at the whole world.

This project confirmed to myself that I want to go into the electrical construction industry. I had been debating if I wanted to go the subcontractor route, or the general contractor route. This project was the final nail in the coffin for me. I just signed with an electrical contractor, in the bay area.

Final Deliverables

The final deliverables of this project were, for project one: one solar panel, one grundfos pump, seventeen house hold connections, and two 500-gallon water storage tanks. For the second project, the final deliverables were sixteen solar panels, two DC disconnects, and one inverter. If you refer to the images below, you can see the work.



Project One, Amazon. Solar Panel Installation.



Project One, Amazon. Water Pump Basin.



Project One, Amazon. Water Storage Tower.



Project Two, Shell. Trenching and Solar House in Background.



Project Two, Shell. DC Disconnects.



Project Two, Shell. Solar House, with connections.

Sources

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