Solar Photovoltaic Panama

Energy Group

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Introduction

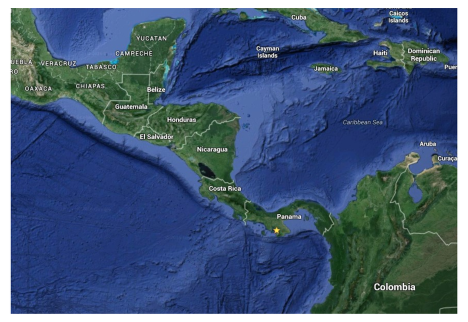

Figure 1: Location of Bajo Grande, Panama

The Panama Solar PV team has designed a small solar electric system to be installed in the remote village of Bajo Grande, Panama.

This system will power a local church with room for possible expansion to a near-by clinic and school. The generator currently powering the church is noisy and requires frequent trips from the village's remote location to buy fuel. In addition to providing needed electric power, the local missionaries see this system as a learning opportunity and educational motivator for the local children, as well as a means of attracting adults to the church.

Key to Figure 2

A) Church
B) The church's kitchen
C) Local clinic
D) School
E) Area for solar panels
F) Location for batteries and primary components

Figure 2" Locations of important buildings in the village of Bajo Grande, Panama where we are planning to install the solar power system.

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-Jessica Kline
-Jonathan Lord
-Spencer Lowman
-Elkan Nelson

Clients

- Rio Missions: A Non-profit missions group in Panama, looking to witness, cultivate relationships, and support the local people in Mariato.

- Dan Cotton: Primary Contact and board member of Rio Missions

Primary Component Design

Our Design:

-The first step in designing a solar panel system is to determine the required load. Early estimates of the power needs of the church (e.g. Speakers, cell phone charging station, lights) were later confirmed when a team working on a bridge design traveled to Panama and obtained specific details on the electrical needs of the church and the small school.

-Because of the advantages of locally supplied components, we identified a local supplier for solar equipment (solarbiz.com). Selection of the primary components (pictured in figure 3) was guided by the constraints of finding the most cost-effective options available from Solar Biz.

- Solar panels convert energy from the sun into a DC voltage. Our design specifies nine panels connected as three parallel strings of three. (figure 4)
- The charge controller adjusts the changing DC voltage and current from the solar panels to the optimum levels necessary to charge batteries and provide power to the system Inverter. Our design uses the Outback FM60 Charge controller. (figure 5)
- Much of the activity at the church occurs in the evening. A battery bank, charged throughout the day by the solar panels, supplies power via the charge controller to the system inverter. Our design calls for eight AGM batteries connected in series. (figure 6)
- The inverter converts the DC battery power output from the charge controller to a usable AC electrical source that matches the standard residential electrical system in Panama. Our design uses the Outback GFX1548 which can handle the current needs of the church/school but would need to be upgraded to accommodate any significant load increase (figure 7)

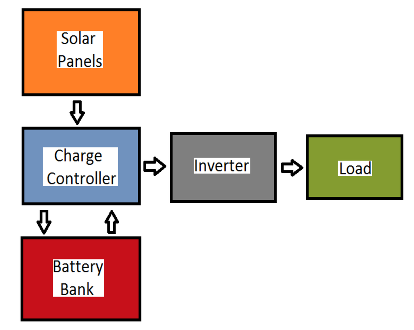

Figure 3: Primary component layout

Figure 4: There are going to be nine Solar World 285 Mono

Figure 5: The Outback FM60 is the charge controller that our design is using. Picture source su-

Figure 6: We are going to be using eight UPG L16 AGM Battery batteries *in the design. Picture source* thesolar-store.com

Figure 7: Outback GFX1548 is the inverter *that was chosen for our design. Picture source* webosolar.com

Further Information

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Secondary Component Design

After the primary components were selected, the actual installation needed to be designed, requiring a number of secondary components and construction considerations

- A spot free from shade but close to the system components to be mounted inside the church needed to be chosen for the panels. Using a Solar Pathfinder, members of the bridge site team identified candidate locations behind and off to the side of the church. The site behind the church was chosen for its proximity to the components.
- A location protected from the weather is required for the electrical components (batteries/Inverter etc). A closet at the front of the church, with open-air window access to the outside was the perfect spot since it offered rain protection, ventilation, and a convenient port through which to run wires from the solar panels
- Once the site for the panels was determined, a mounting system based on locally available galvanized pipe (see Figure 8) was designed. The mounting avoids the problems of termites and flooding, while still remaining relatively inexpensive
- A battery bank shelf (see Fig. 9) was developed to keep the batteries off of the floor in case of flooding
- A component board was created to organize and mount the primary electrical components
- Grounding wires, lightning arrestors, fencing, and other safety features were added to the system to prevent accidents from harming the citizens of Bajo Grande or the solar system itself.
- Final design included specification of necessary wire lengths and gauges.

Figure 8: the nine solar panel ground mounting structure

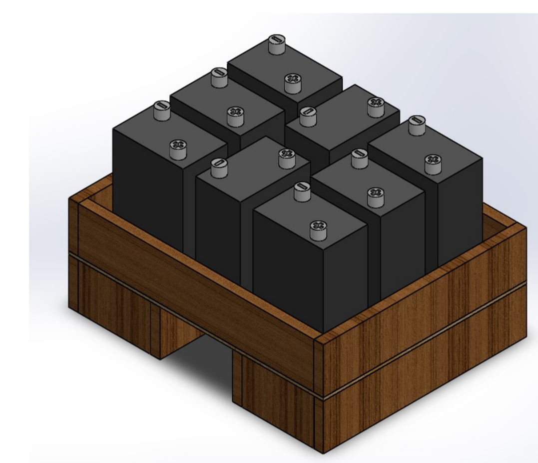

Figure 9: The battery bank shelving with the layout of the batteries modeled on the shelving

Future Goals

- Raise $13,500 to install the system in Bajo Grande
- Design an extension to the system to power the local clinic and school
  - Raise the necessary capital to install this extension

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