IPRO 323

Low-Cost Sustainable Water Pump Design to Serve Rural Villages

Mission Statement:

Our mission is to design an affordable, sustainable, and reliable system to access potable ground water for communities in developing countries.

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Sponsors:

National Collegiate Inventors & Innovators Alliance (NCIIA)

Stuart Grants

Design Objectives:

Affordable: The system must minimize costs so that it is a worthwhile investment for the community to make

Low Maintenance: The system design must have components that require little maintenance and be serviceable by community members

Easy to Assemble: The system must be easy to assemble and install in remote areas without specialized labor

Sustainable: The system must not require fuel to operate due to limited availibility and to minimize adverse effects on the environment

Reliable: The system components must be reliable so that water is accessible when needed and to avoid the cost of replacing components

Methodology

- Investigate previous sustainable water pump designs and determine which energy source would work best in Monterrey
- Testing of Small Solar Panel to evaluate performance in Chicago
- Testing of Small Pump to evaluate performance when connected to a known DC Voltage
- Testing of Small Pump to evaluate performance when connected to a Solar Panel in Chicago
- Evaluate Needs of Farm in Kankakee to determine the required pump and solar panel array
- Evaluate Needs of a typical community in Monterrey to determine the required pump and solar panel array
- Design Phase One and Plan Phase Two of Kankakee water distribution system construction
- Devise a method by which communities in developing countries can easily determine their water needs and select the appropriate components

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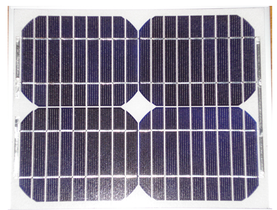
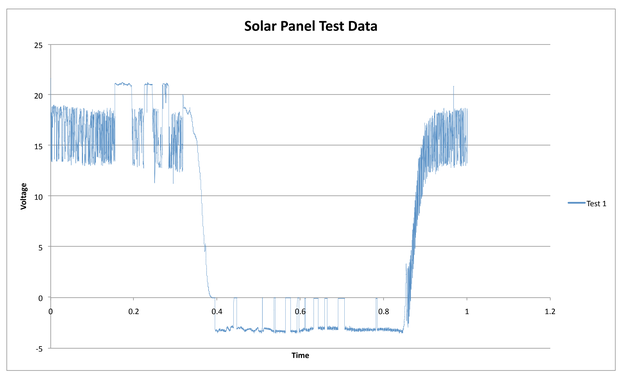
Initial Solar Panel Test Data

In order to test the performance of solar panels, a small one (rated at 17V) was purchased. It was run over two 24 hour periods to evaluate the performance. As can be seen from the graph below, during peak insolation times the panel averages right around the 17 V rating. Because the radiation from the sun is higher in Monterrey (97% of the energy available at the equator), we can expect performance during the day to meet or exceed the manufacturers specifications.





Initial Water Pump Test Data

A small DC solar powered pump was tested using a DC inverter plugged into an AC outlet to see if it would match manufacturer specifications when used under known conditions. The pump output was measured both as a factor of flow rate in gallons per minute and the achieved head rate of the pump. The testing of the pump was successful but restricted due to limitations in the electric component.
Data from testing showed consistent operation between 3 and 4 gallons per minute at 11 Volts and 9.7 Amps; conditions similar to suggested solar panel performance.