ISES Solar Charging Station

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Midpoint Review

Document

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Contents

1.0 INTRODUCTION

Solar systems use several components that are important to the overall operation. The Solar Charging Station uses the most basic number of the components in order to operate. This is done in an attempt to minimize the cost of the system, and allow for full operational function. In order to understand the power that is moving through the system, it is necessary to know and understand the amount of power that the panels themselves output. In order to obtain this knowledge, it is necessary to test the solar panels and obtain data that will allow for the calculation of the power output of the solar panels. This is done through V-I curves that are created from the gathered data. All of the different components in the system, and the testing techniques for the solar panels are necessary to fully understand and correctly operate the Solar Charging Station system. In order to make sure that the system will be correctly installed, cooperation with Northern Arizona University's Facilities department is necessary. This cooperation will guarantee the proper installation of the system, either on an existing building, or on a small structure designed solely for the Charging Station.

2.0 FINAL SYSTEM

Below (figure 1) is a schematic of how the system will be constructed. First, the six solar panels are wired in series and all of the wires are brought together inside the combiner box. The combiner box also houses the fuses which can be removed to disable the system. Next, a single conducting wire runs from the combiner box to the inverter where the DC current is transformed into an AC current. The inverter communicates wirelessly with the display system and the screen outputs all of the energy saving information. A single wire connects the inverter to the AC disconnect box and then feeds to a monitoring system. This system tracks how much power is being produced by the solar panels and then connects to the main circuit board of the business building. To get power to the outlets a wire is connected to the main circuit board, ran through the same monitoring system as before and then to the outlets.

Figure 1- System Outline

3.0 COST PREDICTION

Table 1- Break Down of Cost [1]

Item	Cost Per Unit	Quantity	Total Cost	Application
Sunny-Boy inverter	1597	1	1597	High frequency inverter, 240 VAC, 2000 Watts, 10 year warranty
Sunny-Beam	236.93	1	236.93	Wireless System monitor with Bluetooth. Will display consumption information for educational purposes.
sqd-du221rb-30a	58.67	1	58.67	Square D disconnect switch. 240v ac, NEMA 3R, 2pole, 30 amp
Copper wire	0.9	50	45	Copper wire to wire the whole system
Fuse	3.05	1	3.05	Required by Arizona code, protects the system from having a power surge
Fuse holder	4.65	1	4.65	Required by Arizona code, protects the system from having a power surge
Combiner box	73.75	1	73.75	MidNite solar Pv combiner box, protects the system from overcurrent
Digital utility meter	156	1	156	Bidirectional meter for utility reasons
Square d meter socket	121.04	1	121.04	The main plug for the system
Charging sockets	3.25	6	19.5	Where students can charge their electronic devices.
12 gage single conducting wire	0.5	25	12.5	Connecting electrical components of the system
Labor	7.5	80	600	At $7.50 an hour for about 80 hours of total labor
Total			2928.09	

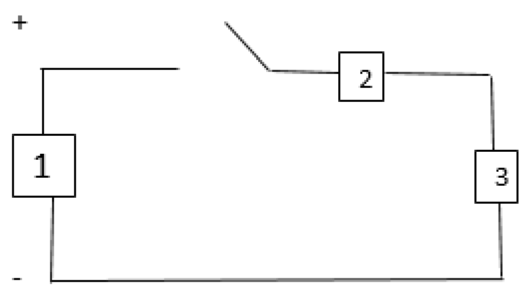
Above, in table 1, all the components are combined and a total cost is produced. With labor costs included the whole process should cost around $3000.00 (labor costs around $600.00). Alongside the costs are a description of the parts, they range from the inverter to the copper wiring. Almost all of the parts can be purchased through Northern Arizona Wind and Sun.

4.0 PANEL TESTING

4.1 Testing Materials

In order to complete the test, the following pieces of equipment will be needed:

1) Solar Panels
2) Connectors for the solar panels
3) A kicker switch to allow variable loads
4) A shunt resistor
5) Two 10 ohm variable resistors
6) At least 16 gage copper wire
7) A digital multimeter
8) A computer and DAQ (Possible)



1: Solar panel that is being tested.

2: Shunt resistor that is place after the switch

3: Variable resistance.

Figure 2- Schematic of Testing Set Up

4.2 Procedure

The testing will begin by setting up the experiment (see figure 2). This will be done by using connectors to attach the solar panels to the rest of the system. There will be a switch connected to the positive side of the solar panel. This switch will allow for the circuit to be completed and will allow for variable resistances to be used for measurements. After the switch will be a shunt resistor. This will allow for the measurement of current. The last component of the system is a variable resistor. This will be comprised of two resistors that can be set up to 10 ohms. The use of a multimeter will be used in order to take the initial measurements. After the multimeter is used, the system can then be attached to a data acquisition system, or DAQ. This would allow for the gathering of more data from the solar panels in a condensed period of time. Data will be gathered at a range of loads from 0 ohms to 20 ohms.

5.0 GREEN FUND APPLICATION

The Green Fund application has gone through the first draft and is currently being edited and revised. After the scheduled meeting with NAU's facilities, the final plan will be in place and the final draft can be submitted. Right before submission, Dr. Acker will review the document and give the final approval. Facilities is important because they give permission to build on campus and will help decide labor costs and final location of the build.

6.0 PROJECT PLAN

The rest of the semester depends on a few meeting in the next couple of weeks. Figure 3 in appendix A shows the meeting with facilities on Friday march 7, 2014. In this meeting the team will get final approval for the proposed project and will work to create an agreeable Green Fund application. If facilities does not approve, the project will return to the preliminary stages. If, as predicted, facilities accepts the project, the project will go as laid out in figure 3. After meeting with facilities, the next step is to meet with Dr. Acker and have him sign off on the project. Once all the approvals are complete, the final proposal will be sent to the Green Fund to get the project funded. Next will come all of the purchasing of components and testing. Because the project will be on NAU property, the team will not be able to actually construct the project, thus once the testing is complete NAU will take over the construction portion.

REFERENCES

[1] http://www.solar-electric.com/

APPENDIX A

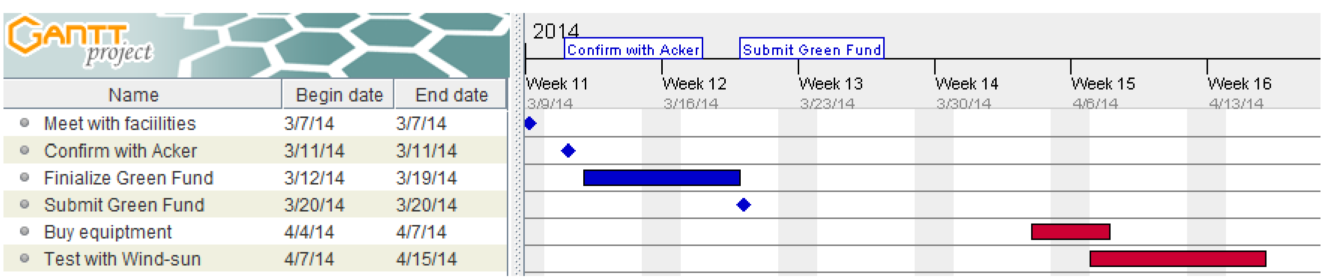


Figure 3- Project Plan