Renewable Energy: Solar Cells

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Abstract

The availability of non-renewable energy sources such as crude oil, natural gas, and coal are diminishing. Renewable energy sources such as solar, hydropower, geothermal, wind, tidal energy, are gaining more and more importance. Many new developments to convert these renewable energy sources into usable forms are taking place. The following research report focused on the solar cell aspect of renewable energy. Experiments were performed and data collected in order to determine which variables affect the output power; whether it be the azimuth of the sun or position of the solar panel. Three different sources (Halogen bulb, Solar radiation, and a power supply) were used to generate DC in order to conduct the experiments as shown in this paper.

Introduction

This project introduces the concept of converting sunlight to electricity using photovoltaic cells. During the research, we will familiarize ourselves with these concepts through the literature, assessment questions, and by conducting a lab experiment to determine the effect of several variables on the output of a photovoltaic cell. The following activity explores energy from the sun in terms of radiant energy to expand on the concept of electricity generation. Finally, we will conduct research on simulation and emulation of solar panels in order to advance the efficiency of the output power.

Project Objectives

During our research, we used four fixtures to conduct our experiments. Each of the four fixtures played a vital role in the research. The first of four was the solar module (Figure 1), the solar module was used to run several experiments from measuring the yield of energy to seeing the output power that was given based off time, month, and position of the sun. The second fixture we used was the Solar Panel test bench (Figure 2), we used this for an individual experiment which was to show the correlation between temperature and output voltage. The Smart-grid workbench (Figure 3) was another fixture that was used in this research. The Smart-grid workbench was used to run a program known as SCADA, which was used for data acquisition and control. The final fixture we used was the live solar panel (Figure 4) which we conducted primarily experiments and comparisons involving angles and inclinations. There are four goals of this work and they are given as follows:

SOLAR MODULE GOALS

1. To conduct experiments to determine the effect of several variables on the yield of a photovoltaic (PV) cell.
2. To compare our emulated solar data with NREL as well as collect live solar data to be used towards developing methods to increase the efficiency of the output power.

SCADA WORKBENCH GOALS

3. Observe simulations using SCADA environment where the data from the solar array simulator will be emulated.

TEST BENCH GOALS

4. To further explore the relationship between the temperature and the output of the solar cell.

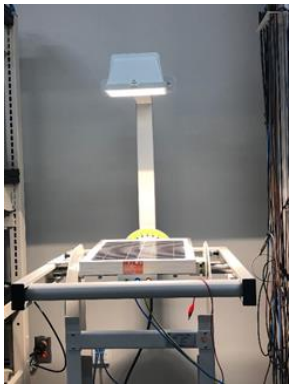

Figure 1: Solar Module

Figure 2: Solar Panel Test Bench

Figure 3: Smart-grid workbench

Figure 4: Solar Panel

Summary and Conclusions

In the Renewable Energy Solar Cell project, we were tasked with conducting research and performing experiments on solar panels utilizing the workbench setup in order to advance the efficiency of its output power, as well as observe simulations in a SCADA environment where the data from the solar array simulator will be analyzed. Over the course of our experiment the data we collected on the inclination and elevation of solar panel, the effect of temperature on the output voltage, and the varying methods to increase the efficiency of a given panel. We hope that the data collected will allow prairie view to make more informed decisions with regard to the design, placement, and installation of parking solar panels at PV.

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