SOLAR TRACKING

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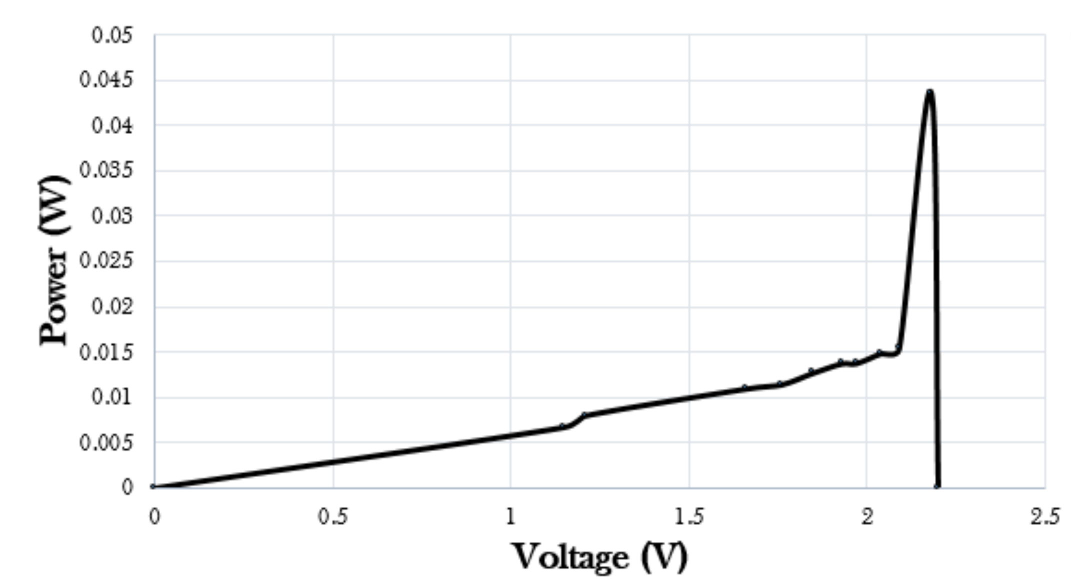
Abstract

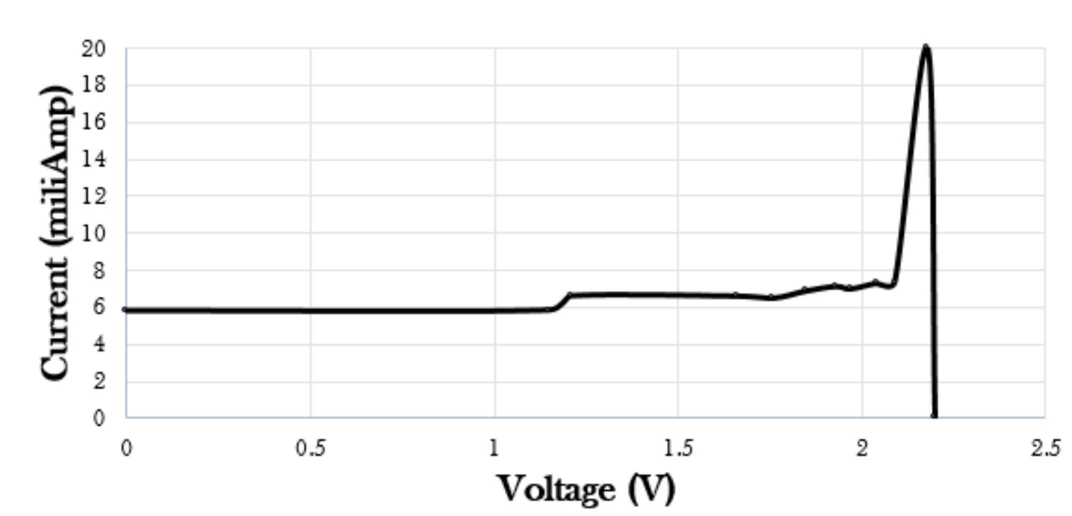
Solar Trackers are used in order to improve the efficiency of solar technology that converts sunlight to electricity. With a stationary collector, the time that sunlight is collected is greatly limited to only certain times of the day based on the angle and location of the module. However, the solar trackers allow the solar collectors to follow the sunlight. As the sun rises and sets, the trackers locate and communicate which directions the collector needs to move towards. A PLC, or Programmable Logic Controller, is used to respond to the shade covering the cell. Solar trackers are not necessary, however they can increase the energy collected by large percentage increases. PV systems with solar tracking systems show an overall 30-45% increase in power outputted.

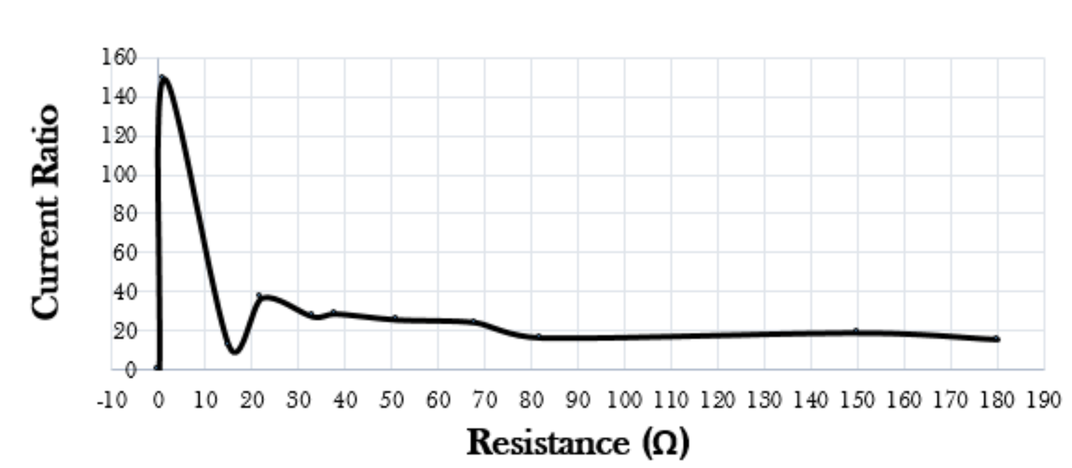
How it works

The PV solar cells are attached to the solar technology in the correct location that would benefit the system. The tracker must be manually directed into the appropriate position and angle when starting the system, by using the manual controller board. A code is implemented into the system using Arduino and a controller board, which sends information from the relays to the tracker to follow the sun. Once a cell is emerged in shade, the code picks up on the hikes in current, informing the tracker to move in that direction, until the current in the shaded cell matches with the other cells. The system consists of two tracking motors, one for the N-S axis, and another for the E-W axis. The PV cells are set up in these directions in order for the code to tell the PLC which direction to move the tracker in.

Data







In order to measure the voltage loss, a 22Ω resistor was used (shown in the bottom left picture). Using light dependent sensors, or Photovoltaic cells, as sensors, the data recorded was current. The current is measured instead of the voltage, because the result outcomes are more reliable. Also, current is made from sun's photons.

For Solar Radiance that drops below 140 W/m2, the registration or current, drops to 0 suddenly. However, there is a stable condition implemented in the code. The code senses these current drops, notifying the tracker to move until the current is stabilized, matching the other solar cells current, or until it returns to steady and consistent.

For the Power-Voltage graph, the Short-Circuit current is 5.07 A, while the Open-Circuit voltage is 2.19 V.

For the Current-Voltage graph, the Short-Circuit current is 5.8 mA, while the Open-Circuit voltage is 2.2 V.

In the Resistance and Current ratio graph to the bottom left, you can see at 1 Ω the current begins to drop to zero, but then at about 22Ω, it stabilizes into a steady flow of current ratio.

Benefits

Why implement a solar tracker with the solar collecting system? A solar tracker system has extremely low cost. Also, the main benefit from using solar tracking is the increase in efficiency of energy collected from 10% up to 100%. Also, PV systems with solar tracking systems show an overall 30-45% increase in power output. The tracker can be extremely accurate, but it also has an adjustable accuracy. By changing the code, the tracker can decrease its accuracy to desired parameters. Trackers are also universal, they can be customized to fit any system. However, the more accurate and customized, mainly used in solar concentrator systems, the higher the cost of the tracker becomes.

Conclusion

The solar tracker provide many benefits to the efficiency of solar collecting, however the manual operating system is requires for the first positioning is decreasing that efficiency. In order to improve solar tracking, the next step would be developing a fully automatic, self functioning solar tracking system. This is necessary, because as the tracker moves the collector to follow the sun, it does not reset itself at the end of the days light cycle. After it tracks the sun till sun-set in the West, a code is needed to direct the tracker to navigate the collector in the East. The tracker has no means of knowing time without it having to be manually inputted every day to run.

Acknowledgements

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