



**CALIFORNIA STATE SCIENCE FAIR  
2015 PROJECT SUMMARY**

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**Project Title**  
**Dye-Sensitized Solar Cells vs. Silicon Based Solar Cells: Which One Is More Efficient?**

**Abstract**

**Objectives/Goals**  
The objective of my project is to compare the efficiency of Dye-Sensitized Solar Cells to that of standard Silicon Based Solar Cells.

**Methods/Materials**  
Three Dye-Sensitized Solar Cells of equal size and thickness were constructed from scratch. These 3 Dye-Sensitized Solar Cells along with 3 commercially available Silicon Based Solar Cells (of same dimensions) were then placed in direct sunlight at the same time. Using a digital multimeter, the output from these solar cells was measured in terms of Open Circuit Voltage (V) and Short Circuit Current (mA). Finally, based on the measurements of Voltage and Short Circuit Current, the efficiency of Dye-Sensitized Solar Cells was compared to that of standard Silicon Based Solar Cells.

**Results**  
In all three trials, the Silicon Based Solar Cells had much higher Open Circuit Voltage and Short Circuit Current readings as compared to the Dye-Sensitized Solar Cells. The Silicon Based Solar Cells had an average Voltage output of 3.55 V, 3.53 V, and 3.48 V, and Short Circuit Current output of 57.6 mA, 57.7 mA, and 55.8 mA during the three trials. In comparison, the Dye-Sensitized Solar Cells had an average Voltage output of only 0.24 V, 0.23 V, and 0.20 V and average Short Circuit Current output of 4.8 mA, 4.7 mA, and 4.4 mA.

**Conclusions/Discussion**  
Efficiency of a solar cell is defined as the ratio of output energy from a cell to input energy from the sun. The amount of electrical power a Dye Sensitized Solar Cell (DSSC) can produce depends on how effectively the photons are absorbed by the dye. Dyes in general have poor absorption across the solar spectrum which means that fewer photons in the sunlight are being used for current generation. In addition, lack of stability and losses due to its chemical components result in an overall lower efficiency for DSSC. Silicon Based Solar Cells in comparison have better absorption across the entire spectrum of sunlight resulting in higher efficiencies. My hypothesis was that given my project settings, I would expect the Silicon Based Cells to be more efficient. Based on the results of output Voltage and Open Circuit Current measurements in all 3 trials, my hypothesis stood correct. In conclusion, Silicon Based Solar Cells are more efficient than Dye-Sensitized Solar Cells.

**Summary Statement**  
To compare the efficiency of Dye-Sensitized Solar Cells with that of Silicon Based Solar Cells.

**Help Received**  
Father provided help: With supervision during construction of Dye Sensitized Solar Cells; while sourcing some of the materials used in the project; during preliminary research of the project.