



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

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Project Title Solar Panel Productivity: Increasing Energy Production by Concentrating Incoming Light and Capturing Reflected Light	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Photovoltaic (PV) technology is one of the primary sources of clean energy; however, most commercially available PV panels have an efficiency of only 14-16%. The way in which solar panels are currently constructed allows a significant amount of light to be reflected away. The silicon itself reflects a significant amount of light, as does the metal used to carry the electric current. This study investigated the ability to increase the productivity of a PV panel by concentrating incoming light and capturing light that is reflected.</p> <p>Methods/Materials A system was designed to compare energy production from a monocrystalline solar panel with the addition of: (1) a linear Fresnel lens to concentrate the incoming light, (2) a one-way mirror film on glass panels to capture the reflected light, and (3) actual mirrors placed at specific angles to capture reflected light. An apparatus was built to suspend a linear Fresnel lens over the solar panel which also allowed the addition of the one-way mirror panels and the angled mirrors in any combination while maintaining the light source and the solar panel in a fixed position. Measurements of light level, voltage, and current were obtained.</p> <p>Results The results showed that concentration of light using the Fresnel lens and capturing reflected light with mirrored surfaces increased energy production. Testing with the lens alone showed a 17% increase in power production over the solar panel alone. Addition of the one-way mirror panels also showed an increase in power production. One-way panels alone gave rise to a 14% increase over the solar panel alone. One-way panels + lens showed a 4% increase over the lens alone, an 8% increase over the one-way panels alone, and a 21% increase over the solar panel alone. Similar increases were seen with the angled mirrors. The combination of the one-way mirror panels + angled mirrors + Fresnel lens showed a 27% increase in power production over the solar panel alone.</p> <p>Conclusions/Discussion This study confirms that concentrating incoming light and capturing reflected light by the methods used in this project can increase power production in PV panels. While each of the methods used separately showed an increase in productivity, the combination of all three methods resulted in the highest increase in power production.</p>	
Summary Statement This project investigated the ability to improve solar panel productivity by concentrating incoming light with a Fresnel lens and capturing reflected light with mirrored surfaces.	
Help Received None	