Waveguide Lens

Team #12

Team Members: Miroslav Drozdov, Claire Kuntz, Jason Zhu, Max Li, Apoorva Sirigineedi
Mentors: Dr. Milton Aguirre, Mauricio Montoya

Purdue Research Foundation

PURDUE UNIVERSITY

Customer Background

Conventional photovoltaic generators, as solar panels, usually have efficiencies that can go up to 23%. However, energy can be harvested from LEDs. Through using the appropriate wavelengths and light focusing devices, LEDs can yield better energy generation efficiencies.

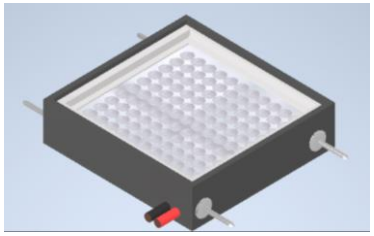
Problem Statement

To develop a cost conscious & scalable prototype, using resin based additive manufacturing, by manipulating properties such as geometric shapes, that can concentrate light into power generation units.

Requirements

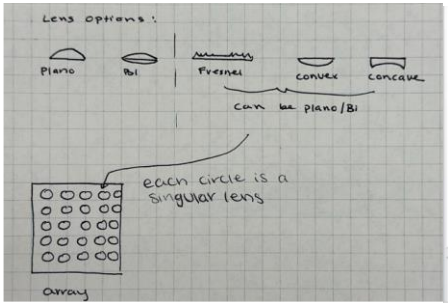
Requirement	Metric
High quality prints	Final transparency
Energy Produced	> 1.54 uW
Focal length	<= 5 mm

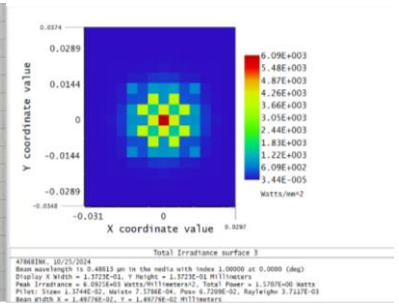
Final Design

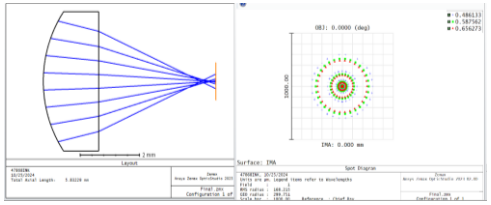


Final prototype increased efficiency by 35.97%

Experimentation and Concepts



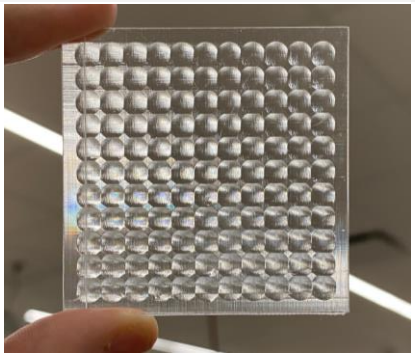




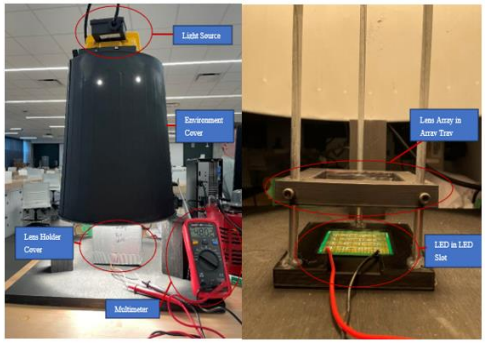
Lens designed in optics simulation software Zemax Opticstudio, to create the most optimized lens for our goal.

Prototyping

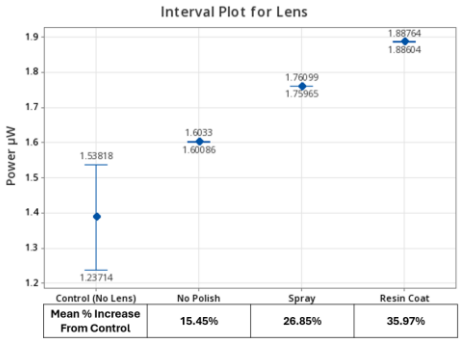
The post-processing phase aimed to optimize lens for light manipulation and manufacturing methods. Resin dipping, polishing, primer application, curing times, and grit sanding were tested across prints. This systematic approach identified techniques that enhance lens quality, efficiently guide light, and maintain long-term performance.



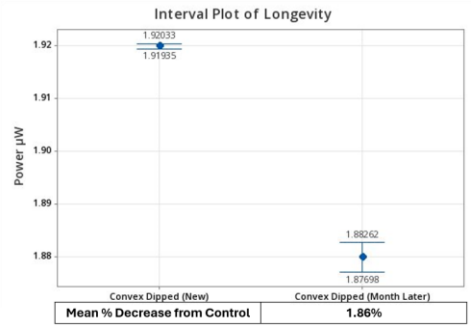
Testing



Testing Phases → 1-Lens Type → 2-Lens Diameter → 3-Post Processing → 4-Longevity



Control (No Lens)	No Polish	Spray	Resin Coat
Mean % Increase From Control	15.45%	26.85%	35.97%



Convex Dipped (New)	Convex Dipped (Month Later)
Mean % Decrease from Control	1.86%

Capstone Fall 2024