

Abstract

Working outdoors is a luxury many people cannot enjoy due to the power requirements of modern computers and mobile phones. Integrating a photovoltaic module into an existing table provides an eco-friendly workspace that delivers renewable energy to meet the demands of today's technology-oriented environment. Existing solutions cost as much as 10 thousand dollars and require a team to assemble. Optimizing the electrical components to precisely meet energy needs while maintaining the integrity of the structure is vital to creating a cheap, yet robust product with an enjoyable user experience.

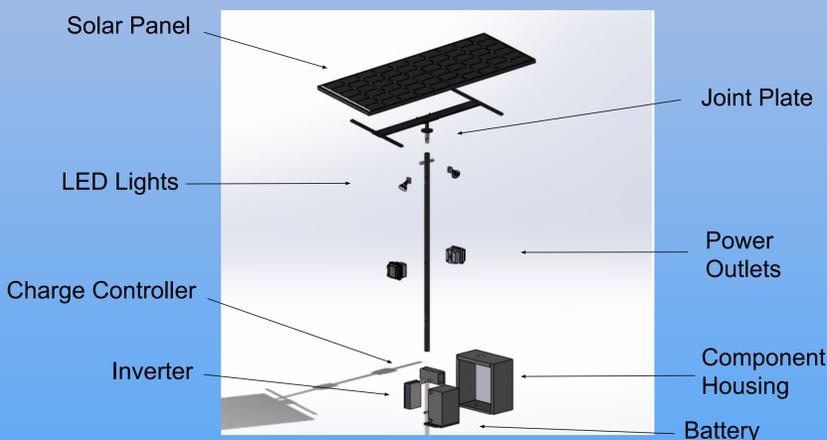


Figure 1: Exploded CAD Model of Design

Design Specifications

The main focus of this project was to design an affordable product mobile enough for two people to assemble that can generate enough energy to power two laptops and two mobile phones simultaneously.

Characteristic	Benchmark	Target	Design
Daily Output	380 Whr	770 Whr	1140 Whr
Weight	> 400 lbs	250 lbs	< 250 lbs
Wind Resistance	~ 40 mph	70 mph	>100 mph
Cost	\$10,000	\$7,500	\$3000

Figure 2: Summary of Design Specifications

Green Space



Figure 3: The Green Space solar-powered workstation

Key Components

Joint Plate



- Interface between the column and solar panel frame
- Allows 160-degree rotation in the azimuth for optimum irradiance
- Quick-release style connection for easy disassembly

MPPT Charge Controller



- Optimizes power transfer between panel and battery
- 30% increased efficiency reduces overall weight

280W Photovoltaic Panel



- Higher-efficiency monocrystalline panel
- Generates 280 Watts of power
- Manageable size for 2 people

Figure 4:a-c

Analysis & Testing



Figure: 5a, 5b. Tip Test and COMSOL Analysis

Through COMSOL analysis and testing of the physical prototype, we determined the design can withstand an excess of 100 mph winds and 70 pounds of force.

Conclusion

Through extensive analysis corroborated by physical tests, our design meets or exceeds all objectives as outlined in Figure 2. This product is capable of powering 3 laptop computers and 2 mobile phones in an outdoor setting with renewable energy that does not require connection to the electrical grid.

Acknowledgements:

Special thanks to Dave Bothman, Tyler Susko, Jim Morrison, Greg Dahlen, Kirk Fields, Andrew Riley, Jewel Snavelly, Andy Weinberg, Roger Green and Pilar Land