

## **Executive Summary**

The Pennsylvania State University's team, Remote Wind Power Systems Unit (PSU), is focused on developing a sustainable, portable wind turbine that can provide power to those in need during the aftermath of natural disasters in the United States. Approximately 25 engineering students from Energy Engineering, Aerospace Engineering, Mechanical Engineering, and Electrical Engineering backgrounds have played a role in the design process. Six students pursuing degrees in Energy, Business, and Finance, Energy Engineering, and Communications have developed the business plan and financial analysis to demonstrate the viability of the team's product.

Remote Wind PSU is a Limited Liability Corporation that was formed in order to provide a portable and sustainable solution to power loss in the aftermath of natural disasters. Remote Wind PSU will design and sell small-scale, portable wind turbines to first responders and community centers. This product is designed to be a sustainable and affordable alternative to diesel generators and solar panels. As of now, Remote Wind PSU has designed and built a prototype, designed a turbine for market scale production, and conducted a preliminary market analysis. Remote Wind PSU was formed in State College, Pennsylvania in 2013.



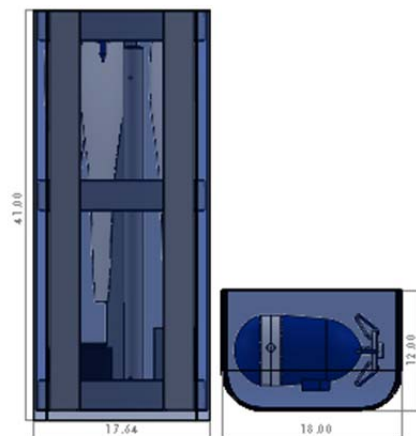
**Figure 1: Deployed Market Turbine (Guy Wires Not Shown)**

Remote Wind PSU has identified a market gap in the mobile electricity generation products for the natural disaster response market. While portable diesel generators and portable solar devices can provide mobile power, they both have disadvantages that can be overcome by a portable wind turbine in the natural disaster response market. Remote Wind PSU's M152 turbine can provide power to 5 to 10 people at a time so people can charge communication devices at your local community center, church, or fire station.

Unlike most micro-wind turbines on the market, the M152 is built into a compact and ergonomic carrying case for transport to virtually any location. To ensure that the system has a small volume, the tower utilizes a telescoping arrangement reducing the height of 13 feet during use to 40 inches during transport and storage. Once erected, the tower is stabilized by guy wires eliminating the need for bulky struts or limiting base

area. The turbine itself is designed to operate in a downwind orientation on a horizontal axis to achieve the low cut-in wind speed of 4 m/s and have the capability to direct itself into the wind, allowing it to always maximize the windswept area without the need of a tail.

Each blade of the micro-turbine can be detached for storage in a convenient carrying case, and when assembled, has a rotor diameter of 1.52 m. This allows the M152 blades to rotate at 650 rpm at rated wind speed of 11 m/s generating



**Figure 2: Packaged Market Turbine**

441 W via a permanent magnet generator. While the wind is blowing, the power generated is stored at the base of the turbine in a 396 Watt hour (Wh) battery. The electricity produced can then be discharged through one USB outlets as well as two 12 V universal outlets.

Remote Wind PSU is in the organizational phase of development at this time. The company plans to take advantage of economic incentives to aid its development such as the Keystone Innovation Network grant program and Ben Franklin Technology Partners. Additionally, the company will seek investment during its second year of production. Remote Wins PSU begins producing turbines during its third month of operation after marketing and collecting orders for the first two months. Marketing consists of email lists, conventions, and magazine and newspaper ads. Breakeven occurs at the beginning of the second year of operation. The company's net present value is \$163,000 after three years of projections.