

Herbert Hoover Presidential Library Association Hoover Uncommon Student Award Application

First Name: Elliot

Last Name: Suiter

Project Proposal Title: Harnessing the Wind

Give a brief, clear statement of project and its goals. I will utilize my own design plans to build and install a 12-foot wind turbine that will power a battery bank and provide a renewable energy source for electronic equipment in my home. I will share what I have learned about wind energy with youths in my Boy Scout troop, in order to promote conservation and hopefully inspire other youths to pursue their goals.

Benefits or importance of project (Why do you want to do this project?) I have always been interested in conserving and helping the environment by recycling and saving fuel wherever possible. Wind energy is huge in Iowa, especially recently with Mid-American Energy's large wind farms being erected across the state. One of their large 2.3 megawatt turbines actually sits on my family's farm in southwest Iowa. This turbine can power 700 homes and is one of hundreds in the area. I love how clean and effective wind energy is ? after the original installation, a wind turbine will produce electricity for years with relatively little maintenance and upkeep. This really got me thinking ? how hard can it be to harness the wind for myself? There are many companies that sell residential wind turbines for use by homeowners, but these cost thousands of dollars, and can take up to 30 years to pay off from energy savings. Therefore, I decided to design and build my own wind turbine. The specific goals of my project are to build a working wind turbine, and then teach other youths about energy conservation and wind energy.

Procedures you will use to complete your project, (How are you going to do it?) Phase I:
My wind turbine project is already underway. I built a prototype last fall that helped me identify design flaws and ways to improve the turbine. Before beginning the project, I did much research on the Internet, looking at various designs and ways of building a wind turbine. I eventually decided on a 12-foot, horizontal axis wind turbine with 3 blades and a steel frame, meaning that the axle that the blades rotate on is parallel to the ground. A turbine like this is sturdy, efficient, and relatively inexpensive to build. Next, I needed to come up with a power source for my wind turbine. I learned that any electric motor, when spun, will act as a generator, so I found a used industrial DC permanent magnet motor on the Internet to use as

the core of my generator. After that, I decided to use threaded steel tubing for the turbine frame and sheet steel to construct a tail vane to point my turbine into the wind. These items could be purchased at my local hardware store. I designed the whole turbine so it could be bolted and threaded together, since I do not have access to a welder. I also made my own blades, since kit blades are around \$200 a set. I was able to find a scrap piece of 6" PVC tubing, which I cut using a reciprocating saw and sanded to make 3 equally balanced 30-inch long blades. I was able to build the entire prototype turbine for less than \$200. I finished fabrication of my prototype turbine in December of 2013 and I then went into a testing phase.

Unfortunately, I was so excited to get my turbine up and running, that I secured my guy wires into the ground using simple landscaping stakes that we had on hand at my house so I could start testing my setup that much sooner. About two weeks after I began my testing phase, there was a large storm with high winds, and one of the guy wire stakes holding the 12-foot pole in place came out of the ground, allowing my turbine to fall over, shattering my blades, and bending much of the steel frame.

Phase II:

Moving forward, I need to correct the design flaws and re-install the wind turbine. I need to straighten the steel parts, redesign my blades, and install a stronger guy wire staking system to make sure my turbine is safe and reliable in the future. My blades did not break until they hit the ground, but the fact that they can be under so much pressure during gusts and storms makes me nervous. I don't want a blade to snap in high winds and hit someone or something. I have talked with my shop teacher at school about this problem, and he suggested sand cast aluminum for my new blades. Aluminum blades would be many times stronger than my current scrap PVC blades, meaning they would bend less in high winds and more effectively catch the wind. Using aluminum would also keep the weight low compared to other metals, allowing my blades to still spin easily with minimal wear on my generator's axle bearings. All I will have to do is make a sand mold of one of my current PVC blades (I have an extra set), and fill it with molten aluminum, something my shop teacher has agreed to help me with. Having more sturdy blades will greatly help the safety and efficiency of my turbine. I also want to prevent my stakes from coming out of the ground again. I originally thought I would use longer stakes that can screw into the ground, but with spring coming, the ground will get very wet and soft, creating a potential weak point in my design. Instead of having to fear if my guy wires and stakes will hold up in high winds, I plan to replace them with something stronger. Once the ground thaws, I will be able to dig footings. I can then purchase and mix bags of concrete to pour into these footings and implant steel eye hooks, helping ensure that my guy wires will never come undone again. I believe that this will be effective based on my experience with concrete and masonry work through my Eagle Scout project at my church.

After completing my wind turbine, I plan to share my knowledge of conservation and energy with my Boy Scout troop. I earned Eagle Scout rank in 2012, and one way I can give back to the troop and encourage younger scouts to keep working toward their goals is to share what I have learned and show them what you can accomplish if you put your mind to it. Scouts would learn about conservation of energy, and how they can help out in their own way, even auditing the energy usage in their own homes. I have proposed this idea to my troop leader and he is agreeable.

Resources/materials you will use to complete your project. 8 bags concrete

3 eye hooks

Steel foundry box

Casting sand

Aluminum

Mentors you will look to for guidance, if applicable. (You must ask for agreement and note in proposal). Mr. Mitch Eagles, Industrial Technology Teacher, Johnston H.S.

Conclusion or results you expect. One of the immediate results of my project will be to provide an alternative energy source for my personal use. When testing my prototype wind turbine, I used a multi-meter to measure the output of the generator in high winds and I found that it produced a peak of about 400 watts. I briefly used this prototype wind turbine to charge a bank of batteries in my house, which powered lights, speakers, my computer, and a space heater in my study room. I determined that if I kept my turbine running constantly, it would pay itself off in less than 4 years. Another result of my project will be to encourage other youths to get involved in energy conservation. My project may even inspire other youths to make their own dreams a reality. Looking into the future, this wind turbine is just the start of my long range goals. I plan to attend Iowa State University to study electrical engineering, hopefully someday working in the renewable energy business. I dream of one day living completely off the grid where I am not reliant on public utilities, but instead would be using clean, renewable energy from the wind.

How your work on this project relates to Herbert Hoover's expertise as an organizer and leader? Herbert Hoover was an avid conservationist and he endorsed hard work. Rather than giving out free money during the Great Depression, he created jobs for unemployed people, thus improving our nation's infrastructure. One of the greatest public works projects of his presidency is the Boulder Dam (now the Hoover Dam), a huge hydroelectric facility that

provides clean energy to parts of Arizona, Nevada, and California. President Hoover encouraged a spirit of hard work and perseverance during tough times. I also try to work hard; going above and beyond in all that I do, including this project. I could have given up when my prototype wind turbine failed. I could have scrapped the whole idea of providing my household with clean, renewable energy, but I didn't give up. I am not only rebuilding, but also redesigning my turbine so that the next time I set it up, I know for sure that it will accomplish my goal of producing clean energy.

How did you find out about this program? When I was younger, my neighbor was a student finalist for the Herbert Hoover Uncommon Student award. This stood out to me because his project was based on agricultural pursuits, and I helped take care of his chores when he was away. I thought it was pretty cool that he was able to share his experience on a broad level and inspire other youths to follow their dreams.