

My wind turbine design aims to make green energy more accessible by creating a safer, quieter, and more user-friendly wind turbine that reduces environmental disruption. I was inspired to build this prototype after wasting a bunch of 3D-printing plastic trying to create a traditional turbine, only to find it loud, unidirectional, and generally unpleasant to be around. Traditional turbines can also pose risks to local wildlife in their vicinity. I wanted to fix these issues so, I set out to develop a more efficient, wildlife-friendly turbine that could make wind energy a viable option for a broader range of users.

Each problem: modularity, noise reduction, omnidirectionality, safety, and simplicity, is straightforward to address on its own. However, combining them presented a challenge. To streamline the design, I integrated features where possible (e.g., using a single container for both noise reduction and safety). I used Blender (CAD software) for modeling, FlowSquare+ (CFD software) for simulating sound and aerodynamics, and a 3D printer to create prototypes.

During simulations and real-life testing, the turbine's RPM remained within approximately 98% of that of a traditional wind turbine, demonstrating comparable efficiency. Noise levels, measured with a microphone positioned 0.5 meters from the hub, showed up to a 65% reduction compared to standard turbines. Each additional module increased noise by only about 2%. The final design has six unique parts, just above my target of five, but achieves full omnidirectional functionality. And lastly, the blades are contained somewhere safe.

This wind turbine combines modularity and accessibility to make green energy more practical and user-friendly. Its quiet, omnidirectional design and ease of repair offer a sustainable solution that's both efficient and considerate of its environment, bringing wind energy one step closer to widespread, everyday use.

*As mentioned by a judge, I have no ethical way to test for bird safety. Its "safety" comes from the fact that the turbines are not spinning out in the open, away from the flight path of birds.

Thanks: big thanks to my parents for giving me the money to build the thing. Also, a thanks to the guys over at *FlowSquare+* who allowed me to use their software for free to test my prototypes. Another thanks to Paul Falstad and his soundwave simulation software. Without these fine people, this project literally would not exist.