Wind EnGen
Portable Vertical Axis Wind Turbine

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Introduction & Background

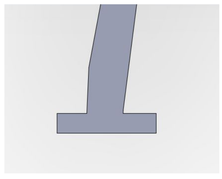
- There is a perpetual deficiency of electrical energy
- Experiencing positive trend in off-grid demand for electricity
- Power banks and other charge carriers present short-term solution to such issues but do not solve problem in long run
- Efficient, reliable sources of renewable energy are key to solving issues related to energy shortages and inaccessibility
- Need for inexpensive and consistent energy source made from infinitely recyclable (sustainable) material
- Affordable, sustainably-built vertical-axis wind turbines (VAWTs) are uncommon
- Savonius VAWT configuration poses strong advantages over others due to its ease-of-use, widespread application, and low

Objectives & Hypothesis

- Create a proof-of-concept, portable VAWT that can produce output power sufficient to charge a mobile phone
  - Portability: able to be carried in a backpack
  - Sustainability: infinitely recyclable material
- Predicted power output ~ 5.32 W
- Expected power to be less than that produced by the comparable TexEnergy horizontal axis model

Design Approach

- Utilized TexEnergy base and generator for standard comparison in testing
- Savonius blades initially printed out of PLA filament with elliptical curvature for capturing wind
- Slotted “T” embedded for user-friendly blade insertion and removal



Figures 1-3 (left to right, top to bottom). “T” shape on blade, “T” slot in shaft, Completed VAWT ready for testing

Testing & Results

- Data was collected so that wind speed and output voltage could be compared ultimately for power output calculations
- Voltage was tested through a circuit consisting of the turbine (power source), varying resistance, and single conducting wire

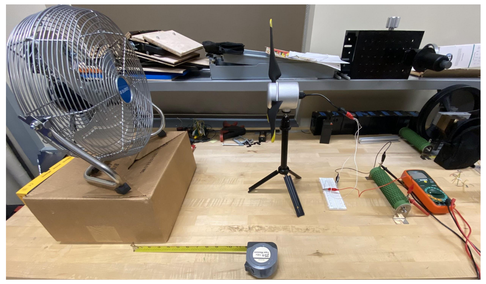


Figure 4. Test Setup Used for Both TexEnergy and Wind EnGen

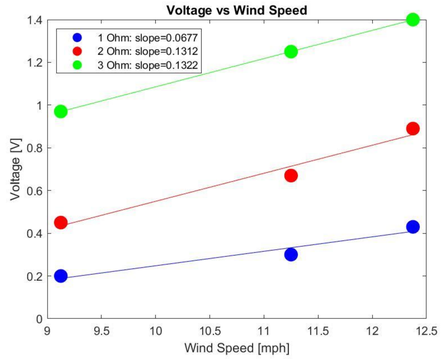
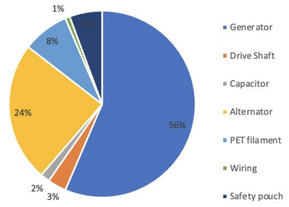


Figure 5. Voltage vs. Wind Speed Plot for TexEnergy Turbine

- Next testing steps: gather data for the Wind EnGen VAWT by following a similar process to that of the TexEnergy test (find ideal load, measure voltage across resistance, plot data)
- Results for Wind EnGen are expected to follow a similar trend to that of the TexEnergy data but of smaller magnitude

Business Plan & Target Market

- Target audience consists of mostly backpackers and off-grid populace aged 20 - 29
- Wind EnGen production costs projected to fall from prototype levels of $155 to ~$62 wholesale
- Distribution through partner tech and travel stores like *Dick's, Camping World,* or *REI*
- Marketing through renewable energy fairs and conferences



Social & Environmental Benefit Analyses

- Wind EnGen offsets carbon emissions from power required to charge mobile devices
- A single iPhone charge produces between 3g and 35g CO2, depending on grid load curve
- Enhanced efficiency and lower waste than portable batteries or car chargers
- PET filament used for production to maximize recyclability of turbine
- Allows for long-term flexibility in electricity generation when disconnected from grid
- Turbine durability and portability ensure suitability for extreme conditions
- Potential for expansion into charity sector and supply free power for underprivileged communities

Conclusions

- Product represents original model for proof-of-concept prototype geared towards sustainability and portability
- Turbine parts are low-cost and easily 3D-printable with recyclable materials (e.g. PLA and the more sustainable PET filaments)
- Results of testing process were lower than anticipated → Refine design:
  1) reduce diameter of overall turbine
  2) add “caps” to reduce wind escapage

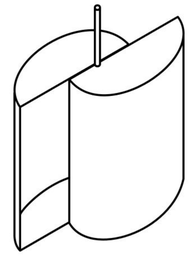


Figure 6. Savonius VAWT with “caps” on blades

Acknowledgements

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