SMALL SCALE WIND DESIGN
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Abstract
This project determined the feasibility of small-sized wind turbines placed in residential areas by:
• Researching different types of wind turbines.
• Calculating turbine efficiencies in all wind zones.
• Calculating payback periods of top five overall most efficient wind turbines.
Currently small scale wind turbines have low efficiencies and long payback periods, making them less attractive compared to large turbines.

Methods/Process
Developed a database of wind turbines based on:
• Approximate Dimensions
• Weight
• Estimated power output
• Minimum wind speeds
• Cost
Data sites and references include:
• WPI Database
• U.S. Federal Wind Energy Program
• Department of Energy

Formula $P = \frac{5}{9} V^3 \pi r^2$ where
• $V$ = wind speed in m/s
• $R$ = area of blades in m$^2$

Results/Outcomes

Background

Horizontal Turbines
• Earliest horizontal windmills date back to the 12th Century.
• Originally used to grind cereals and create flour.
• Modern turbines used to generate electrical power.
• Can reach heights of almost 400 ft. and generate up to 4 MW of power.

Vertical Turbines
• Were invented in the early 1900’s.
• Two main types of vertical axis wind turbines; Darrieus turbines and Savonius turbines.
• Generally less efficient than horizontal turbines but smaller and less expensive.

Conclusions

• Larger wind turbines produce more power than smaller wind turbines at the same wind speeds.
• Larger wind turbines are more costly and generate more noise, less accepted by public for urban development.
• Smaller wind turbines are more acceptable for public.
• It is not cost effective to install a small wind turbine for home use.
• Payback period is too long for small wind turbines.
• Few areas in the U.S. where wind speeds are feasible to install small wind turbines.

Recommendations

• One type of wind turbine can be profitable in the short term (under ten years) and that is the Aeolos H-5.
• Only a few areas have strong enough wind speeds to make small wind turbines profitable.
• Those areas include parts of:
  • Vermont
  • California
  • Alabama
  • New Hampshire

References
Images used for this presentation acquired from
• http://www.morguefile.com/
• http://www.windsolar-products.co.uk