



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 small 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.

Project Goals/Objectives

- Determine the efficiencies of varying wind turbines.
- Determine the cost of different types of wind turbines.
- Conduct a cost benefit analysis for the researched windmills.
- Determine if it is worthwhile to install a small scale wind turbine on a home.

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.



Methods/Process

Developed a database of wind turbines based on:

- Approximate Dimensions
- Weight
- Estimated power output
- Minimum wind speeds
- Cost

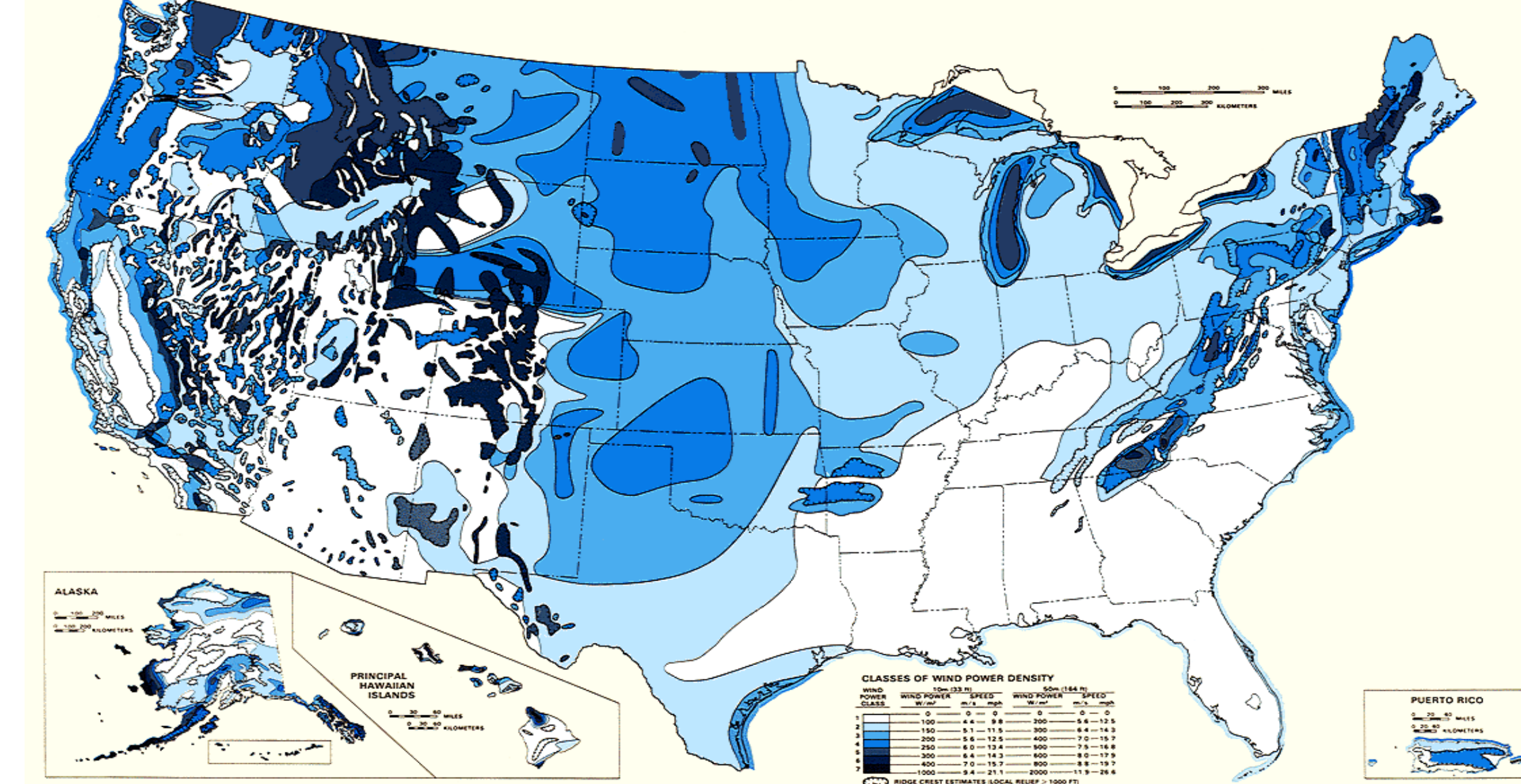
Data sites and references include:

- WPI Database
- U.S. Federal Wind Energy Program
- Department of Energy

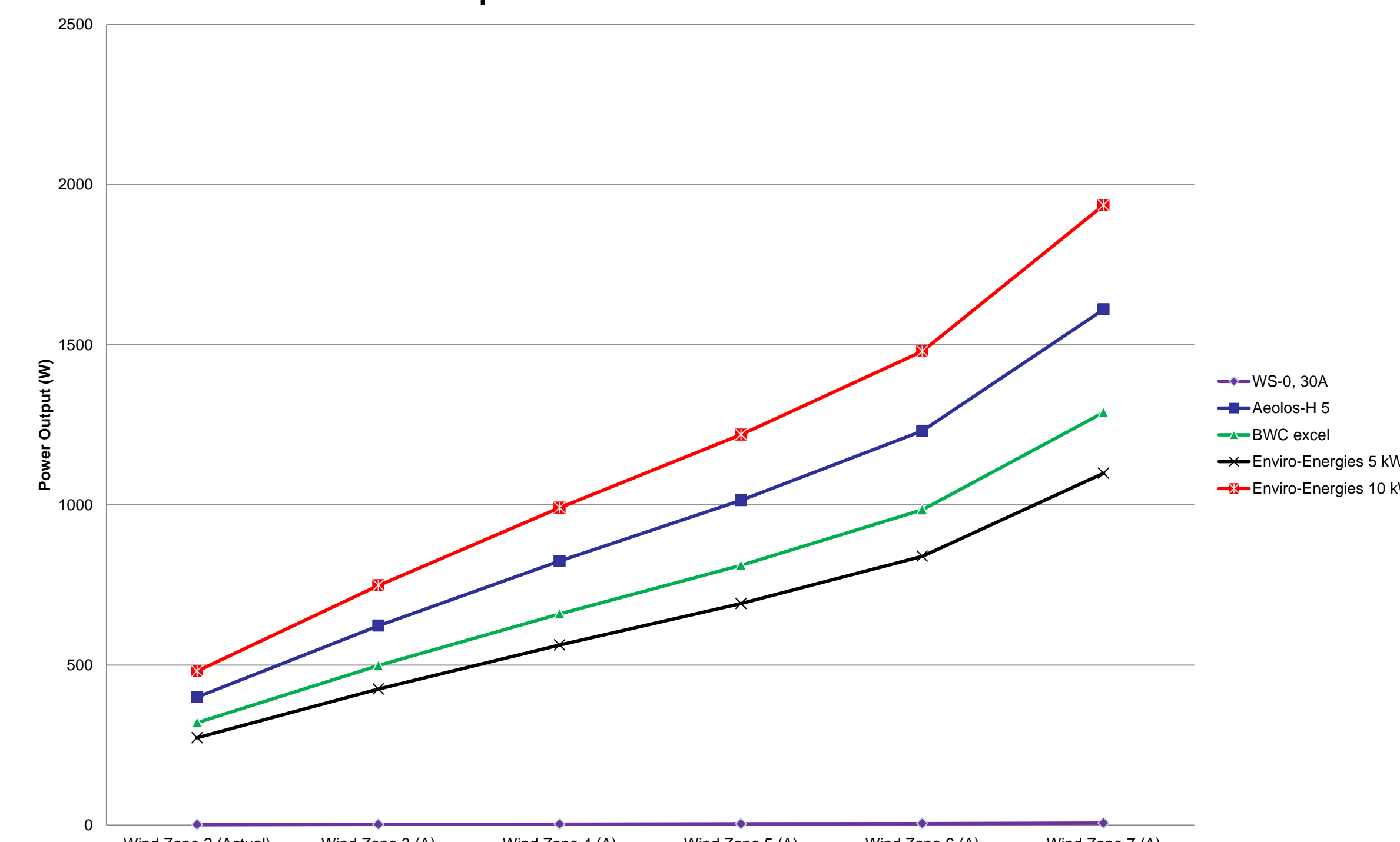
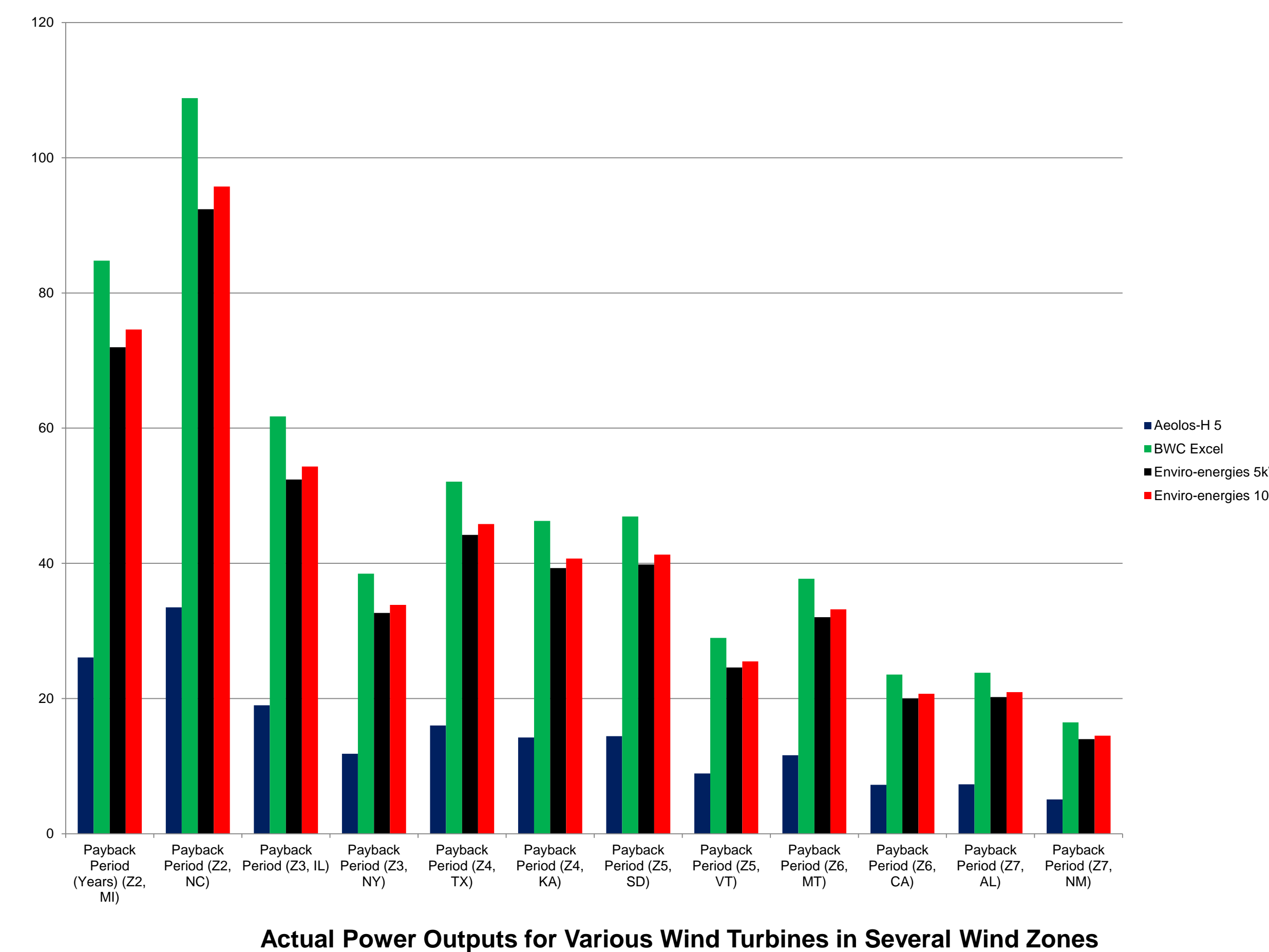
Formula $P = .5 \times V^3 \times 4\pi \times r^2$ where

- V = wind speed in m/s
- R = area of blades in m²

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Results/Outcomes



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 Aelos 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
- Determining factor in installation of small wind
 - No care for return on investment

References

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