Wind Harvest Company Prototype - Windstar 480-5

Antelope Valley, CA | Installed 1986

The model 480-5 support structure was designed by a consulting structural engineer who incorporated changes intended to solve problems found in the model 480-4 turbine. The turbine was set up in Antelope Valley in Los Angeles County.

Model 480-5 Specifications	
Rotor Height (m)	13.7
Rotor Diameter (m)	4.9
Swept Area (m^2)	44.6
Number of modules	4
Number of blades per module	5
Number of stators	5
Turbine Spacing	3 rotor diameters
Solidity	33%

The main features of this model were as follows:

- The structural members were heavy-duty pipe with steel tension rods.
- The turbine had the same three modules as the 480-4 model.
- The brake was improved and so was the drive train.
- Grip notched belts were used for better torque ratings and a Morse speed reducer.
- A full set of quality blades from the 480-4 turbines was unavailable; however Alcoa had some NACA 0012 blades of extruded aircraft aluminum (6061-T6). The NACA 0012 blades had a smaller cord and were thinner requiring 5 instead of 4 blades per rotor to maintain a 33% solidity.
- The turbine was installed with an induction and a direct current alternator with the utility line load for the induction generator and a bank of space heaters to handle

excess load from the DC alternator. Ben Parks designed the electrical circuit with a special alternator control on the alternator field current to optimize turbine output. Unfortunately, it did not operate as expected. We concluded that a simple on-off switching system would be more effective, which would take advantage of the flywheel qualities of the rotor.

The turbine did not function well because of the thinner blades. It was difficult to start. We determined that the airfoil's slenderness profile was the problem. The thicker profile has better stall characteristics. We greatly improved aerodynamic braking by connecting all pitching blades to a central shaft-mounted brake disc. This machine represented a step increase in our turbine design knowledge.

The Antelope Valley wind resource was marginal, which made it difficult to obtain significant data in a short amount of time.

We decided to test turbines in a wind farm resource, specifically the San Gorgonio Pass near Palm Springs, Ca. We leased a site from Fred Noble and Wintec at their Whitewater site on BLM land.

This location was an excellent site with high winds and turbulence. We also decided that the turbine steel frame had to be made in a country with lower manufacturing and steel costs than in the US to be cost-competitive. We acquired a Chinese agent who set us up with Chinese manufacturers. A delegation of Chinese officials met us at the Antelope turbine and decided they wanted to do business with us. It appeared that we were ready to build a "manufacturer prototype".