



Maintaining Wind Turbine Production

Single Turbine to Wind Farms Applications

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Wind Turbine Maintenance

Turbine

Site

Community

End



Turbines & Preventative Maintenance



Preventative Maintenance

- Two or Three Inspections Per/Yr.
Determined by Site and Annual Capacity

Average Cost

USD .015 - .02 Original Turbine Cost

Or

USD/kWh .01 Based on Economy of Scale

Preventative Maintenance

- Sensors' and Data Recorder
 - Vibration
 - Oil Particle Count
 - Accelerometer
 - Temperature
 - Wind Direction – Yaw
 - Anemometer

Preventative Maintenance

- Evaluation of Data Recorder
 - Basic Trends including alarms
 - Analyze data for predictive maintenance
 - Electronic Parameters
- Electrical Components
 - Measure Voltage Drops
 - Tighten and Inspect
 - Lighting Protection

Preventative Maintenance

- Tighten and Inspect Components

Nacelle

Rotor blades & Hub Assembly

Gear box & Components

Electric generator & Servo Motors

Yaw mechanism

Hydraulic system & Cooling systems

Brakes, aerodynamic & mechanical

Tower & Fountain Components

Refurbishment, Major Overhauls

- Major Components

 - Gearbox

 - Generator

 - Set of rotor blades

 - 15-20% of original turbine ea.

- Projected / Design Lifetime

 - 20 years

 - 120 K/hrs. of Operation

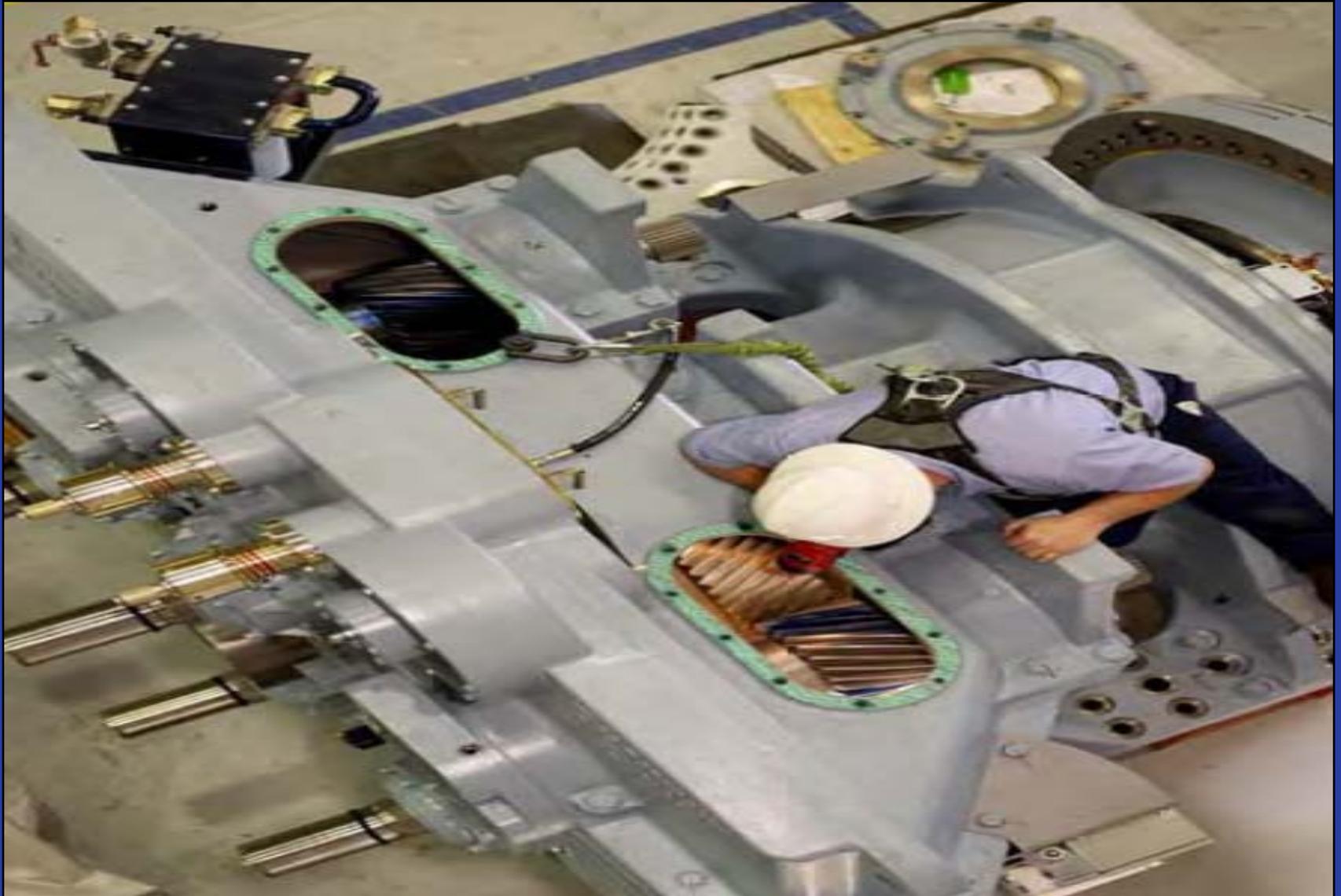
Free Standing Turbines



Crane Lifting Refurbished Rotor



Gearbox / Major Components Serviceable



Guyed Application for DG



Guyed Tower Lowering for Service



Guyed Application



Small Turbines for DG Applications





Site

Turbulence; Natural and Equipment
Placement

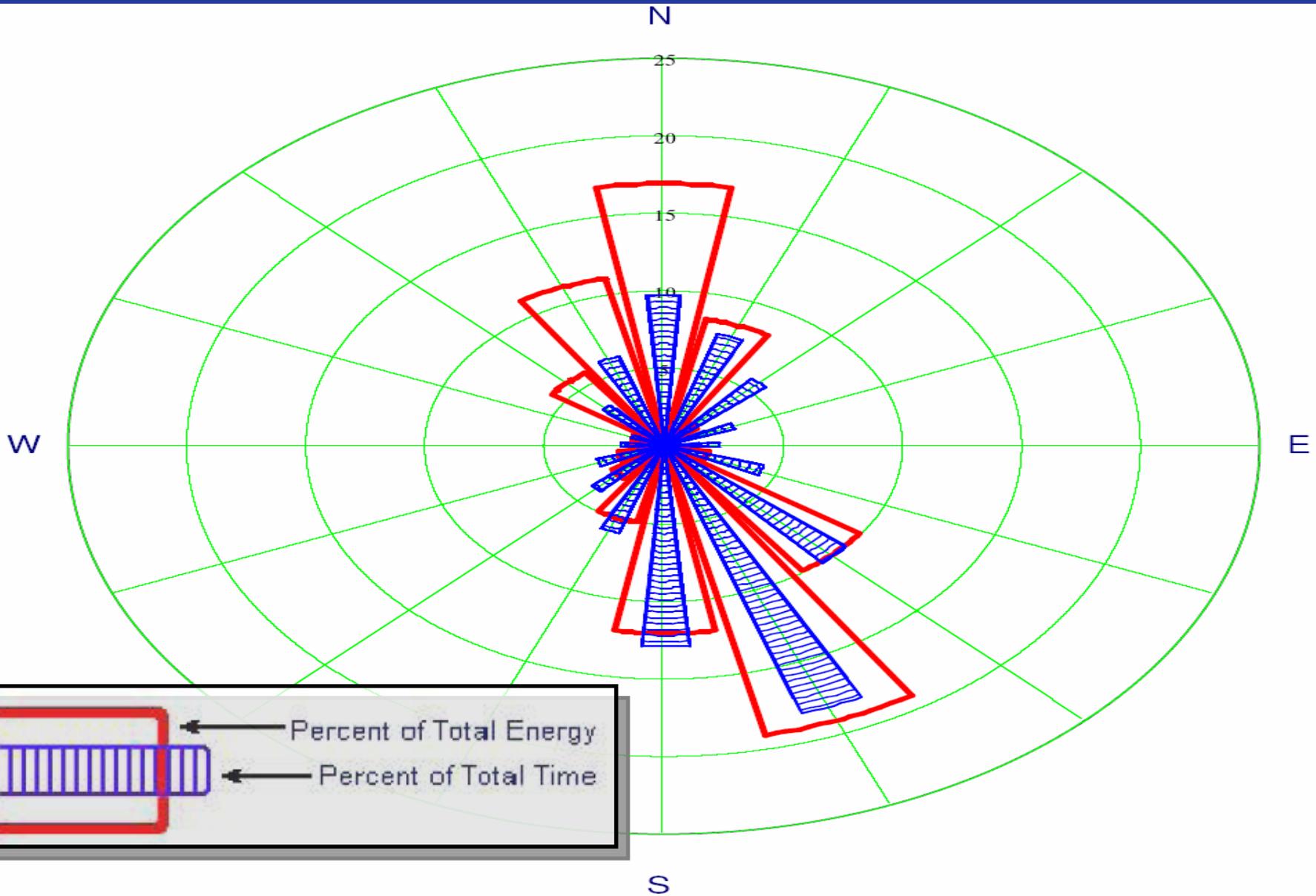
Prevailing / Hours of Wind

Endanger Species to Radar

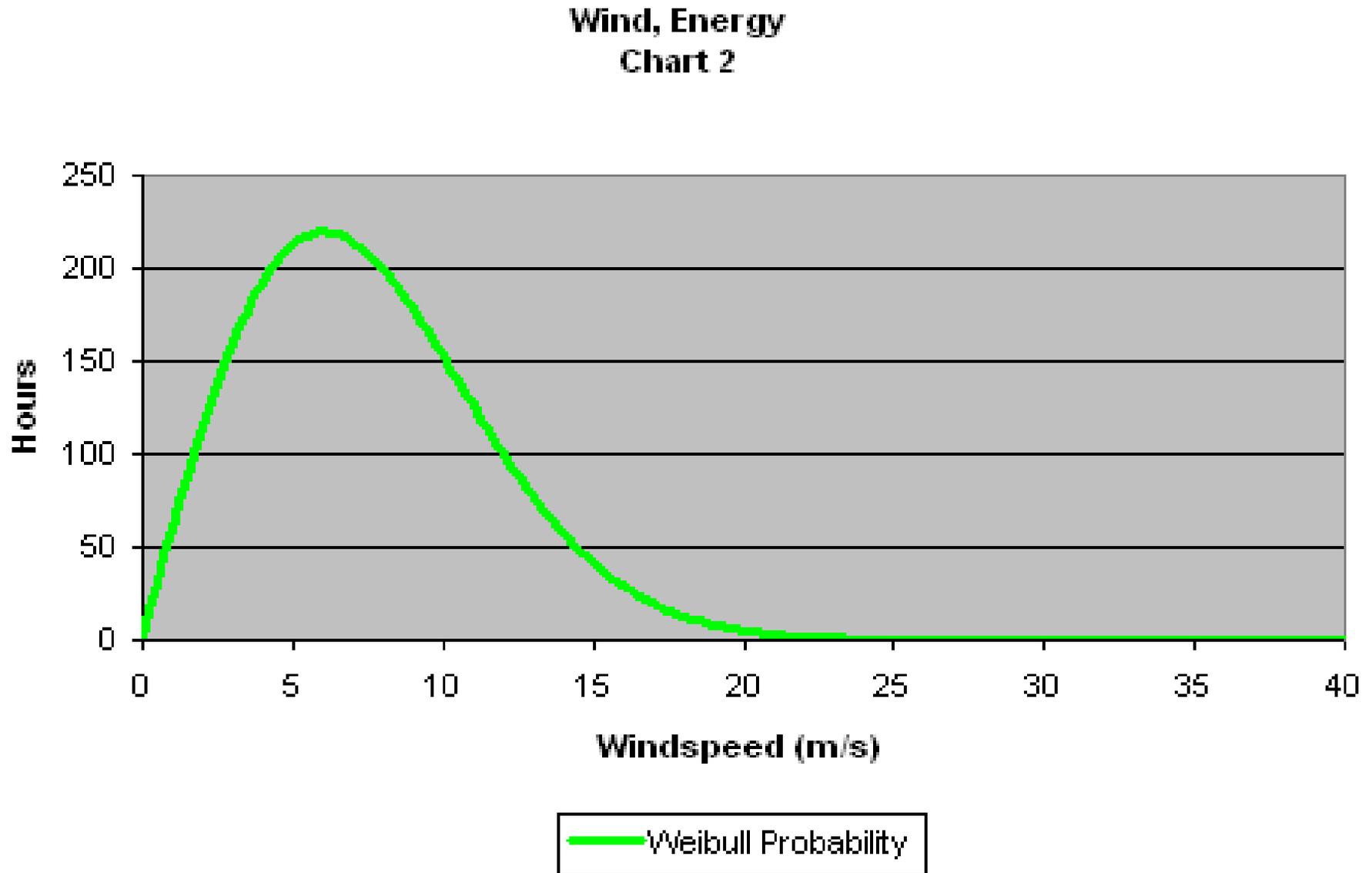
Turbulence & Wind Direction



Prevailing Wind / Wind-Rose

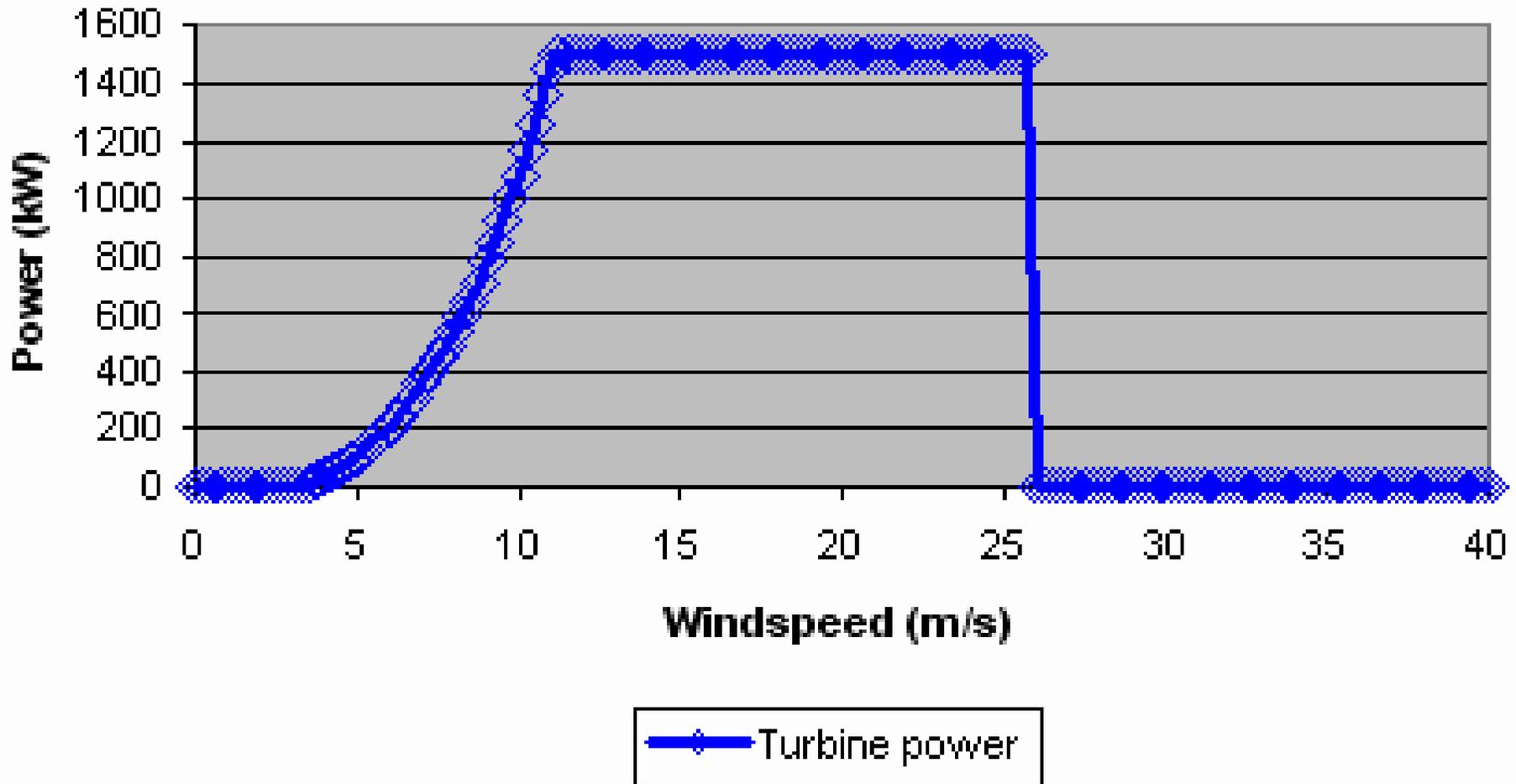


Site – Hours vs Windspeed



Production vs Windspeed

**Power Curve
Chart 3**



Vegetation and Road Maintenance



Endanger Species



Greater Earless Lizard

Radar and Wind Turbines





Community

Not in My Back Yard



Disputed View



Accepted View





The End

- All Contracts Require;

Restoration of Site to Original Conditions

Environmental Impact Study

References

- Sandia National Laboratories
<http://www.sandia.gov/wind/>
- American Wind Energy Association
<http://www.awea.org/>
- National Renewable Energy Laboratories
<http://www.nrel.gov/wind>
- National Wind Coordinating Collaborative
<http://www.nationalwind.org/>
- Danish Wind Industry Association
<http://www.windpower.org/en/tour/econ/oandm.htm>



Questions?

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SEA



**New Orleans
August 5-8**