

Kotzebue Wind Farm Operational Experiences

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Wind/Diesel 2004

Girdwood

Kotzebue, Alaska

A Unique Environment

- 30 miles north of the Arctic Circle
- Low, flat terrain consisting of tundra and permafrost
- Annual average temperature -5.8°C (22°F)
- Average snowfall – 127 cm (4.2 feet)
- Winter wind-chill temperatures reach -120°F
- Access for barge shipments 3 months

Kotzebue Wind Power Project

- **12 – AOC 15/50 turbines**
 - 3 installed July 1997
 - 7 installed May 1999
 - 2 to be commissioned Oct. 2004
- **Rated Turbine Capacity**
 - - 66 kW continuous rating
- **1 – Polar 100 turbine**
 - installed April 2002
- **Rated Turbine Capacity**
 - 100 kW continuous rating



Entegrity AOC-15/50



Entegrity AOC Development Issues

- Entegrity under new management is addressing operational issues to improve the AOC
- The basic machine has been reliable, but can be improved
- Maintenance has been reasonable in both time and cost, refinements will make the machine even more reliable
- Communication with the company has improved

Entegrity AOC Development Issues

- Reviewing other braking systems
- Machine is being reviewed for solutions that will potentially lower cost but not cause other problems
- KEA is taking an active role in the evaluation of these solutions
- One of the goals that we have is to see as much standardization as possible in Alaska machines

Entegrity AOC Development Issues

- Tip-brake refinement
 - Slip ring vs. Rotary Transformer
- Cold weather starting
 - Lubrication
 - Yaw bearing grease
- Anemometer replacements
- PLC cards
- Communications issues
 - Target practice

Northern Power Systems Polar 100 kW



Northern Power Systems

Northwind 100

- NPS has been working on improving cold weather operation of the machine
- The machine experienced a number of faults due to conservative settings on the machine while testing for cold weather conditions
- They have made a number of programming changes
- Kotzebue provides a good test for cold weather

Northern Power Systems

Northwind 100

- The machine experienced some issues with the yaw motor after installation
- There have been some issues with dust from the ???
- Relationship with NPS has been good and they have been responsive to problems and issues

Results to Date

- Initial project operational since May 1997
- Initial turbines have operated through 6 winters
- With 10 turbines KEA has seen 39% penetration with no negative effect to system
- Project has produced over 5 million kWh
- Power quality has not been an issue
- Maintenance and operations costs have been low

Construction Issues



Arctic Foundations



Tilt Up Towers



Thermocouple/Piling Temperature







Bird Issues

- The species of concern on the Alaskan coast are the Spectacled Eider and the Stellars Eider
- Both species are considered endangered



Bird Issues

- KEA is participating with the US Fish and Wildlife Service in a study to document avian interaction with wind turbines
- KEA has monitored the site during migratory periods since 1997
- There have not been any avian mortalities associated with the site

Penetration Issues

- KEA is reaching level of penetration that will require new operating procedures and equipment
- KEA has hired an engineering firm to evaluate companies and equipment that will move us into higher penetration levels