Northern
POWER SYSTEMS

Challenges and Solutions: Implementation and Supporting Complex Wind-Diesel Applications in Remote Locations

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June 2009

Direct.

Outline

- Northern Power Systems
- Remote Locations
- Complex Logistics
- Environmental Challenges
- Solutions

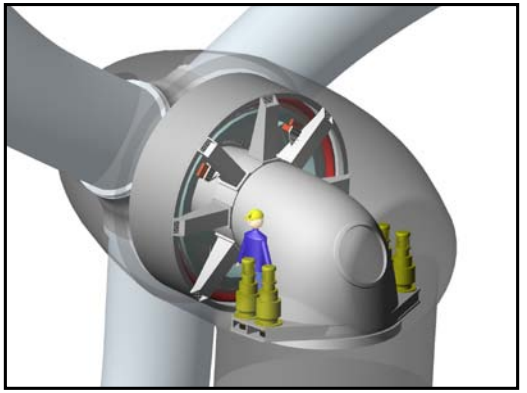




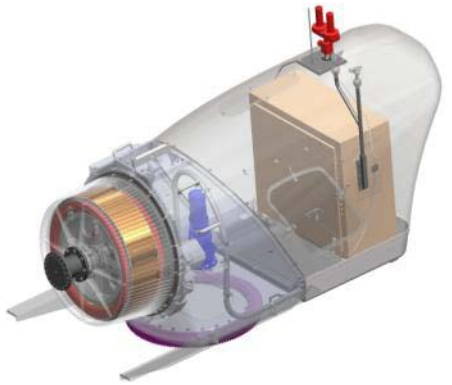
Northern Power Systems

- **Over 30 years of wind turbine design, manufacturing and installation**
  - DOE, NREL, NASA and NSF
  - Power for military and science
  - Sustainable quality power
  - Specifically for extreme, remote applications

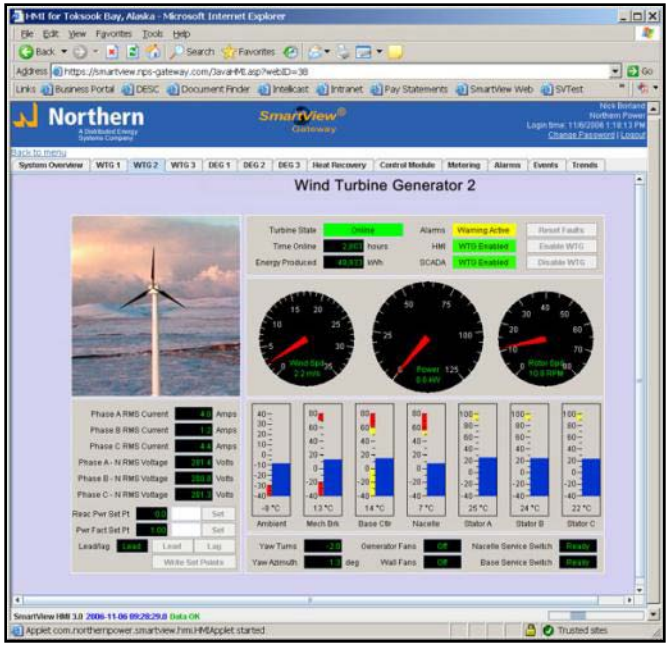
- **Wind Energy Focus**
  - Remote village power
  - Cold weather solutions
  - Wind-diesel integration and controls



Northwind® 100 Design

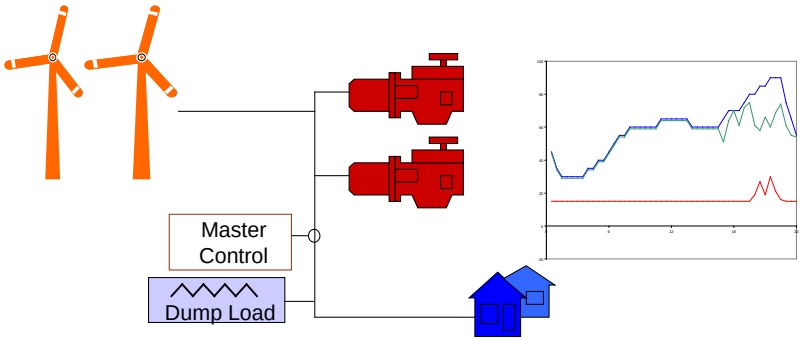


- Direct-drive, Permanent Magnet Generator
- Fixed pitch rotor
- Monopole Tubular Tower
- SmartView® Remote Monitoring
- Arctic Model Temperature spec: 55° C to -40° C



Turnkey Village Power

- Diesel gensets
- Diesel and Balance of Plant Controls
- Northwind® 100 wind turbines
- Northwind® load controller
- Thermal and electrical distribution
- SmartView® remote energy monitoring



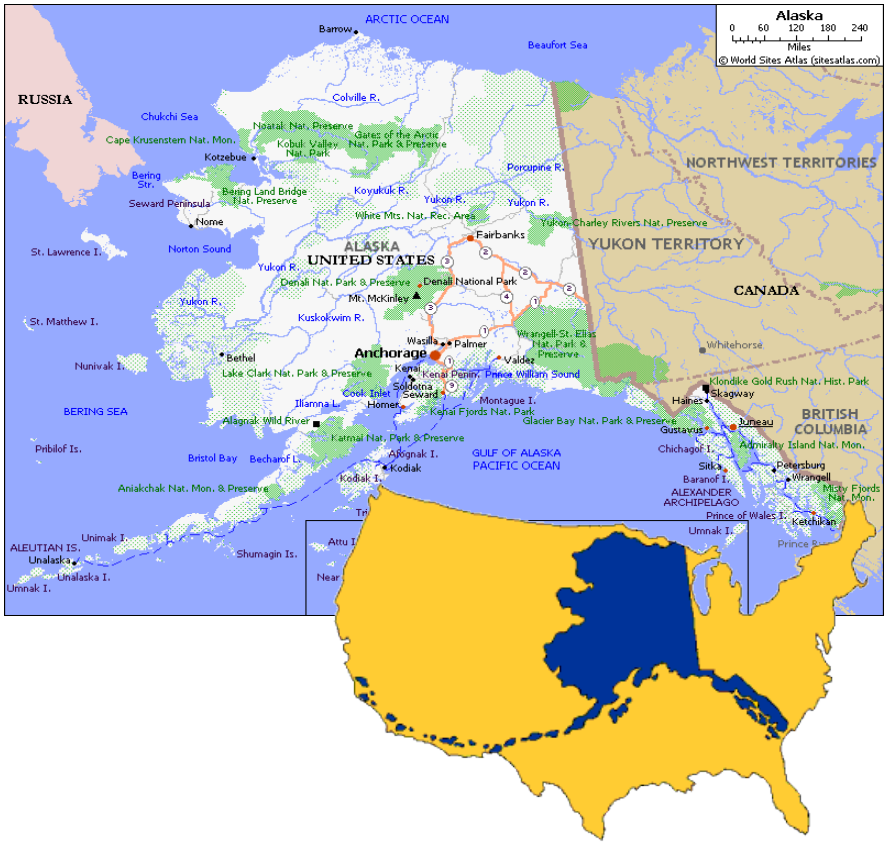
Remote Location

Challenges

- Limited access
- High travel costs
- Local tech support
- Response time

Solutions

- Advanced planning
- Local partners



Complex Logistics

Challenges

- Narrow shipping windows
- Staging of equipment
- Narrow construction windows
- Personnel logistics

Solutions

- Advanced planning
- Local partners

Delivery

Travel

Transportation

Difficult Environmental Conditions

- **Physical obstacles in the “bush”**
  - Boardwalks are common
  - Above ground utilities
  - Tundra too soft for vehicles

Summer Tundra/Permafrost

Poor Soils

- **Soils present unique challenges**
  - High variability
  - Lack of stability
  - Climate change impacts

Complex Foundations

Low Temperatures and Icing

- **Challenges**
  - Meeting low temperature specs
  - Discouraging ice build-up
  - When to initiate shut down?

- **Solutions**
  - Nacelle heating
  - Hydrophobic coatings
  - Smart controls

Hydrophobic Blade Coating

Conclusion

- Use correct equipment for application
- Employ strong regional partner
- Train local technicians
- Turnkey solutions provider
- Synchronized projects in a cold and remote areas
- Use remote energy management software
- Prepare for environmental difficulties

Kasigluk, Alaska

Canadian Cold Climate Opportunities

Thank You

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