Blade Workshop

Initial National Reliability Database (NRD) Results

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Program Goals and Objectives

Working through industry partnerships to:

- Develop National reliability baseline statistics for the US wind energy industry
  - Turbine component failure rates are higher than expected by some
  - This is the first long-term, data based, national effort to quantify and track these failures
- Guide efforts to address important component reliability problems
- Provide feedback for improving design and manufacturing practices
- Help wind plants:
  - Improve asset management for
  - Optimize O&M practices
    - Preventive maintenance
    - Parts inventory optimization
    - Condition-Based Maintenance (CBM)
    - Prognostic & Health Management (PHM)
Subcomponent and Materials – Supply Chain

Components

Turbines

Plant Development

Plant Operations

Reliability Analysis

Data Warehouse

Individual Reports

Can contribute to increased availability of data partner operations

Baseline Reliability Information

This information will influence expectations for the market

Technology Improvement Opportunities (TIO’s)

Increase industry reliability to advance the technology maturity level

Five Steps for data partnership
1. Non-disclosure agreement if required
2. Data transfer to Sandia
3. Format data for warehouse
4. Analyses performed
5. Reporting

Data Driven Analysis Improves Reliability

Working through industry partnerships….
National Reliability Database

Other Databases
European, NREL, etc.

National Reliability Data Portal
Publicly available normalized statistical results

Normalized statistical reports/analyses to industry

Data formatting – SNL staff

SNL Informational Firewall

Data Warehouse
- Relational Database
- Time Series data system
- SCADA reports
- Operational field data
- Work orders – Maximo, electronic, manual

Analysis
Identify Technology Improvement Opportunities

Proprietary reports/analyses to data partners

Proprietary information - available to Sandia and data partners only

Publicly available information
Wind Farm A

- 0-5 years of operation
- 100+ turbines
- Two blade replacements due to lighting
- Lots of strikes
Wind Farm B

- 5-10 years of operation
- 100+ turbines
- Manufacturing related issues—laminations, voids
- Leading edge erosion
- Trailing edge splits
- Every blade struck by lightning at least once
- Grounding
- $100k spent on blade repairs
- 3 blades replaced due to lightning over life
- 6 blades/year replaced - 1/time
- Tune blades with lead shot
Wind Farm C

- 0-5 years of operation
- 0-50 turbines
- Bonding/laminations - delaminations, voids
- No onsite inventory
- Clean every year
- Replace in sets– around 5 since start of ops
Wind Farm D

- 5-10 years operation
- 100+ turbines
- Issues are QC
- Bug fouling, leading edge erosion
- Repairs, not replacements for lighting damage
- Clean when gearboxes are changed (rotor down)
- Around 40 blades replaced
Wind Farm E

- 0-5 years of operations
- 50-100 turbines
- No problems
Database Observations

- Multiple Work Orders
- Inspection takes minimal time
- Repairs take longer
- Replacements may take weeks
Conclusions

- Non standardization of data
- O&M may not be standardized either
- Around 18 years MTBF
- Crane required for replacements
- Availability requirements in contracts typical