



Public Renewable Partnership webinar on wind plant/turbine O&M

O&M of GE 1.5 MW Wind
Turbines



Support Systems

Safety

Quality Control

Technical Services

Training

Purchasing

Inventory Control

Human Resources



Developing “Safety Culture”

- Fostering a “culture of safety” is the single most important element in any safety program.
- We educate all employees regarding their roles and responsibilities for safety.
- Everyone from the top executive to the first line employee impacts safety and we must all do our part to provide a safe place to work.
- Behavioral safety makes safety everyone’s responsibility.



“Safety Culture”

- Starts with employee orientation
- Safety Training
- Technical Training
- Continuing Education
- Management Involvement



“Safety Training”

- No employee performs tasks if not trained
- All training documented
- Weekly safety meetings
- Specific training such as: forklift, high voltage, crane operator, electrician, etc.
- Personal protective equipment



“Management Involvement”

- Supervisor’s monitor their employees to ensure proper procedures are followed.
- Must follow all safety procedures.
- Employees hold management to “Higher Standard”.
- Interact with employees, “Pat on the Back” when job is done properly.
- Discipline



“Safety Officers”

- Non-management
- Located at facilities
- Performs employee training, (in house)
- Conducts facility inspections
- Presents safety meetings
- Monitors employee health and safety
- Investigates incidents
- Attends quarterly supervisor/safety officer meeting conducted by Safety Manager



Injury and Illness Rate

- Monitored monthly using North American Incident Calculation System
- Types of injuries tracked to prevent re-occurrence of incident
- Information shared with all facilities
- Monthly Injury & Illness spreadsheets provided to customers if requested



Quality Control

- Responsibilities
 - Quality Control
 - Technical Support
 - Training



Quality Control

- On-Site Audits
 - Turbine maintenance inspections
 - Turbine acceptance inspections
 - End of Warranty inspections
- Internal Audits
 - Review of all completed maintenance check lists
 - Update pending repair lists
 - Review of oil sample analysis reports and gearbox inspections



Quality Control

- Document Control
 - Distribution of revised work procedures
 - Distribution of Manufacturer Service Bulletins
- Calibration
- Traceability



Technical Support

- Trouble shooting
- Work procedures
- Specifications
- Deviations



Training

- Continuous Training
 - Training seminars / courses / work shops
 - Turbine manufacturer training
 - In-House training
 - Classroom
 - Hands-on



More Decision Considerations: (behind the scenes)

In addition to the things that are evident on the site, there are a number of additional things that require the same level of due diligence that are not as evident, such as:

- **HR Function** – The O&M is very much a people intensive business, and requires focused efforts on recruiting, benefits, retention.



More Decision Considerations: (behind the scenes)

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- **HR Function** – The O&M is very much a people intensive business, and requires focused efforts on recruiting, benefits, retention.
- **Procurement** – The O&M provider should have experienced procurement specialists and sufficient volume in the industry to obtain best pricing.



- Failed 34.5 kV Splice

One place experience of procurement helps to keep costs down. Lost revenue due to down time can add up fast.





More Decision Considerations: (behind the scenes)

- **Insurance Coverage** — There should be comprehensive insurance in place (at correct levels) and the ability to provide things like insurance certificates.



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- **Insurance Coverage** — There should be comprehensive insurance in place (at correct levels) and the ability to provide things like insurance certificates.
- **Financial Strength** — Does the company have the financial resources to stay on the job and stand behind things like warranties.



Tools of the Trade

Special needs for today's MW wind turbines

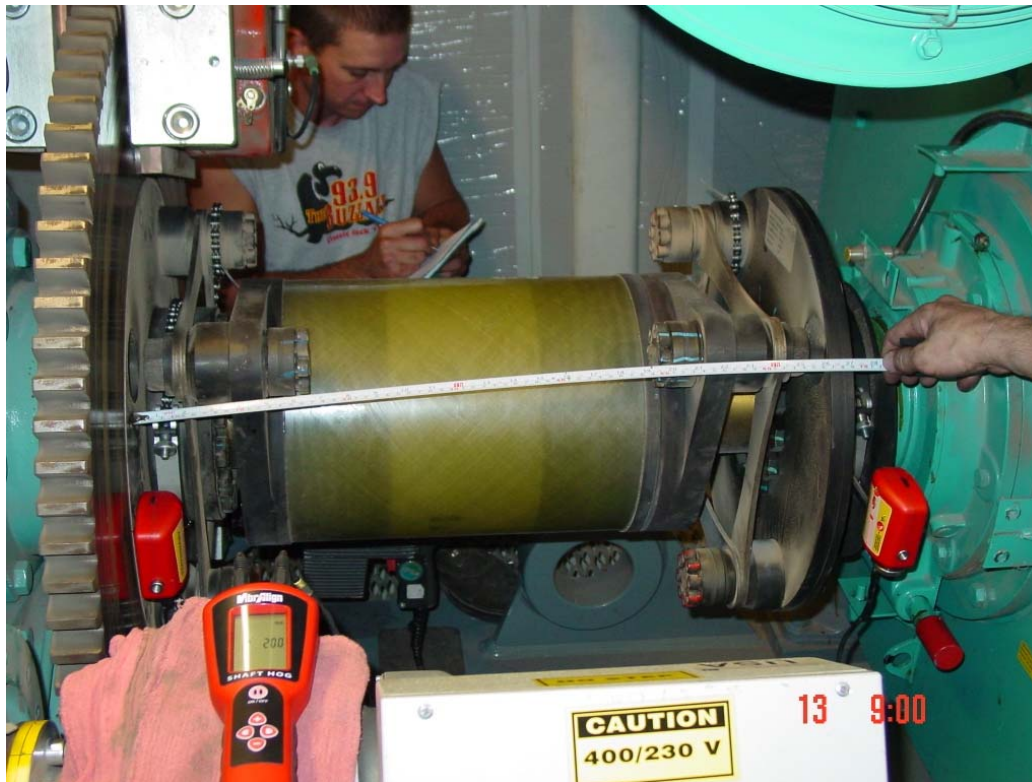


- Shaft Hog for Generator-to-gearbox alignments





- Generator Alignment





- Alkitronic





- HyTorque





- Blade Mitigation Crane and lowering of rotor





In Conclusion:

- O&M professionals “make it look easy”.
- Doing O&M right (keeping costs low and availability high) is anything but easy.