Loss Prevention Standards – Asset Class(es)

Managing Shut Down Wind Turbines – 12 Top Tips

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Shut down wind turbines, i.e., turbines subject to prolonged planned or unplanned outages, can be vulnerable to loss or damage, including from some exposures not normally present, or which are not normally of significant concern.

This Loss Prevention Standard provides 12 Top Tips for reducing the potential for loss events whilst wind turbines are shut down.

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Managing Shutdown Wind Turbines – 12 Top Tips

Introduction

During the operational lifetime of a wind turbine, it can be shut down for prolonged periods for a number of reasons including, but not limited to:

- Awaiting spare parts with long lead times.
- Logistic issues with transporting large components to site.
- Availability of specialist workers.
- Grid-imposed downtime.
- Restricted weather windows.
- Gaps in Operation and Maintenance support.
- Challenges with life-extension agreements.

The consequences of a prolonged shutdown can be significant with isolated turbines being more vulnerable to deterioration, wear, stresses and strains, water ingress and other damage. The risks of such damage can be reduced or mitigated by following formal procedures as recommended in this document, in addition to the advice provided by the Original Equipment Manufacturer.

Note: This document relates to shutdown wind turbines and is focussed on Property loss prevention and related risk management guidance. It is not intended to address Liability exposures.

Understanding the Risks

Prolonged shutting down of wind turbines exposes them to a number of potential hazards and subsequent damage. These include:

Structural and component damage including bearings, brakes, motors, and the tower.

Water damage caused by leaks and condensation can cause electrical damage as well as accelerated corrosion. Aviva is aware of incidents where wholesale replacement of key components has been necessary as a result of such incidents, leading to protracted and costly repairs.

Undetected faults due to lack of monitoring and possibly activity in and around the turbine.

General deterioration which includes gearbox and other oils pooling and becoming contaminated; components seizing or corroding; bearing and brake wear.

Whilst the Operations and Maintenance (O&M) provider should ensure the wind turbine is managed via an extended shutdown procedure, general maintenance checks such as oil and grease condition sampling will need to be managed throughout the outage.

Managing the Risks

1. Avoid Prolonged Shutdowns

Shutting down a wind turbine is undesirable, not only from a loss of revenue viewpoint but also from upkeep and condition perspectives. Three of the main causes of prolonged shutdown are end of life service arrangement changes; planned shutdown for maintenance/servicing; and breakdowns, with the two latter causes often exacerbated by lack of spare parts or the resources to repair the damage or fault.

- Upon nearing end of life, ensure life extension permissions and service negotiations are planned well in advance, and resolved prior to the end of existing servicing contacts. This will ensure a straightforward handover between service providers and reduce the potential for shutdown due to a lack of servicing support.
- Understand the critical components for your turbine equipment, and their general lifespan and availability.
- Ensure the O&M providers hold adequate stocks of essential spares at the site, including spares that have been phased out of production, or what spares are available within short notice from other stockholdings.
- Request up-to-date copies of spares inventory lists from your O&M provider on a regular basis and establish a major component strategic spares strategy in collaboration with the O&M and asset management company.
  - ✓ Request periodic checks on lead times are completed for parts not held in stock to identify any potentially changing exposures.

2. Shutting Down Procedure

When a prolonged shutdown of the wind turbine is necessary, ensure a formal shutting down procedure is in place. This states the rules and guidelines to help ensure the turbine is shut down safely and is in line with the Original Equipment Manufacturer (OEM) recommendations and accepted industry best practice.

- Ensure the service contract with the O&M company includes a robust shutting down procedure with rules and practices that reduce the potential for loss or damage either during the process or thereafter.
- Ensure your wind turbine Insurer and Broker are informed.
- Ensure any unnecessary combustible materials are removed.
- Consider installing a Condition Monitoring System in addition to existing performance monitoring. This may include vibration and oscillation monitoring on drivetrain components, blades, or the tower.

3. Auxiliary/Back-up Power Sources

Auxiliary/Back-up power systems are essential for controlling the various systems within the turbine.

- Ensure energy systems remain live through the shutdown period.
- Back up energy provision should be provided to help avoid issues caused or impacted by a failure of the primary energy systems.
  - ✓ Where temporary generators would be required, ensure:
    - Supply agreements have been formalised with local hire companies.
    - Connecting infrastructure is installed, including standing surfaces, fuel sources, connections etc.
    - Where permanently installed, generators should be tested regularly.
    - Fuel tanks should be adequately bunded and secured from theft with spill handling kits nearby.

4. Water Ingress

Ensuring the nacelle remains watertight during shutdown periods is critical. Seals and water diversion strips on any openings can become damaged, decay etc., and allow water ingress which can lead to increased humidity, corrosion, and damaged components/equipment.

- Check any watertight seals present are in good order and replace if they are due for imminent replacement or where they are likely to deteriorate during the period of isolation.
  - ✓ Ensure adequate seal spares are maintained on site.
- Any ‘clam shell’ doors should be checked to ensure they remain fully shut. Actuator motors can occasionally run at different speeds, resulting in misaligned doors and potential water ingress.
  - ✓ Proper ‘clam shell’ door closure should be verified via the use of photographic evidence where possible.

5. Humidity Control

One of the most significant causes of damage during a shutdown period is internal condensation permeating equipment such as generators and electrical components. The risks of condensation accumulating can be reduced by the use of dedicated humidity control systems which automatically operate to remove excessive moisture in the nacelle. Aviva have seen incidents where water has damaged critical components and equipment leading to costly repairs and significant down time.

Ensure the risks of condensation have been fully risk assessed and appropriate control systems implemented.

- Based on the findings of a risk assessment and considering such factors as geographical location and temperature levels, humidity control systems may need to be installed within site turbines, and where present should remain energised during any period of isolation.
- Integrated humidity control systems are favoured over portable powered dehumidifiers due to the risks of being knocked, damaged etc. Where portable systems are used, ensure:
  - ✓ They are only used as a temporary solution whilst the source of water ingress has been addressed, or permanent humidity control systems are installed.
  - ✓ Secured/fixed to a robust structure within the turbine.
  - ✓ Collection troughs are checked routinely and emptied as necessary.
  - ✓ Units do not impede access movements within the turbine.
  - ✓ They are subject to appropriate electrical testing.
  - ✓ The use of extension leads in limited and organised to minimise wear and tear and accidental damage.

6. Idle/Free-spinning Mode

The Turbine should be left in a safe functional state during the shutdown period.

- Where the system condition allows, ensure the turbine is left in idle mode. This allows the blades to naturally move with the wind, albeit whilst out of the wind direction and with feathered blades to limit excessive movement.
- Locking the rotor/blades other than for short periods e.g. during maintenance or repair works is not recommended. This can create structural stresses to the bearings, blades, tower, and brake system, and allow water ingress. When the rotor is locked off, a procedure should be in place to return to idle mode after the works are completed, assuming the turbine is to remain out of service.
- Ensure any rotor locks are removed post inspections/servicing to prevent bearing wear.

7. Heating and Cooling

Heating the internal areas of the turbine is essential during cold periods and in colder regions. This helps prevent condensation and thickening of lubrication fluids. Blades heaters are also essential in colder regions to help prevent ice accumulating and structural strains. Hot weather climates can also lead to damage without functional cooling systems, such as thermal expansion, plastic deformity etc.

- Ensure heating and/or cooling systems remain live during any downtime and are programmed to automatically operate when hot/cold weather temperature thresholds are achieved.
- Ensure heating/cooling systems are used in conjunction with automatic humidity control systems to help prevent condensation accumulating.
- Internal temperatures should be monitored to detect any heating system failure.

8. Monitoring

- Ensure monitoring systems remain live during any shutdown period.
- Upgrading monitoring to the most enhanced offering is also recommended during periods of isolation.
- Where not already present, and where there are particular areas of concern e.g. water ingress, consider installing monitorable video cameras within the higher risk areas to also monitor conditions within the wind turbine.

9. Maintenance

Wind turbines can deteriorate when not in normal operation and it is essential that ongoing maintenance continues during the shutdown period.

- Review maintenance scheduling with the O&M provider and asset management company to assess the adequacy of current arrangements and ensure maintenance and servicing continues and is appropriate for the new risks introduced by way of the isolation. Refer Aviva Loss Prevention Standard **Maintenance Regimes** for further guidance.
- Utilise downtime periods to carry out upcoming servicing/maintenance works, statutory inspections etc. This can help prevent future down time.
- Any hot work repairs should be discouraged within turbines, however where absolutely necessary should be completed in line with a formal hot work management system.
  - ✓ Refer Aviva Loss Prevention Standard **Hot Work Operations** for further guidance.

10. Emergency Response

Existing emergency response arrangements may not be adequate, or address issues that arise when wind turbines are shut down for prolonged periods. .

- Ensure turbine performance and condition monitoring systems are continuously monitored off site to help ensure immediate alerts to emergency conditions.
- Review emergency maintenance plans to ensure very prompt attendance in the event of a reported fault.
- Review existing emergency response procedures to ensure they remain adequate.
- Consider whether the shutdown condition introduces new risks requiring specific response.
- Ensure statutory and regulatory inspections are up to date and maintained during any down time.
  - ✓ This extends to ladders, fixing points, fire extinguishers, and emergency rescue kit e.g. controlled rate descending devices.

11. Self-Inspection

A programme of regular self-inspections can help ensure issues and developing faults can be identified and remedied promptly, potentially avoiding associated loss and damage.

- Ensure a programme of regular self-inspections is in place to inspect the turbine internally.
- This should include checks for condensation or evidence of condensation, hose condition, oil and other fluid levels, water seals and diversion strips, heating, humidity control systems and fixings, and other systems, structures or components that could cause or exacerbate a loss incident.
- Self-inspections should be recorded, and any remedial work actioned promptly.
- Refer Aviva Loss Prevention Standard **Self Inspections** for further guidance.
- The areas around the wind turbine and other valuable assets at the site should be maintained clear of combustible goods during any period of repair and low occupancy. This helps prevent against the risks of arson and malicious damage. Refer Aviva Loss Prevention Standards **Housekeeping – Fire Prevention** and **Arson Prevention** for further guidance.

12. Restart Procedures

A formal restart programme should be in place to ensure that once the wind turbine is ready to be recommissioned, it is fully assessed and checked prior to start up. This can help avoid faults occurring as a result of the downtime.

- Ensure a fully documented recommissioning procedure/checklist is in place to check all systems and equipment, electrical systems, oil quality and levels, filters, lubrication systems, safety features etc.
  - ✓ OEM recommendations should be followed, and any temporary measures and other impairments reviewed to ensure they will not impede the re-start.
- Where the shutdown is due to breakdown or fault, a cause and effect analysis should also be undertaken to identify any knock on effects to other components as a result of the breakdown.

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For more information please visit: Aviva Risk Management Solutions – Specialist Partners

Sources and Useful Links

- BS EN 61400 - Wind turbines
- Wind Turbine Safety Rules (WTSR) Energy Institute

Additional Information

Relevant Loss Prevention Standards include:

- **Housekeeping – Fire Prevention**
- **Hot Work Operations**
- **Self-Inspections**
- **Arson Prevention**
- **Unoccupied Premises**

To find out more, please visit Aviva Risk Management Solutions or speak to one of our advisors.

Email us at riskadvice@aviva.com or call 0345 366 6666.*

*The cost of calls to 03 prefixed numbers are charged at national call rates (charges may vary dependent on your network provider) and are usually included in inclusive minute plans from landlines and mobiles. For our joint protection telephone calls may be recorded and/or monitored

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