LE Erosion

Examples, Severity & Repair

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Agenda

1. LE Erosion
2. LEE Examples
3. Severity & Categorization
4. Repair
5. Current Works
LE Erosion

- Degradation of LE material
- Level of erosion depends on,
  - Climate conditions
  - Blade coating & underlying material
  - LE Protection, etc.
- Results;
  - May lead to high downtime
  - May require expensive repairs
  - Can result in loss of AEP

Source: https://www.windpowerengineering.com/maintenance-operations/leasily-applied-covering-fix-leading-edge-erosion/
LEE Examples - Offshore
## Severity & Categorization

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DAMAGE</th>
<th>ACTION</th>
<th>TURBINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cosmetic Readings of lightning system below 50mΩ</td>
<td>No need for immediate action</td>
<td>Continue Operation</td>
</tr>
<tr>
<td>2</td>
<td>Damage, below wear and tear</td>
<td>Repair only if other damages are to be repaired</td>
<td>Continue Operation</td>
</tr>
<tr>
<td>3</td>
<td>Damage, above wear and tear Readings of lightning system above 50mΩ</td>
<td>Repair done within next 6 months</td>
<td>Continue Operation</td>
</tr>
<tr>
<td>4</td>
<td>Serious damage</td>
<td>Repair performed within next 3 months Damage monitored</td>
<td>Continue Operation</td>
</tr>
<tr>
<td>5</td>
<td>Critical damage</td>
<td>Immediate action required to prevent turbine damage Contact technical support</td>
<td>STOP Operation safety is not ensured</td>
</tr>
</tbody>
</table>

Repair

- Complexity depends on
  - Damage size
  - Depth
  - Blade type

- Also, weather conditions (!)
  - Effective on availability
  - May lead to increased costs
  - Temp. >15°C and RH<70%

- New repair materials (?)
Current Works

- Aligning with one manufacturer on damage categorization
- Conducting LEP material testing
- Measuring AEP loss on different LEP types
- Helping our suppliers to improve
Questions?