

Bladena

Experts in blades

Advisory services

Catalogue



Bladena Stronger blades, More energy

BLADE ENABLER

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We are your *blade experts*.

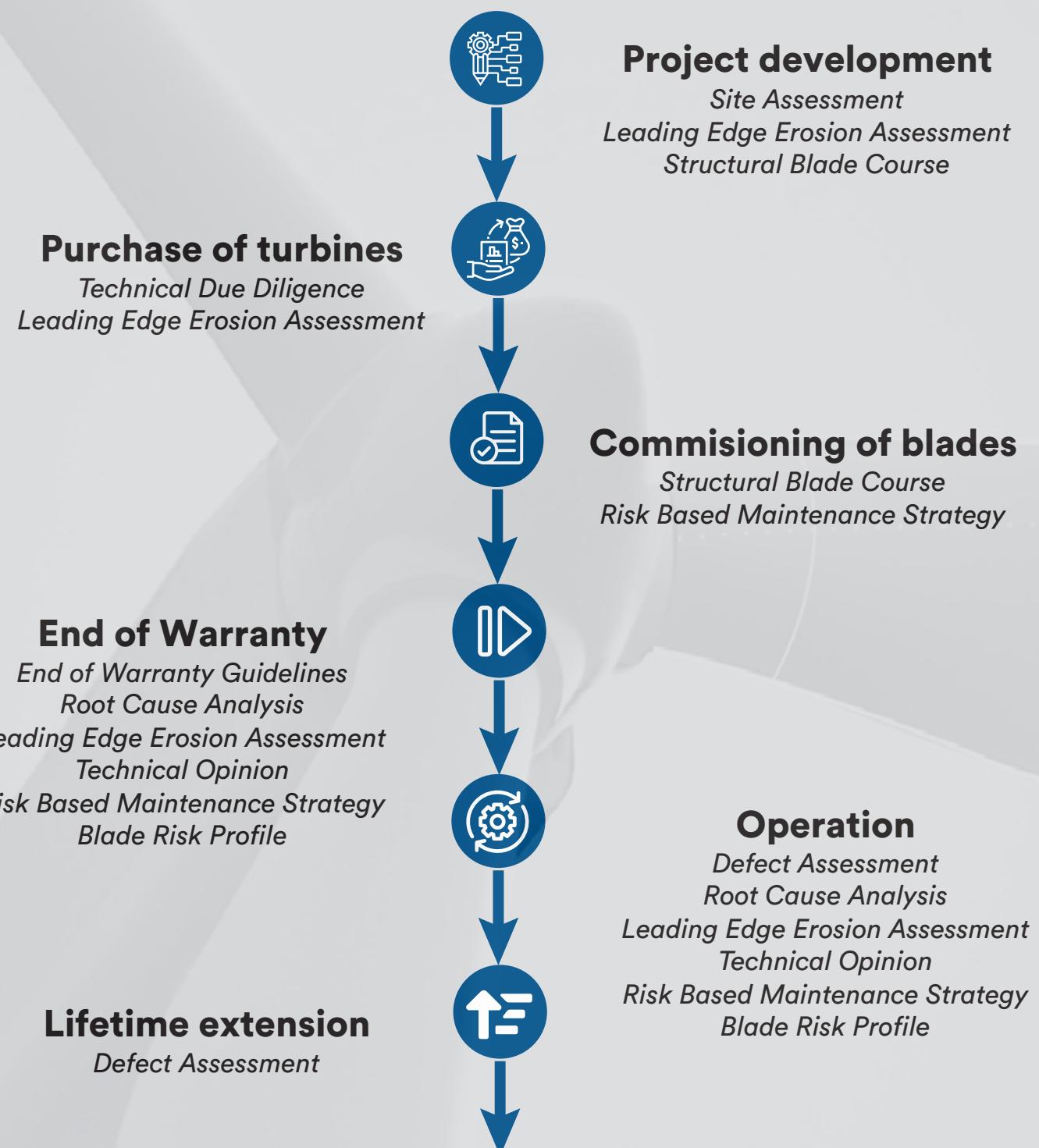
In Bladena we are passionate about blades. Our business is based on advanced blade data achieved through field experience and science. We use our expertise to help you optimize your blade asset strategy, by lowering your operation costs (OPEX) and decreasing downtime periods, hence more AEP (annual energy production).

Advisory services

by Bladena

When can you use our Advisory services?

Bladena during the blade's lifecycle:



Advisory Services allocation in the blade's lifetime is indicative and a number of advisory services are relevant/crucial on many stages of the blade's lifecycle.

Structural Blade Course

by Bladena



Introduction

Bladena offers both light and advanced blade course where knowledge regarding structural aspects of wind turbine blades, leading edge erosion and lightning protection systems is given, specifically developed for either Asset Managers or Individual Service Providers (ISP). The knowledge in all modules is streamlined in such way that any unnecessary information is stripped out, making the course easy to follow and understand.



Delivered values

- A blade course focusing on the specific needs.
- The blade course is taught by experts in each field.
- Only state-of-the-art knowledge is being used during the course.
- Offered as webinar, in-house or at Bladena.



Outcome

- Understand wind turbine blades from a WTO and ISP perspective.
- Understand the loads on blades under different field operation conditions.
- Get familiar with blade failure modes.
- Classify structural blade damages and understand the risk of each damage type.
- Get a basic understanding of blade design, certification, and testing philosophy.
- Get a better understanding of different inspection methods leading to big data and how to use them.
- Understand the root cause of leading edge erosion and lightning, as well as their possible consequences and current solutions.
- Familiarize with risk-based maintenance for decision making optimization.

Technical Due Diligence

by Bladena



Introduction

The Technical Due Diligence (TDD) is an assessment of a specific blade design during the project development or purchase of turbines stage. The TDD is not a re-certification of the blade, but an assessment of what has been done on the top of what standards require.



Delivered values

- Risk awareness with the wind turbine owner (WTO) having a clear picture if the OEM (original equipment manufacturer) has invested more than the minimum required by the certification body for a new blade.
- Better management of technical risks of blades.
- Qualitative and quantitative risk assessment of the integrity of blades (structural, lightning, and erosion).



Utilized tools

- Bladena's structural knowledge and field experience, as well as holistic blade understanding.
- Numerical comparison study of the re-engineered blade.
- Deep dive sessions with the OEM and blade factory visit.



Outcome

An expert opinion on a specific blade design that highlights the potential risk when the blade is under operation.

Introduction

The objective of the Defect Assessment is to have an overview of the structural damage(s) on the blade. It is a data gathering on the defect(s) observed in the fleet, benchmarking against Bladena's Blade File (BBF). Thus, the Defect Assessment concludes if defects are serial damages which other operators also experience. Next steps are recommended by Bladena that consequently make it easier to the wind turbine owners (WTO) to recognize the needed action(s).

Delivered values

- Data gathering defining the type of defect(s)/damage(s), length and position on the blade.
- Trends regarding the characteristic of the defect(s)/damage(s) and benchmarking against similar blades through the Bladena Blade File (BBF).
- Risk profile of the specific blade type.
- Recommended next steps and following actions.

Utilized tools

- Benchmarking through Bladena Blade File (BBF) and Guide2Defect Database with 60000+ damages and structural knowledge about different blades. The database includes knowledge regarding small, medium and large blades.
- Bladena's structural knowledge and field experience.

Outcome

An educated assessment that gathers all the data providing a benchmarking against same/similar blade types and next steps recommendation for risk mitigation.

Root Cause Analysis

by Bladena



Introduction

The main objective of the Root Cause Analysis (RCA) is to document why the structural damages occurred on a blade, in other words, to reveal the cause(s) of the structural damages.

Additionally, in case a solution on how to mitigate the damages is proposed, the Root Cause Analysis (RCA) will reveal the impact of this solution as well.



Delivered values

- Root Cause(s) identification, giving a clear understanding on how wind turbine blades are behaving under real conditions/operation.
- The RCA can be used in a negotiation dialogue where the cause of the damage may point out the owner as responsible for the costs of the blade repair/exchange. The same approach can be made in a negotiation with a OEM service where service agreements contracts are discussed.
- Bladena's RCA provide necessary technical base for such a dialogue (see bullet point above).



Utilized tools

- Information assessment (documents, pictures, site visit, SCADA, etc.).
- Structural modeling using FEM.
- Testing (sub-component, large-scale or full-scale).
- Bladena's knowledge and understanding on how blades operate in the field.
- Field measurements.



Outcome

A third party analysis that presents and explains the root cause(s) of the damage(s) on your wind turbine blade together with recommended solution(s)/next steps to mitigate risk.

Technical Opinion

by Bladena



Introduction

The main scope of the Technical Opinion is to document how come the structural damages occurred, and if other blades are in danger of experiencing the same issues. In other words, it is aimed to put in a context why the structural damages have took place, addressing standards shortcomings from when the blade designed, as well.

In case of solution(s) towards risk mitigation, the Technical Opinion reveals the impact of this solution on the blade.



Delivered values

- Fundamental understanding why the blade has failed and what is the effect of the solution.
- Answers if the proposed solution addresses the root cause.



Utilized tools

- Bladena's holistic understanding on wind turbine blades and value chain.
- When needed, FEM tool for comparison studies towards risk quantification.



Outcome

Clear understanding of the cause(s) of the blade failure and capitalize it in front of OEM.

End of Warranty Guidelines

by Bladena



Introduction

The End of Warranty (EOW) related advisory services are divided into three parts:

- EOW specifications
- Analysis of EOW inspection reports
- Technical opinion of EOW inspection reports

In the EOW Guidelines Bladena provides a proper inspection campaign of the blade, ensuring that the wind turbines can be operated cost-efficiently as long as possible.



Delivered values

- Clear understanding of the state of the assets in the field.
- Benchmarking of the findings through Bladena's Blade File (BBF).
- Risk reduction when undertaking the operational responsibility.



Utilized tools

- Next Generation Inspection Reports (NGIR).
- Innovative inspection strategies.
- Bladena's Blade File (BBF) and Guide2Defect.
Database with 60000+ damages and structural knowledge about different blades.
- Bladena's Blade Damage Catalogue.



Outcome

Solid inspection guidelines that help towards cost reduction by detecting failures of blade critical component as early as possible.

Site Assessment/Risk Based Maintenance Strategy

by Bladena



Introduction

Depending on the moment of the blade lifetime, this service is divided into:

- Site assessment (Project Development phase):
- Risk based maintenance strategy (End of warranty phase)

The main objective of this service is to evaluate the risk associated to a specific wind farm fleet providing or supporting a WTO to create uniform guidelines for Operation and Maintenance activities on the blades. The guidelines will be formulated considering the particularities of each blade type and site conditions from a holistic perspective.



Delivered values

- Tailor-made holistic risk analysis: structural considerations, leading edge erosion and lightning.
- Hotspot identification: analysis of expected areas where the most concerning damages will take place according to internal knowledge and FEM analysis.
- Criticality analysis for each possible failure mode.
- Individual wind turbine qualitative risk evaluation to support to prioritize actions.
- Wind farm qualitative risk evaluation to support to prioritize actions.
- KPI (Key Performance Indicator) analysis.
- O&M guidelines for a customized educated risk-based maintenance strategy.



Utilized tools

- Data assessment (inspection reports, technical documents, weather conditions, etc.).
- Structural modeling using FEM.
- Possible FMEA (Failure Mode Effect Analysis).
- Qualitative risk evaluation to support to prioritize actions.



Outcome

Educated risk analysis and customized O&M strategy to minimize risk depending on the specific site conditions, blade model, expected hotspots, and expected failure mode's development.

Leading Edge Erosion Assessment

by Bladena



Introduction

The main objective of the Leading Edge Erosion Assessment is to provide a technical opinion on the specific customer's needs following an analysis based on understanding the sources of the risk, the possible impact on the O&M strategy, and the possible existing risk mitigation actions.



Delivered values

- Risk analysis based on the weather conditions and blade characteristics.
- Evaluation of different Leading Edge Protection (LEP) systems.
- Evaluation of O&M strategies for leading edge erosion.
- Evaluation of erosion model to predict the expected erosion propagation based on current testing standards.
- Education, knowledge sharing, and design of O&M erosion strategy.
- Assessment of the erosion status of a current wind farm on operation.



Utilized tools

- Data assessment (pictures, inspection reports).
- Documentation review: TSA (Technical Supply Agreement), BIM (Blade Integrity Management), and others.
- Use of Bladena Blade File (BBF) and Guide2Defect as a reference for similar cases that can help in the assessment.



Outcome

An educated, technical report from a risk perspective, with the purpose of either helping with the decision making for future O&M strategies or assessing specific concerns regarding the leading edge erosion status of a wind farm.



Introduction

The main objective of the Blade Risk Profile assessment is to provide a risk analysis on the blades of the customer's fleet. Based on the customer's priority, field data and structural knowledge from Bladena, an assessment of one or more blade types are selected. The risk analysis includes: Hotspot identification, criticality level and suggestion to risk based maintenance strategies e.g. state-of-the-art monitoring techniques.



Delivered values

- Identification of the top damage-prone blades in your fleet.
- Hotspot identification of the selected blades.
- Criticality assessment based on the hotspot location.
- Guidelines for recommended actions that address the risk of the blades, e.g. inspection methods, monitoring techniques based on the identified damages.



Utilized tools

- Bladena's field experience and structural knowledge.
- Bladena's database with 60000+ defects and structural knowledge about different blades. It includes knowledge regarding small, medium and large modern blades.
- State-of-the-art Finite Element Method (FEM) numerical simulation tool.



Outcome

Knowledge about the blades that are prone to critical damages and high risk. Solid understanding of the criticality level of the potential failure modes and understand the existing repair options. Understanding of how to categorize damages based on various parameters. Additionally, obtain recommendations on how to proceed to reduce the risk and operation/maintenance costs.



Other completed assignments

- **Measurement/monitoring assessment:** advice on specific measurement/monitoring techniques that aim the detection of specific structural failure modes.
- **Fleet performance analysis:** qualitative analysis on the possible influence of leading edge erosion and structural damages on the operational blade efficiency.
- **Assessment on material composition and modular blades:** technical documentation regarding modular blades and material distribution along the blade layout for blade models.
- **FEM education:** technical documentation sharing knowledge on the type of analysis that must be followed for specific Finite Element Model studies.
- **Asset lifetime estimation:** loads analysis combined with Finite Element Model for specific critical structural damages and subcomponent testing to estimate the possible lifetime of a blade.
- **Owner's requirements:** set of additional specifications added on top of existing certification requirements found in standards today, aiming in managing technical risks better.
- **Investment analysis:** business case analysis studying the possible economic and risk benefit of specific O & M strategies making use of the Bladena's CAR Tool.



Bladena's unique toolset

- **Bladena's Blade File (BBF) and Guide2Defect**

Database with 60000+ damages and structural knowledge about different blade. The database includes knowledge regarding small, medium and large blade.

- **CAR tool**

Cost and Risk analysis tool for the most optimal O&M planning.

- **State-of-the-art FEM analysis tools**

- **Structural knowledge and field experience**

- **Partnerships all around the industry**

**Get in touch to learn more about our services and
their application to your business.**

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