COOPERATION TO INCREASE THE PROFITABILITY OF AGING GERMAN WIND FARMS

Effective Measures for Economic Operation after the End of the full Maintenance Contract and during Continued Operation

Bernd Höring, 8.2 Monitoring GmbH

Cooperation – Stronger Together

8.2 | The Experts in Renewable Energy

- Company within the 8.2 Group
- 25 years of CMS experience in Wind
- CMS-Hardware, delivered by partners
- VibraLyze**PRO** – Multi-Brand CMS analysis software
- 8.2-**Inspect**-App – inspection software
- Analysis, Inspections, RCA, DD & Consulting
- Global business with 130 employees
- Independent

ONYX InSight

- Company of the BP Group
- 30 years rotating machinery engineering and software development in Wind
- eco**CMS** – advanced sensing hardware
- fleet**MONITOR** – CMS independent cloud based analytics solutions
- field**PRO** – service & inspection software
- Global business with over 80 employees of those 10 Software Development Engineers
- Independent

Condition Monitoring System 4.0

8.2 | The Experts in Renewable Energy

In partnership with ONYX InSight

5th ANNUAL WIND TURBINE TECHNICAL SYMPOSIUM

1.050 participants
(US / EU / APEC)

Existing turbines / Germany

- Currently approx. 54 GW Onshore / 8 GW Offshore or 30,000 WTG in total
- 1/3 of the turbines are older than 15 years !
  - **Dismantling**
  - **Repowering**
  - **Continued operation after 20 years**
- The risk of damage increases with age
- How can economic operation be ensured?

Condition Monitoring System 4.0

- Next generation CMS
  - **ecoCMS** with 3D-**MEMS s**ensors
  - Development based on newest IoT-Technology
  - Cloud-based analysis software – **fleetMONITOR**
- Proven analysis service by 8.2
- Intelligent SCADA Data analyses software – **AI HUB**
- Service life extension through main bearing flushing

Synergy for the benefit of our customers

- Best cost/benefit ratio through ecoCMS retrofit, even for sub megawatt class
- Integration of all status information fleet**MONITOR**
- Detection of anomalies before they come to a standstill through intelligent SCADA analysis - **AI Hub**
- Reducing of OPEX costs up to 15 %
- Reliable information to help asset management make the right decisions

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ecoCMS – Technology

3D-MEMS (SD)

3D-MEMS (HD)
acceleration sensor

- 3D-MEMS (Micro-Electronic-Mechanical-Sensor), sampling rate up to 25.600 S/s, including temperature sensor for bearings
- 1x inductive proximity sensor rpm0 for speed measurement
- 1x optical proximity sensor rpm1 for localization of the faulty rotor blade
- ecoCMS unit for data acquisition and pre-processing
- Internet connection via local network or 4G router
- Secure communication via VPN to wind farm network

Speed sensor, rpm0

Rotor position, rpm1

ecoCMS unit

Data processing & Work flow

fleetMONITOR

Multi-Brand
Analysis software

Raw signals
Time domain signals
RPM & Process conditions

Resampling
Order analysis
Normalisation

Calculation
Amplitude FFT
Envelope FFT
Broadband values
Classification
Kinematic data
Threshold setting
Knowledge base

Pattern comparison
Thresholds and characteristic fault correlation

Trending
- Broadband values
- Frequency selective values
- Special characteristic values

Alarming
- Warning
- Alert
- System

Analysis and Validation
by 8.2 CMS-Experts

Reporting
Recommendations
by 8.2 CMS-Experts

Information
Mail/Call to
Operator/Owner

Actions
by
Operator

Feedback !

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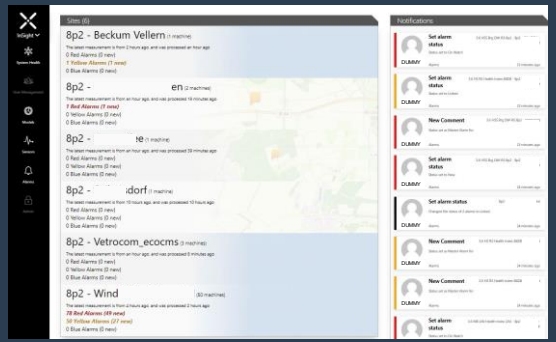
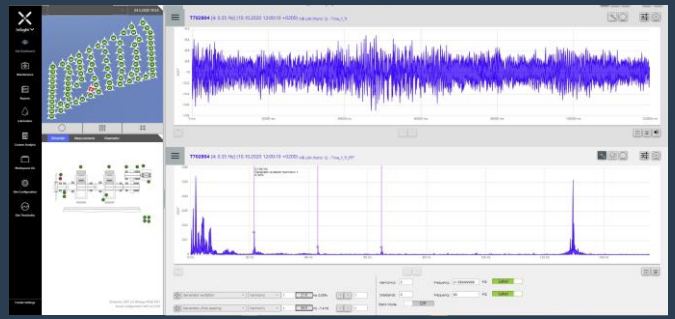
Usual data analysis by 8.2 - fleetMONITOR

Work place



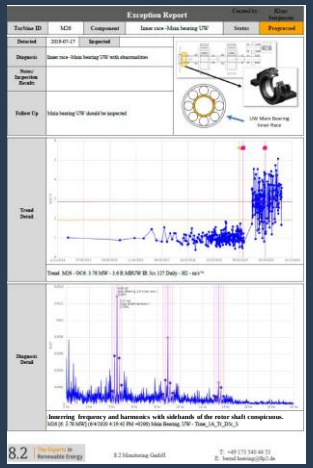
Dashboard – wind farm overview

Alert message



Analyses by Experts

Trend with Report marker



Report / Recommendation

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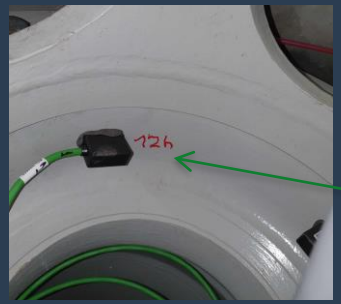
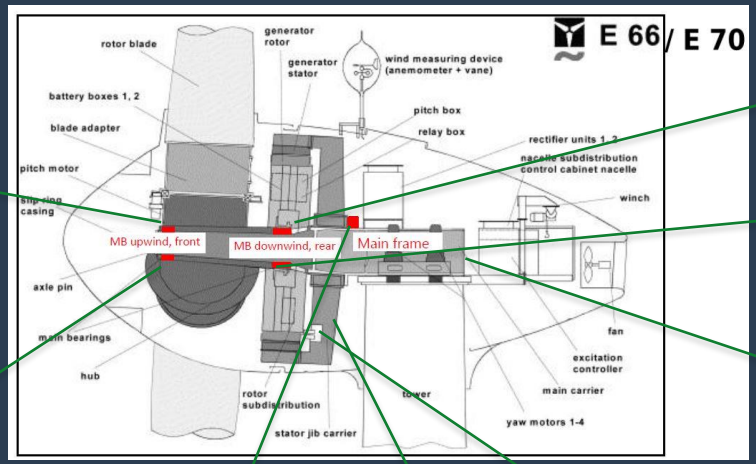
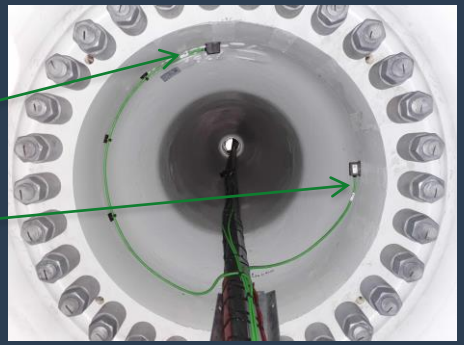
CMS retrofit E-70 / Sensor positions



Main bearing A, 12h





Main bearing B, 12h und 3h

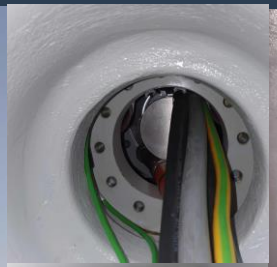
Main bearing A, 9h

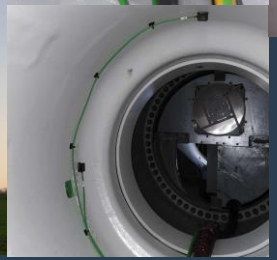
Main frame/Tower, 12h

Speed sensor, rpm0

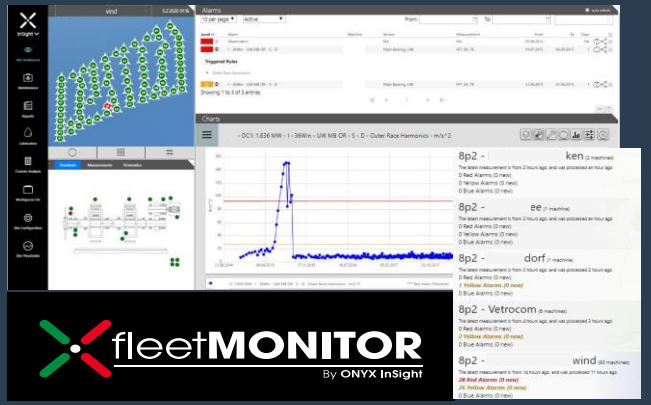
Rotor position, rpm1

Retrofit example – E-82 / GE1.5





3D-MEMS +
temp. sensor



ecoCMS
smart – fully digital
over 5.000 x installed

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“Next generation” SCADA-Monitoring

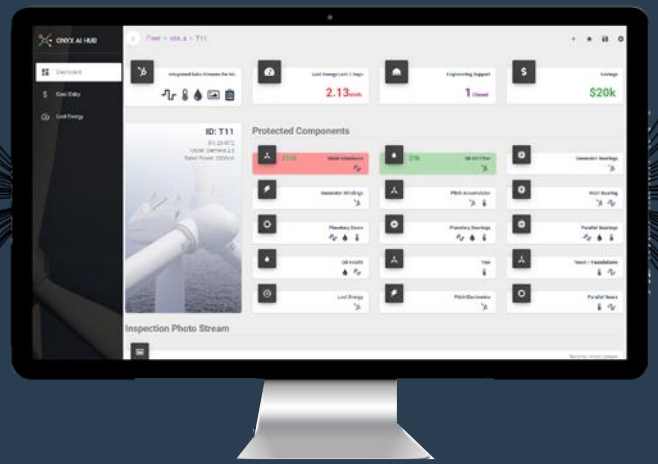
SCADA

Vibration

Oil-/Grease analysis

Inspections

CMMS (ERP, SAP)



Drive train

Loss of yield

Tower/Blades

Electronic

Engineering Support

AI - and MachineLearning (ML) algorithms coupled with proven engineering models

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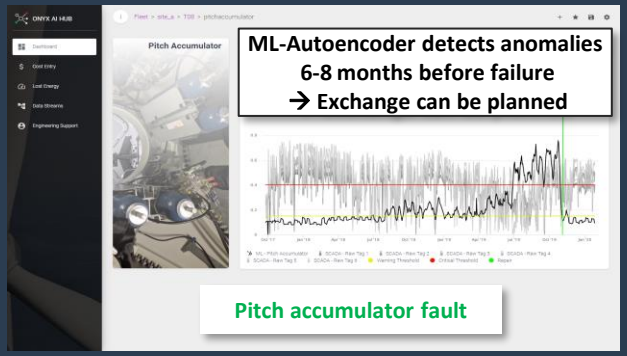
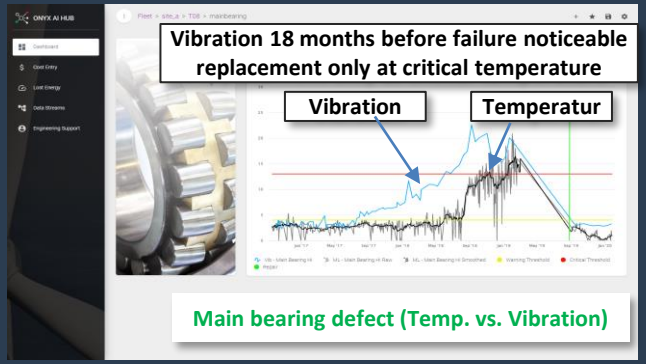
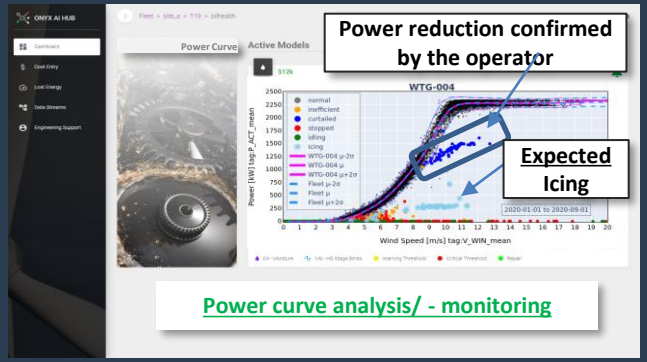
SCADA / AI HUB – Case study



Pitch accumulator fault



Main bearing defect (Temp. vs. Vibration)



Power curve analysis/ - monitoring

AI and Machine Learning (ML) algorithms coupled with proven engineering models to enable

- early detection of anomalies
- a proactive maintenance planning
- a prevention of damage progression
- the reduction of machine downtime

Lifetime extension of main bearing

- Main bearings are durable, but costly components, if damage occurs
- With ecoCMS and fleetMONITOR main bearings can be monitored safely
- In case of a detected damage, the operating time can be extended by many months with main bearing grease flushing
- The main bearing replacement can thus be optimally planned

Main Bearing Grease Flush - Technology

- Process with turbine-specific adapters
- Uses a specific light oil as flushing medium
- Cleans bearings from >95% of old grease and deposits
- Usually completed in one shift
- Closed process, no contamination of the plant
- Rinsing devices all bundled /Lift bags
- Patent protected by ONYX technology

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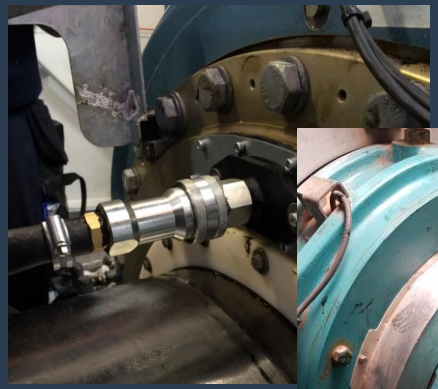
Main bearing flush - results

before

during

after



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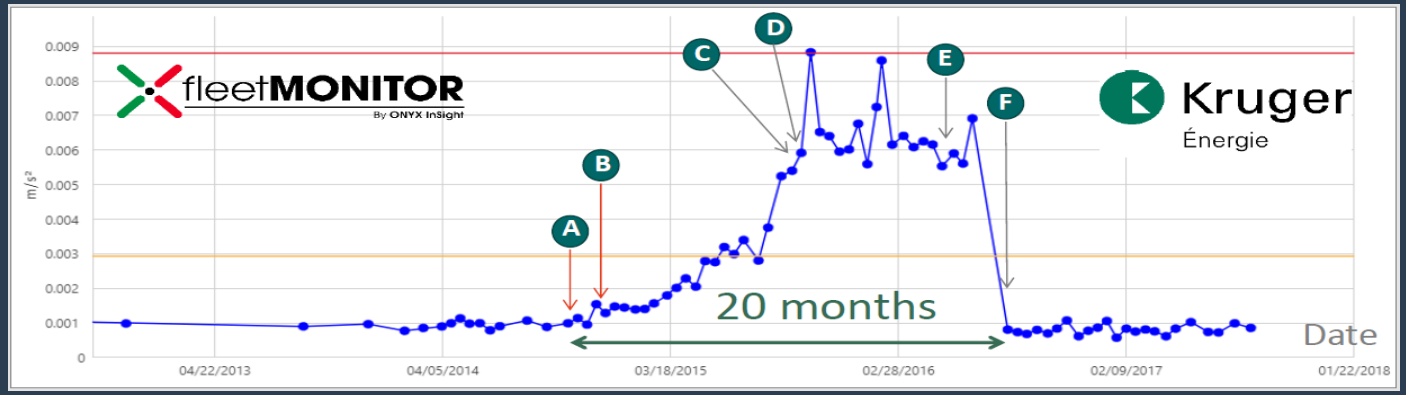
Case study – Main bearing flushing



	Activity	Comment
A	Fault detection by ecoCMS	Service report
B	Inspection video endoscopy	Damage confirmed
C	1st MB grease flushing	Abrasion, particles removed
D	Inspection Videoendoscopy	Damage confirmed
E	2nd MB grease flushing	Abrasion, particles removed
F	MB exchange	Combined repairs

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I will be happy to answer your questions

Link: https://onyxinsight.com/monitoring-hardware/
Link: https://onyxinsight.com/monitoring-software/