Opportunities in Predictive Maintenance in Wind Power Production

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Tribological Challenges in Industrial Applications
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Content

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Wind power production in Europe and Finland
The most common failures in wind turbines
Example case, Main gearbox failure
Our Company

Producing wind energy since 1998

Builders of the world’s first wind farm in offshore frozen sea conditions in Tahkoluoto, Pori

Managing the entire life cycle of wind farms from design to operation and maintenance

Cost-effective, competitive and market-based wind power

Strong ownership by 8 Finnish energy companies
Wind Farm Capacity

- 7+2 Wind farms in operation and under construction
- 410 MW nominal power in total
- 1200 GWh annually
**Wind Farms**

**IN PRODUCTION (MW)**
1. Annankangas, Raahe 34,5
2. Jokela, Kalajoki 36,0
3. Kuljunniemi, Raahe 20,7
4. Nikkarinkaarto, Raahe 34,5
5. Reposaari, Pori 15,6
6. Tahkoluoto offshore, Pori 44,3
7. Polusjärvi, Pyhäjoki (test phase) 43,0

**UNDER CONSTRUCTION (MW)**
8. Alajoki-Peruralinna 92,4
9. Oosinselkä, Pori & Eurajoki 93

**ONSHORE, IN PLANNING (MW)**
10. Siikajoki 251
11. Pesola, Soini 35-85
12. Korpi-Matti, Merikarvia 43
13. Perho, Kokkoneva 252-340

**OFFSHORE, IN PLANNING (MW)**
14. Tahkoluoto extension, Pori 400-550
15. Ulkonahkiainen, Raahe & Pyhäjoki 300-700
Growth in Wind Power Capacity in Europe

Top 6 (sum. Onshore and offshore)
- Germany (63 GW)
- Spain (27 GW)
- UK (24 GW)
- France (18 GW)
- Italy (11 GW)
- Sweden (10 GW)

Finland 2,6 GW at the end of 2020

Reference: Wind Europe, 2021
Wind turbine capacity increased by 26% in 2021. At the end of year 2021, there were 962 wind turbines in Finland, totaling 3257 MW. The feed-in tariff closed.
Fingrid Estimation of the Development of Wind Power Capacity in the 2020s

Figure: FG/ Mikko Heikkilä 15.3.2022
Wind Turbine Development

The most important individual component
Generally, the availability level are 95-98 %
– Depends on the degree of maturity of the product
Product development of wind turbines has been extremely fast in recent years
– Are products robust and reliable?

“Technically, there is no upper limit. That is certainly demonstrated by offshore. It really is an economic trade-off decision. How are you going to deal with the logistical challenges for a specific geography?”

Jorge Magalhães CTO, Siemens Gamesa (Recharge 1.12.2020)
Example of Wind Turbine Layout

- Pitch system
- Main shaft assembly
- Gearbox
- Hydraulic station
- Mech. brake
- Generator
- HV unit
- Yaw system

Reference: https://slideplayer.com/slide/5778016/
Failure Frequency and Downtime

Main Gearbox Failure

Alarm from one of the swaft sensor
More metal particles were found
Endoscope inspection: Severe tooth fracture in 1st stage planet gear
Lead time of crane and gearbox: 30 (90) days
Stop time total: 91 days
Repair time: 7 days
Lost production: 37 000 MWh
Lost revenue: 310 (316) kEUR
Potential savings: ~ 286 kEUR
Thank you!

Questions?