



Innovative technology to increase efficiency and extend the lifetime of gears and bearings



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Winterwind
INTERNATIONAL WIND ENERGY CONFERENCE
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REWITEC GmbH

- Founded in 2003
- Part of Cargill since July 2022



Manufacturer of

Phyllosilicate additive technology



- Close cooperation with research institutes and universities
- Patents in Europe, China and US



The challenges of unscheduled maintenance costs

- Design flaws, environmental conditions, missing or even wrong maintenance can cause unforeseen breakdowns:



Maintenance represents **25%** of the total wind turbine cost over its lifetime



Unscheduled maintenance represents **30 - 60 %** of total maintenance costs

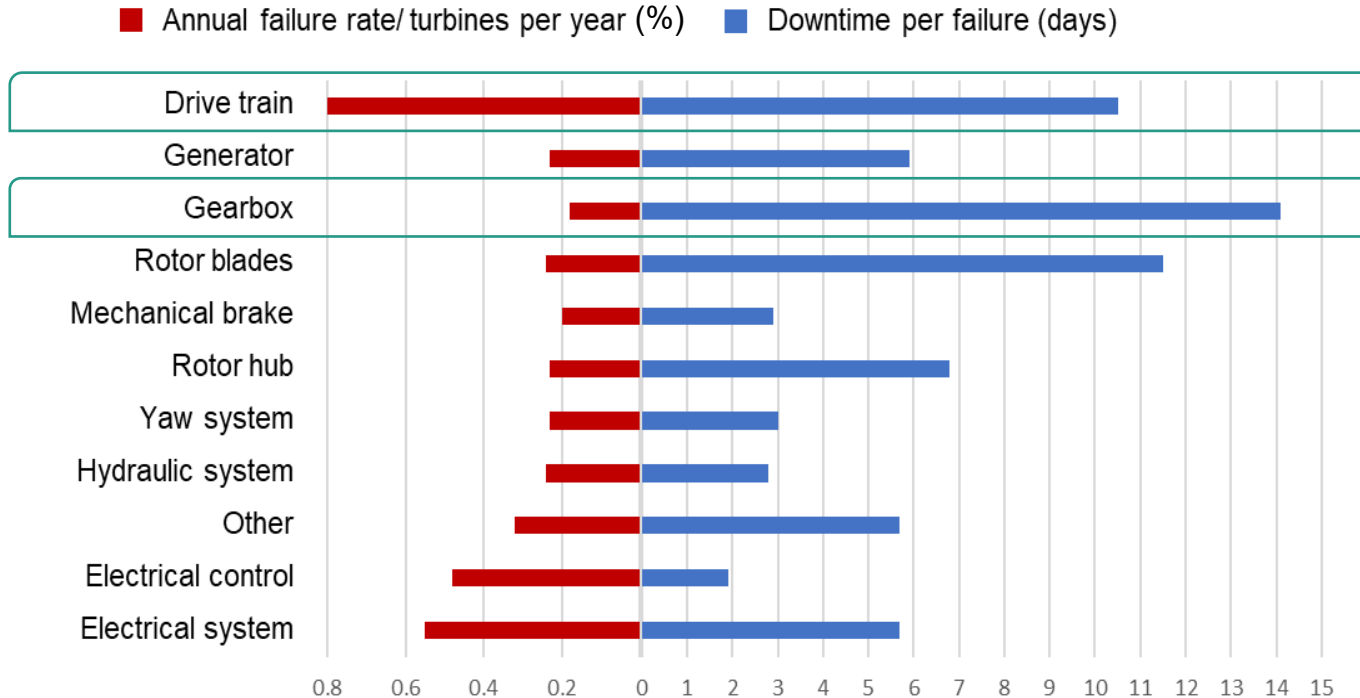


Up to **14 days** needed to repair a gearbox or bearing - more than any other component

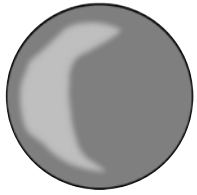


Average cost to repair a gearbox failure is **\$380,000**

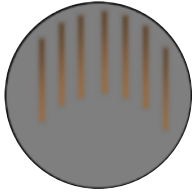
Wind turbine reliability remains an issue



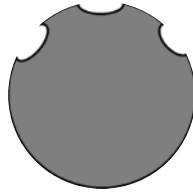
Typical damage to wind turbine gears & bearings



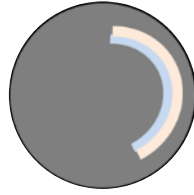
**Micropitting/
grey staining**



**Fretting
corrosion**



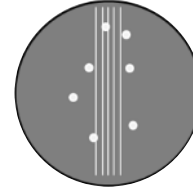
**False
brinelling**



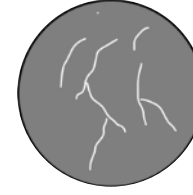
**Smearing and
scuffing**



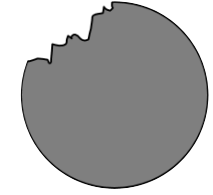
**Chemical
corrosion**



**Electric
damage**



**White etching
areas/
cracks**

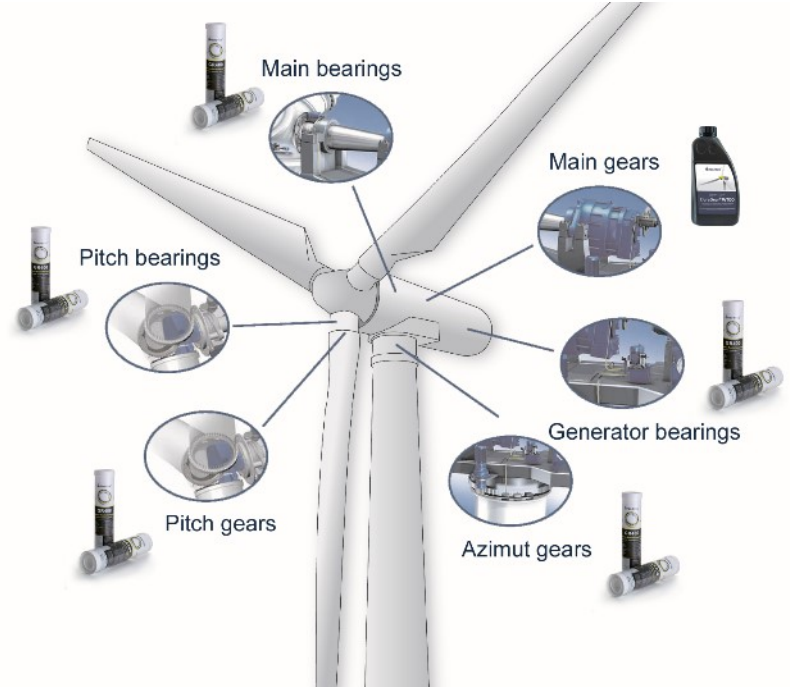


Macropitting

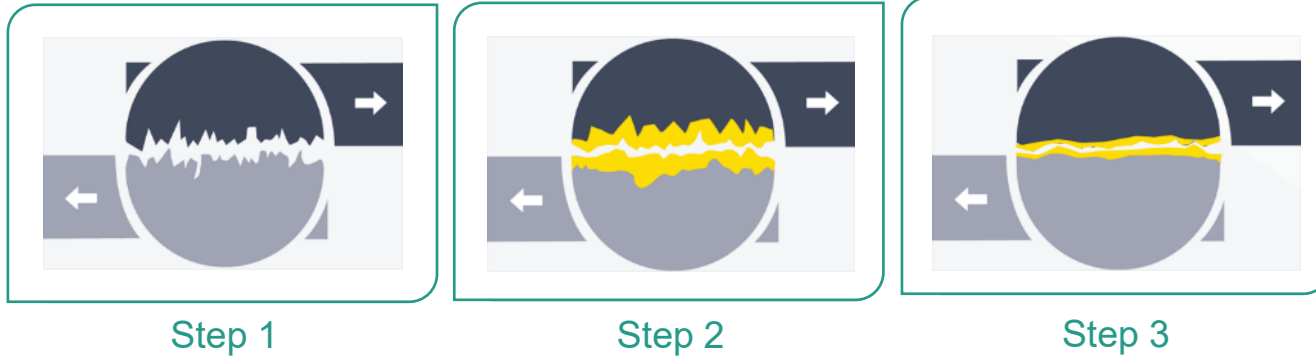


Application in wind turbines

- Surface damage can be costly, the technology can **prevent, repair** and **protect** them
 - More than 3,000 successfully treated wind turbines globally



How does it work?



Significant reduction of friction, wear, roughness and temperature

Advantages:

- Compatibility to all common lubricants
- Temperature independent
- No chemical interactions with other lubricant parts
- Low dosage

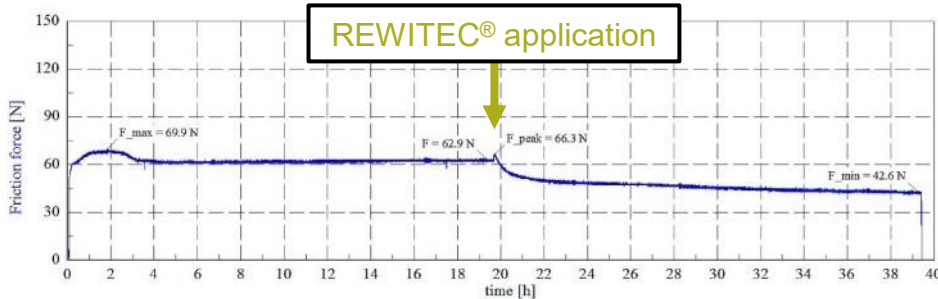
Scientific test

2-Disc assembly rolling wear test – gear oils



Reduction in friction

- Stress value: 1 GPa (normal force 2150 N)
- Rotating speed: 424 rpm / 339 rpm, slip 20 %
- Test-duration: 39,3 h
- Temperature: oil inlet temperature 60 ° C
- Friction coefficient: $\mu = \text{normal force} / \text{friction force}$



Castrol Optigear Synthetic X320



Oil	Friction reduction	Roughness reduction
Castrol Optigear Synthetic X320	33 %	41 %
Mobilgear SHC XMP 320	35 %	44 %
Klübersynth GEM 4-320N	40 %	54 %
Fuchs Unisyn CLP 320	36 %	50 %
Amsoil PTN 320	46 %	18 %
Shell Omala S4 GX 320	42 %	25 %
Klüberbio EG 2-150	55 %	40 %
Fuchs Pentosin EG FFL-7A	41 %	35 %
Automotive racing gear oil	55 %	40 %

Surface repair (short test)

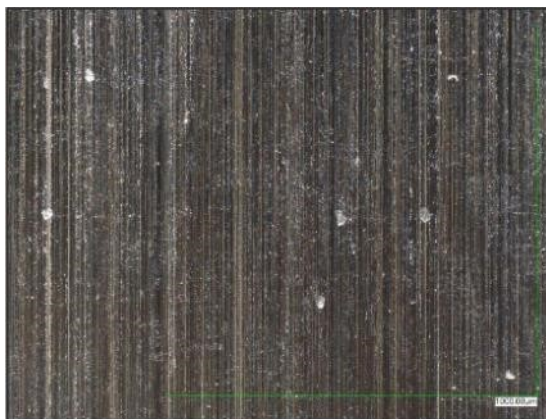


2-Disk surface roughness:

Ra reduced by 34 %

Rz reduced by 40 %

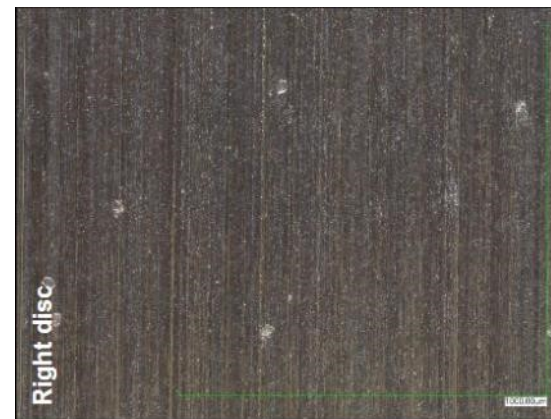
Blank disk



Ra = 0.30 μm

Rz = 2.70 μm

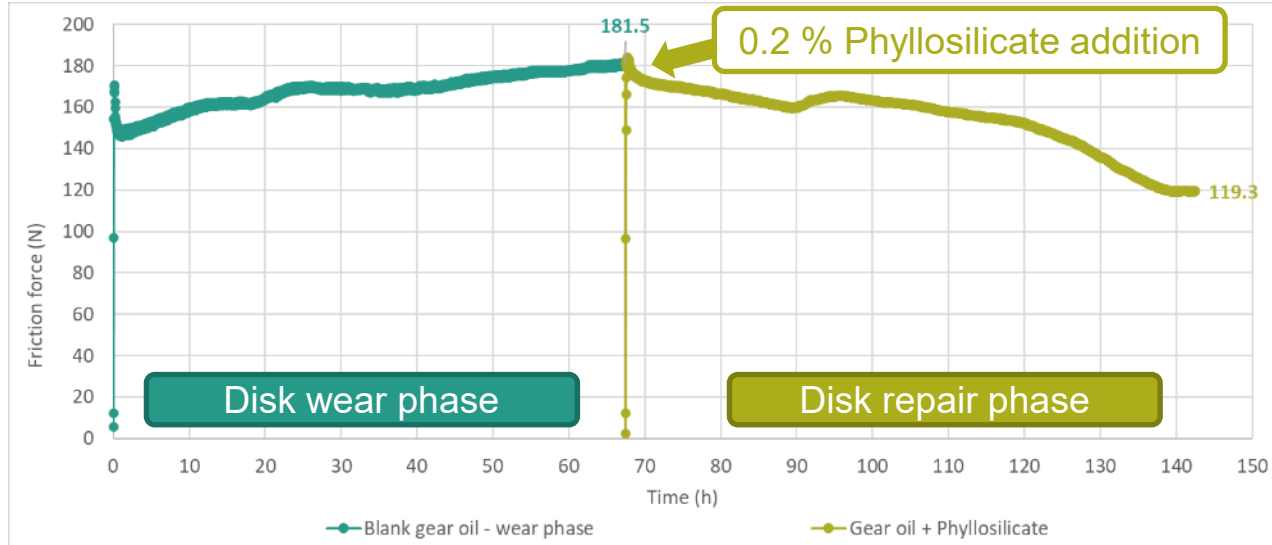
Gear oil + Phyllosilicate



Ra = 0.20 μm

Rz = 1.62 μm

Friction reduction (endurance test)

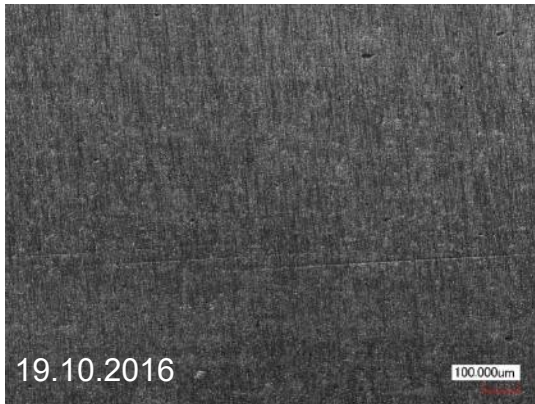
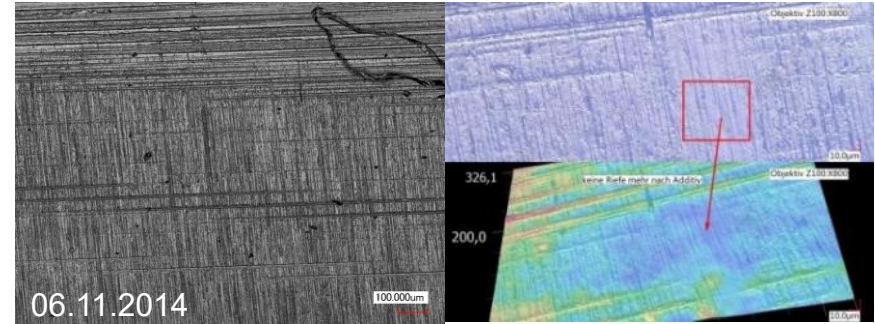
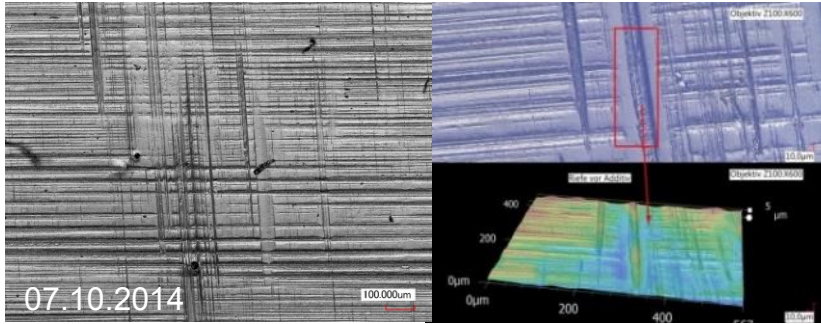


Cargill 2-disk test rig endurance test

- ISO VG 320 industrial gear oil
- Load: 2190 N
- The Phyllosilicate technology gave a 62 N (34 %) reduction in friction force
- Rotating speed: 424 rpm / 339 rpm, slip 20 %
- Oil temperature: RT 10 °C

Example of application

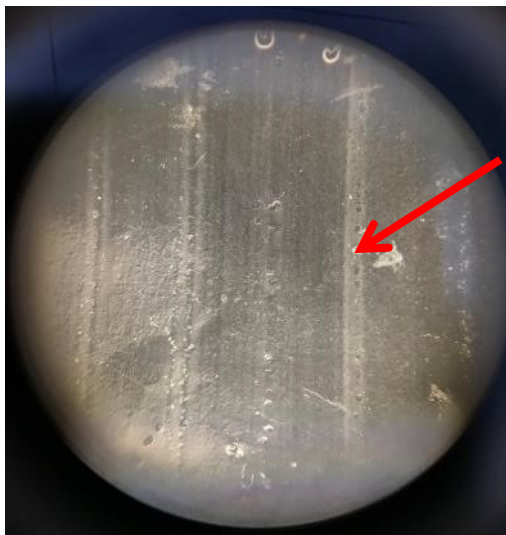
- Wear development on a Bosch Rexroth gear tooth (GE 1.5 SL) over a period of two years



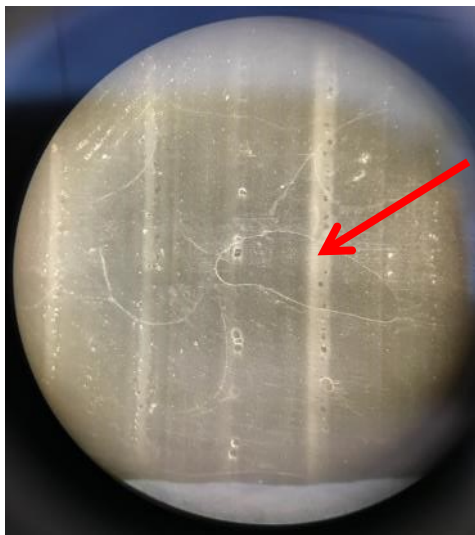
- Run through marks on the tooth flank after 6 weeks and 2 years:
 - Reduction of the surface roughness and friction force
 - Improved load carrying capacity
 - Less stress for the tooth flank

Coating and analysis of a GE 1.5 MW wind turbine main bearing (outer ring)

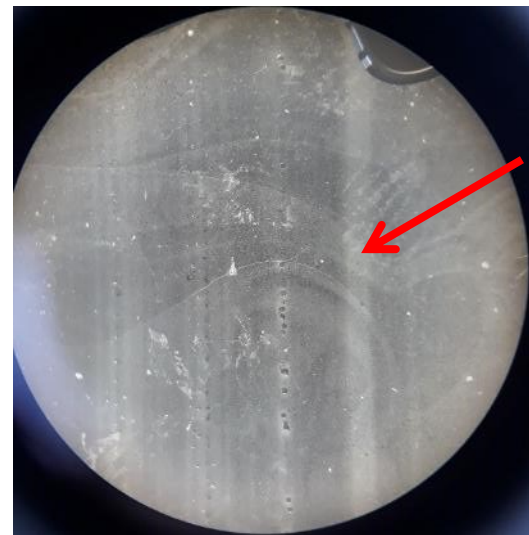
Picture: Before wind turbine was treated



Picture: **5 months** after wind turbine was treated with additive



Picture: **12 months** after wind turbine was treated with additive



→ Red arrow shows the same right track on the surface imprint

Coating and analysis of a GE 1.5 MW wind turbine main bearing (outer ring)

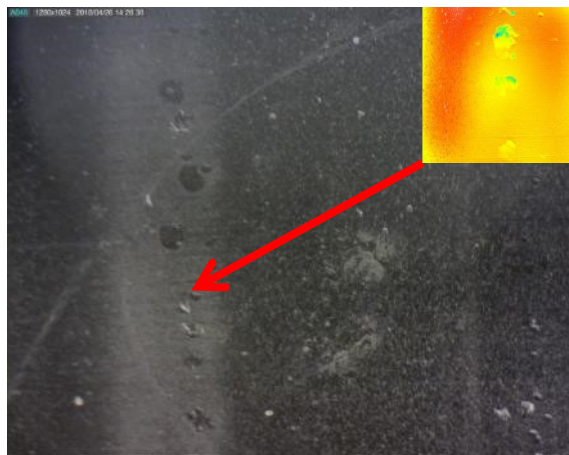
Picture: Before wind turbine was treated

Ra = 0,556 μm (within the track)



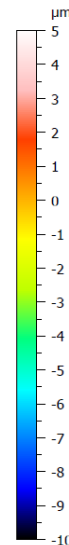
Picture: 5 months after wind turbine was treated with additive

Ra = 0,403 μm (within the track)



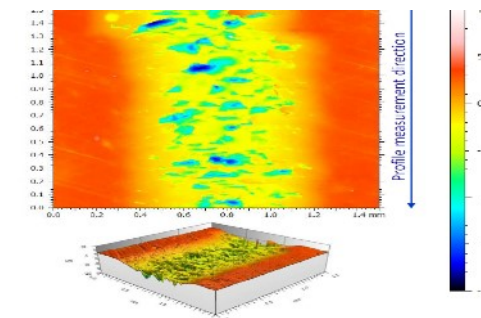
Picture: 12 months after wind turbine was treated with additive

Ra = 0,225 μm (within the track)

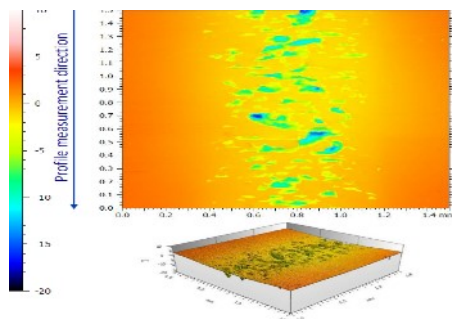


Red arrow shows the same right track on the surface imprint

Main bearing (outer race) on GE 1.5 MW wind turbine



Before wind turbine was treated with additive

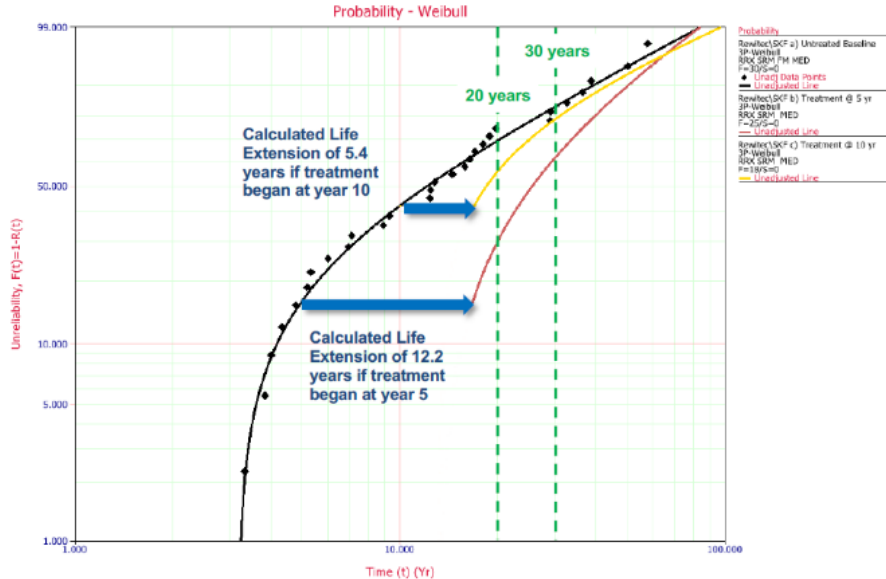


6 months **after** wind turbine was treated with additive

Calculated life extension of up to 17 years

Acciona AW1500 Generator Side Mainshaft bearing – SKF 23188

file:///C:/Users/.../www.skf.com



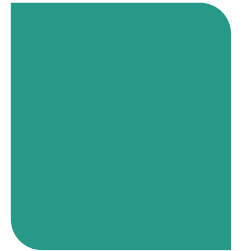
- **Results:**
 - Significant reduction in the probability of failure of a main bearing by REWITEC®
 - Less roughness
 - Less friction
 - More even load distribution
 - Lower local pressure/stress



The earlier the application, the greater the lifetime extension

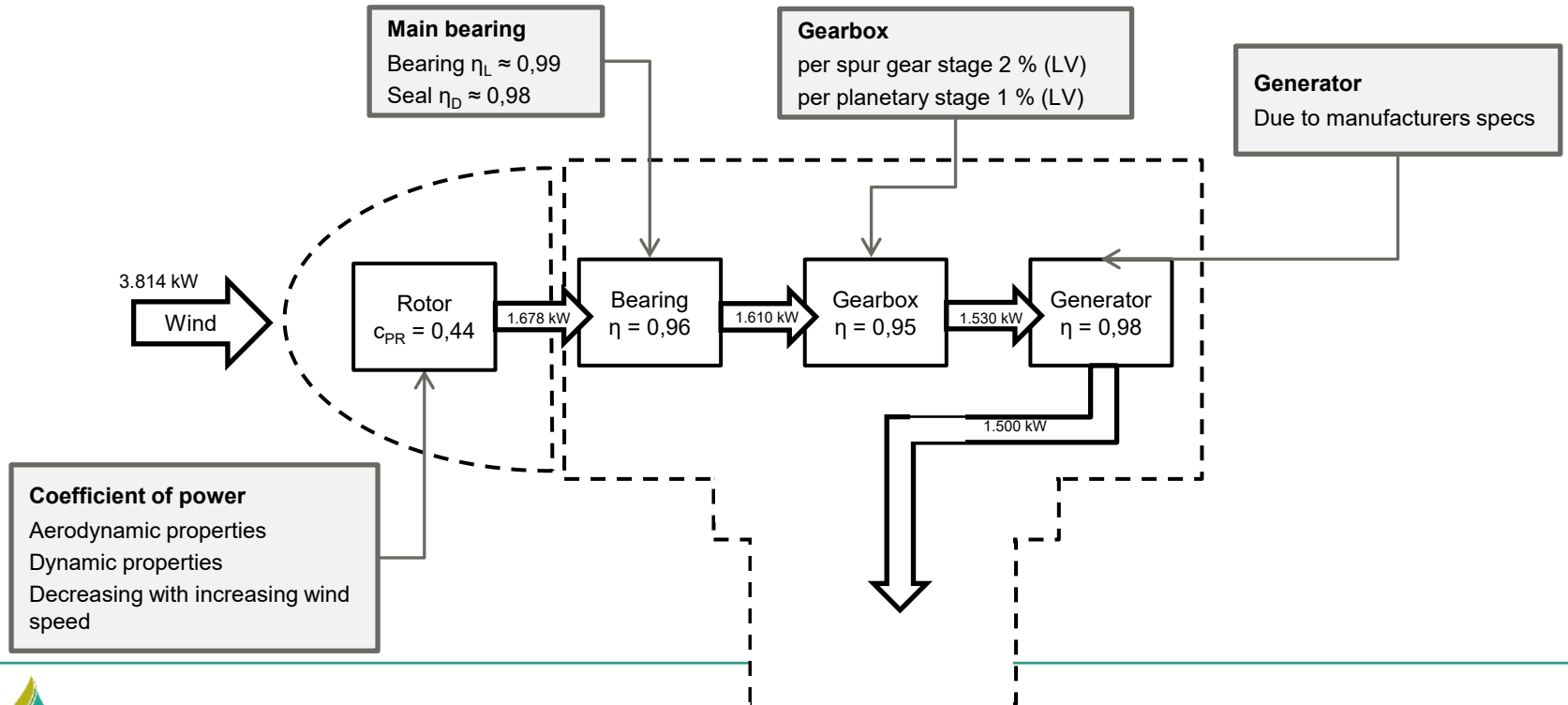
Efficiency project

- Efficiency and power loss
 - Suedwind S77(REpower MD77)
 - Rated power 1,500 kW
 - Hub height 85 m
 - Commissioning 2002

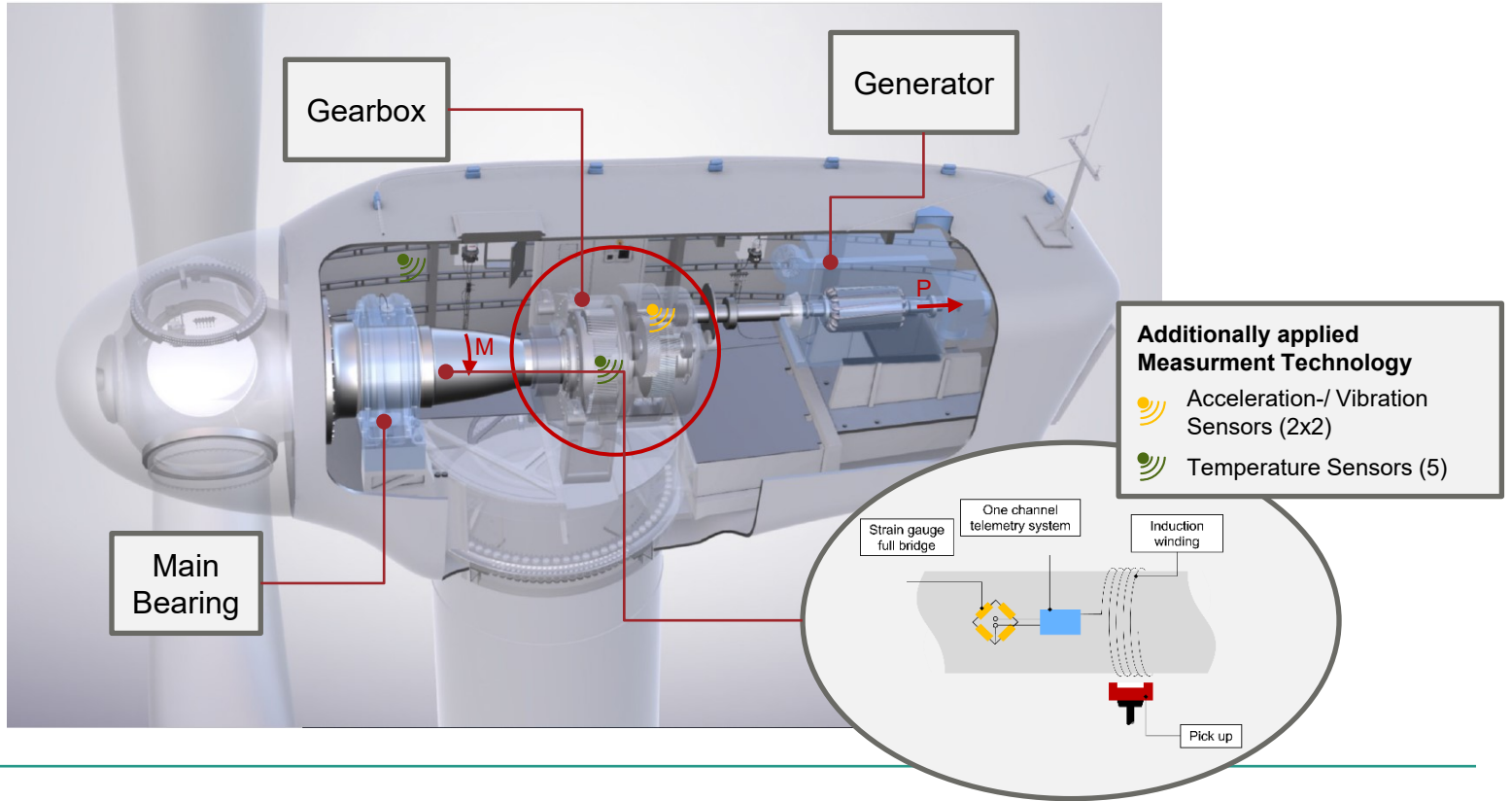


Efficiency (powerlosses)

Of the mechanical-electrical Drivetrain of Suedwind S77 Wind Turbines



Planned Measurement Technology by Windtest Grevenbroich



Our services



Technical consulting,
up-tower inspections



Component surface
imprinting



Component damage
analysis and reporting

Conclusion

- Less surface roughness, friction and temperature in the drive train system means:
 - Less stress and wear for gearboxes and bearings
 - Less stress and longer life for the lubricants
 - Repairing and protection effect
 - Higher efficiency
 - Higher reliability and availability, no downtime
 - Significant lifetime improvement
 - Cost savings, higher earnings



Do you need more information?

Please do not hesitate to contact us.

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