



“TTS stands for an environmentally friendly, sustainable, cooperative business development aimed at achieving win-win situations for both parties.”

### The all-in-one solution

#### Troubleshooting

- Of different types of turbines, converters, electrical system, mechanical system and hydraulic system
- Mobile vibration measurements and expert analysis
- Visual inspection and video endoscopy of the gearbox
- Generator (transmission) alignment
- Operational balancing of the rotor

#### Maintenance

- Regular maintenance as per manufacturers specifications (mechanical and electrical)
- Inspection and repair of rotor blades
- Converters maintenance as per maintenance specifications
- Preventive maintenance (mobile vibration measurement, drive train alignment, field balancing)

#### Service

- 24/7 data remote control (monitoring, reset, data analysis, field support)
- Spare parts supply (converter SEG system, MITA controller and parts, Bosch hydraulics, gearbox and generator, blades and hub)
- Immediate assistance at any time (24/7)
- Training - we offer full training for the customers and their staff

### The TTS way

- Independent service provider and further establish total customer orientation
- Best performances in communication, service and quality
- Partnership and personal contact as the best base for development
- Qualified TTS engineers & knowledge
- 17 years' experience
- Best in class in customer satisfaction

[www.tts-renewable.com](http://www.tts-renewable.com)

### Your worldwide partner for wind turbines!

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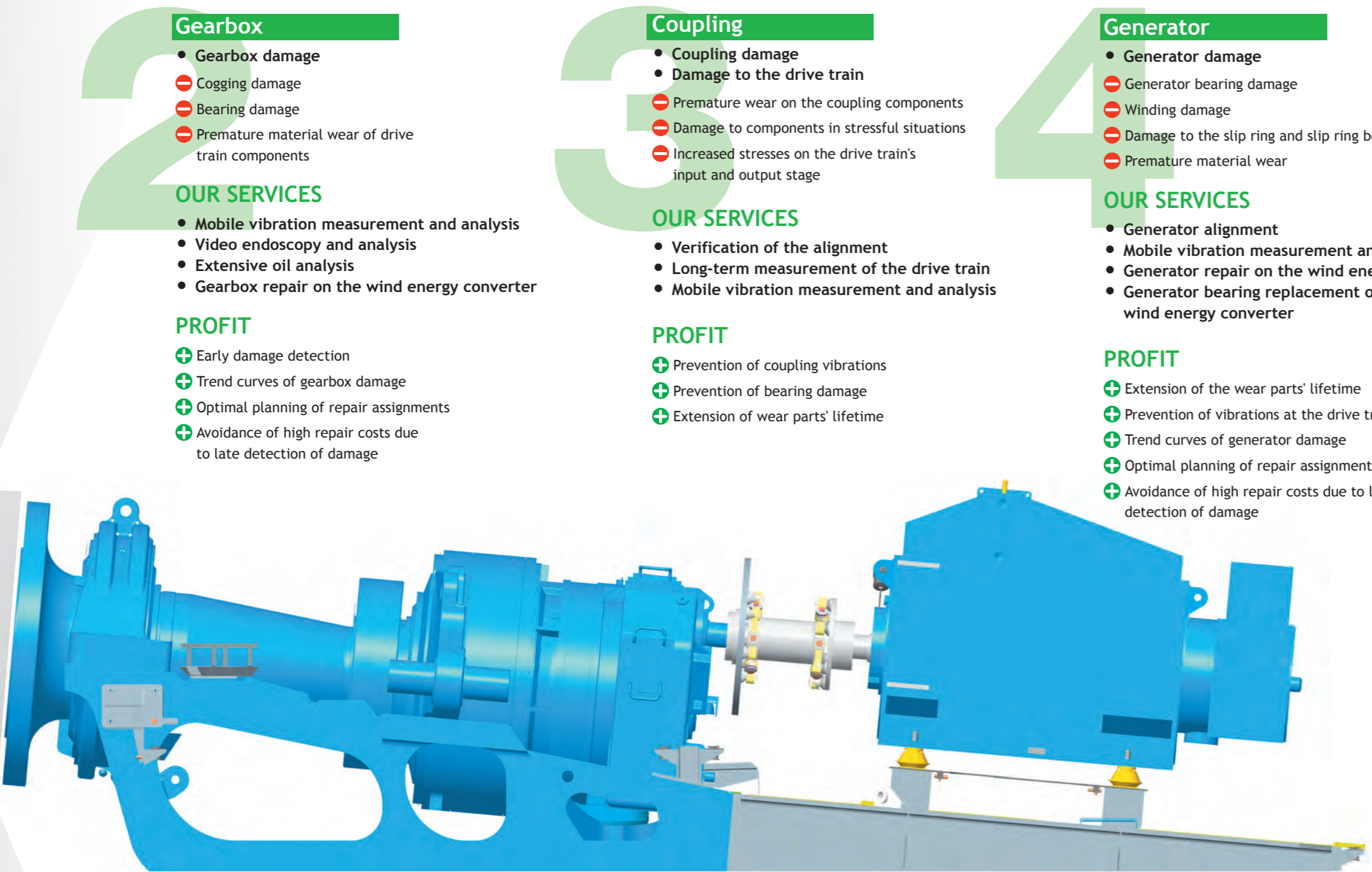


*Wind turbine optimization*



# With us you rotate right...

## Damage / Faults and how to avoid them.



### Rotor / Rotor blades

- Aerodynamic imbalance
- Mass imbalance
- ➖ Later start of the wind energy converter
- ➖ Reduced production
- ➖ Premature material wear on bearings and fastening components
- ➖ High repair costs in the event of damage

### OUR SERVICES

- Photographic blade angle measurement and adjustment
- Field balancing (measurement and elimination of the imbalance)
- Rotor blade expertise and rotor blade repairs

### PROFIT

- ⊕ Earlier start of the wind energy converter during periods of weak wind
- ⊕ Prevention of drive train vibrations in all speed ranges
- ⊕ Extension of the wear parts' lifetime

### Gearbox

- Gearbox damage
- ➖ Cogging damage
- ➖ Bearing damage
- ➖ Premature material wear of drive train components

### OUR SERVICES

- Mobile vibration measurement and analysis
- Video endoscopy and analysis
- Extensive oil analysis
- Gearbox repair on the wind energy converter

### PROFIT

- ⊕ Early damage detection
- ⊕ Trend curves of gearbox damage
- ⊕ Optimal planning of repair assignments
- ⊕ Avoidance of high repair costs due to late detection of damage

### Coupling

- Coupling damage
- Damage to the drive train
- ➖ Premature wear on the coupling components
- ➖ Damage to components in stressful situations
- ➖ Increased stresses on the drive train's input and output stage

### OUR SERVICES

- Verification of the alignment
- Long-term measurement of the drive train
- Mobile vibration measurement and analysis

### PROFIT

- ⊕ Prevention of coupling vibrations
- ⊕ Prevention of bearing damage
- ⊕ Extension of wear parts' lifetime

### Generator

- Generator damage
- ➖ Generator bearing damage
- ➖ Winding damage
- ➖ Damage to the slip ring and slip ring body
- ➖ Premature material wear

### OUR SERVICES

- Generator alignment
- Mobile vibration measurement and analysis
- Generator repair on the wind energy converter
- Generator bearing replacement on the wind energy converter

### PROFIT

- ⊕ Extension of the wear parts' lifetime
- ⊕ Prevention of vibrations at the drive train
- ⊕ Trend curves of generator damage
- ⊕ Optimal planning of repair assignments
- ⊕ Avoidance of high repair costs due to late detection of damage



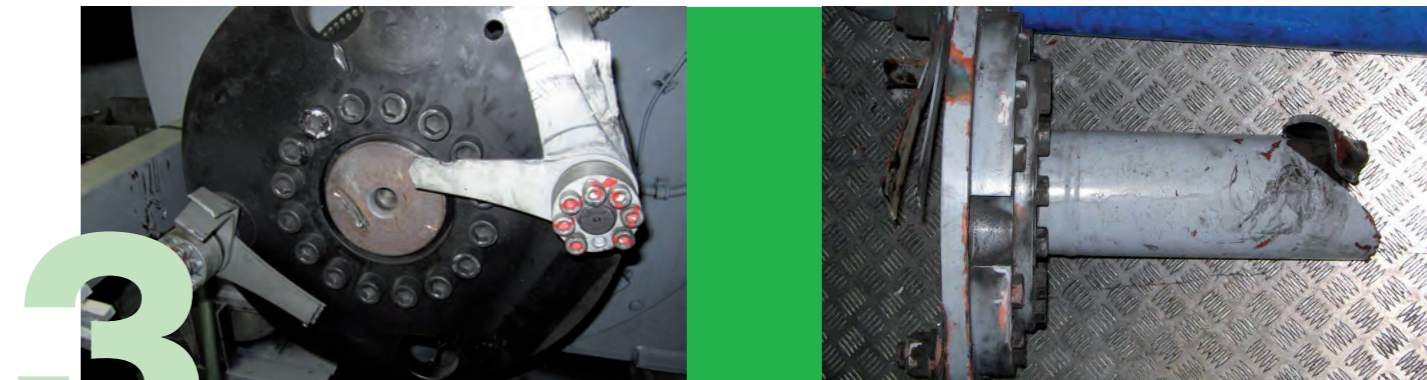
Blade tip damage

Burst trailing edge



Bearing damage

Inner ring damage



Defect on the disk pack

Coupling demolition



Rollover damage

Defect on the slip ring

## Further problems due to drive train vibrations!

- Damage to the nacelle cladding
- Damage to hydraulic components

- Damage to the machine frame and load-bearing components
- Damage to the control cabinets and installed components

- Damage to pumps / units
- Damage to various bearings