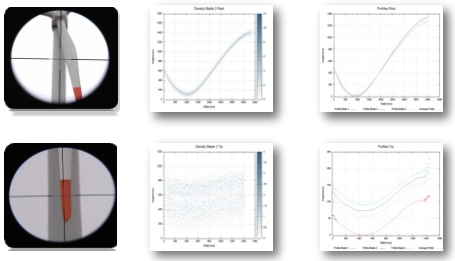
ROMEG

Laser based measurement of the rotor geometry

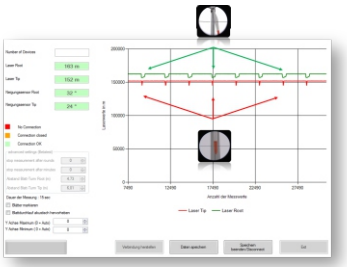
Method of measurement

Dynamic Geometry Measurement (DGM) is a method for the verification of the aerodynamic condition and the aero-elastic behavior of a wind turbine rotor and the turbine itself.

Data processing



Data recording



Analysis of data on site

-The results are immediately availabe on site after recording and analysis
- Measuring process is fast thus allowing to measure whole wind farms within a short time

- Measurements are taken during turbine operation: No yield losses and in real operating conditions.
- The asymmetries of the rotor and the axial movement of the tower are assesed at the same time, thus enabling the measuring and observing of the overall behaviour of the WTG under real operating conditions.

Measurement parameters

Angular differences at root section: accuracy ± 0.15

Angular differences at tip section: accuracy ± 0.3°

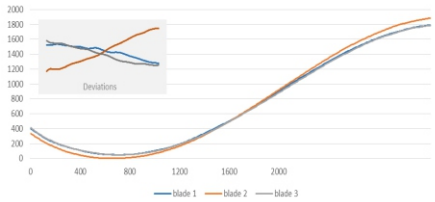
Radial sharing: accuracy ± 0.01°

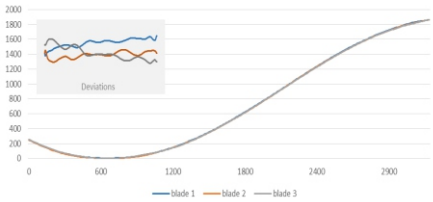
Tower clearance: accuracy ± 50mm

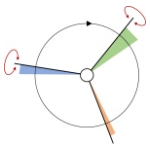
Tower movement: accuracy ± 10mm

Functions of the ROMEG system

The main function of the ROMEG system is the measurement of relative blade angle deviations.







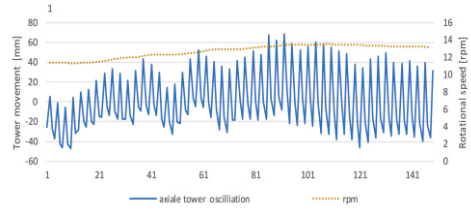
According to our our data of measuring more than 1500 Wind turbines (WTG):

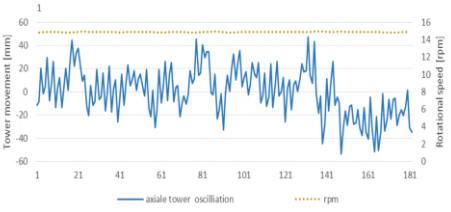
20% of the WTG: deviation of more than 1° ⇒ urgent need for correction.

40% of the WTG: deviation between 0.5° and 1° ⇒ need for correction.

40% of the WTG: deviation of upto 0.5° ⇒ no need for correction

Tower movement





In this graph you see the axial tower movement and rotational speed before and after correction of the blade angles. The oscillation behaviour of the tower is an indicator of the detected blade angle deviations.

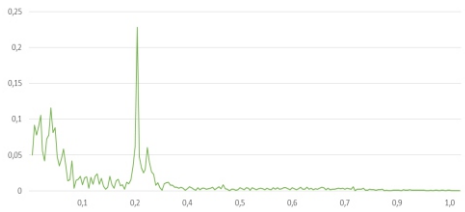
With annual measurements you can detect changes in the behaviour of the tower and the foundation.

Reduction/increase of tower top and yaw bearing lifetime (years) for various pitch misalignment configurations, for example at a 3MW Turbine.

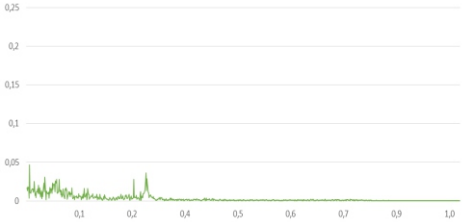
m	0/0/1 °	0.5°/0/-0.5°	0/0/2 °	1°/0/-1°	0/0/3 °	1.5°/0/-1.5°
3	-1.16	-1.26	-4.59	-4.26	-3.37	-7.58
4	-2.16	-2.06	-6.99	-6.39	-7.58	-10.43
5	-3.17	-2.83	-8.87	-8.12	-10.28	-12.37
6	-4.12	-3.54	-10.28	-9.47	-12.01	-13.69
7	-4.98	-4.16	-11.37	-10.54	-13.21	-14.65
8	-5.78	-4.72	-12.26	-11.43	-14.11	-15.40
9	-6.56	-5.22	-13.02	-12.21	-14.84	-16.02
10	-7.33	-5.68	-13.69	-12.89	-15.48	-16.55
11	-8.10	-6.11	-14.29	-13.50	-16.05	-17.02
12	-8.88	-6.52	-14.83	-14.05	-16.55	-17.42

Vibration analysis of the tower movement - FFT analysis

Before correction



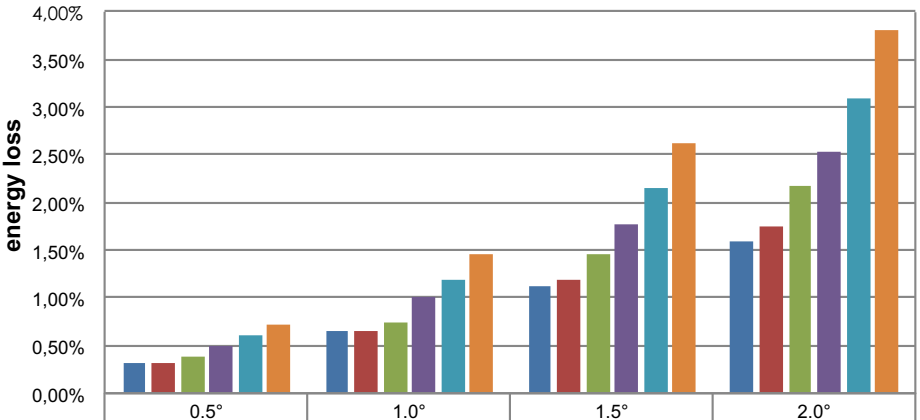
After correction



Technologies under development

- Laser distance measurement from the nacelle
- Divisions of rotor segments - mass imbalance
- Load classification
- Yaw compensation

calculated energy loss vs.pitch angle differences vs. avg.windspeed



	0.5°	1.0°	1.5°	2.0°
6.5m/s	0,33%	0,65%	1,13%	1,60%
6.0m/s	0,33%	0,65%	1,20%	1,75%
5.5m/s	0,38%	0,75%	1,46%	2,18%
5.0m/s	0,50%	1,00%	1,76%	2,53%
4.5m/s	0,60%	1,20%	2,15%	3,10%
4.0m/s	0,73%	1,45%	2,63%	3,80%

The measuring process with ROMEG is carried out on turbine in operation:

- No yield losses during measurement
- Measurement takes place under real conditions
- Fast measuring process - whole wind farms within a short time
- Results are immediately available

A well balanced rotor results in:

- Better performance
- Higher availability
- Longer service-life of all components

Please contact us for an offer for the measurement and optimization of your plants or if you have any questions on this subject.

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