

## Center for Wind Power Drives (CWD) RWTH Aachen University, Germany



*4 MW nacelle test bench with device und test*

### General description of facility

At CWD a 4 MW wind energy system test bench is available to examine entire drive trains of wind turbines generators (WTG). The rotational drive is provided by a direct drive motor with high dynamic capabilities. For realistic loading the rotor flange of the WTG, a wind load simulator is available for applying tilt-bending, yaw-bending, rotor thrust and weight and lateral forces in order to control all six mechanical degrees of freedom. The imposed loads are sensed in all DOF.

The electrical power generated by the test WTG during operation is feed in a grid emulator build by 20 MVA electronic converters. The grid emulator is designed to test grid compliance according to international standards and addresses 50 Hz and 60 Hz supply grids as well as fault cases such as voltage dip, overvoltage and frequency shift.

To enable the test turbine with real natural frequencies a Hardware-In-the-Loop system (HIL-system) is developed by CWD. By using the HIL-system the WTG controller can be integrated in test scenarios and the drive train operates with realistic dynamic in 3D wind fields. HIL technology is also available to control the grid emulator.

Various industrial wind turbines have been tested with the 4MW test stand. However, two research nacelles are available at the 850 kW and 2.7 MW power levels, which have been modified by numerous in-house modifications such as

- Modified gearbox (gear geometry, bearings, ...)
- Conversion of the main bearing from a 4-point to a 3-point suspension system
- Equipping the 3-point suspension system with an asymmetrical spherical roller bearing
- Exchange of the electrical equipment from full converter to partial converter, etc.

The available research nacelles have therefore lost their original industrial character. Additionally, there are different simulation models, based on Simpack MBS and Matlab, available at the CWD.

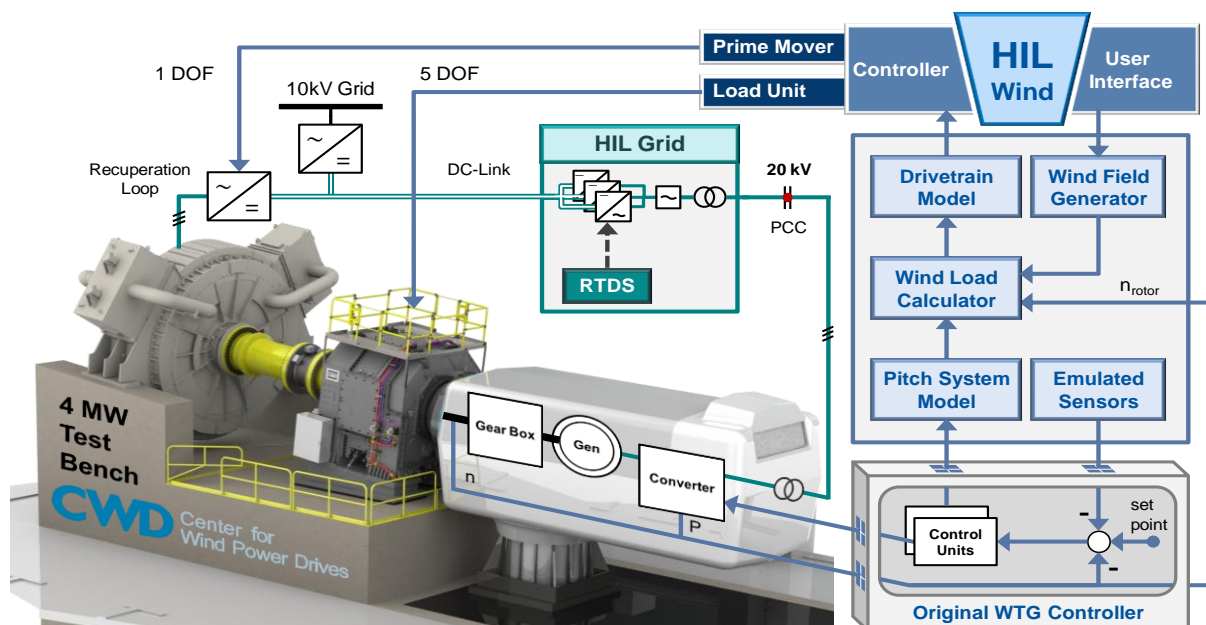
## Location of site

The CWD is located in Aachen, Germany, on Campus Boulevard 61 near the Dutch border. It is accessible by public transport and by car.

- The coordinates are: 50° 47' 04" N 6° 02' 40" E
- Plus Code: Q2MV+R4 Aachen

## Control and measurement systems and signals.

A flexible measuring system with approx. 500 channels is available at the 4MW test stand. For the best possible signal-to-noise ratio, we work with distributed front ends that are placed as close as possible to the sensors and send the measured values via LAN to the central measuring computer in the observation room. The channels can be configured with three different time bases - very fast, moderately fast, slow. The built-in sensor technology is determined by the experiments.



*Hardware In the Loop scheme*

## Research possibilities

Possible Topics:

- Round robin test with comparison of test bench investigation and field test of a complete WTG
- Lifetime estimation of blade bearings under IPC and CPC
- SCADA data investigation with respect to WTG condition monitoring

Preferred are binational or European research projects, small investigation as starters can be discussed.

## Contact data and more information

Name: Ralf Schelenz

e-mail: [ralf.schelenz@cwd.rwth-aachen.de](mailto:ralf.schelenz@cwd.rwth-aachen.de)

phone +49 241 8096797

Website: [www.cwd.rwth-aachen.de](http://www.cwd.rwth-aachen.de)

LinkedIn: <https://www.linkedin.com/company/center-for-wind-power-drives>