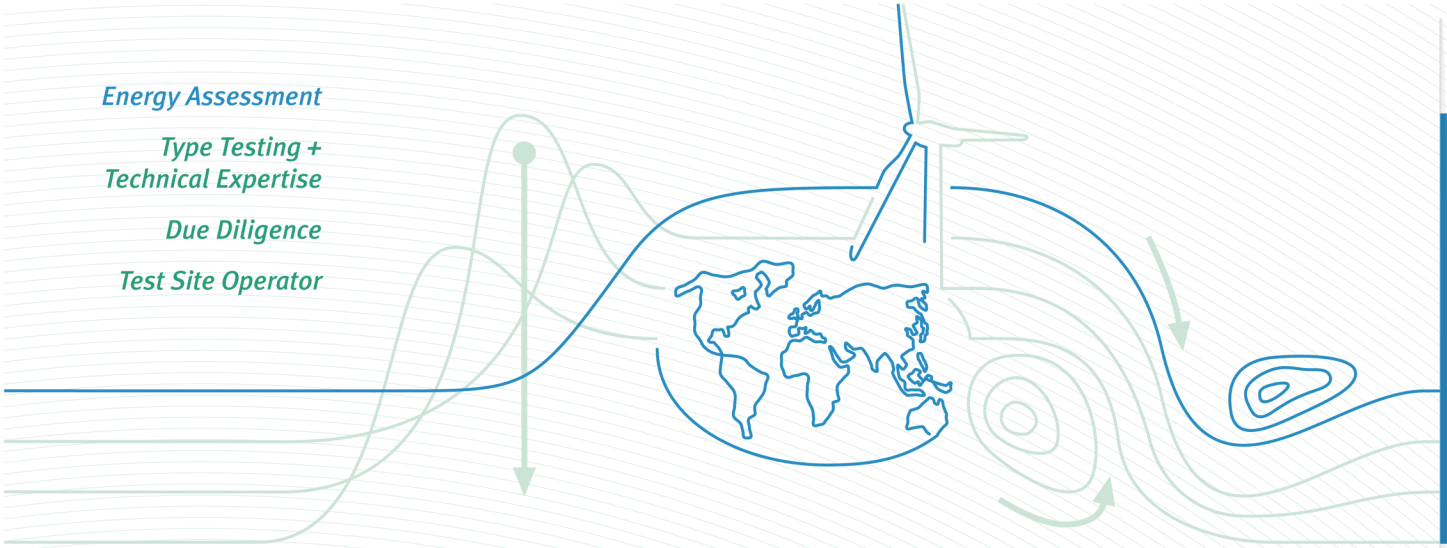
Energy Assessment

Type Testing +
Technical Expertise

Due Diligence

Test Site Operator



Energy Assessment

References
windtest grevenbroich gmbh

Company Profile

More than 18 years of experience in an industry that is only little older. Since 1996, windtest grevenbroich gmbh (wtg) provides predominantly manufacturers, planners and operators, but also authorities, the finance sector and private individuals, first-class services in the areas of planning, development, optimisation, quality assurance and consulting in the technological and economic advancement of wind energy – both on the domestic market and abroad.

Innovations and optimisation measures for turbines, PV systems, components, CHPs, combustion engines or complete wind and PV farm configurations in relation to grid requirements are assessed in every detail, measured and planned by more than 35 experts – either on the company-owned, one of the worldwide largest test field for inland wind turbines in Grevenbroich, or locally at the customer's sites. Thus wtg makes a considerable contribution to the improvement of the technology and efficiency, the acceptance and the export opportunities of wind energy farms.

The measurements and expert reports of wtg-specialists provide customers with the very certainty they need for planning and implementation of wind energy projects. After all, reliability is our highest principle. We are also involved in numerous national and international bodies, ensuring that our staffs always have their fingers on the "pulse of time". On the other hand, their work results frequently affect statements, standards, or the legislation.

www.windtest-nrw.de

windtest
grevenbroich gmbh

windtest grevenbroich gmbh
Frimmersdorfer Straße 73a
41517 Grevenbroich · Germany
Phone +49 (0) 2181-22 78-0
Fax +49 (0) 2181-22 78-11
E-mail info@windtest-nrw.de

The shareholders of the windtest grevenbroich gmbh are:

- 25,0 % Federal state of North-Rhine-Westphalia (NRW), represented by NRW BANK
- 37,5 % RWE Innogy GmbH (utility)
- 12,5 % District of Neuss (authority)
- 12,5 % City of Grevenbroich (authority)
- 12,5 % ee energy engineers GmbH (TUEV Nord group).

The diversified shareholder structure (utility operator, private company, municipalities) guarantees the independence of our services.

Test site Grevenbroich

www.windtest-nrw.de

windtest grevenbroich gmbh

windtest grevenbroich gmbh
Frimmersdorfer Straße 73a
41517 Grevenbroich · Germany
Phone +49 (0) 2181-22 78-0
Fax +49 (0) 2181-22 78-11
E-mail info@windtest-nrw.de

Our Quality References

- **Operator** of an **onshore test site** for inland wind turbines in Germany
- Exclusive partner for all measurement services for the largest **onshore test site in Europe** in the Netherlands
- DAKKS accredited according to **IEC 17025**, signed the Multilateral Agreement (MAL)
- **Independent** (referring to the shareholder structure of windtest grevenbroich gmbh)
- Full Member and Chairwoman of **MEASNET** Group (international organization)
- Member of **EWEA** (European Wind Energy Association)
- Member of **AWEA** (American Wind Energy Association)
- Member of committee for standardisation **FGW** (national organization)
- Member of working Committee Noise Emission (national organization)
- Member of working Committee Renewable Energies / Wind energy **VGB Powertech** (international organization)
- Member of Windgutachterbeirat und Sachverständigenbeirat des Bundesverband Windenergie e.V. **BWE** (national organization)
- Named Measuring Body for Sound Measurements according to §26 of the German Immission Control Law (**BImSchG**) (national organization)
- Partnerships or common projects with **universities in Brazil, Germany, South Korea** (International)

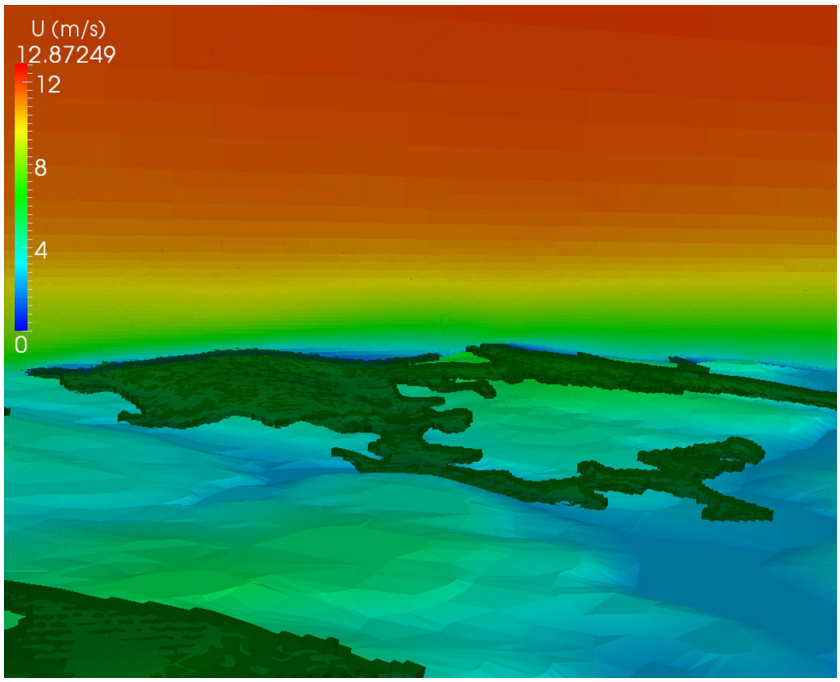
www.windtest-nrw.de

windtest grevenbroich gmbh

windtest grevenbroich gmbh
Frimmersdorfer Straße 73a
41517 Grevenbroich · Germany
Phone +49 (0) 2181-22 78-0
Fax +49 (0) 2181-22 78-11
E-mail info@windtest-nrw.de

Energy Assessment

Since 1996 wtg realized world-wide more than 1.750 projects in the field of site / energy assessment. Our services (site assessment, wind mapping, micrositing, technical due diligence) are requested in many **European countries** (e.g. Germany, France, Poland, Greece, Turkey, Luxembourg, Spain, Bulgaria, etc.) but also **on global level** (e.g. Canada, Egypt, South Korea, Chile). For energy assessments of complex sites we use CFD (computational fluid dynamics)-based simulation software (O.F.Wind / WindSim). In order to keep a high standard wtg is mentoring several master theses concerning CFD-validation (comparison of several CFD-models, comparison of available forest models etc.).



CFD-modelling of the horizontal wind speed component (dark green: forested area)

www.windtest-nrw.de

windtest grevenbroich gmbh

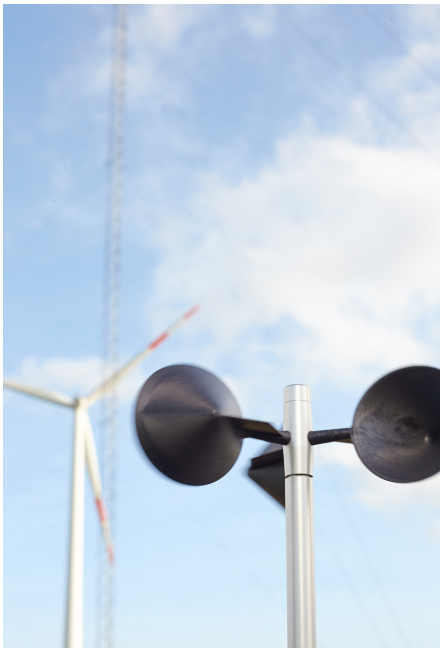
windtest grevenbroich gmbh
Frimmersdorfer Straße 73a
41517 Grevenbroich · Germany
Phone +49 (0) 2181-22 78-0
Fax +49 (0) 2181-22 78-11
E-mail info@windtest-nrw.de

Our Projects (extract)

- **Wind map** of the federal state of **Rhineland-Palatinate** (140 agl) based on a **CFD-model (O.F.Wind), 2012**
- Preparation of a concept for a wind farm [165 MW] with 2 LiDAR-systems and 2 met masts to improve the performance of individual wind turbines
- Analysis of met mast and SoDAR-system data in complex terrain, **Chile**
- **Support, approval and documentation of the measuring equipment** of a met mast with 200 m height, **Germany**
- Comparison of met mast data and LiDAR-system data at a complex site covered by forest

Installation, remote maintenance and analysis of wind measurements (met mast, LiDAR, SoDAR)

We offer turnkey solutions or individual services like the determination of the measurement system positions, validation of remote sensing devices (LiDAR / SoDAR), installation of measurement systems (with co-operation partners), calibration of the complete measurement chain, approval and acceptance check, remote maintenance of the measurements, detailed data analysis according to MEASNET (filtering, filling etc.), in-situ test of anemometers as well as bankable wind measurement reports.



Cup anemometer & met mast on our test site in Grevenbroich

www.windtest-nrw.de

windtest grevenbroich gmbh

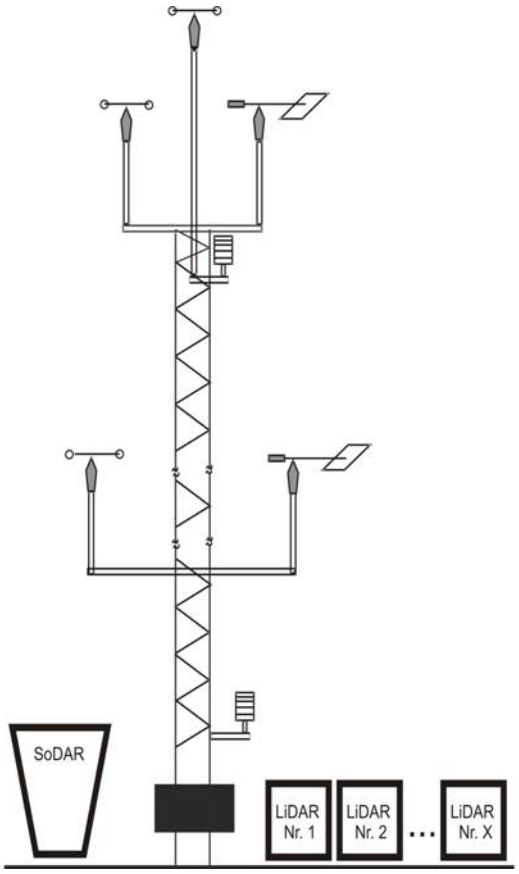
windtest grevenbroich gmbh
Frimmersdorfer Straße 73a
41517 Grevenbroich · Germany
Phone +49 (0) 2181-22 78-0
Fax +49 (0) 2181-22 78-11
E-mail info@windtest-nrw.de

Our Projects (extract)

- Installation, calibration of the complete measurement chain, maintenance of met masts on our test site in Grevenbroich
- Regular approval and acceptance check of met mast in Germany, Poland, France, the Netherlands and Luxembourg
- Regular approval and acceptance check of LiDAR / SoDAR-systems in Germany
- Remote maintenance of the measurements (on global level)
- **Microsting** for wind measurements on different sites, **Luxembourg**

Validation Services

According to MEASNET guideline 'Evaluation of site-specific wind conditions, Version 1' “the accuracy of remote sensing devices (RSD) like SoDAR or LIDAR-systems should be evaluated by comparison to cup anemometer … before each application”. The accuracy test can be executed at the planned site (if a met mast is installed) or at a special Remote Sensing Validation Service Station as on our test site in Grevenbroich.



Schematic set-up of our Remote Sensing Validation Service Station

www.windtest-nrw.de

windtest grevenbroich gmbh

windtest grevenbroich gmbh
Frimmersdorfer Straße 73a
41517 Grevenbroich · Germany
Phone +49 (0) 2181-22 78-0
Fax +49 (0) 2181-22 78-11
E-mail info@windtest-nrw.de

Benefit to the customer

- Large validation sector range (>200°)
- Simultaneous validation of multiple systems (SoDAR/LiDAR)
- Validation of any commercial remote sensing system
- Comprehensive infrastructure including IEC compliant 100/115 m met mast
- Various program and report options
- Setup and validation compliant to new IEC 61400-12-1 ed. 2

Our Clients

Germany

- ABO Wind
- BMR Energy Solutions
- Breeze Two
- Enercon
- Energiekontor
- EFI Energy Farming
- edf en
- Gamesa
- Iberdrola
- Juwi
- Ostwind
- SeeBA
- STEAG
- Shell AG
- wpd

Utiities

- Essent
- RWE Innogy GmbH
- EnBW
- EON Mitte
- ENSO Energie Sachsen Ost AG

Europe

- Contino, Spain
- Contino Wind Group, Poland
- Ecotera, France
- edf en, France
- Gamesa, Spain
- Infinivent, France
- Lagerwey, Netherlands
- Natenco SAS, France
- Nordex Iberica, Spain
- VSB energies, France
- Société d'Electricité du Nord, France

Utilities

- SEO, Luxemburg
- RWE Renewabels polska sp.z.o.o.

www.windtest-nrw.de

windtest grevenbroich gmbh

windtest grevenbroich gmbh
Frimmersdorfer Straße 73a
41517 Grevenbroich · Germany
Phone +49 (0) 2181-22 78-0
Fax +49 (0) 2181-22 78-11
E-mail info@windtest-nrw.de

Overseas

- Daewoo, South Korea
- Wind Works Power, Canada
- Cepri, China
- GIZ, Chile

Contact

For more information do not hesitate to contact:

Benjamin Böhme

b.boehme@windtest-nrw.de

+49 2181 2278-41

www.windtest-nrw.de