

WIND ENERGY

Shaping our world



Wind Energy – a Sustainable Energy Supply Solution

Energy is our passion, and has been for more than 50 years. With great success – as authenticated by our clients – Tractebel Engineering (formerly Lahmeyer International) is dedicated to delivering expertise in planning, engineering and consulting services in the energy sector.

Renewable Energy is gaining increasing importance. Photovoltaic, biomass, solar thermal as well as wind energy have become significant parts of the current energy markets and will stay as such also in the future. Especially wind energy has started a tremendous success story in the 90s which is continuing till today. Wind energy projects have shown that they can contribute cost efficiently and sustainably to modern energy generation.

Within this framework, the provision of consulting services for wind energy projects is one of our core competences within the context of renewable energy.

Tractebel – Market Leader as Wind Energy Advisor

Tractebel, as one of the world's leading engineering and advisory companies, has been implementing wind energy projects for decades.

Today Tractebel is a worldwide market leader for overall wind energy technical services which are based on a broad pool of experts, the sophisticated methodology models, and state-of-the-art technology for onshore and offshore projects.

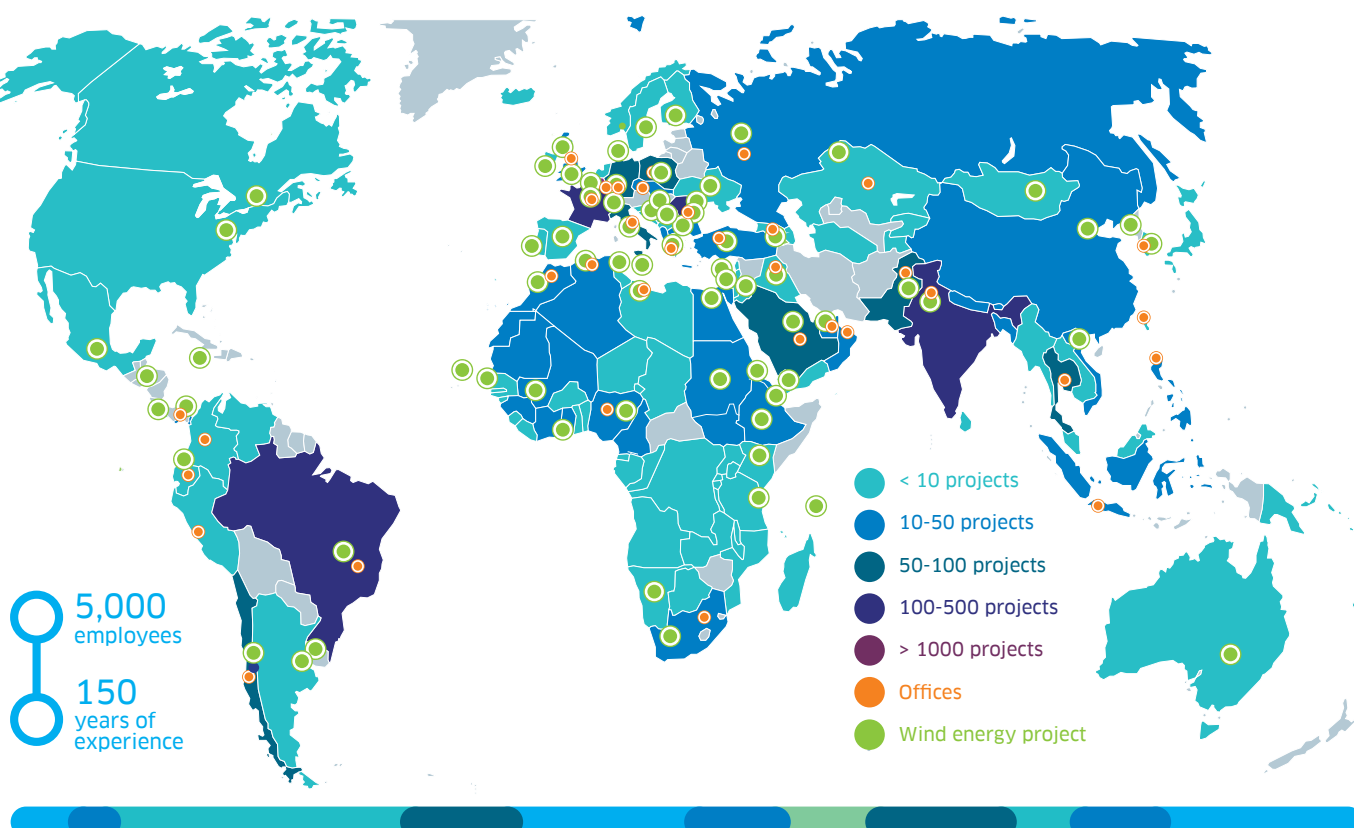
Pool of Experts

Our project managers provide our clients with long-term experience in project development, assessment, construction and operation. They are supported by numerous in-house specialists.

This cooperation permits an in-depth know-how for all kinds of wind energy projects. Our team has its roots in more than 10 nations and is fluently speaking many languages, which is the base for our high intercultural competence.

World-wide Presence in Wind Energy

With wind energy projects in more than 85 countries, Tractebel has gained experience in complex terrain, multicultural environments and diverse markets.

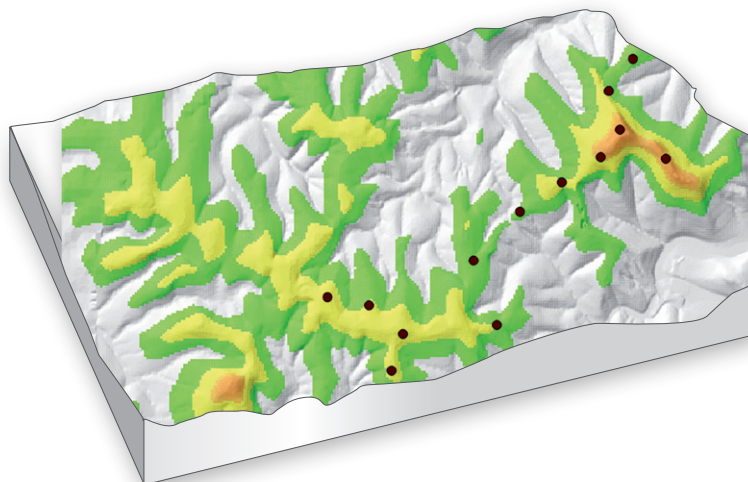
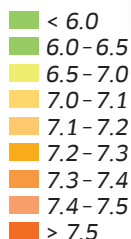


Our Clients and Markets

Tractebel provides its services for the whole range of the wind energy market, from first pilot projects in developing markets to studies for large size portfolios for financing institutions in established markets:

- For governmental institutions and international development organisations, we mainly provide Owner's Engineering Services in developing wind markets.
- We often support local project developers as Owner's Engineer in planning and realizing of their projects – especially in emerging markets.
- For institutional investors and commercial as well as development banks we act in established markets mainly as Lender's or Investor's Engineer.

Wind speed
[m/s]



Wind resource maps in complex terrain, calculated with suitable non-linear model

Key References

- Wind measurements, more than 300 masts evaluated
- Countrywide wind mapping for 16 countries
- Wind potential evaluations for more than 1,680 wind farms
- Feasibility studies for more than 230 wind farms (14,400 MW)
- Tendering support for more than 110 wind farms (6,700 MW)
- Due diligence studies for more than 1,150 wind farms (35,000 MW)
- Construction supervision for more than 140 wind farms (7,400 MW)
- O&M supervision for more than 90 wind farms (3,800 MW)



Ortona wind farm, Italy



Turbine Transport in Morocco

- Site identification
- Planning and execution of wind measurement campaigns
- Analysis of wind measurement data
- Wind mapping by use of different models (e.g. CFD) for complex and flat terrain
- Long-term correlation
- Wind resource assessment studies accredited according to DIN EN ISO/IEC 17025:2005

Wind Potential

- Site suitability assessment
- Wind park layout (micro siting)
- Access road survey / planning
- Environmental impact assessments (EIAs)
- Turbine technology assessment
- Grid integration (study) concept
- SCADA systems layout
- Cost estimates (assessment of investment and O&M cost)
- Time scheduling

Engineering & Planning

- Preparation of tender documents
- Evaluation of bids
- Contract preparation/ negotiation (EPC, PPA)
- Financial close support
- Due diligence studies

Tendering & Contracting

Operation & Maintenance

- Supervision of O&M services
- Training of O&M personnel
- Revision of wind forecasts
- Preventive maintenance supervision
- Condition monitoring supervision
- Regular inspections
- Repowering advise
- Dismantling support

Implementation

- Contract management
- Complete site management
- Factory inspection
- Supervision of construction of offshore and onshore projects
- Supervision of turbine erection
- Supervision of substations and network equipment installation

- Commissioning, witness of acceptance tests, taking over certificates
- Site calibration



Installation of turbines, Poland



Construction in Korea

Special Topics



Hybrid Systems

- Wind / diesel / PV systems
- Combination with batteries
- Wind / desalination systems
- Rural electrification



Electrical Engineering

- (High voltage) network stability calculation
- Offshore and onshore electrical network design
- Isolated grids
- Substation design



Offshore Wind Farms

- Planning and design services
 - Project management services
 - Due diligence services
 - Technical risk assessment
 - Market studies, strategic advice
- Including experiences of our subsidiaries Tractebel Overdick and Tractebel DOC.



Energy Economics and Planning

- Planning and design services
- Project management services
- Technical risk assessment
- Market and strategy analyses



Tractebel is a global Player in Wind Energy

and combines the expertise of:



Tractebel provides a full range of engineering and advisory services throughout the life cycle of its clients' projects, including design and project management. As one of the world's leading engineering and advisory companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 5,000 experts and presence in more than 70 countries, we are able to offer our customers multidisciplinary solutions in energy, water and urban.

Tractebel Engineering GmbH

Friedberger Str. 173
61118 Bad Vilbel, Germany

Phone: +49 6101 55-0
Fax: +49 6101 55-2222
info-de@tractebel-engie.com
www.tractebel-engie.com
blog-tractebel.lahmeyer.de



5,000
employees



662 M€
turnover

150

More than 150 years
of experience

Since December 2014, **Tractebel Engineering** (formerly Lahmeyer International) belongs to Tractebel and thus is part of the international ENGIE Group headquartered in Paris. Tractebel (Brussels, Belgium) and Tractebel Engineering GmbH (Bad Vilbel near Frankfurt, Germany) cooperate on numerous international projects as one company.

Tractebel Engineering GmbH is one of the few certified laboratories accredited by Deutsche Akkreditierungsstelle GmbH (DakKS) according to DIN EN ISO/IEC 17025:2005. We carry out assessments in the fields of determination of wind energy potential and energy efficiency of wind power plants as well as analysis of wind measurements.



Loading of offshore wind energy components