

KEY REFERENCES

Our project references cover a wide range of services in the lifecycle of offshore wind projects. The examples below include activities performed by Tractebel Engineering and its affiliates Technum-Tractebel Engineering and IMDC.

C-POWER

This huge offshore wind park on the Thornton Bank off the Belgian coast involves 60 wind turbines with a capacity of 5 MW which will generate over 700 GWh per year. Phase 1 of the project is our principal reference in offshore wind and explains best our expertise in this field. We were involved as Owner's Engineer from the very beginning of project development for assistance in procedures, definition, follow-up and interpretation of the soil investigation campaign; set-up and design of hydrodynamic and morphological analysis; preliminary design of various foundation alternatives; and basic design of gravity base foundation. We drafted the specifications for the 3 main contracts and assisted C-Power throughout negotiations. As Owner's Engineer we remained responsible for the detailed design of the scour protection for the foundation, for which we conducted physical model testing. Throughout execution, about 15 of our employees were involved in site management and coordination. For phase 2 of the project we are closely involved in the review of the different foundation alternatives of the REpower 5 MW wind turbine and will further assist C-Power in the negotiation of all contracts.

ELDEPASCO

This wind farm, 37 km from the coast of Zeebrugge, Belgium, will generate 670 GWh per year and will cover an area of 15 km². We were involved in setting up the design basis and the specifications for soil investigations. We also performed the preliminary design of the foundation alternatives.

SIMULATION FOR THE SEANERGY PROJECT

BLUE4POWER

Blue4Power is a joint venture between Electrabel and Jan De Nul to build a wind farm 60 km off the Belgian coast. The first turbines should be commissioned in 2013. Tractebel Engineering supports the development, concession file drafting, environmental impact assessment (EIA), permitting, basic design of the electrical infrastructure, wind resource assessment, energy yield calculation, turbine layout, design basis and feasibility studies.

SEANERGY

For this wind farm 15 km off the coast of Knokke-Heist, Tractebel Engineering was involved with full project development – site screening, basic design, permitting, environmental impact assessment, wind resource assessment, energy yield calculation, elaboration of specifications, tendering, contracting and site follow-up – until suspension of the project.

MACAU

A feasibility study was conducted for CEM, the local utility company in Macau, who were interested in developing offshore wind farms.

NORTHER

Tractebel Engineering supported the elaboration of the domain concession application for this offshore wind farm 25 km of the Belgian coast, developed by the Belgian wind farm developer Air Energy.

TRACTEBEL Engineering
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Offshore and onshore flexibility

OFFSHORE WIND

TRACTEBEL ENGINEERING TODAY

One of Europe's major engineering consultancies, Tractebel Engineering is part of GDF SUEZ, an industrial group with the financial strength to address the challenges of the future. With approximately 3,700 people in 20 countries, we offer life-cycle engineering solutions for power, nuclear, gas, industry and infrastructure clients. Services include a full range of engineering assignments: Architect Engineer, Owner's Engineer and Consulting Engineer. Our customers are private and public companies, as well as national and international institutions.



POWER NUCLEAR GAS INDUSTRY INFRASTRUCTURE

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CHOOSE EXPERTS, FIND PARTNERS

AN INTEGRATED APPROACH TO WIND PROJECTS

Fast-evolving technology, rising fuel prices and changing regulations are bringing a remarkable evolution in wind-based power generation. International standards now guarantee both greater safety and common methods for determining wind turbine performance and design. The power rating of wind turbines has increased rapidly: from 200 kW in 1990 to today's state-of-the-art 6 MW turbines. At the same time, wind farms are being increasingly sited further off-shore and in deeper offshore waters, up to 60 km off the coast and up to 40 m water depth. It is expected that global wind power generation capacity will surpass 120 GW by the year 2010.

Thanks to its international, independent and multidisciplinary expertise, Tractebel Engineering offers an integrated approach for your offshore wind project, including siting and energy yield calculations, undersea foundations and transmission systems. We will support you throughout your project, providing assistance not only with technical issues but also in environmental, social and legal matters. We make sure your project is feasible, yielding maximum economic return and minimal risk.



C-POWER TURBINE

C-POWER WIND FARM

We believe in lasting partnerships. Our goal is to achieve a sustainable energy solution that meets both your needs and the needs of the environment for a long time to come. This means encouraging a constant and open dialogue to ensure we fully understand your needs and your constraints. Our offshore wind energy team offers support to project developers at any stage of an offshore wind farm project. From the initial site selection and licensing to realisation and commissioning, Tractebel Engineering is your long-term partner, either as consultant, owner's engineer or contractor's engineer.



CABLE CROSS SECTION

PHYSICAL MODEL TEST

CABLE INSTALLATION



OVERSEA TRANSPORT OF FOUNDATIONS

C-POWER CONSTRUCTION SITE

MEASURING DEVICE

THE RIGHT KNOW-HOW

Within Tractebel Engineering and its subsidiaries Technum–Tractebel Engineering and IMDC we have access to all the skills, competences and know-how to complete the many different tasks involved in your offshore wind project, from producing the electricity in the first place to transmitting it to land and its further distribution.

SURVEYS AND INVESTIGATIONS

Conducting any kind of survey in a frequently hostile offshore environment is difficult and challenging. We can organise and implement surveys and investigations anywhere in the world, from preparing the specifications, supervising the work, executing the surveys, analysing the results and writing the interpretation report which forms the basis for designing the structures. This report is based on the results and recommendations geotechnical, geophysical, hydrodynamic, morphodynamic and magnetometric surveys.

WIND ANALYSIS

We have the resources to assess the wind potential and energy output. This helps us optimise the location of the wind turbines and the overall layout of the wind farm. We combine existing data from meteorological stations with current data obtained from our own measurement masts. The combined data is fed into a model that calculates the wind potential on a particular site. This allows us to accurately calculate the energy that can be generated by a wind turbine or a wind farm. By studying the wind climate, phenomena such as wake effects, turbulences and extreme wind speed can be assessed and the risks minimized. We can then select the optimal wind turbine for the site guaranteeing optimal economics of the wind farm.

FOUNDATIONS

Most offshore wind turbines are fixed to the seabed using monopiles. Alternatives include gravity base foundations, jackets and tripod subsea structures. Our designs include state-of-the-art technology and best practices from the execution point of view. We analyse what is best for the particular project in terms of materials and environmental conditions and produce fully integrated conceptual, preliminary and detailed designs incorporating modelling and simulation using advanced FE software. Modelling is a vital aspect as the foundation has to take into account hydrodynamic and wind loading from the turbines themselves.

SCOUR PROTECTION

Erosion is an important issue for offshore foundations. The scour protection is designed to prevent erosion of the seabed and takes account of interaction with the foundation stability and the cable connections. Based on the hydrodynamic and morphodynamic conditions we can design and define the quantity and size of materials necessary to protect the seabed around the offshore foundations and ensure stability.

CABLES

It's likely that the cable trajectory will pass through various seabed materials, sandbanks and obstacles, all of which have to be surveyed with one of the above techniques. In order to ensure the employment of the correct cabling techniques and to optimise the cable trajectory, the seabed mobility has to be analysed.

ELECTRICAL DESIGN

The electrical equipment in turbines is limited to switchgear and in some cases transformers. Offshore substations are more complex and incorporate transformers, high voltage switchgear, reactors, back-up generators, and control and protection equipment, all of which need to be precisely engineered. Tractebel Engineering can take care of the electrical design of the turbines, their interconnection in a wind farm and the undersea substations. A key challenge is the harsh maritime environment and the difficult accessibility of offshore wind farms. Our electrical designs therefore minimise maintenance as much as possible, saving time and labour. We also take into account the unpredictability of the available wind, while we have developed specific technologies to implement high voltage undersea junction boxes (220 kV and beyond).

GRID CONNECTIONS

Onshore electrical equipment for substations and grid extensions is largely similar to that required offshore, e.g. transformers, switchgear, reactors, back-up generators, control and protection equipment, and overhead lines and underground cable. We provide an overall grid analysis, and undertake the design and connection of cabling to the onshore grid connection point. The concept avoids having to install a multi-changer on the offshore substation. Instead it is located onshore. This makes the transformer safer and more reliable, while reducing maintenance costs.

OUR SERVICES

OWNER'S ENGINEER

We can advise our clients from the very beginning of a project through to its commissioning.

Our services range from feasibility analysis, permitting & licensing, basic & detailed design, contracting, project realisation, supervision & follow-up, operation & maintenance, and even future decommissioning.

CONTRACT INTERFACE MANAGEMENT

Efficient coordination of all aspects throughout the execution of a project is possible through contract interface management, which is one of our key competences. It enables us to control every aspect of the project and assign and supervise the work that has to be done in each phase.

RISK ANALYSIS

Analysing the risks associated with a project is another capability of Tractebel Engineering. The financial, economical, timing and execution risks are assessed and the proper mitigation scenario's are studied and prepared. This is particularly relevant in the harsh environment of an offshore deep-water wind farm.

DUE DILIGENCE

Tractebel Engineering offers due diligence services to its clients as and when required. Areas include validation of conformance, estimated schedule and cost, construction requirements and costs, permits and environmental assessments.

WORKABILITY ANALYSIS

Any work performed offshore is extremely dependent on the weather conditions, so contractors' quotations and schedules have to take into consideration the inevitable weather delays. With the use of sophisticated software and statistics on the wind, waves and weather, we can calculate the number of days per year that your offshore project might be subject to weather delays. This provides a clear, practical insight into the workability of a particular project and ensures schedules are realistic and feasible. We can translate this in a contractual weather downtime protocol.

HIGH-TECH SOFTWARE

We use hi-tech software to meet your challenges:

- **ANSYS ASAS** – Integrated FE modelling of offshore structures such as foundations for wind turbines
- **Arc View and MapInfo** – Geographic information system (GIS) software for visualising, managing, creating, and analysing geographic data
- **DELFT3D** – hydrodynamic and sediment transport modeling
- **Eurostag** – dynamic grid modelling

- **GRLWEAP** – Wave equation analyses and driveability studies
- **LPILE** – Analysis of piles and drilled shafts under lateral loading
- **SWAN** – wave modeling.
- **WASP** – Wind atlas analysis and application
- **Windfarmer and WindPro** – Design and planning of wind farms

