Success of a wind energy project is directly linked to its energy yield. Assessment of wave and current data is necessary for offshore wind farm foundation design.

An optimal wind site is crucial for an economically feasible wind project. Therefore the wind resource has to be assessed accurately. Detailed information about environmental factors such as wind, waves, water levels and currents are prerequisites for the successful and optimised structural design of an offshore project, where the foundations are typically exposed to harsh weather conditions.

Ramboll covers all engineering disciplines for tailor-made site assessments, both for wind and waves. Our many years of experience in offshore wind foundation design combined with having wind consultants, Metocean and steel designers under the same roof, makes communication lines short and a mutual understanding of the data requirements for each particular design stage ensures a smooth design progress and eventually a highly efficient operation of the plant.

Our expertise in wind
Ramboll is also the competent partner for all services for onshore wind assessment – from simple to highly complex terrain locations. Our multidisciplinary teams determine the wind conditions by applying various simulation models (WindPRO, WASP, CFD) and calculate the annual energy yield. Due to our 25 years of experience, we have expertise from more than 6,100 onshore wind projects with over 21,000 MW installed power worldwide.

Our competence in performance analysis
Ramboll provides reliable solutions for the validation of onshore and offshore wind turbine power curves. Temporary wind measurements by means of nacelle-mounted LiDAR devices also provide the opportunity to fine-tune the individual plant and optimise it for its specific site, whether in complex terrain or in larger compounds. Wakes and turbulences and their effect on the rotor-swept area can be detected, as well as misalignments of control systems.

Ramboll's performance optimisation analysis provides detailed recommendations to clients for specific measures to be carried out. The subsequent adjustment of the turbine’s integrated sensors and amendment of control settings considerably increases the yields and reduces the operational loads on the components, thereby extending the turbine’s lifetime.

For further information, please visit www.ramboll.com or contact us directly:

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Metocean assessment

Offshore wind turbine foundations are sensitive to loads at the sea surface. In order to provide reliable assessments and site selection, Ramboll establishes a numerical model, driven by global boundary data calibrated with local field measurements. Boundary wave data is provided from state-of-the-art global numerical models by highly experienced data suppliers. Project-specific requirements such as geographical locations and data resolution are considered carefully so the most suitable product can be chosen. Ramboll sets up numerical models covering spectral and Boussinesq wave modelling and flow modelling.

Based on the obtained wind, wave and water level time series, statistical analysis are carried out to provide extreme and operational values for the foundation design.

Wind assessment

As a DAkkS Accredited laboratory (DIN EN ISO / IEC 17025: 2005), Ramboll works with national and international guidelines and standards for the wind industry to create science-based analyses. We determine the wind conditions by met mast, SoDAR or LiDAR systems or modelling based on operating results from comparative wind turbines. Our expert evaluations include the validation of the modelling results and the evaluation of the calculation of uncertainties and probabilities. This is supported by our portfolio which covers the complete spectrum of the wind farm cycle – from wind farm planning (site quality according to local regulations, preliminary assessments, wind resource maps, wind measurement campaigns, wind energy yield assessments) to analysis of existing wind farms (production data analysis based on monthly checks, loss analysis based on SCADA data, due diligence).

Performance assessment

Ramboll works with laser measurement devices mounted on wind turbine nacelles to sample the undisturbed wind flow in advance of its arrival at the turbine rotor plane. The knowledge of the wind data that we thus obtain enables a detailed analysis of the turbine’s performance characteristics. Whether onshore or offshore turbines are concerned – this method enables us to reliably validate power curves and to identify underperformance. Potential misalignment of control settings can be detected through analysis of SCADA data and wind data measured by the LiDAR device. Consequently, the turbine’s sensors can be adjusted and all relevant control parameters influencing the turbine’s performance can be optimised.

Due to the circular scan of the wind field characteristics around the entire rotor, Ramboll draws conclusions about the rotor-equivalent wind speeds, wind direction, veer and shear. This allows us to detect and visualise the wakes and turbulence intensity to fine-tune and optimise operation of wind farm composites or turbines at complex sites.