# Wind energy

## Our experience and insight is helping to develop and enhance wind energy assets.

FRAZER-NASH CONSULTANCY
A KBR COMPANY

**We are supporting the development of the next generation of wind turbines and helping our partners to develop more efficient projects.**

Wind energy has been at the heart of the clean power revolution, and will continue to be a key technology in the drive to reduce emissions from power generation. Our dedicated team provides expert support to you across the project life cycle for both onshore and offshore wind. This expertise allows us to provide deep technical insight for manufacturers, project developers, asset managers and operators.

Floating wind is a very promising technology with the ability to reach very large scale in deep water sites, offering the potential for reducing installation, decommissioning and material costs compared to conventional offshore wind. Our unrivalled experience of commercial projects runs across the breadth of the technology development stages and across the full life cycle for floating wind projects.

### Technical advisory

Offshore wind farms, particularly floating ones, require a vast array of technical skills to develop, design, implement, operate and ultimately decommission. We have worked extensively with original equipment manufacturers (OEMs), developers, operators and third-party providers in support of offshore wind farms across the project life cycle and can bring this experience to bear to help advise our clients.

We have over 800 subject matter experts spanning a wide range of disciplines enabling us to execute these activities or provide review as required. Through independent impartial advice we help our clients to:

- Appraise and review project and technology feasibility
- Manage the technical risks especially during the design phases
- Support turbine/foundation design optimisation
- Manage technical interfaces
- Provide technical due diligence
- Engage with project certification bodies
- Triage operational issues and advise on solutions.

We understand the issues that matter and have the knowledge to appraise data from early design through to decommissioning, focusing engineering activities in the right place.

Specifically, within floating wind we have unrivalled project experience having supported the fundamental engineering activities on six separate projects over a period of 10 years.

To date we have delivered projects that include:

- Loads analysis and certification engagement on behalf of an OEM
- Design of commissioning testing programmes and operational analysis of outcomes
- Developing tool chains for floating wind analysis
- Undertaking structural analysis of key components
- Undertaking feasibility assessments for commercial scale developments
- Managing project interfaces between OEM, developer, foundation design and certification bodies.

With technologies and markets changing, this practical experience is critical to achieving project success.

## Floating wind

Our team have been supporting floating offshore wind since 2015 and have acquired significant experience in that time, covering the full breadth of technology development stages and across the project life cycle. Our expertise is recognised internationally, and our experience spans from leading large international research and development programmes through to supporting developers through Front End Engineering Design. We also provide direct support to wind turbine manufacturers, foundation designers, as well as directly supporting the leasing authorities.

Our experience gives us a deep understanding of the challenges and specific complexities of floating wind, which along with our experience in the development and integration of novel technologies, means we are well positioned to support the development of your projects.

Our floating wind project team brings together experience with key strengths including:

- Numerical modelling of floating wind systems.
- Aeroelastic loads analysis of wind turbines.
- Structural loads analysis of towers, floating foundations, and moorings.
- Evaluation of novel technology solutions.
- Energy yield assessment.
- Practical experience of offshore project commissioning and operations.

## Independent loads analysis

Our bespoke computational models and analyses help us to provide you with sound advice on your current or future assets.

Where operational performance data is not readily available, one of the key tools available for understanding wind turbine performance is independent loads analysis. This analysis can be used in several ways:

- Design optimisation in FEED
- Digital twins
- Life extension of current assets
- Evaluation of retrofit add-ons/controller upgrades
- Optimisation of operation and maintenance activities
- Root cause analysis of fault.

When it comes to independent loads analysis, it is important to understand the accuracy of the modelling and to use the results appropriately. Our extensive experience of commercial projects and understanding of how the system operates allow us to create bespoke computational models to represent any commercially available turbine. These models, coupled with our ability to understand the behaviour and analyse the outcomes allow us to provide our clients with sound advice on their current or future assets. Our key differentiators in this area of work are:

- Understanding suitable modelling fidelity to ensure value for money for our customers
- Our experience of commercial projects to ensure behaviour is representative
- Our ability to provide focused and clear advice to our customers.

## Energy yield assessment

The accuracy of energy yield assessments is of critical importance to wind farms investments, especially offshore, where significant project financing is required. An industry realisation that the effects of wind farm blockage may be under accounted in aerodynamic loss estimates reflects that improvements can still be made. Similarly, the advent of new technologies such as floating wind farms and hybrid wind/solar/storage farms represent the opportunity for large steps forward for the industry, but require new methods to account for them in yield assessments and business cases.

We operate at the forefront of this space, helping our clients using cutting-edge methods built around the fundamental understanding of how assets work and how they interact with the resource. We know the tools and modelling approaches that exist and are under development, and we appreciate how to use them, combine them and interpret their outputs. We have built our in-house processes around uncertainty, acknowledging that quantifying the impact of what you don't know allows you to better exploit what you do. Our skills include:

- Wake and blockage loss calculations
- Floating LiDAR measurement campaign planning and data analysis
- Energy yield assessment practices for floating wind farms
- Energy yield assessments for hybrid wind/solar farms
- Business case development for design approaches such as overplanting.

We have over 10 years' experience of engineering design on behalf of MHI Vestas Offshore Wind, supporting with loads analysis, controller design, commissioning and performance analysis. We understand both the complex technologies and physics required to assess the yield and are currently leading the Carbon Trust Floating Wind JIP Yield workstream in this area.