BMT Group

"Where will our knowledge take you?"

Offshore Renewable Energy

Services and solutions

Where will our knowledge take you?

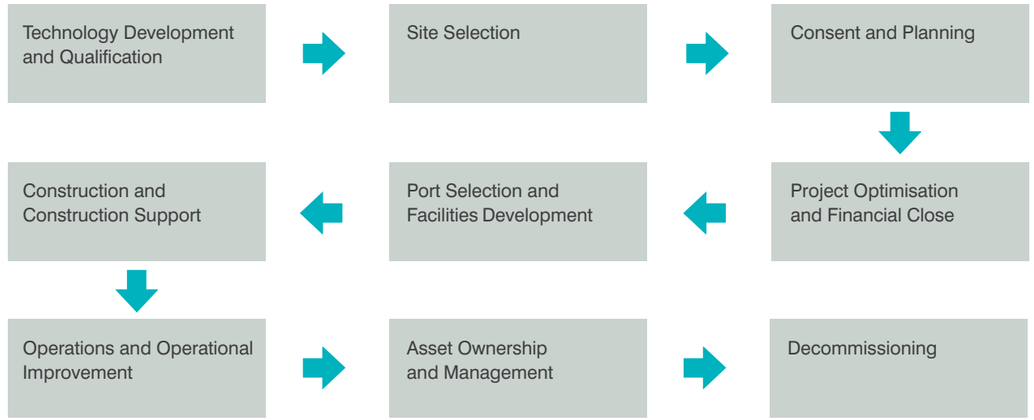
BMT provides products, services and solutions to those involved in the development and operation of offshore renewable energy.

The BMT group is a leading international multi-disciplinary maritime engineering, science and technology consultancy providing a broad range of products and services across the energy and environment, defence and transport sectors.

BMT has unrivalled skills and experience of meeting the unique challenges of operating in the harsh marine environment.

Our experience in marine renewable energy reaches back to early work on wind and wave energy devices in the 1980s. We now provide an extensive range of specialist products and services supporting all phases of the development and operation of wind, wave and tidal energy projects.

With offices strategically located to support each major renewable energy region, BMT provides the industry with insight and solutions to the engineering and environmental challenges of extracting energy from above, upon and beneath oceans and seas.



renewableUK
Company Member

BMT is a company member of RenewableUK, the leading and most credible voice on wind, wave and tidal energy in the UK.

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“BMT has been providing specialised support to renewable energy projects since the early 1980s.”

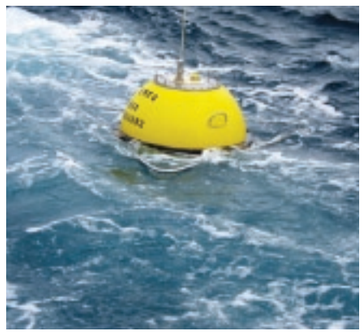
Metocean Information Services

Drawing on state of the art capabilities in data collection, data management and data analysis, numerical modelling and forecasting, BMT is able to provide comprehensive metocean information for all offshore renewable energy areas worldwide. Our metocean information services support safe and cost effective design and operations at all stages in the project life cycle.

Metocean Design Criteria

Our metocean specialists provide the criteria required for concept and detailed design including energy generation potential. They have experience of supporting design teams for projects in all of the world's renewable energy regions providing data on ambient and extreme wind speeds, wave heights, currents, surges, temperature, icing conditions and fog.

BMT has been providing tidal developers with metocean data to predict resource and loadings on tidal current generator devices. The information is being used by developers planning installations at the European Marine Energy Centre and other sites.



Operability Statistics

BMT provides operability statistics based on comprehensive in-house databases of high quality satellite and model derived metocean information. We combine weather and seastate expectations with the limitations of vessels and with task schedules to assess the feasibility, cost and financial risk of installation and operations.

To support cable lay operations BMT has performed a number of workability analyses to assess the feasibility and to estimate the likely costs and financial risks associated with weather.

We simulated the operation using the limiting weather conditions to assess both the probability of interruptions and downtime caused by unfavourable wind and wave conditions.

Weather Forecasting Services

BMT's forecast services are designed to help clients minimise time lost waiting on weather and to ensure operations are conducted within safe working limits. We also provide operational forecasts to support prediction of energy yields. Forecast services are customised to meet specific requirements and are available globally for both offshore and near shore locations.

Vessel Operability Assessments

To support vessel selection we provide vessel operability assessments based on combining a detailed understanding of the metocean conditions at the location or along the transit route with knowledge of vessel performance and performance limits to assess if the vessel is suitable for the task proposed.

Scour

We predict scour conditions around foundations, cables and port structures and propose scour protection designs.

BMT supplied a Dutch renewable energy major with reliable wind forecasts for onshore and offshore locations. Using in house operated and validated high resolution atmospheric models calibrated against local observations, we provided forecasts that enabled accurate power output estimation.

Marine Operations and Risk

Installation and operations of offshore renewable energy requires a wide range of specialist marine operations. With our extensive knowledge of ships, shipping, ports and port operations backed up by a detailed understanding of the harsh marine environment BMT provides planning and real time support to marine operations.

Vessel Performance

BMT assesses the response behaviour of specialist vessels and their crew manoeuvring under difficult environmental or geographic circumstances. These services are supported by a range of advanced tools including our DNV certified ship and bridge simulator REMBRANDT for simulating the station keeping of vessels and the software package ANSYS AQWA for simulating operations including the response to waves during lift operations.

Planning Marine Operations

BMT provides services to support vessel selection, plan vessel routing, design channel layouts in ports and inland waterways and plan passage through locks. We specialise in assessing the navigation of vessels operating in restricted waterways or in close proximity to other vessels in both expected and worst case weather and tide conditions using real- and fast-time vessel simulation.

Risk Assessment and Management

There are numerous risks in marine operations that can lead to losses, project delays and cost overruns. BMT specialises in the systematic identification, assessment and management of marine risk.

De-risking Marine Operations

BMT helps to de-risk marine operations from mobilisation to demobilisation. We identify what can go wrong, and review the proposed risk controls to develop comprehensive emergency/contingency plans and identify any additional specific mitigations that are required. We can quantify the risk using our offshore windfarm models that simulate the proposed operations to assess likely variability in overall duration and cost, predict losses and show the sensitivity to programme delays, equipment failure and weather.

De-risking Marine Transportation

We support ship owners, charterers and insurance companies by attending loading and unloading operations of major wind farm components and to advise on lashing and securing. We also assess damage to wind turbine installations as a result of transportation.

Safety Management

Safety in offshore projects is paramount. Risks need to be identified, assessed, controlled and mitigated within the structure of robust and defensible safety management systems. BMT has developed safety management systems across a wide range of marine industries.

As part of the EU Safety@Sea project BMT developed operational risk management systems for use in marine rescue control centres managing sea areas with offshore windfarms. This included the installation of simulation software to support operational control for search and rescue planning and manoeuvring simulation.

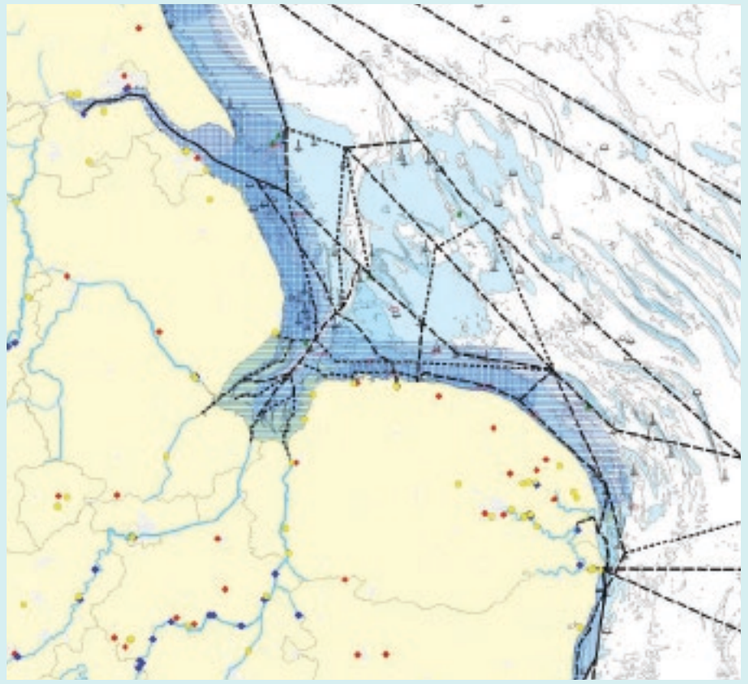
Safety Assessment

BMT has extensive experience in safety assessment including hazard identification, hazard and operability studies, safety critical system assessment, writing safety procedures and developing justifications and cases.

BMT ran preliminary design Hazard and Operability Study (HAZOP) workshops to aid the design of the Pulse Tidal Demonstrator.

BMT produced a failure modes, effects and criticality assessment of a Turbine Access System to support its qualification for offshore wind farm use.

© Pulse Tidal



Port Design and Operations

The construction and operations of offshore wind farms, tidal arrays and wave energy parks places special requirements on ports. BMT supports reliable, cost effective and environmentally sound activities in ports, harbours and terminals. We assess trends in port development and advise on the suitability of ports to support specific operations alongside their core businesses.

BMT reviewed existing and new vessel traffic on the Humber to provide assurance that the additional activity expected in support of offshore renewables could be accommodated within the constraints of this waterway. Existing traffic was assessed based on DfT data, AIS records and local consultation. Results of this analysis formed the part of the the Environmental Statement submitted during the planning application process.

Windfarm Support Vessels
The 26m Extreme Semi-SWATH has been designed for Turbine Transfers and will provide significantly better seakeeping than conventional WSVs.

> “We provide bespoke designs that have been optimised to provide high performance solutions for challenging requirements.”

Specialist Vessel Design

BMT offers an extensive range of specialised vessel designs and associated consultancy services. We provide bespoke designs that have been optimised to provide high performance solutions for challenging requirements.

Windfarm Support Vessels

Benefitting from extensive customer feedback and operational experience BMT has developed a suite of WSV designs from 18m to 33m in length with a variety of propulsion options. The design has been developed from a well proven hull form which has been in service for a number of years in rough weather environments. Numerous WSVs have been built and more are under construction in shipyards worldwide.

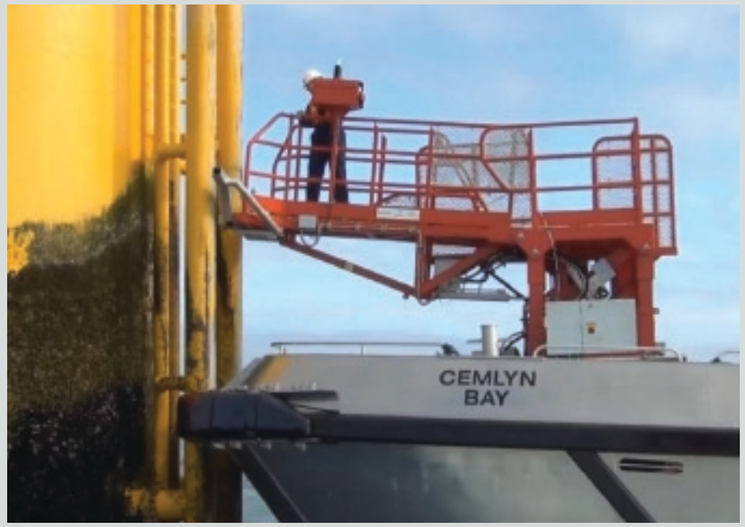
A number of key features are incorporated to improve their operational capability:

- Resiliently Mounted Superstructure - to reduce structure borne vibration and ambient noise.
- Active Motion Damping - to improve trim and reduce motions in head seas
- Active Fender System - to minimise the impact loads on the turbine boat landings

BMT designed the 19m Wind Farm Support vessel constructed by Veka.

Turbine Access

BMT has teamed with Houlder to develop a new offshore turbine access system. It is lightweight and allows use by vessels without dynamic positioning systems. It has a safer step-across to the tower than the friction lock-on method and can transfer in higher wave conditions. A development of this system has been selected by the Carbon Trust for support as part of its Offshore Wind Accelerator programme.



Engineering

Our wealth of experience and knowledge of naval architecture, marine engineering, hydrodynamics and aerodynamics gives us a unique capacity to contribute to improved safety, reliability, performance and economics of all types of offshore renewable energy.

Systems Engineering

BMT analyses complex problems and identifies and assesses the best possible solutions. Our systems engineers systematically capture requirements and propose solutions supported by robust technical assessment, through life costing and investment appraisals.

Naval Architecture

BMT has an enviable reputation in naval architecture. Our naval architects take a holistic view of design from initial concept, through feasibility studies, Class level and detailed production drawings as well as in-service support. Our customers can rely on our naval architects and designers to make enhanced performance and reliability their priorities.

Marine Engineering

The marine environment puts special demands on equipment. Our marine engineers have specialist skills in mechanical engineering design and analysis, materials, fatigue, corrosion and corrosion prevention, the use of metals and composites in the marine environment, underwater engineering and transmission systems.

Wind Tunnel Testing of Offshore Structures

Aerodynamics is an important aspect of the safe and reliable design of an offshore installation. BMT operates large in-house wind tunnel facilities to help designers assess wind loads, current loads and helideck wind environment. Wind tunnel testing can also be used to quickly investigate remedial and mitigating measures should problems be identified.

Ice Engineering

Wind and hydrodynamic analysis in cold climates need to be supplemented with an assessment of the effect of ice. BMT has specialist experience in ice engineering and provides a wide range of specialist cold region engineering consultancy.

Power Systems Design

Our capability allows us to define an optimum system architecture for generation, power conversion and grid connection. We specialise in local grid and closed systems where the size of the loads are similar to the size of the generation sources and can include the integration of renewable energy sources. Our designs take best advantage of the load profile and available power sources while accommodating the inherent variability of renewable energy sources.

Technology Management

Our technology management expertise facilitates the development of technology from concept through to the level of technical maturity required for commercial deployment. We identify the most suitable development activities to mature technologies and systems. Our established toolsets and processes help to de-risk technology development decisions by providing a structured and consistent approach to technology management.

Hydrodynamic Analysis

The prediction of current and wave loading is a key component of offshore engineering design for station keeping, mooring design, vessel stability, structural integrity and safety. BMT's specialist knowledge and experience in numerical modelling of vessel response and physical model testing provides an unrivalled analysis and consultancy capability.

BMT provided turbine performance and design calculations support to Rolls Royce for a low head tidal turbine for a tidal fence across the Severn. BMT provided technical justification for the contra-rotating turbine concept, and developed analytical code for optimising the design.

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1: Power Systems Design

BMT investigated alternative power conversion options for a large wind turbine trading off cost, power density and reliability to recommend a choice between low voltage and medium voltage systems.

2: Marine Engineering

BMT provided Marine Current Turbines with early stage design support for next generation tidal device concepts.

Availability and Reliability

The harsh marine environment is a challenge to equipment and constrains servicing and repair operations. High levels of availability, low cost of ownership, achievable maintenance regimes and practical through life support are goals that have to be set, planned for, managed and monitored.

Maintenance Programmes

Thorough maintenance programmes ensure inherent reliability is continually achieved and increased during the operational lifetime of a project. Our in-service support capabilities include performance tracking to see if inherent reliability is being achieved, reliability growth modelling to see if growth is within expectations, failure and corrective action systems to define improvement actions, reliability-centred maintenance to optimise maintenance and availability improvement programmes.

BMT undertook an assessment of the design, operation and maintenance concepts of the Pulse tidal energy generator, including an assessment of the maintenance tasks required to achieve the inherent design reliability, and calculation of the resulting cost of generation.

Maintenance and Support Costs

Location, technology, construction and support options are all interrelated and critically dependent on metocean conditions. BMT specialises in optimisation in the marine environment and has techniques and models that predict variability in construction programmes, optimise construction logistics, predict downtime due to servicing, repairs and logistic delays, aid support decisions on type and number of support vessels and assess the implications of support port options.

BMT made an assessment of the availability of the NaiKun offshore windfarm based on modelling the turbines, transformer station and the export cables, together with the weather windows for maintenance, the capability of the support vessels and the wind resource.

Reliability and Availability Assessment

Our engineers specialise in improving reliability by embedding design for reliability, maintainability and survivability into design processes. Our unique capacity to link reliability engineering and extensive understanding of metocean conditions means that we can provide availability predictions and energy output modelling that fully takes into account the impact of weather and the harsh maritime operating environment.

BMT worked with a major wind turbine manufacturer to implement an advanced reliability programme into its design for a new offshore wind turbine.

Foundation Design and Installation

The selection of foundation design and installation methods is a key decision in the development of offshore projects. They are a significant part of the capital cost, have to be optimised for each location and their integrity assured over the life of the development.

Steel Structures

Combining our knowledge of hydrodynamic and aerodynamic forces, structural design analysis and material properties in the marine environment BMT can assess and monitor the design integrity of both fixed and floating offshore structures.

BMT is evaluating fatigue design methodologies and design criteria for offshore wind turbine support structure design. This project will be used to provide guidance to the US Department of the Interior in the adoption or development of fatigue design rules.

Concrete Structures

BMT is part of the GBF consortium that has developed an innovative cost effective concrete gravity foundation and a unique installation methodology that uses a bespoke Transport and Installation Barge (TIB) to transport and install a completed wind turbine generator in a single offshore operation in a wider operational envelop saving cost and time.

The development of the GBF foundation system is being supported by the Carbon Trust as part of its Offshore Wind Accelerator programme.

Navigation

The impact on others users of the sea of wind farms, tidal arrays and wave energy parks have to be fully understood. As well as the obvious restrictions on the ability of some vessels to navigate in the area when arrays are operation there are many other considerations. These include co-existence with existing commercial interests such as aggregate dredging, sub-sea cables and pipelines, military responsibilities, future oil & gas developments, fishing, diving and also the impact of construction traffic on port infrastructure.

Navigation Risk Assessments

Decisions on location, orientation, marking and traffic management require a detailed understanding of sea use and navigation risk. We have extensive navigation experience and have tools for modelling displaced traffic, for simulating navigation in and around windfarms and for assessing economic impact on maritime transport.

Navigation Impact

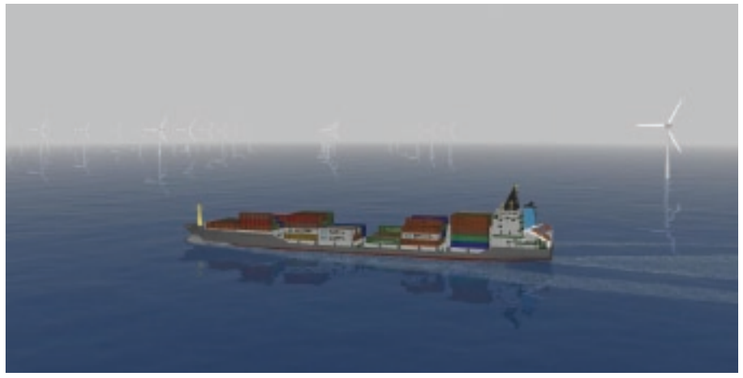
BMT has extensive experience in assessing the impacts of developments on shipping and navigation. This has ranged from assessing the development of major port developments in the Far East to the potential impact of wave hub on passing traffic.

Traffic Survey

We have a variety of techniques for surveying traffic that can reduce or eliminate the need for expensive boat based surveys. These including data capture from radars and the ability to track and analyses ship movements from AIS data.

Computer Simulation

Maritime regulators frequently require researched opinion using appropriate computer simulation techniques to investigate the displacement of traffic and, in particular, the creation of 'choke points' in areas of high traffic density. BMT has the ability to simulate ship movements in and around arrays, along shipping lanes / ferry routes and in ports to assess the change in risk.



Navigation Guidelines

We wrote the UK methodology for assessing the Marine Navigation Safety Risk for Offshore Wind Farms.

Navigation Risk

BMT prepared the marine navigation safety risk assessment for Hong Kong's first offshore windfarm.

Navigation Impact

BMT produced a navigation impact assessment for a tidal fence across the Severn.

Strategic Advice

BMT specialises in meeting the challenges of exploiting, operating in and surviving the marine environment. With 1,400 staff and with offices near the main marine renewable energy regions and at key locations in the supply chain including the UK, the Netherlands, the USA, China, Abu Dhabi and Hong Kong, BMT is well placed to provide strategic support to all phases of offshore renewable energy development.

Vessel Routing Around the UK

BMT conducted an assessment of all vessel traffic and developed an offshore renewable energy installation navigational zoning scheme for the UK Maritime and Coastguard Agency (MCA). This was used to support the selection of round three windfarm development zones.

Offshore Windfarm Risks

BMT, together with Wind Prospect Ltd, produced guidelines to facilitate offshore wind development in an efficient, cost-effective and risk aware manner for Taiwan's Industrial Technology Research Institute (ITRI).

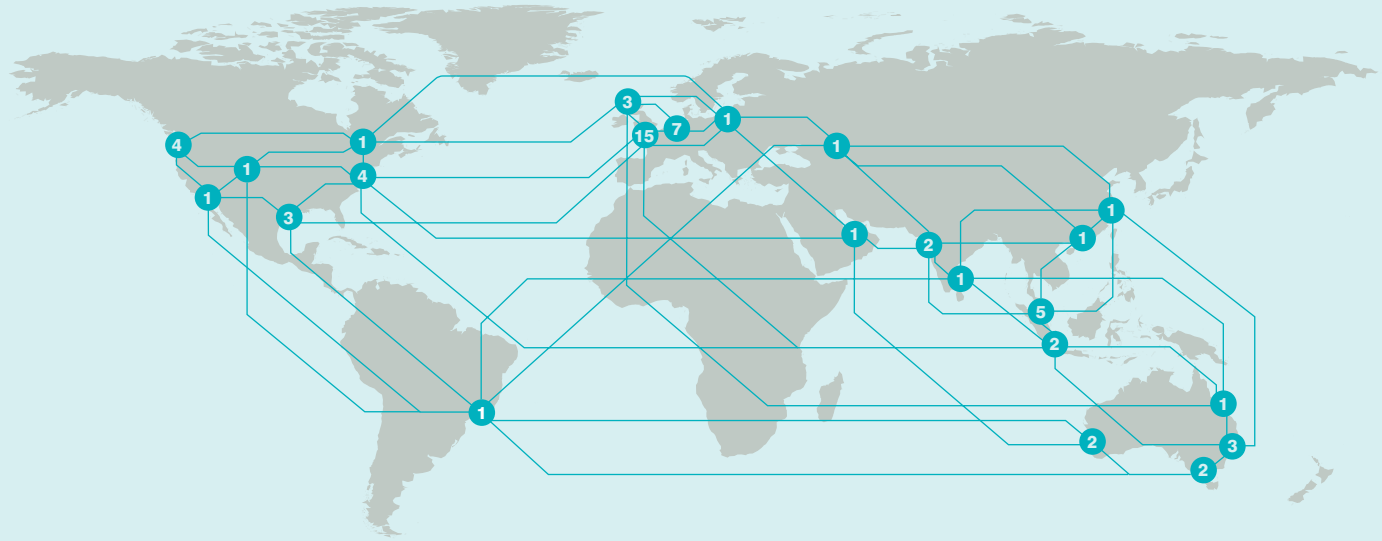
The guidelines review the current state of the offshore wind market and key hazards typically associated with project development.

Strategic Options Study

BMT developed strategic options for a Taiwan Government Agency study. This study included a road map of what needed to be done, identification of the key industrial development required to build offshore wind farms and a commentary drawing on European and Asian experience.

The BMT group is an international design, engineering and risk management consultancy, working principally in the energy and environment, transport and defence sectors.

With locations in all of the major markets we serve, ours is an active network that sees us sharing skills and knowledge, combining disciplines and building international teams to create integrated answers to the questions of our national and international customers.



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