Offshore Renewables
Engineering Innovation
The offshore Renewables revolution will be at the forefront of helping the UK meet its greenhouse gas emissions targets over the next generation. Engineering innovation across a range of disciplines will be essential to yield the step change in generating capacity that is required. Atkins, as one of the world’s leading offshore engineering consultancies, are proud to be at the vanguard of this industry transformation.

Martin Grant, Managing Director Atkins Energy
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The Facts

Climate change resulting from CO2 and other greenhouse gas emissions poses a huge threat to human welfare. To contain that threat, the world needs to cut emissions by about 50% by 2050, and to start cutting emissions now. A global agreement to take action is vital. But a global agreement will not be possible unless the countries of the rich, developed world provide leadership... A fair global deal will require the UK to cut emissions by at least 80% below 1990 levels by 2050.

The Committee on Climate Change

Offshore Renewables - The Facts:

• The UK is legally obliged to reduce greenhouse gas emissions by 34% from 1990 levels by 2020
• The Committee on Climate Change has recommended reductions of 80% by 2050
• Increasing Renewable generation to 30% of the UK generation mix by 2020 could reduce power-sector emissions by 40% from 1990 levels and significantly contribute to meeting the overall UK emissions reduction targets
• There is currently approximately 500MW of offshore wind energy generating capacity installed in the UK
• The Crown Estate lease process is introducing a total of 33GW into the development cycle through Rounds 1, 2 and 3
• Capital expenditure in the offshore Renewables sector to achieve 2020 targets is estimated to peak at £17Bn per annum
Company Overview

Plan
The challenges facing our clients are multidimensional, often because of the increasingly complex modern environment. From cost and risk planning, feasibility studies and logistics, to impact assessments and stakeholder engagement activity, we plan every aspect of our clients’ projects.

Design
Atkins designs intellectual capital such as management systems and business processes. We also design physical structures such as office towers, schools, bridges and highways. Whatever we design, we apply the same passion and creativity combined with the rigorous quality standards.

Enable
Our clients choose Atkins because they want to focus on their core operations. They entrust us to look after the management of projects, people and issues – ensuring that deadlines are met, costs are controlled and success is delivered.

In all that we do, excellence is our benchmark. We take pride in understanding our clients’ challenges and delivering excellent solutions. This means the application of innovative management techniques, the use of cutting-edge materials, the deployment of technology in novel ways and the highest level of client care.

Breadth and Depth
Much of our work is on capital projects. As the largest multidisciplinary consultancy in Europe and the world’s eighth largest international design firm, we have the breadth and depth of skills our clients need. We’re the safe pair of hands entrusted with delivering the most ambitions solutions, as a selection of our work shows:

- Terminal area masterplan and terminal building design for Yinchaun Hedong Airport (China)
- Design, engineering and planning consultancy for the Glasgow Airport Rail Link (UK)
- Wing design and analysis for the Airbus A350 XWB aircraft (UK)
- Masterplanning and detailed design services for the Durrat Al Bahrain resort (Bahrain)
- Local transport planning policy evaluation for the Department for Transport (UK)
- Planning and infrastructure support for the London 2012 Olympic Park (UK)
- Highways management services for Cambridgeshire County Council (UK)
- Managing Agent for HBOS’s property portfolio (UK)
- Project management and cost estimating for the construction of the World Trade Center Memorial and Visitors Center, New York (USA)
The Bahrain World Trade Centre is a pioneering stride for environmental architecture, the first building in the world to incorporate large scale integrated wind turbines which comprehensive ground tests indicate will generate 11-15% of the energy requirements of the two towers.
Atkins offshore structural engineering capability dates back to the 1970's and we have been at the forefront of the discipline ever since. Much of our capability originated in the Oil and Gas sector, and we are still heavily involved in this area. However, we have successfully transferred many of our skills onto a number of offshore Renewables projects.

Atkins undertakes all aspects of structural analysis, ranging from strength and fatigue assessment to extreme loading studies. The team has an extensive knowledge of wind turbine technology, having undertaken independent design audits of 20 wind turbines for major developers. We have also undertaken structural design and analysis commissions for a number of wave and tidal energy converters, utilising our world leading expertise in wave loading.

Our expertise encompasses fixed and floating structures and includes:
- Concept, FEED and detailed design
- Structural integrity management
- Repair and modification
- Assurance, verification and audit
- Safety, risk and reliability
- Finite element modelling
- Strength assessment
- Fatigue assessment
- Survivability assessment
- Computational fluid dynamics
Case Study
Galloper Wind Farm Offshore Substation Platform

Atkins has been commissioned by McNulty’s (Fabrication Contractor) to carry out the detailed design of the topsides for the Galloper Wind Farm Offshore Substation Platform. This encompasses multiple disciplines such as Structural, Utilities, Electrical, Architectural, Safety Engineering, Mechanical, Piping Design and Telecommunications. The complete topsides are expected to be in the order of 1600 tonnes.

One high voltage offshore substation platform (OSP) will be used to collect and transform the energy generated by the Galloper Wind Farm from 33 kV to 132 kV for transmission to shore. Three phase 132-kV high-voltage subsea cables will transport the power to the grid connection point, which will be located near Sizewell in Suffolk.

The OSP will be designed as a normally unmanned installation. The platform acts as a central hub for the Galloper Wind Farm control system and contains facilities to allow personnel to standby and monitor the Wind Farm. Although the OSP is not required to function as accommodation, it is required to provide temporary accommodation in the event of stranding of the operations team.

Key Contact

Professor Mike Willmore
Director, Offshore Engineering

Mike is a civil engineer with over 30 years experience. He is responsible for the development of a technical assurance regime across the department and for establishing technical leadership on key offshore engineering projects. He is Project Director on a number of major offshore projects, including the detailed topsides design of the Galloper Platform in the North Sea and the concept/FEED design of Solan installation West of Shetlands.
Substructure and Foundation Design

As Wind Farms are developed further offshore, in deeper water and with larger turbines, the focus on innovative substructure and foundation design is increased to find a cost effective solution. Atkins is at the forefront of development of such innovative solutions, having undertaken the concept study for the Beatrice installation (see case study opposite) and having been involved in the UK Government funded CORLEX study (Cost Reduction and Life Extension of Offshore Wind Farms).

Our experience also includes the substructure design of offshore substation platforms. We are, for example, currently designing the foundations and jacket substructure for the Thanet Wind Farm offshore substation platform.

Our team of geotechnical experts who work closely with our structural design team have extensive experience in offshore engineering in the Oil and Gas and Renewables sectors, including seismic and dynamic geotechnical engineering.

Our expertise includes:

- Substructure design and analysis
- Engineering geology assessment
- Geotechnical foundation design
- Scour protection
- Monopile design and installation
Case Study
Beatrice Wind Farm Concept Study

Atkins was commissioned by Talisman Energy to undertake a concept study for the installation of 5MW turbines in 45m water depth. Loading assessments were undertaken looking at wave, current, wind and self-weight and these were applied to a number of design concepts, including floating, gravity based, piled and jack-up structures.

Design evaluation of three shortlisted concepts was undertaken to consider structural strength for transportation and installation loads; structural and foundation strength to resist in-place extreme and operating loads; fatigue performance to resist cyclic wave loads and fluctuating wind loads; and dynamic performance to resist resonance or dynamic amplification at blade passing frequencies, wave and wind energy frequencies.

Fabrication and installation assessments of the shortlisted concepts were also undertaken, which involved considering traditional and novel installation methodologies. Finally, installation costs and schedule estimates were derived utilising Monte Carlo simulation.

Key Contact

Dr Ramsay Fraser
Director, Structural Engineering

Ramsay is a structural engineer with 25 years postgraduate experience in offshore engineering. His technical experience includes design and analysis of offshore structures (jackets, topsides, GBS, jack-ups, semi-submersibles, subsea templates, pipelines and wind turbines), hydrodynamics of fixed and floating structures, non-linear and dynamic FE analysis, structural reliability analysis, and fracture and fatigue damage assessments. He holds a PhD in Finite Element Principles, and has a thorough understanding of the theory used by ABAQUS, USFOS, SESAM, STRUREL and FLUENT.
Atkins has a strong transmission and distribution team, providing electrical engineering consultancy services to key clients such as National Grid and Central Networks. Services range from design and procurement of substations, through to grid connection assessments for planned new generation assets in the conventional, nuclear and Renewable generation sectors.

By combining our electrical engineering capability with our offshore structural engineering, Atkins is able to offer a wide range of technical services to both Wind Farm developers and OFTOs (Offshore Transmission Operators) and we are actively engaged in both sectors.

Our expertise includes:
- Network planning and development
- Power system modelling
- Protection studies and fault calculations
- New connection applications and scheme design
- EHV/HV substation design and build
- EHV Cable Design
- Power distribution and protection equipment specification (e.g. Transformers, switchgear, cables, protection relays)
- Automated controls for substation and process industries (PLC/DCS/SCADA)
- Construction management and commissioning
Case Study
FEED Design of 40kV Submarine Cable and Substations

Atkins was commissioned by the Arabian Oil Company, Saudi Arabia, to undertake the FEED (Front End Engineering Design) of a new power supply link to an existing gas and oil gathering station located approximately 40kM offshore in the northern part of the Persian gulf. The commission included the design of:

- A 42 km long 40 kV submarine cable
- Offshore utility platform connected by a bridge to an existing Living Quarters
- Two 40 kV, 20 MVA substations (one at each end of the submarine cable) housing gas insulated switchgears.

The project included both design elements and management of a major subcontractor who carried out the cable route survey (42 km x 3km). It was a multi-disciplined, multi-location design and engineering project involving process, mechanical, piping, structural, architectural, civil, electrical, instrumentation and safety disciplines. Electrical power system, load flow and short circuit studies were carried out.

Key Contact

Ingar Loftus
Principal Electrical Engineer

Ingar is one of our specialists in electrical system development. He is a chartered engineer with over 15 years experience in high voltage electrical engineering. He is principally engaged in the future development of the grid system, both onshore and offshore. He has undertaken master planning for new infrastructure projects worldwide including complete feasibility studies for the electrical infrastructure for major projects in Central America, Middle East, Africa and the Indian Sub-Continent.
Atkins acquired MG Bennett, a leading mechanical engineering consultancy, in 2008. Working across a wide range of sectors, MG Bennett has undertaken numerous mechanical design commissions, including the design of the Falkirk Wheel Boatlift and the backup system to the Channel Tunnel boring machines. In the Renewables sector, MG Bennett has undertaken the complete design of a 1MW turbine and is actively engaged on the detailed design of a number of Renewable energy devices.

Our expertise includes:

- Concept design
- Detailed design including technical drawing
- Structural analysis
- Fatigue analysis
- Dynamics / seismic analysis
- Failure analysis
Case Study
DeltaStream Basis of Design Document

Tidal Energy Ltd are developing DeltaStream, a 1.2MW capacity tidal energy generator, distinct from other devices as it does not require fixing to the sea bed, therefore eliminating much of the installation cost. Atkins has been commissioned to generate design parameters for the DeltaStream device.

The design parameters include an overview of the operational environment, including predicted tidal current flows and survival design conditions based on the most severe occurrence expected over a 50 year period. Operational design loads and abnormal loads (including the effects of various failure modes) are being calculated for major components. Finally, construction, transportation, installation and decommissioning loads are being assessed.

The document will be updated and maintained as new design data becomes available from CFD simulation or model testing.

Key Contact

Nick Cooper
Technical Director, Design

Nick is the former Managing Director of MG Bennett, and is a Fellow of both the Royal Academy of Engineering and the Institution of Mechanical Engineers. His landmark projects include the design of large moving structures such as the Falkirk Wheel and process tools such as the A380 Creep Forming tool.
Reliability Engineering and Asset Management

Working from our offices in the UK, US and Australia, Atkins has a long established world class capability in reliability, availability and asset management across many sectors of the energy industry.

This capability is focused on key elements of the energy business, supporting our clients during all phases of the project life cycle from design through procurement and construction, commissioning and in-service operations.

Our Reliability Engineering and Asset Management expertise encompasses:
- Reliability Strategy Development and Implementation
- Maintenance Strategy Development and Optimisation
- Availability and Performance Simulation Modelling
- Reliability Engineering and Design Assurance
- Supply Chain Logistics and Spare Parts Optimisation
- Asset Management and Reliability Training and Skills development

These business level services are underpinned by extensive practical experience of reliability and maintenance management at all levels across a number of industries, coupled with widespread expertise in specialist tools.
In large power transformers the quantity of insulating oil can be substantial and, therefore, can represent a significant fire potential. Recognising this potential hazard, Atkins Reliability Group, based in Glasgow, were requested to support an extensive Offshore Wind project, with the objective of establishing the expectation of a fire/explosion developing as a result of an oil-filled Transformer failing catastrophically.

The analysis included a Failure Modes and Effects Analysis (FMEA) to establish critical aspects of the transformer operation and maintenance, coupled with detailed fault tree analysis supporting quantification of potential hazard frequencies. Particular consideration was given to common mode factors which had potential to undermine the multiple protection devices/processes incorporated to prevent the onset of some failure conditions and inhibit escalation of other developed faults.

The study advised on key equipments, upon which the through life safe and reliability operation of the transformer would depend and the necessity for actions to address related weaknesses in the design/operation.

**Case Study**

**Transformer Failure Assessment**

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**Key Contact**

**Duncan Gray**

**Chief Engineer, Reliability Group**

Duncan has over thirty years experience in the oil & gas and energy industries. His career has spanned project management, operations, design, and consultancy roles. In previous employment, Duncan was Chief Consultant on numerous engineering Asset Management studies, each focused upon developing unique and optimum operating policies/strategies for clients and based upon use of latest reliability engineering methodologies.
Securing development consent is a key milestone in the construction programme for infrastructure projects and carries the potential for substantial programme risks. These risks are further exacerbated by the number of consents currently required and by the number of consent granting bodies involved.

As such, a ‘planning led’ approach is recommended. Atkins employs expert chartered planners with significant ‘lead consultant’ experience in the field of infrastructure development who work with engineers and programmers to secure consents as part of the delivery team.

Atkins is the leading integrated planning and environmental consultancy in the UK, recognised through winning the ‘Best Consultancy’ award for four consecutive years at the prestigious Edie.net awards. In addition to providing a full suite of Environmental Impact Assessment services, we have a proven track record in consents management for complex infrastructure projects and as such, are well placed to support projects through the planning process.

Our expertise include:
Atkins has town planners with relevant experience and environmental experts in both the marine and terrestrial environment for all environmental disciplines including:
- Ecology
- Air, climate and odour
- Noise and vibration
- Landscape and visual assessment
- Cultural heritage and material assets
- Hydrology and hydrogeology
- Geology, soils and contamination
- Sustainability
- Socio economics

Our solutions are comprehensive providing advice for:
- Consents
- Environmental management plans
- Strategic Environmental Assessment
- Appropriate Assessment (Natura 2000 sites)
- Stakeholder engagement strategy
- Planning risk assessments and mitigation
- Environmental Impact Assessment
- Sustainability appraisal
Atkins was commissioned to provide an assessment of environmental management across the Estate’s operations. The aim was to present a comprehensive assessment of the Estate’s performance, both positive and negative, and to propose a realistic way forward.

The Crown Estate owns around 55% of the foreshore (between mean high and mean low water) and approximately half of the beds of estuarial areas and tidal rivers in the United Kingdom. It also owns the seabed out to the 12 mile territorial limit, including the rights to explore and exploit the natural resources of the UK Continental Shelf, excluding oil, gas and coal. Our objective was to integrate environmental considerations with commercial and other demands in order to achieve effective stewardship of the Crown Estate.

Information on the activities and the management of stewardship operations across the Estate was obtained from numerous sources, including workshops, site visits, and detailed discussions with key personnel. A report was produced reviewing the key environmental issues affecting each estate, how these are managed at present and improvements to the Estate’s environmental management of its properties.

### Key Contact

**Nigel Coulshed**  
**Head of Marine Regulation and EIA**

Nigel has over 14 years experience of environmental assessment and management within the UK. Nigel has been the project director and project manager for EIAs and SEAs for numerous infrastructure project including bridges, ports & harbours, causeways, Renewable energy, roads, nuclear industry, wastewater and energy projects.
Atkins has an enviable reputation in providing an extensive range of process safety services at various stages of plant life for fixed and floating offshore facilities worldwide. These include:

- HAZOP & HAZID Studies
- Conceptual, Coarse & Detailed Risk Assessment
- Safety Element Design and Modification Reviews
- Safety Case Delivery
- Compliance, Auditing and Investigations
- Due Diligence

Atkins is adept at selecting the appropriate techniques and applying the highest levels of process engineering experience to obtain meaningful safety analysis.

We use a range of well known tools and software to deliver these services efficiently and cost effectively. More importantly, Atkins’ staff are proficient in applying safety theory in a sensible and practical way in combination with the commercial and technical realities of each operating environment.

The hazards associated with operating offshore Power Generation facilities are similar to Oil & Gas facilities and therefore many of our services and techniques are transferable. In addition to Oil & Gas facilities, we have also provided safety support to renewable projects such as the Pelamis wave energy converter and Inner Gabbard Offshore Substation Platform.
Case Study
Inner Gabbard Wind Farm Offshore Substation Platform

Atkins was commissioned by Siemens to carry out a number of safety studies during the detailed design of the topsides for the Inner Gabbard Wind Farm Offshore Substation Platform. The assessments completed by Atkins included a Fire and Explosion analysis to determine whether the protection measures on board were suitable. An Escape, Evacuation and Rescue study was also completed to ensure that the provisions provided on the platform to allow personnel to escape were sufficient for the various manning levels that could be present.

The non-process hazards that are present on any offshore facility were also reviewed. These included helicopter crash, boat transfer, ship collision and global structural failures. The output from these assessments were used to perform a Quantitative Risk Assessment (QRA) of the platform to ensure that the risks to personnel were As Low As Reasonably Practical (ALARP).

Key Contact

Mike Green
Chief Engineer, Offshore Safety and Downstream Engineering

Mike, who is Head of the Oil & Gas department in Glasgow, holds an MSc in petroleum engineering. He has over 25 years experience in the Oil and Gas Industry and has specialised in offshore safety since 1990. Prior to that, he worked for a major international oil company where he was involved in engineering, operational and management aspects of a number of existing and new offshore developments. Mike spent a significant proportion of this time at a senior supervisory level offshore, with assignments as production foreman, well operations foreman and Offshore Installation Manager. Mike has also provided safety support to the renewables industry, managing Atkins safety support during to the Pelamis and Inner Gabbard projects.
The evidence shows that ignoring climate change will eventually damage economic growth. Our actions over the coming few decades could create risks of major disruption to economic and social activity, later in this century and in the next, on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century. And it will be difficult or impossible to reverse these changes. Tackling climate change is the pro-growth strategy for the longer term, and it can be done in a way that does not cap the aspirations for growth of rich or poor countries. The earlier effective action is taken, the less costly it will be.

Stern Review on the Economics of Climate Change, 2006
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