



AtkinsRéalis

ENERGY STORAGE



Engineering
Net Zero™





THE CHALLENGE

The requirement to store energy is a fundamental component of the modern global energy system.

Together, with our industry partners and clients, and our global team of consultants, designers, engineers and project managers, we can change the world.

Energy security and supply across international boundaries, combined with the global Net Zero challenge creates new demands on existing storage assets and drives the need to define, develop and implement new storage infrastructure.

The development of large scale energy storage space in underground facilities such as salt caverns and depleted oil and gas reservoirs as well as on surface in vessels is essential to the effective operation of the energy system providing both resilience and system balancing.

AtkinsRéalis Energy Storage specialises in the subsurface storage of hydrocarbons and clean energy products. We are at the forefront of the development of the Net Zero energy system and working closely with our clients to develop complex hydrogen facilities. These projects will be integrated into various Net Zero industrial clusters.

Key to our approach is our ability to transfer learning and expertise from the use of Hydrogen in plants such as refineries and nuclear facilities.

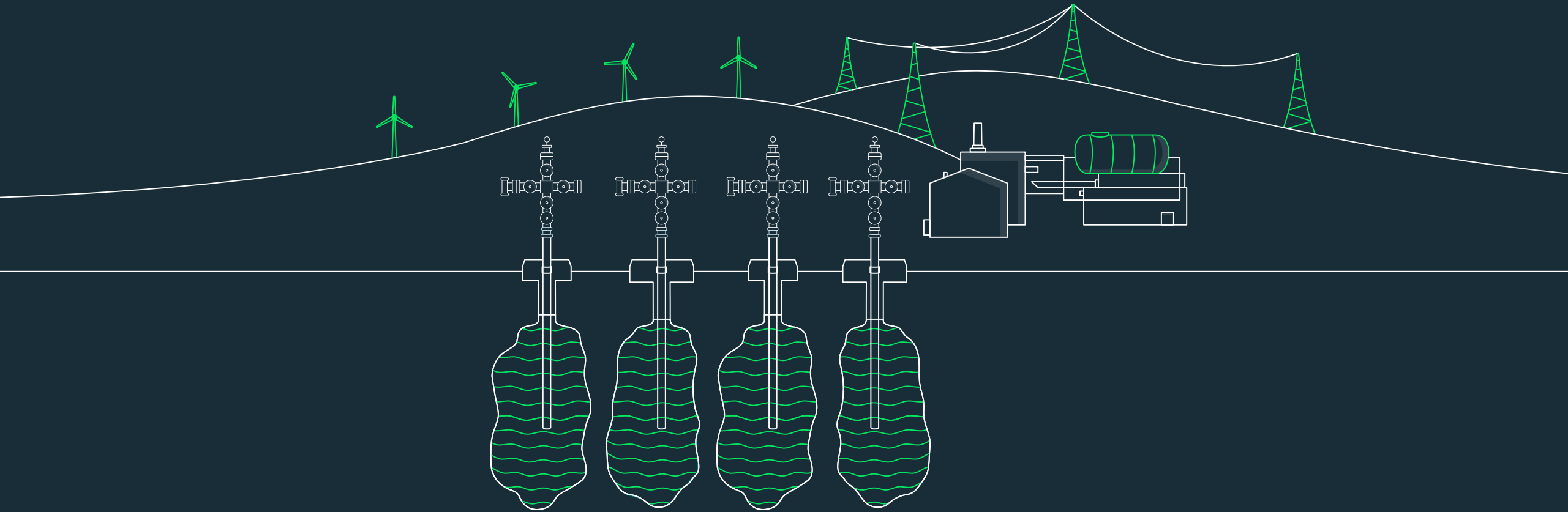
We use these skillsets and experience to mitigate and manage the novel aspects of hydrogen project and hydrogen technology risk.

Delivered by our dedicated, in-house Energy Storage team, our project and technical staff support our clients throughout the project lifecycle in the development, engineering, design and execution of energy storage facilities.



OUR SERVICES

A comprehensive end-to-end service offering



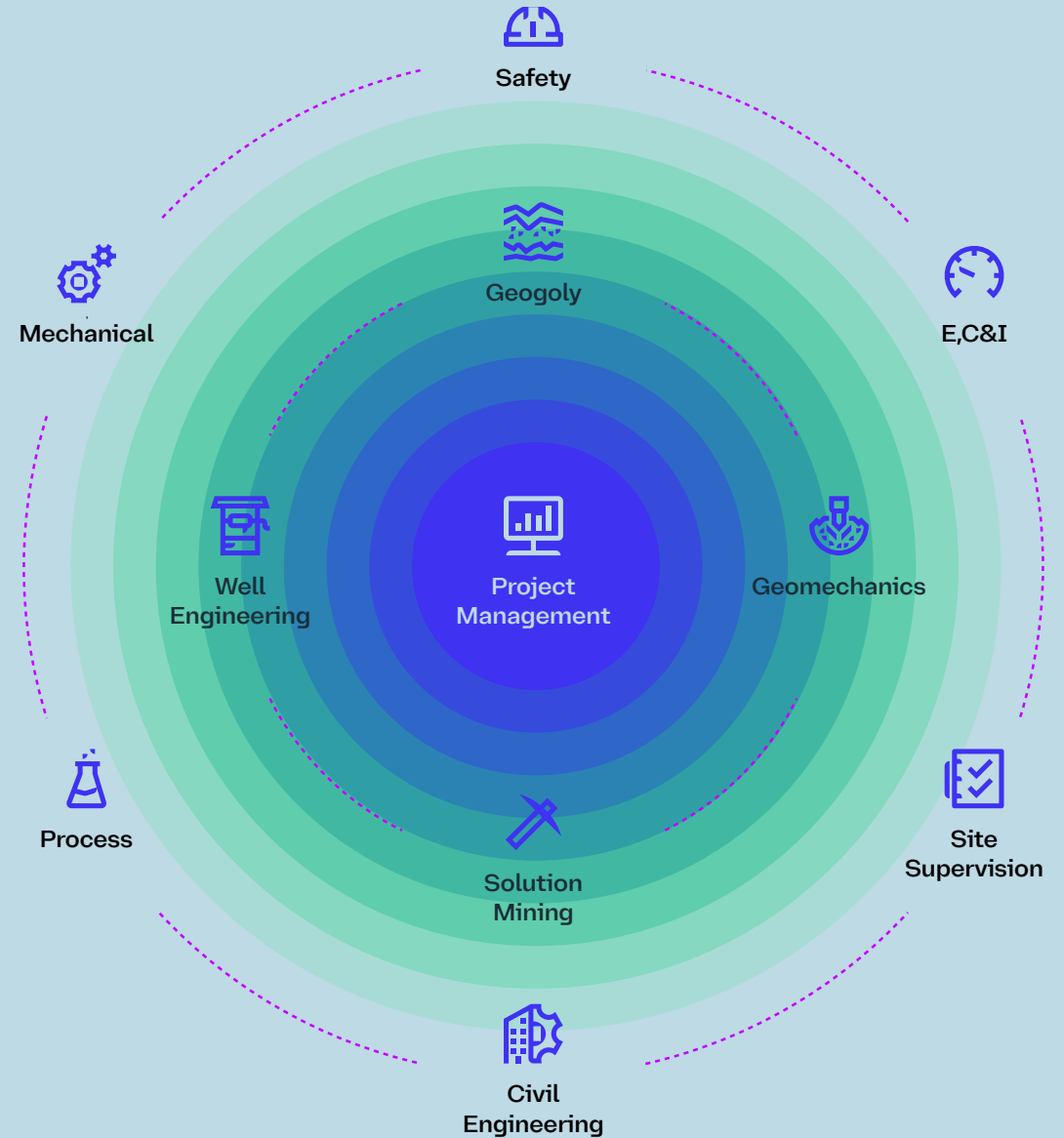


OUR SPECIALIST MULTIDISCIPLINARY SURFACE AND SUBSURFACE EXPERTISE

We combine multi-disciplinary technical excellence with rigorous project management and effective collaborative behaviours to underpin our reputation as a leader in the energy storage sector, where we provide services to multiple clients across the UK and Europe.

In delivering these services, we have developed an in-house, specialist, multi-disciplinary team with the skillset and experience to understand how to mitigate, minimise and manage storage project and infrastructure risk.

Fundamentally, we understand the equipment and systems as well as the critical interfaces between processing plant, wells and the storage asset.





OUR SPECIALIST MULTIDISCIPLINARY SURFACE AND SUBSURFACE EXPERTISE

PROJECT MANAGEMENT

Our Project Management team have extensive sector experience and expertise. We work collaboratively with our clients to define, plan and deliver project objectives minimising risk to programme, cost and quality.

Our project management services can be tailored to compliment client capabilities.

GEOLOGY

Geological assessment is inherently open to interpretation. Our team of Geological specialists have years of experience in the assessment and interpretation of geological formations. They are engaged early in the design process to ensure risks are identified and coordinated with geomechanics and solution mining.

GEOMECHANICS

Our world leading Geomechanics team provide state-of-the-art analysis and numerical modelling to assess the subsurface conditions.

They collaborate closely with AtkinsRéalis subsurface disciplines and client operations to ensure the maximum value is extracted from the storage asset.

SOLUTION MINING

A well planned and controlled solution mining process is critical to the successful delivery of underground caverns ultimately minimising the risk of latent issues which can impact future operations.

Our experts have been involved in the development of hundreds of caverns around the world providing an unparalleled level of experience to deliver our clients solution mining needs.

WELL ENGINEERING

The engineering and operation of wells presents significant risk to any subsurface storage project. In addition, there are inherent differences between energy storage and E&P well requirements. Our specialist in house well engineering team understand these risks and differences.

We provide services throughout the lifecycle of a well including design, implementation, operation, workover and integrity management where our expertise allows us to manage, plan, engineer and supervise well operations.

PROCESS PLANT ENGINEERING

Our process engineering team includes specialist capability in Process, Mechanical, Electrical, C&I and Civil Engineering. We are experienced in delivering integrated surface and subsurface energy storage projects and can offer a comprehensive set of services from design, engineering, analysis to asset management and operations support. We drive efficiency and safety in the delivery of complex surface plant engineering works.

SAFETY

Safety is our priority where it is embedded in the planning of our projects from the outset and assessed continuously throughout delivery. We have safety specialists with extensive experience of process safety studies (HAZOP, HAZID), risk assessments as well as overall safety management systems. We do this to not only comply with national and international standards but also our client's policies and procedures.

SITE MANAGEMENT AND SUPERVISION

Our site management and supervision teams are there to ensure works are implemented safely and in compliance with design and engineering requirements of the project. We can provide site management and supervision throughout all phases from construction, commissioning, performance testing and close out. Our site services are flexible providing assurance of 3rd party works and direct management of supply chain as EPC-M.



OUR EXPERIENCE AND CAPABILITIES

Delivered by our dedicated, in-house, energy storage specialists, our project and technical staff support our clients throughout the project lifecycle in the development, engineering, design, construction and commissioning of energy storage facilities.





OWNER'S ENGINEER SSE

AtkinsRéalis is a long term delivery partner to SSE Gas Storage, providing a range of Engineering and Project Services to the salt cavern storage sites at Aldbrough and Atwick.

In 2013, AtkinsRéalis were appointed as their Subsurface Technical Authority and in 2017, we were appointed as their Owners Engineer. We continue to support as Owners Engineers today.

AtkinsRéalis current support to SSE covers a range of services both at site and from the AtkinsRéalis home office, including, but not limited to:

- Provision of optimisation assessment of existing assets to maximise storage potential.
- Management, planning, engineering and implementation of major projects, including:
 - Dry Recompletion of Gas Storage wells.
 - Decommissioning of storage assets.
 - Development of Hydrogen storage projects.
- Engineering and design of major modifications to existing surface and subsurface assets.
 - Procurement support.
 - Construction management and supervision.
 - Provision of maintenance management.
 - Development of two well integrity management processes and procedures.
- Management, planning, engineering and supervision of major well interventions.
- As Owners Engineer, we enact the project on the client's behalf providing the project management, site management and technical expertise and supervision of the works to ensure the project is delivered to programme, cost, and quality.





ISLANDMAGEE ENERGY: POWER-TO-X DESNZ

AtkinsRéalis has been appointed to develop the engineering design of new H₂ storage facilities on the Islandmagee Energy site in N. Ireland.

AtkinsRéalis is providing concept design and front-end engineering design (FEED) services for the proposed hydrogen storage at Islandmagee as part of the first-of-a-kind Ballylumford Power-to-X project. The project is part of the UK Government Long Duration Energy Storage Demonstration innovation competition, run by Department for Energy Security and Net Zero (DESNZ).

AtkinsRéalis have provided concept design and FEED services to support Islandmagee Energy's vision for Large Scale Hydrogen Storage at the Islandmagee site, utilising proposed salt caverns to store hydrogen.





ALDBROUGH HYDROGEN STORAGE EQUINOR

Equinor's Aldbrough hydrogen storage (AHS) project is a joint venture with SSE to develop a first of a kind, major hydrogen storage plant.

The facility will be located adjacent to the existing Aldbrough Gas Storage site. With a planned capacity of at least 320GWh, Aldbrough Hydrogen Storage would be significantly larger than any hydrogen storage facility in operation in the world today. The Aldbrough site is located to store the low-carbon hydrogen set to be produced and used in the Humber region and will be a key part of the East Coast Industrial Cluster developments.

SSE Thermal and Equinor's partnership in the Humber marks the UK's first end-to-end hydrogen proposal, connecting production, storage and demand projects in the region.

While the Aldbrough facility would initially store the hydrogen produced for the Keadby Hydrogen Power Station, the benefit of this large-scale hydrogen storage extends well beyond power generation. The facility would enable growing hydrogen ambitions across the region.

AtkinsRéalis have collaborated with Equinor, SSE, and environmental consultants ERM, to assess the feasibility of the project and to develop the concept design for the surface and subsurface infrastructure.

Our international experience in the development, engineering and execution of major subsurface energy storage projects, coupled with our knowledge of the location, means we were able to develop an optimum solution for the project, tailored to Equinor's storage needs.





OWNERS ENGINEER NORD-WEST KAVERNENGESELLSCHAFT MBH (NWKG)

AtkinsRéalis is a long-term delivery partner to NWKG in Germany.

NWKG are responsible for the operation of the German national hydrocarbon reserve where they operate several storage sites across Germany.

We have a multi-year Owners Engineer contract with the client. This contract has two main facets, provision of technical services and support, and operation of a Project Management Office (PMO).

Our technical services are focussed on both the long term strategic aims of the NWKG organisation including its long term storage development plan as well as support to operations to enable the continued use of the subsurface storage assets.

Part of our role includes assessment of the assets for future strategic opportunities such as alternative decarbonised fuels.

AtkinsRéalis has established an embedded PMO responsible for managing NWKG's portfolio of major CAPEX projects. Our role on each project evolves as it matures through the project lifecycle where our focus is on ensuring projects are delivered to programme, cost and quality.





HYDROGEN STORAGE NORTHERN GAS NETWORKS (NGN)

AtkinsRéalis has been appointed by NGN to support the development of a hydrogen storage facility in Teesside, UK.

NGN is developing plans to supply hydrogen to domestic and commercial properties in Redcar as part of its Hydrogen Village project. The plans involve producing hydrogen locally, from renewable energy sources.

Storage will be a key component of the system designed to provide resilience of hydrogen supply to the Hydrogen Village.

AtkinsRéalis has worked closely with NGN to investigate and develop the concept design for both surface and subsurface storage options.

We have developed a concept process design, layouts, high-level operating philosophy, and an AACE class 5 cost estimate.



THE ENERGY TECHNOLOGIES INSTITUTE (ETI) HYDROGEN STORAGE APPRAISAL

AtkinsRéalis was commissioned by the ETI to undertake an appraisal of salt cavern behaviour when operated in a hydrogen storage scenario to meet peak electrical demands (up to 1GWe).

This two-year feasibility study included a review of UK salt storage sites, and available gas turbine technologies to burn up to 100% hydrogen.

We examined caverns in Cheshire, Teesside and East Yorkshire and worked closely with UK leading cavern storage operators including Storengy, SSE Gas Storage and SABIC to base our research on real cavern data. Our work advanced the understanding of the potential use of salt caverns to provide hydrogen storage in a low carbon economy.

During this feasibility project, our services included:

- Health safety and environmental (HSE) regulatory and compliance guidance.
- Full-chain cost model, including capital expenditure, operational expenditure to AACE International Level 5.
- Project planning, management and systems integration.

Technical subsurface specialists:

- In-depth understanding of the geology and stratigraphy of the identified salt fields.
- Determination of minimum and maximum cavern pressure.





NATURAL GAS STORAGE EDF ENERGY

AtkinsRéalis supported the development and implementation of the Hill Top Farm gas storage facility. This project involved the construction of a major extension of the existing gas plant at Hole House and the addition of 10 new gas storage caverns.

We were appointed to carry out the detailed engineering design, equipment specification and planning of the well construction and completions. Subsequent to this, we then provided Owners Engineer services to oversee the main drilling, completion and commissioning works.

AtkinsRéalis provided a wide range of technical and project management services through the design and execution phase, including:

- Geomechanical assessment.
- Well and completion design and optimisation.
- Equipment specification, including casing, tubular, Christmas trees, wellheads, downhole safety valves and completion equipment.
- Drilling contractor strategy and selection.
- Construction sequencing support.
- Development of mechanical integrity test procedure and criteria.
- Regulatory compliance and HSE liaison.
- Conceptual design of drilling pads and wellhead cellars.
- Safety support including HAZOP, Hazardous Areas classification, fire and explosion risk assessment and SIL assessment.
- Quality assurance of the contractor works.
- Technical oversight and support during drilling and completion activities.

AtkinsRéalis continues to support EDF providing operational asset management support on an ongoing basis.



OUR LOW CARBON TRACK RECORD

Over 100 years ago we made our mark while the energy sector was undergoing a major transformation.

Today, as a new energy paradigm emerges, our clients recognise us for our sustainable project execution and tangible contributions to improving people's lives around the world.

Our teams are based in the UK, Europe, Middle East, Canada and the United States.

Across the globe AtkinsRéalis has 27,000 engineering and project management staff with over 3,000 working on low carbon energy projects. Our experts deliver offshore wind, hydroelectric, carbon capture, hydrogen and power distribution projects.

LEADING INDUSTRY BY EXAMPLE

TRANSMISSION & DISTRIBUTION

We work with National Grid, Office of Gas and Electricity Markets (OfGEM), and Energy System Operators (ESOs) to support the transformation of the grid to support increased decentralisation of supply from renewables. We provide services in network planning and development, power system modelling, High Voltage and Low Voltage substation Front End Engineering Design and detailed design and support to utility regulation.

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LOW CARBON HYDROGEN

We work closely with our clients to support the development of hydrogen projects. We have provided project development and multi-discipline engineering and design services to organisations including SSE, EDF, TAQA, INEOS, PROTIUM and MASDAR.

Our hydrogen project portfolio includes hydrogen production from electricity and reforming fossil fuels, hydrogen storage, transport and demand cases including power generation and transport.

Rachael.Eatwell@atkinsrealis.com

CARBON CAPTURE

We delivered SaskPower's groundbreaking Integrated Carbon Capture and Utilisation initiative in Saskatchewan, Canada. We have completed feasibility, concept and FEED studies for carbon capture projects for Drax, Energy Technologies Institute, SSE, National Grid, the Department for Business Energy and Industrial Strategy (BEIS) and the International Energy Agency. AtkinsRéalis is the owner's engineer for the pioneering Whitetail Clean Energy project on Teesside in the UK.

Julie.Gilmour@atkinsrealis.com

INDUSTRIAL DECARBONISATION

We support energy intensive industries to develop their roadmaps to Net Zero through specialist engineering advice. We assist our clients in understanding their current energy demands and greenhouse gas emissions and utilise our in-house tools, methodologies and expertise to identify viable technology interventions to achieve targeted levels of emissions reductions.

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NUCLEAR

We work alongside our clients to provide unparalleled support throughout the entirety of the nuclear lifecycle. We are working on projects to realise the benefits of nuclear generation in a low carbon energy system, including for hydrogen generation and direct air carbon capture. We are also heavily involved in the future of nuclear power developing small modular reactors (SMRs) and fusion projects.

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WIND & RENEWABLES

We carry out design, geotechnical, environmental, asset integrity and life extension work on offshore and onshore wind turbines for developers in the UK and globally. We provide transmission and distribution services for offshore wind connectivity to the grid and we integrate renewable energy with hydrogen generation projects.

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WORKING
TOGETHER
TO PROTECT
TOMORROW

DIFFERENTIATORS BRINGING VALUE TO OUR CLIENTS

FULLY INTEGRATED GLOBAL TECHNOLOGY CENTRE

Our advanced global technology centre located in India is fully integrated with our day-to-day client delivery and held to the same high-quality standards and systems across our organisation. Our focus on investing in the best tools and data processing capabilities and a team that has delivered hundreds of projects all over the world provides our clients the opportunity to achieve lower costs, and longer working hours - seamlessly.

LOCAL COMMUNITIES AND SUSTAINABLE DEVELOPMENT

We are committed to leaving behind a positive and sustainable legacy for the communities in which we work. We have a demonstrated track record of our commitment to community engagement, particularly in industrial work locations, delivering:

- Skills training and mentoring programs
- Involvement in our local community's organizations
- Traditional knowledge and community studies
- Assistance in education and health services
- Permitting and approvals

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