



Nuclear New Build

Shaping the future of nuclear energy



Welcome to Wood

Wood is a global leader in engineering, project and technical services. It combines the experience and expertise of Amec Foster Wheeler and Wood Group into a full-scope service company supporting industrial assets for customers worldwide.

Playing a critical role in nuclear projects across the world

We have been at the forefront of nuclear energy for over 60 years. We are passionate about nuclear energy, its role in the world today and in the future. Our reputation is founded on the very best technical expertise and the reach to deliver this knowledge locally to projects across the world. Our approach is highly collaborative and based on long-term relationships. We are a trusted partner for customers on five continents.

Our people write the world's standards

At the very heart of our business are our nuclear specialists, including international technical leaders in their field.

We choose to be technology independent so that we can bring our partners the very best-in-class experience from different technologies and vendors.

We also own the UK's largest independent nuclear research and testing facilities with 12,000m² of labs and test rigs plus remote handling and inspection technology.

As part of Wood, we can call on the skills and resources of more than 55,000 multi-disciplinary professionals across engineering, design, project and programme management disciplines.

Technical excellence breeds innovation and assurance

By combining engineering and technical excellence with innovation, research and development, we have the ability to solve the world's most complex nuclear problems safely and cost effectively. Our experience across the lifecycle provides unique insights into the complex issues faced by our customers, including the commercial challenges caused by fluctuating global energy prices. Our technical support spans all project phases including design, licensing, qualification, construction, commissioning, operations and decommissioning.

We provide flexible, commercial and technical solutions that span the entire nuclear lifecycle of civil and defence nuclear markets at Tiers 1, 2 and 3. This is enabled by a powerful combination of research and development, expert knowledge of nuclear regulatory and licensing frameworks, design, engineering and project and programme management.

Playing a key role in every UK new build project.

We are working at the world's most challenging decommissioning sites including Sellafield, Chernobyl and Fukushima.

Developing critical technologies for the future including SMRs, Generation IV reactors and fusion.

Strategic lifetime partner for fleet critical projects and life extension support to EDF Energy.

More than 50 years as provider of technical assurance and research services to ensure the safe and reliable operations of the UK's nuclear submarine fleet.

Leadership of international joint ventures across the lifecycle. Accredited to BS 11000, the world's first international standard on collaborative business relationships.



Nuclear New build

Our global new build expertise includes:

Reactor design

Spanning concept through to detailed design and design substantiation. We are technology independent and have comprehensive experience of all major reactor types that encompasses Nuclear Island, Balance of Nuclear Plant and Balance of Plant, ensuring the design is tailored appropriately.

Reactor operations and improvement

Working with our customers in keeping design intent, plant condition and technology working together to maximise the reliability, output and lifespan of nuclear power plants.

Inspection Validation Centre (IVC)

We have 40 years' experience of developing and providing independent inspection validation of very high integrity components such as the RPV, steam generator and pressuriser through the whole lifecycle, from the end of manufacture and pre-service through to periodic in-service inspection validation.

Equipment Qualification (EQ)

Our experience and laboratory capability to test and qualify safety critical components makes us ideally placed to provide a full suite of EQ services, from EQ plans and test programmes to preservation strategies.

Owner's Engineer

Proud of our long-term partnerships, we support our customers' interests to deliver the complexities of a project. The Owner's Engineer role is an important strategic position with the objective of de-risking and improving the overall outcome of the project.

Licensing, environmental studies and safety case

We have long-term, established relationships with global licensing bodies, with deep understanding of licensing, regulatory and technical approval requirements, including Europe, the Middle East and Asia.

Nuclear and conventional safety management

Our expert safety teams help our customers to develop safety processes to meet ongoing licensing conditions. We offer expertise across all major international regulatory regimes. In addition, if the regulatory framework is not well established, we can advise on its creation.

Environment and Infrastructure

Our team has extensive experience in the investigation, appraisal and mitigation of the potential impacts of nuclear new build, ultimately leading to successful application for planning consent.

Technical safety

Experts in international codes and standards, we lead the way in our safety case approaches and techniques, achieving successful design substantiation. As the first UK-based member of the European Technical Safety Organisation (ETSON) we work with IAEA, WNA, ASN and others on continually improving global nuclear safety codes and standards.

Global nuclear pedigree

We are technology independent and have comprehensive experience of reactor design and operations and new build programmes for all major reactor types: PWR, BWR, VVER, AGR, RBMK, Magnox, GenIV technologies, SMRs and Fusion.

Environmental permitting

We have studied, assessed and successfully applied for all of the necessary environmental permits required to construct and operate a nuclear power station.

Site characterisation

Our contaminated land consultants, geologists and hydrogeologists have investigated sites in order to prove their suitability for nuclear new build.

Plant engineering, procurement and construction

Our programme management and EPCm/EPC experience means we have programme and project managers, construction experts and multi-disciplinary engineers who know exactly how to assess a project's value and how to manage and deliver high-value, complex programmes.

“Technology independent with comprehensive experience of reactor design, operations and new build programmes”

Research, development and ingenuity

A business based on knowledge

Wood's deep technical understanding of nuclear energy is underpinned by constant research and development on behalf of vendors, operators, regulators and state governments.

Our 12,000m² complex of laboratories and test rigs – the largest independent laboratories in the UK – includes the UK's High Temperature Facility, which carries out essential research on materials for Generation IV future reactor designs. The labs provide a unique combination of multi-disciplinary experts, practical technicians and nuclear-experienced site operatives who can develop concepts, build prototypes and implement engineering change or major projects on site. Our experts include world leaders on research into the corrosion and structural integrity of materials in pressurised water reactors. To assist this research, we have the rare capability to replicate complex chemical, radiological and physical operating environments encountered in the nuclear industry.

World-leading expertise

Wood's nuclear staff are at the forefront of their disciplines, including international technical leaders in their field. Many play an active role in International Atomic Energy Association (IAEA) missions, technical committees and International and National Industry Standard committees.

Our Heads of Profession network drives the professional development of technical and scientific staff whilst our knowledge management system is recognised as good practice by the IAEA. This is supported by a Competency Assurance System (CAS) which supports and substantiates the competency of our staff. We also understand that good ideas often come from diverse thinking and our approach to diversity and inclusion is award winning.

Independent Nuclear Assurance

We support operators and regulators with Independent Nuclear Assurance (INA) and Independent Technical Assurance (ITA). Our impartial, expert, second opinion – based on the best technical and safety advice – helps licensees manage the risk in designs and safety cases.

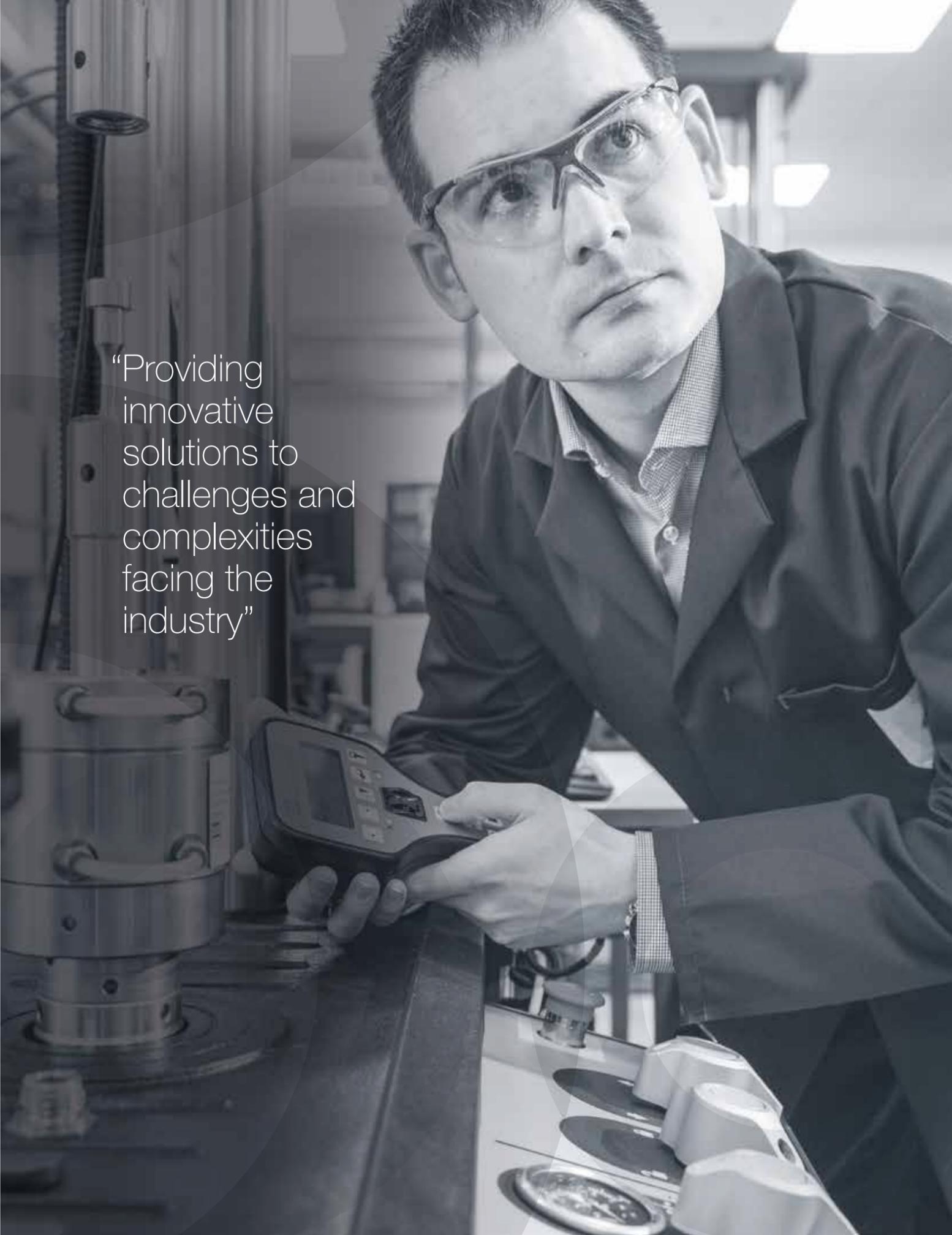
Developing the future

Wood has a leading position in reactor technology, conceptual design and engineering relating to new nuclear technologies including Generation IV reactors, fusion and small modular reactors (SMRs). We are the largest UK industrial contributor to ITER, the world's largest nuclear fusion project, where our work ranges from designing prototypes for key components to complex remote handling systems essential for reactor operations.

Our work on SMRs includes designing the reactor cores and containment, steam generators and refuelling systems and drawing up policies for waste management, environmental management, licensing and decommissioning. We are also leading the UK Digital Reactor Design project, a government-funded research programme focusing on the use of virtual engineering and high-performance computing to enhance the techniques used to design reactors and optimise their performance.

A critical success factor

No matter where we work or what we're doing, we never compromise on the safety of our people, our partners or anyone affected by our projects. Our relentless commitment to safety is encapsulated in our strategy for achieving sustainable, world-class health and safety performance. Our HSSEA performance is a critical factor of our business success. We never stop searching for ways to refine and strengthen our safety management approach to ensure it is at the forefront of a continually evolving industry. What's more, our breadth of expertise across the entire nuclear lifecycle enables us to holistically manage nuclear safety and wider health, safety, security and environmental (HSSE) issues at every level.



“Providing innovative solutions to challenges and complexities facing the industry”

A trusted, strategic partner

Ensuring the development, design, build and commissioning of cost-effective and safe nuclear power plants

In the following section you can find examples of Wood nuclear new build projects. Working with global customers, we use our experience from across the lifecycle to reduce risk and overall programme cost, while delivering technical excellence for our customers.

By building long-term strategic partnerships with our customers, we align our business performance to our customers' critical success factors at both a commercial and reputational level.

A collaborative approach

Collaboration with delivery partners and customers is a hallmark of many of our major projects. We are one of the first organisations in the nuclear sector to achieve BS 11000, a collaborative standard for assessing and selecting potential partners and managing business relationships. We operate Lifetime Quality Assurance (QA) Programmes, which ensure that our quality policies are regularly reviewed, and we are approved to international standards of quality, including: ISO 9001; ISO 14001; and OHSAS 18001.

Our successful participation in the early stages of nuclear new build projects has led to many of our customers engaging our support throughout the entire nuclear lifecycle.

The UK regulatory environment is acknowledged within the industry as the toughest worldwide. Wood's experts have worked closely with regulators both in the UK and globally for over 60 years, bringing that unique experience to our nuclear new build customers to ensure their projects meet the most stringent requirements.

We are the first UK-based member of the European Technical Safety Organisation (ETSON) and work with the IAEA, WNA, ASN, ASME and other authorities on improving global nuclear safety codes and standards.



“Reducing risks and lifetime programme costs from new nuclear”

Supporting the introduction of the EPR into the UK – Partnering with EDF Energy



Customer: EDF Energy
Location: UK and France

EDF Energy is developing new nuclear power stations at Hinkley Point and Sizewell. These will use the Areva EPR reactor technology and are based on the design of the Flamanville 3 power station under construction in France.

Wood is working with EDF Energy on the UKEPR nuclear new build programme.

This work broadly falls into three categories:

- Engineering and technical support
- Planning regulations and Generic Design Assessment (GDA)
- Nuclear procurement

Scope: Engineering and technical support

Wood has supported EDF Energy's Nuclear Engineering Division, the Responsible Designer for the UK EPR Project, since 2008. This has included the delivery of packages of design development and also embedding employees within a number of EDF Energy offices in France and the UK. It has been a multi-disciplinary programme, involving engineering and technical specialists from across the company. We supported the mapping of French codes and standards to equivalent UK standards, and modified documents translated into English, to ensure absolute clarity for the UK regulators.

We also played a key role in the localisation of French reactor technology into the UK statutory regulatory environment. We provided support to complete basic design reference, which was a requirement of the post-GDA reference design process, and helped to meet regulatory expectations with regards to the quality of submissions and responses to GDA findings.

Benefits:

- 60 years' experience of UK licensing led to quick and efficient acceptance of new reactor technology in the UK regulatory environment.
- Localisation of codes and standards and documentation led to clarity and proficiency in efficient resolution of UK regulatory requirements.
- Support and influence to design strategy.
- Reduction of waste volumes achieved significant cost savings through:
 - Support to optimising UK nuclear supply chain delivery strategy;
 - Early engineering of waste routes.
- Technical support to assessment findings allowed project to progress into nuclear site licensing and consenting phase.

Scope: Planning regulations and Generic Design Assessment (GDA)

As part of the statutory licensing process that EDF Energy/ Areva obtained through the GDA, a design acceptance confirmation and statement of design acceptability were granted from the UK regulatory authorities for the EPR reactor design. EDF Energy has separately obtained a Development Consent Order (DCO) to build a new power station at the Hinkley Point site. Wood has provided support to EDF Energy in achieving these significant milestones, using technical expertise in areas such as human factors analysis, safety case analysis, structural integrity, civil engineering, instrumentation and control and regulatory requirements. Pragmatic assessment of the discrepancies in the reference design from UK requirements and justification of critical elements of the design meant that minimal changes were needed.

The DCO was one of the first awarded under the UK's new regime for permitting major infrastructure projects. Our involvement in this was substantial, from providing a significant amount of the technical input into the environmental impact assessment, to supporting the application with expert witness testimony at the planning enquiry. We continue to work in key roles within the EDF Energy team, to achieve regulatory approvals for construction through the preparation of the pre-construction safety (PCSR) process.

Benefits:

- Pragmatic assessment of discrepancies in the reference design and justification of critical elements of the design meant that minimal changes were needed.
- Integrated approach to site data for use in site planning, permitting and nuclear licensing.
- Supporting a positive view of the environmental impact to local communities and stakeholders during public consultation.

Challenges and solutions

Partnering with our customers to drive performance and innovation

Scope: Nuclear procurement

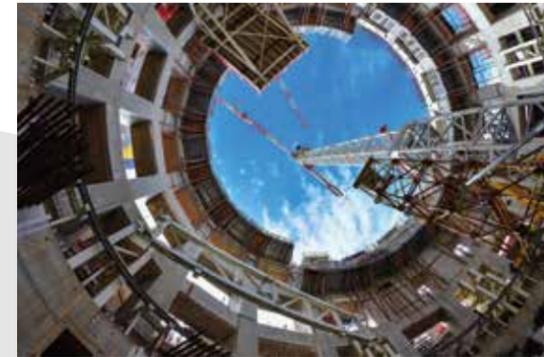
Wood provided procurement, safety, quality and commercial resources to support the procurement of several nuclear power plants to current European regulations. Services provided included: procurement consultancy – developing the strategy and process including the assessment; contract strategy, development and cost management from budgets to assessment of tenders and cost auditing; quality management services from contract development to assessment and development of the supply chain.

Wood designed and managed the procurement processes from sourcing, vendor financial checks, pre-qualification, qualitative and commercial assessment, and the technical (qualitative) management of the invitation to tender and vendor assessments of all contracts. This also included UK competence requirements for health, safety, security, sustainability, environmental requirements and quality (HSSSEQ) including vendor oversight. In partnership with EDF Energy in France and the UK, Wood managed the competition assessment. This included advising and managing the evaluation rules and tender criteria that would be the most economically advantageous.

As well as developing the acquisition and purchasing strategy for EDF Energy UK, we managed the cost and qualitative parts of the procurement. We also provided contract support and training in relation to International Federation of Consulting Engineers (FIDIC) and New Engineering Contract (NEC).

Benefits:

- Applied the concept of partnering and BS 11000 including diagnostics with the customer and supply chain as part of the procurement process.
- Supported EDF Energy in assessing the security, socio-economic, training and environmental aspects of the bid, including logistics, associated developments, skill and local workforce issues and supplier days.
- Advised the senior French and UK management teams on cost, price and productivity.
- Facilitated and delivered the collaborative working framework.
- Implementation of the Construction Design and Management regulations for all the procured contracts to enable the Responsible Designer to be able to comply with its duties.
- Quality management services for all procurement contracts.
- Provided competence management for all supply chain tiers 1-6.
- Vendor engagement and training in nuclear safety, quality and production improvement.



We are dedicated to working with our customers to help licence, design, build and commission cost-effective, innovative and safe new build nuclear reactor power plants.

We can also help to maximise the value of these new assets. We have been at the forefront of the industry for over 60 years, providing an expansive range of services spanning the entire nuclear lifecycle.

Today, we continue to bring innovative thinking to the opportunities and challenges shaping the future of the industry.

Ensuring the constructability of the world's largest energy experiment - ITER

Customer: ITER Organisation

Location: Saint-Paul-lès-Durance, Provence, France

Scope: Construction Management-as-Agent

ITER is the world's largest magnetic confinement plasma physics experiment. In southern France, 35 nations are collaborating to build the world's largest tokamak, a magnetic fusion device that has been designed to prove the feasibility of fusion as a large-scale and carbon-free source of energy based on the same principle that powers our sun and stars. The ITER experiment is crucial to advancing fusion science and preparing the way for the fusion power plants of tomorrow.

Roles and responsibility

Wood is lead partner in the construction management-as-agent contractor on the ITER site.

MOMENTUM, a joint venture made up of Wood, Assystem and KEPCO E&C, is in charge of construction preparation and project management, contract management, site coordination, works supervision and completions. Under a €174m contract lasting up to 10 years, the team provides construction project delivery including preparation of construction work packages, and supervises site activity. The aim is to ensure optimum outcomes for safety, people, quality, and schedule cost and performance. Wood, the largest UK industrial contributor to ITER, has been working on the project for decades. We have designed systems and components such as the first wall panels, test blankets and neutral beam remote handling equipment and have carried out studies into manufacturing, decommissioning and waste management.

Benefits:

MOMENTUM is there to help ensure that the ITER machine is constructed on time, on budget and that work is carried out safely. It oversees contract management, construction preparation, project management, site coordination, and works supervision for the installation of more than one million components. As ITER's FIDIC engineer (The International Federation of Consulting Engineers, an international standards organisation), MOMENTUM instructs contractors and assesses their work. It also manages the interfaces between contractors, which are critical in understanding where one work scope stops and another starts.

Regulatory experience

Independent regulatory expertise



We have exceptional experience of the issues relating to regulatory compliance including site selection, site characterisation, design calculation, safety cases and approvals, site licensing, environmental impact assessment and planning.

Our understanding runs so deep that we've helped our customers to overcome their challenges across three continents. We are also regularly consulted by international regulatory bodies.

We understand the needs of our customers because we work with governments, utilities, developers, operators and regulators to understand all of the dynamics, challenges and issues facing the industry today.

AP1000 GDA submissions

Customer: Westinghouse

Location: UK

Scope: GDA support for the AP1000

The AP1000, a GENIII+ pressurised water reactor, has been assessed by the UK's nuclear regulators, the Office for Nuclear Regulation and the Environment Agency. Their Generic Design Assessment (GDA) looks at the safety, security and environmental aspects of the reactor's design.

Wood assembled and led a team of experts to assist Westinghouse in achieving an interim design acceptance confirmation of Step 4 of the GDA for the AP1000, a critical stage in the reactor design approval process. Wood again supported Westinghouse in addressing outstanding issues and the project achieved the final design acceptance confirmation in March 2017.

Benefits:

- Project was delivered on time and to very tight timescales.
- Interim design acceptance confirmation was successfully achieved.
- UK context and regulatory interface was simplified.
- Efficient 'resource call -off' arrangements were set-up to tap into UK experts.

NuGen Nuclear New Build

Customer: NuGeneration Limited (NuGen)

Location: UK

Scope: Environmental services

Wood has been providing environmental services to NuGen since 2014 to assist in obtaining the necessary consents, permits, licences and approvals for the construction and operation of the proposed Moorside Nuclear New Build in West Cumbria. To date, this support has included primary supply chain assistance to NuGen for the delivery of underpinning baseline environmental characterisation, assessment requirements and document drafting for the:

- Environmental Impact Assessment (EIA) Scoping Report for the anticipated Development Consent Order application;
- Stage 2 Statutory Consultation Preliminary Environmental Impact Report (PEIR);
- Operational Environmental Permits for the Radioactive Substances Authorisation (RSA), Water Discharge Activity (WDA) and Combustion Activity (CA);
- Proactive planning scheduling and delivery of stakeholder engagement with a range of statutory and non-statutory stakeholders.

Wood has conducted/overseen the delivery of specialist baseline surveys that will be required to inform the EIA, permitting and evolving engineering design for the Moorside Project for all terrestrial and marine environmental interests.

A comprehensive range of baseline surveys extending across the terrestrial and marine environments have been conducted including:

- Marine and terrestrial flora and fauna;
- Air quality surveys at key locations around the development sites and adjacent to the key road and rail links;
- Noise and vibration monitoring around the development sites and adjacent to the key road and rail links;
- Surface water quality monitoring of all potentially important watercourses around the Moorside site;
- Ongoing groundwater quality and water level monitoring of the key groundwater resources around the Moorside site;
- Ornithology surveys of the key terrestrial and marine habitats that may be affected by the Moorside project;
- Archaeological and historic environment asset studies including specialist geophysical surveys of the Moorside project sites;
- Support to the Site Suitability and Site Characterisation investigations including locally deployed logistics management and operational personnel.

Benefits:

- Significant contribution to design iteration to date.
- Robust procurement procedures to secure a supply chain partnership that demonstrates best technical and commercial value for the customer.
- Extensive species mitigation proposals presented with respect to species licences, habitat creation requirements and biodiversity offsetting proposals.
- Active contribution to NuGen's strategy of environment and sustainability support for local communities.

Unparalleled experience and expertise combined with local knowledge



We demonstrate our commitment to developers, vendors, owners and operators and respond to new build challenges by helping them to capitalise on opportunities in their programmes.

Our ability to leverage cross-industry experience from other power and energy sectors enables us to bring unique insight and expertise to our customers' challenges.

Horizon Nuclear Power – Supporting power generation within the UK

Customer: Horizon Nuclear Power
Location: Gloucester and Wylfa North Wales
Scope: Framework contract

Horizon awarded Wood a framework contract to provide specialist engineering and technical design services for its proposed nuclear power stations at Wylfa on Anglesey and Oldbury in South Gloucestershire, to help meet the UK's need for stable and sustainable low carbon energy. In November 2012, Hitachi Limited acquired Horizon and announced that the technology for the new nuclear power plants would be the Advanced Boiling Water Reactor (ABWR), provided by Hitachi-GE Nuclear Energy.

Wood is working with Horizon Nuclear Power to advance the early planning and engineering work for the programme of works at Wylfa and Oldbury. The framework contract includes development and planning, site investigation, engineering, environmental permitting and waste management and planning plus project management support.

Through the contract, Wood will provide engineering and safety case specialists, initially in the following areas:

- Embedded experts for key engineering disciplines;
- Licensing, permitting and regulatory consents;
- Environmental modelling;
- Project management and controls;
- Balance of plant design;
- Integrated management systems and organisational development;
- Aiding the development of Horizon's organisation in order to meet the Nuclear Site Licensing Conditions;
- Support in the ability for Horizon to become a more effective 'Intelligent Customer', which is a regulatory requirement.

PGE EJ1 Owner's Engineer to Poland's New Build Programme

Customer: PGE EJ1
Location: Warsaw, Poland
Scope: Owner's Engineer to Poland's new build programme

Wood supports PGE EJ 1 in preparing and executing the first nuclear power plant build project in Poland with a dedicated team based in-country.

Initial work has focused on supporting the customer with strategic technical, commercial and programme management advice in the pre final investment decision (FID) phase.

This has included organisational development, knowledge creation, techno-commercial optioneering and feasibility studies required to present to senior stakeholder organisations, in order to inform decisions regarding the country's civil commercial nuclear strategy.

Our support has included:

- Capacity building and operational readiness;
- Contract management;
- Safety culture;
- Engineering support;
- Licensing;
- Integrated management system;
- Project management office;
- Integrated Proceedings support;
- Quality Assurance;
- Site infrastructure;
- Testing and start-up;
- Training oversight;
- Supply chain oversight.

Collaborating and delivering on the UK's largest new build project

Customer: NuGeneration Limited (NuGen)
Location: UK
Scope: Non-intrusive radiological survey

Wood has been supporting NuGen over the past two years, as it prepares to develop its nuclear new build project at Moorside in Cumbria, UK, adjacent to the existing Sellafield site. This is currently the UK's largest nuclear new build project and one of the most important nationally significant infrastructure projects, which will deliver up to 3.8GW gross capacity on completion. Before acquiring the Moorside site, NuGen undertook initial site characterisation to determine whether the site was suitable for the proposed development. Wood was contracted to investigate, interpret and report radiological, chemical, hydrogeological and geological conditions.

Wood undertook a non-intrusive radiological survey using our Scanplot technology. The system provided a spectrographic analysis of the site referenced back to GPS coordinates. Results from the survey were used to plan the intrusive investigation. Near-surface sampling, trial pits and boreholes were taken in order to investigate each of the variables that would determine the suitability of the site. Our in-house laboratory was contracted to undertake a range of spectrographic and isotope-specific analysis. We worked within an exceptionally busy programme – all analytical results were required to be validated, interpreted and reported in time for NuGen to exercise the option to acquire the site.

Our laboratories developed innovative solutions and implemented a shift system in order to meet the requirements of the programme. Our consultants worked alongside laboratory staff to receive, model, consider and report results.

The work was reported within budget and programme to a quality that exceeded the customer's expectations. The report was used to support NuGen's decision to continue developing the project.



Hitachi-GE Nuclear Energy, Limited. – Supporting the Advanced Boiling Water Reactor (ABWR) regulatory assessment for new build

Customer: Hitachi-GE Nuclear Energy, Limited.
(Hitachi-GE)

Location: Wylfa and Oldbury

Scope: Framework contract

In 2012, Hitachi Limited announced that it had acquired Horizon Nuclear Power and that ABWR technology would be used for the proposed new nuclear power plants at Wylfa Newydd on the Isle of Anglesey, and at Oldbury-on-Severn, in South Gloucestershire. These plants will be provided by Hitachi-GE.

To progress successfully through the necessary regulatory assessment, Hitachi-GE required partners to support them with expertise in UK regulatory standards.

Wood was awarded a framework contract to provide engineering and associated services primarily in support of undertaking the ONR and Environment Agency's Generic Design Assessment process.

The project successfully achieved Generic Design Assessment in December 2017.

Through the contract, Wood provides engineering and safety case specialists, initially in the following areas:

- UK context for codes, standards and supply chain specifications;
- Seismic analytical methodology;
- Aircraft impact assessment;
- Structural integrity (incredibility of failure);
- Internal and external hazards;
- Civil and structural design of RadWaste facility;
- Environmental permitting for GEP submission;
- Nuclear HVAC;
- Acceleration of regulatory consents and approvals particularly for the GDA.

