Offshore Decommissioning

Local knowledge, global expertise
Arup is the creative force at the heart of many of the world’s most prominent projects in the built environment and across industry.

We are an independent firm of designers, planners, engineers, consultants and technical specialists offering a broad range of professional services. Through our work, we make a positive difference in the world.

We are truly global. From 100 offices in 38 countries our 12,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion.

Founded in 1946 with an enduring set of values, our unique trust ownership fosters a distinctive culture and an intellectual independence that encourages collaborative working. This is reflected in everything we do, allowing us to develop meaningful ideas, help shape agendas and deliver results that frequently surpass the expectations of our clients.

The people at Arup are driven to find a better way and to deliver better solutions for our clients.

We shape a better world.
Offshore Decommissioning Capability

Existing Asset Assessment & As-Built Condition Analysis

Arup has a proven track record using point cloud acquisition to develop as-built digital representation (BIM modelling), while capturing contemporary information such as residual inventory to successfully undertake offshore oil and gas existing assets assessments and as-built condition analysis. Arup’s extensive experience of both modern and historical maritime construction materials and methods puts us in the best position to inspect and assess existing facilities in offshore environments for environmental impact, accidental or deliberate damage both above and below water as well as for the potential of re-use, continued use, or upgrading, and developing repair/replacement solutions using the latest methods and technology.

Decommissioning Plans & Comparative Assessments

Arup provides project management, planning, option assessments, carbon foot-printing, and cost estimation support on decommissioning projects for onshore and offshore facilities. Arup has experience of complete structural assessment of offshore platforms throughout the decommissioning process and a successful track record of assisting in the modification of platforms during the final period of production as well as the structural checking of the cutting, lifting and transportation phases as well as load-in evaluation at onshore facilities.

Structural Integrity & Asset Condition Analysis

Arup has a proven track record of providing structural and foundation integrity services for onshore and offshore facilities, as well as soil/structure interaction analysis. Our structural health monitoring approach includes 3D modeling, linear and non-linear finite element analysis, fatigue assessment, service life modelling and code compliance checks, and provides us with a bespoke determination of the residual structural asset life. Integrity and risk assessments are performed using deterministic and probabilistic criteria, and inputs from our corrosion and metallurgy experts. Using techniques such as parametric deconstruction analysis, we are able to evaluate the effects of component removal, partial disconnection and load decommissioning using digital modeling, including partial state structural integrity.
Offshore Decommissioning Capability

**Environmental Impact Assessments, Management & Control**

Arup covers all environmental impact assessments and production of environmental management and control plans for a wide range of major developments. We cover all environmental aspects of offshore and onshore works associated with decommissioning of oil and gas field infrastructure. Arup and our associated specialists provide services which range from pre-decommissioning environmental surveys, inventories of materials, scoping of assessments, onshore and offshore survey, impact assessment, hazard and risk assessment, environmental management plans, emergency response, pollution control and post-decommissioning monitoring. Our assessments are fully integrated and cover all project activities including topside, jacket, footings and pipeline decommissioning, drill cuttings pile disturbance, well plugging and abandonment.

![Environmental Impact Assessments, Management & Control](image)

**Financial, Regulatory & Business Case Advisory**

Arup’s award winning Transaction Advice team has a recognised track record in advising clients to make the right investment decisions by translating technical and commercial issues into financial analysis and clear recommendations. This allows our clients to fully evaluate high value solutions, business cases and risk profiles to create a competitive edge for investors or delivery certainty for asset owners. Our strong advisory track record spans the energy and utilities sectors, both onshore and offshore.

Our in-house financial and regulatory experts have advised a number of major utilities with regards to decommissioning programmes, and have a unique understanding of the key commercial drivers relevant to this sector.

![Financial, Regulatory & Business Case Advisory](image)

**Programme & Project Management**

Arup’s 500 project managers draw on their expertise in design, construction, compliance management, four dimensional planning, time and cost control to fulfil complex briefs on behalf of clients across the globe.

Our project managers create and lead carefully-crafted project teams – bringing focus, assurance, efficiency and creativity. The calibre of our people allows us to tackle the complexity of combined infrastructure, engineering, technical and specialist consulting on offshore decommissioning projects.

![Programme & Project Management](image)
Advanced Technology & Research

Arup’s Advanced Technology and Research (AT+R) award winning practice offers specialist design and engineering services for all aspects of the built environment, including offshore oil and gas platforms. Multidisciplinary teams work collaboratively on projects, generating value through developing and applying innovative concepts, alternative design strategies and advanced numerical optimisation techniques.

Asset Management

Arup is at the forefront of providing asset management advice to its clients. We have contributed to the development of the BSI guidelines on asset management, and helped shape the new international standard ISO 55000 Asset Management guidelines. Our understanding of these frameworks enables us to advise clients find the right balance between three crucial business drivers: cost, risk and performance. Arup’s asset management consultants work in unison with our technical experts in sectors such as energy, infrastructure and utilities to develop fully-integrated asset management strategies, aligning the clients strategic direction with what is happening on-the-ground.

Geophysics & Geology and Contaminated Material

Wherever difficult ground conditions, sensitive environments or ambitious projects present geotechnical challenges, Arup provides robust and advanced solutions. We combine this with a unique expertise in the domain of contaminated ground and dealing with radioactive materials.

To the full range of geotechnical needs, we bring interconnected skills in foundation and landfill engineering, environmental geotechnics, hydrogeology, tunnel and seismic design, geographic information systems, engineering geology and many specialised services. We have a unique understanding and appreciation of the offshore oil and gas sector having worked on an array of projects, including in the North Sea.

Public & Stakeholder Consultation

Arup has led and successfully delivered public consultations and stakeholder engagement for a number of high profile and controversial projects in the UK, notably in the nuclear and unconventional gas sectors. Our unique approach to consultation, based on informing the public and key stakeholders at all stages of a project’s development and the preparation of a strategy at the outset of a project for engagement with key consultees is appreciated by clients. We use innovative engagement tools to optimize communication such as photomontages, animations, sound auralisation using SoundLab™ and GIS response mapping.

Knowledge Management

Arup is a recognised expert at providing knowledge management in the built environment with a track record of developing and delivering bespoke knowledge strategies for a number of government and private bodies to facilitate best practice sharing, innovation, encourage collaboration and knowledge sharing between industry, academia and other technology providers. Via our bespoke surveys and systems design, database management, post processing of data and diagnostic and prognostic techniques, we have assisted safety critical industrial players (including the offshore oil industry, nuclear power generators and rail operators) to manage their data better and to utilize it to increase performance and safety while reducing cost and risk. We recognise the importance of knowledge management in the oil and gas sector, where the mobility of the workforce can create challenges to knowledge sharing and dissemination.
Dissecting Decommissioning

Arup recognises the importance of setting out a clear, concise and unambiguous breakdown of the decommissioning process to facilitate effective, diligent management of these complex programmes.

Each new programme in the expanding decommissioning market needs to build upon the experience gained from installation and operation, as well as those decommissioning projects which have already been undertaken. Project and programme management, technical analysis, financial modelling, regulatory control, knowledge management and resource provision all benefit from a clear, logical and unified breakdown of the overall task.
People

David Gration
Advanced Technology and Research Leader

David has a successful track record in the completion and management of multi-disciplinary engineering projects in the infrastructure, offshore and built environment sectors. David is an expert in the use of advanced engineering techniques to both justify the continued use of existing structures and enable the application of innovative decommissioning methods. David’s strong analytical background coupled with his experience in the assessment of both steel & concrete, fixed & floating offshore structures make him ideally placed to evaluate decommissioning concepts, develop detailed proposals and justify approaches and methods to certification authorities and regulatory bodies. David led Arup to successfully develop a system of constant monitoring of integrity of offshore structures using natural frequency measurements and variation. He has been at the forefront of the structural assessment of offshore platforms throughout the decommissioning process.

Gordon Jackson
Offshore Structural Design Leader

Gordon is one of the most experienced designers of offshore structures in the industry. Clients look to him to deliver safe, reliable solutions that meet their key drivers. Gordon has extensive experience in the feasibility, conceptual development and delivery stages of marine and offshore projects. He has developed and delivered concrete and steel platform solutions with worldwide application. His emphasis has been in the application of value engineering to problems and the development of innovative construction and installation methods with the aim of reducing capital expenditure or schedule. From this experience, in concrete platforms in particular, clients are often looking for end-of-life issues to be resolved and decommissioning options to be explored and Gordon has worked on a range of such projects, including the Bentley ACE Platform, as well as the decommissioning options study of the Cheviot Hybrid steel and concrete substructure.

Michael Daly
Offshore Installation Business Leader

Michael is the leader of Arup’s offshore installations business in Europe and has two decades of project experience in the energy infrastructure sector. His experience in offshore oil and gas includes project management, civil and structural design, permitting, procurement, construction management, and contract administration. Michael has gained particular experience in regulatory requirements for energy projects including grid connections, foreshore licensing, EU procurement Directives for utilities, and decommissioning of offshore installations. Michael has in-depth experience of decommissioning options studies, having recently worked on two steel jacketed offshore platforms.
Clare Lavelle  
North Sea Offshore Expert

Clare leads the energy consulting team in Scotland and the Northeast. She has a breadth of experience working in the energy sector in the UK and Scotland. Her experience spans both technical, environmental and policy aspects of onshore and offshore energy projects and she is a strong and effective project manager. She has a specific understanding of the regulatory regime and commercial drivers applicable to offshore energy projects, which enable her to provide seamless solutions to clients’ briefs.

Ian Feltham  
Structural Blast & Analysis Expert

Ian provides expert guidance and assistance on the solutions of special structural engineering problems, including the use of advanced methods of reinforced concrete design and analysis including strut-and-tie models and reinforcing for multi-axial stress fields and analytical methods for solving complex problems, including decommissioning. He is a recognized expert at estimating buckling loads and their effects on design of reinforced concrete and steel structures. Ian also has substantial experience in designing structures to resist blast loading and estimating vibrational effects in structures.

Karen Warner  
Structural Integrity Instrumentation & Monitoring Expert

Karen has over two decades of experience in the design of control and instrumentation systems utilised on a variety of project sectors including buildings, rail, bridges and on and offshore energy structures. She has experience of all types of control and monitoring systems such as programmable logic controllers, HVAC controls and data acquisition systems; all with their associated user interfaces. This experience has been used to design data acquisition systems to monitor the structural integrity of on and offshore energy structures, as well as integration of the systems with the topsides supervisory control and data acquisition system (SCADA). Integrity monitoring of existing off-shore structures assists in assessing remaining life and structural integrity during decommissioning activities.
Simon Cardwell
Metallurgy & Corrosion Expert

Simon is a Chartered Metallurgist with over two decades of experience providing specialist materials advice to clients across the globe. He is an expert in metals used in the built environment from a cradle-to-cradle perspective, including materials selection and specification, manufacturing technology and corrosion technology. He specialises in fracture and fatigue of cast and welded steel fabrications for statically and dynamically loaded structures. His skills have been brought to bear on a wide range of offshore projects including the design and specification of steel jackets, concrete gravity base structures and offshore wind farms.

Peter Scuderi
Strategic Asset Management and Performance Improvement Expert

Peter has 30 years’ experience managing and directing projects in the construction and infrastructure sectors, notably working on large projects of asset management in the nuclear industry. He has worked with CEOs and business leaders in government and industry facilitating strategy development as well as following through with implementation initiatives such as policy, business planning and operational performance improvement. Peter is also highly experienced in dealing with safety critical industries’ data management strategies.

Tim Hawley
Organisational Change Expert

Tim has a successful track record of improving organisational effectiveness and delivering value from complex integrated change programmes associated with an investment in physical assets, facilities and infrastructure, by integrating people, processes, systems and stakeholders. Within these programmes knowledge management has played either a central or major strategic role. Tim shapes management thinking around how best to leverage intellectual capital and adopt new ways of working, in moments of change such as decommissioning. Tim has led a series of major organisational transformational programmes across the globe and authored a number of papers and articles on knowledge management, including the book “Making Knowledge Management Work for Your Organisation”, published by the Ark Group (2012).

Ben Francis
Energy Commercial & Business Case Expert

Ben is a commercial specialist with over 14 years of experience in infrastructure and energy industries. Ben is a senior member of Arup’s Transaction Advice team advising on the development and investment in energy projects and businesses, with a particular focus on the offshore industry.

Ben combines his technical, commercial, financial and regulatory knowledge to develop holistic solutions to technical & commercial problems from offshore project delivery, operations to decommissioning. He is experienced with the different commercial arrangements, contracting and payment mechanisms used across the industry and has experience in helping regulators develop commercial contracting and payment structures for new projects. Ben is experienced at working with the insurance market and has developed a comprehensive understanding of the technical and commercial interface between projects and their insurance arrangements.
Projects

PSE Kinsale Energy Decommissioning Study, Ireland

Arup assisted PSE Kinsale Energy Ltd with an early stage decommissioning options assessment study for the Kinsale Head development. The study involved preparation of an inventory of facilities to be decommissioned, examining the relevant legislation and decommissioning options, and ranking the various options against safety technical, environmental, financial and socio-economic criteria. Arup also provided structural engineering assessments of the structures to be decommissioned.

Ravenspurn Processing Platform Decommissioning Study, England

Arup was commissioned to undertake a detailed study into the costs and risks associated with decommissioning the 28,000 ton concrete substructure for the Ravenspurn North Central Processing Platform, the first gravity substructure installed in the North Sea to have been built entirely in a dry dock. The study enabled the operator of the time, BP, to have a clearer understanding of the costs of the decommissioning.

Ichthys Riser Support Structure Verification, Timor Sea, Australia

Arup was commissioned by INPEX Browse Ltd to undertake an independent verification of the RSS foundation design during the EPCI phase of the project. The objective was to build a fully submerged, jacket like offshore structure supported on a shallow skirted foundation. Combining G&G, structural, seismic, and oil & gas engineering expertise with a dynamic soil structure analysis, Arup provided the client with the confidence to go ahead with the project.
**Confidential - Offshore Structure Subject to Derogation Assessment, North Sea**

Arup was commissioned to undertake the complete fatigue assessment of a concrete substructure throughout production to determine the starting point for the future life assessment of an offshore platform, on behalf of a confidential client. We also undertook the complete fatigue assessment of the structure in post-decommissioned configuration and established combined expected damage. In the process we successfully ran risk assessment workshops to identify material and component degradation mechanisms and consequential failure modes appropriate to the long-term life of the remaining structure. We also successfully reviewed the predicted structural failure modes, and assessed the consequences of partial failure with a view to developing mitigation in terms of monitoring and/or planned intervention.

**Cheviot Development, North Sea**

Arup was commissioned by ATP Oil & Gas Ltd to develop front-end engineering design solutions for concrete and hybrid substructures and for the front engineering design for the Cheviot Development, with a strong emphasis on designing for decommissioning from the outset. The steel concrete hybrid design allowed a number of removal methods to be considered, increasing the client’s confidence that a suitable decommissioning scheme would be included in the field development plan. Arup’s scope included the development of oil storage system for Octabuoy, specification and supervision of offshore and onshore site investigations, preparation of tender documents and evaluation of resultant construction tenders with a view to ensuring minimal decommissioning costs to the client.

**Julimar Offshore Geotechnics Assessment, Australia**

Arup has been appointed by GE Oil & Gas to provide geotechnical design for a subsea system located in the North West shelf of Australia. Arup’s scope involved analysing landing, in-place, seismic and decommissioning conditions for two Manifolds and two PLETs (Pipeline End Termination) in addition to soil-structure interaction of three spools connected to the structures. The skirted perforated mudmat foundation was designed for pre-service and in-place conditions as well as for decommissioning purposes. To ensure that the foundation would be re-usable, we assessed the removal forces required to decommission the foundation, causing minimal disturbance to the structure. Our analysis showed that provided the decommissioning of mudmats is undertaken in a controlled manner, the suction forces generated can be significantly reduced, generating a more efficient and easier operation.

**Decommissioning and Re-Use of the Maureen Platform Study, Scotland**

Arup was commissioned by Phillips Petroleum UK Ltd to assess the engineering feasibility, cost and sustainability of the various decommissioning and reuse options put forward to the client. Using the Arup Sustainable Project Appraisal Routine (SPeAR™) model, we were able to analyse the sustainability of each option identified. These options included using the platform base as piers for a bridge over deep water in Scotland, converting the oil platform to a heavy lift crane which could be used to decommission future oil platforms, and cutting the structure into elements which could be used in the construction of new port structures identified in the UK and Northern Europe.
Confidential - Offshore Structure Decommissioning Assessment, North Sea

Arup was commissioned by a confidential client to undertake the complete structural assessment of an offshore platform throughout the decommissioning process. The evaluation process will include the modification of the platform during the final period of production as well as the structural checking of the cutting and lifting phases.

Decommissioning of Offshore Concrete Gravity Based Structures in the OSPAR Area, International Association of Oil and Gas Producers

Arup collaborated with the International Association of Oil and Gas Producers to review the previous version of the report with respect to the description of Concrete Gravity-Based Structures. Our analysis, which was utilised in the final report focussed on the fundamental design characteristics of the different options, and the technical/practical issues associated with their removal including refloating, under-base grouting, structural integrity.

Confidential - Integrity Instrumentation & Monitoring System, North America

Arup was commissioned to assist a confidential client in the development of an advanced monitoring system, combining tried and tested offshore sensor technologies with modern data management and processing facilities, to monitor all aspects of the construction and mitigate risk. This technique of smart monitoring could well be used in the decommissioning processes, and as a mitigation measure for partly decommissioned structures in the North Sea.

Dunlin Alpha Project Change Assessment, North Sea

Arup was commissioned to undertake a structural assessment of the proposed change of operation for the Dunlin Alpha Concrete Gravity Substructure (CGS). We successfully completed the analysis of an existing CGS to determine the effect on the structure of modifying storage and operational parameters. This included re-working an existing finite element model of the structure to reflect the relevant changes and completing the required design checks.

Wandoo ‘B’ Concrete Gravity Substructure (CGS), North West Shelf, Australia

The Wandoo ‘B’ Concrete Gravity Substructure (CGS) was the first CGS to be installed in Australian waters and provides both oil storage, and support to the offshore production facilities deck. Consisting of a four-shafted CGS with offshore barge installed topside and a net storage volume of 400,000 bbls, the installation involved ballasting one end of the structure to touchdown on the sea bed, followed by rotation to achieve full underbase contact. This technique, which ensured greater stability in the critical stages of installation, was pioneered by Arup more than 15 years ago.

Wandoo’s topside was installed using the float over technique: bearings within the steel stab-in connections reduced forces generated by the barge response to wave conditions. Use of this technique in open ocean conditions was another first.
PSE Kinsale Energy, Ireland.
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