The group engineer, construct, commission and maintain critical infrastructure for the energy, resources, nuclear, utilities, life sciences and food and beverage sectors. In-house products and services span the entire asset lifecycle to reduce risk and optimise cost and productivity and include concept, feasibility investigation, consulting, project definition, design, procurement, logistics, construction, commissioning, upgrades, operations and operating improvement services. The Group are also the market leaders in electrical, instrumentation and control system solutions.

CBW’s 4 + 6 + 4 business model describes the services, markets and regions in which the group operate. From an established base in Scotland, CBW utilise a global network of operating centres to provide full asset lifecycle services to projects globally.

Clough works with some of the world’s largest energy and resources companies to engineer, construct, commission and maintain a comprehensive range of infrastructure for energy and resources projects. The company was established in 1919, and today utilises a workforce of nearly 4000 people from operating centres across Australia, Papua New Guinea, UK, North America and Asia.

Booth Welsh is a specialist engineering services company, employing over 250 engineering and technical personnel. Established in 1989, the company is recognised as a market leader in lifecycle services for control systems, from front end engineering design through to service and replacement. In 2014, after a year of working together, Booth Welsh became a wholly owned subsidiary of Clough.
CBW is a global engineering and brownfield service provider that delivers a comprehensive suite of in-house products and services, underpinned by more than a century of combined experience, advanced technology, specialised manufacturing capabilities, sophisticated project delivery expertise and extensive asset maintenance management experience.

Our seven areas of differentiation include:

- **Full Project Lifecycle Delivery Model**
- **Experience and Reputation**
- **Global Operations**
- **Market Leaders in Electrical, Control & Instrumentation**
- **Technology and Innovation**
- **Commitment to Zero Harm**
- **Workforce Performance Optimisation**

An Entire Asset Lifecycle Delivery model

CBW are committed to providing innovative solutions tailored to client requirements across every phase of the asset lifecycle. The group engineer to construct, then construct to operate, commission and maintain, optimising safety, productivity and cost across every phase of a project.

This project execution expertise has been developed through work on some of the world’s mostlogistically challenging energy and resources projects and provides a fresh approach for clients looking for a new way of contracting.

Clough Booth Welsh’s full asset lifecycle solutions utilise innovative technology and systems to drive performance and provide confidence on delivery schedule. A comprehensive reporting regime makes project teams accountable for early detection and intervention on potential productivity issues to ensure all projects consistently deliver on their cost and schedule promise.
Clough Booth Welsh combines Clough’s 96 year track record in global oil and gas delivery with Booth Welsh’s specialised knowledge and capability developed over 25 years of working with blue chip companies across multiple industries around the globe. Over time Clough Booth Welsh have established the reputation as a specialist in the delivery of technically and logistically challenging projects and have a niche market position in the delivery of full lifecycle services for control systems.

- **Clough projects**
- **Booth Welsh projects**

### 1919
Clough is established in Perth, Western Australia.

### 1964
The Habourworks Clough Joint Venture is formed (today BAM Clough).

### 1966
- **Barrow Island Oilfield Development**
  Western Australian Petroleum
  Western Australia
  Awarded the Barrow Island Oilfield Development, Western Australia’s first significant petroleum resource development.

### 1981
- **North Rankin ‘A’**
  Woodside Offshore Petroleum Pty Ltd
  Western Australia
  Award of Woodside’s North Rankin ‘A’, Clough’s first major offshore construction project.

### 1985
- **North West Shelf LNG and Condensate Jetty**
  Woodside Offshore Petroleum Pty Ltd
  Western Australia
  Construction of the LNG and Condensate Load Out Jetty, the first structure of its kind ever built in Australia.

### 1988
- **Wesfarmers LPG Natural Gas to Liquids Plant**
  Wesfarmers
  Kwinana, Western Australia
  Wesfarmers LPG natural gas to liquids plant is completed, Clough’s first turnkey gas processing contract.

### 1989
Booth Welsh Associates is established in Ayrshire, Scotland.

### 1991
- **Provision of Professional Engineering & Installation Services**
  Global health & nutrition company
  UK
  Long term provision of complete range of technical services from design to commissioning and additional maintenance support resource.

### 1992
- **SAGE Project**
  Exxon Mobil
  Aberdeen, UK
  Testing, pre-commissioning & remediation work at St Fergus gas plant.

### 1995
- **East Spar Development**
  WMC Petroleum
  Varanus Island, Western Australia
  EPCIC for two-well subsea development, pipeline and two gas plant trains on Varanus Island. The project was awarded Australia’s top engineering honour, the Sir William Hudson Award.

### 1997
- **QPL Phosphoric Acid Plant**
  WMC Fertilisers
  Queensland
  Turnkey development of a phosphoric acid plant including project management, detailed design, procurement, construction, pre-commissioning and testing services.

### 2000
- **Ravva Satellite Gas Field Development**
  Cairn Energy India Pty Ltd
  India
  EPIC contract for a gas wellhead platform, pipelines, and onshore gas processing facilities.

### 2001
- **Bayu-Undan Hook-Up and Commissioning Project**
  ConocoPhillips Australia
  Timor Sea
  Commissioning of the wellhead platform, topsides the entire field production systems.

### 2003
- **PNG Oil Refinery Project**
  InterOil
  Papua New Guinea
  EPCIC of an offshore production platform, subsea and onshore pipelines and onshore gas plant.

- **BassGas Project**
  Origin Energy
  Bass Strait, Australia
  EPCIC of an offshore production platform, subsea and onshore pipelines and onshore gas plant.

- **Provision of long term management of work services**
  EDF Energy
  UK
  Full asset management, safety system analysis, critical equipment analysis, maintenance reviews and technical governance reviews.
Bayu-Undan O&M Services
ConocoPhillips Australia Timor Sea
Operations and maintenance services to the ConocoPhillips’ Bayu-Undan facilities.

Panna Field Development Project
British Gas Arabian Sea, India
EPCIC for three additional platforms and four pipelines off the west coast of India.

Woodside Engineering Services Contract
Woodside Energy Ltd Western Australia
Provision of Engineering Services to all Woodside’s Australian oil assets.

Woodside LNG Jetty - Train V Expansion
Woodside Energy Ltd Western Australia
Construction of a second LNG loading berth at Woodside’s Karratha onshore gas plant.

Pluto LNG Jetty
Woodside Energy Ltd Karratha, Western Australia
Construction of a 300m long approach jetty.

Boiler Inspection Support
EDF Energy UK
Design of a high integrity communications pathway to facilitate the engagement of the on-site controlled area inspection team.

PNG LNG Project EPC4 and Upstream Infrastructure
ExxonMobil PNG Limited Papua New Guinea
Construction of critical infrastructure for the PNG LNG development project and EPC of the Hides Gas Conditioning Plant.

Gorgon Downstream LNG Project EPCM
Chevron Australia Pty Ltd Western Australia
EPCM of the LNG downstream and logistics portion of the Chevron-operated Gorgon LNG Project.

FPSO P63 Sulphate Removal Water Injection Project
Veolia Brazil
E&I design, control system design and configuration, control panel build, integrated factory tests, off-shore commissioning, operator training, and operational support for the control system.

Bottling Plant Upgrade
File, UK
Provision of an automation solution as part of a bottling plant upgrade. The final control system allowed for a significant increase in productivity.

PNG LNG Jetty - Marine Works and Topsides
Chiyoda JGC Joint Venture Papua New Guinea
Design and construction of the LNG and condensate offloading jetty for the PNG LNG project.

FPSO P63 Sulphate Removal Water Injection Project
Veolia Angola
E&I design, control system design and configuration, control panel build, integrated factory tests, off-shore commissioning, operator training, and operational support.

Nitrogen Storage & Vapourisation plant
EDF Energy UK
E & I engineering design, instrument and related equipment procurement, in-house control panel design/fabrication, field installation and commissioning of all parts of control system for an enhanced Nitrogen Injection System.

Ammonium Nitrate/Nitric Acid Plant Number 3 (NAAN3)
CSBP Limited Kwinana, Western Australia
EPC of an Ammonium Nitrate Acid Plant, following the successful completion on the ECI phase.

Ichthys Integrated Project Management Services
INPEX Ltd Western Australia
Provision of Offshore Integrated Project Management Support Services (IPMS) for the Ichthys LNG Project.

High Pressure Methanol Injection System
Offshore Azerbaijan
Design and build of a prototype high pressure methanol injection system for use on an offshore oil production platform. The system achieved a major step improvement in the level of safety and methanol flow management.

Jubail SWRO Phase 2
Al Fatah Water & Power Saudi Arabia
Control system design and configuration, control panel build, integrated factory tests and site commissioning of a control system for a new reverse osmosis water treatment facility.

Wheatstone Hook-up and Commissioning
Chevron Australia Pty Western Australia
Pre-commissioning, commissioning of integrated float over deck systems, offshore hook-up, and start-up assistance.

Wheatstone Product Loading Facility and Tug Berths
Chevron Australia Pty Western Australia
Design and construction of a 1.2 kilometre jetty.

Ichthys Material Offloading Facility & Product Loading Facility
INPEX Operations Australia (through JKC JV) Darwin, Northern Territory
Design and construction of the Ichthys LNG Project Module Offloading Facility (MOF).

Ichthys Product Loading Facility (Jetty)
INPEX Operations Australia Darwin, Northern Territory
Design and construction of the Ichthys Product Loading Jetty.

Gryphon GARP Offshore
Core Oil & Gas Aberdeen North Sea, UK
Completion of the remote as-building exercise for all of the instrumentation loop diagrams which included around 3000 drawings.

Arrow Upstream FEED
Arrow Energy Limited Gladstone, Queensland
FEED for the full upstream development of the Arrow CSG to LNG project.

Clough projects: Booth Welsh projects
Along with Clough-owned and operated engineering centres of Booth Welsh, CH-IV and e2o, Clough establishes teaming agreements with strategic partners to suit project requirements. This brings together a unique combination of local knowledge and international expertise.

Clough Booth Welsh’s global presence is underpinned by parent company, Murray & Roberts (M&R). Clough is a wholly owned subsidiary of M&R, South Africa’s leading engineering and construction services company. M&R has delivered infrastructure throughout South and Southern Africa for more than 110 years and is today recognised as an international engineering and construction group underpinned by world-class companies. The group employs a workforce of over 30,000 people.
Booth Welsh represents Clough’s global centre of excellence for electrical, control & instrumentation. The company is a global market leader in control system design delivery and uniquely offers the full spectrum of in-house control system services, spanning initial concept and feasibility studies through design, build, installation, commissioning, and long-term monitoring, maintenance and asset management services.

Booth Welsh has delivered control systems all over the world to a range of industries with a focus on the upgrade and replacement of legacy control systems on brownfield sites. These solutions have helped a large number of companies to increase operating efficiencies, cut costs, improve quality and reduce risk.
CLough BOOTH WELSH APPLIES INNOVATION TO ADAPT TO THE CHANGING NEEDS OF THE INDUSTRY.

State of the Art Design Tools
Clough Booth Welsh engineers have significant experience and capability in the use of Intergraph’s SmartPlant Enterprise suite, and the systems, procedures and workflows to enable effective and efficient project management, cost control and concurrent, multi-discipline design. By using 3D modelling and intelligent design systems (Smart 3D), Clough Booth Welsh maximise the benefits of data integration throughout the engineering, fabrication and construction phases of projects.

Cloud based technology enables engineering work share across Clough Booth Welsh’s multiple global engineering offices, enabling efficient engineering design, problem resolution and around the clock engineering support to projects.

Project Management Systems
Clough Booth Welsh are recognised as pioneers in the development of integrated project management systems that take a full asset lifecycle approach to project execution. This is achieved by controlling the links between engineering, procurement, construction, commissioning and operations and maintenance.

The group is harnessing new mobile platforms and tools to drive information into our geographically dispersed operations and have invested significantly in data, systems and technologies. The result is an ability to sustain field variations to less than 2 per-cent.

ClearView Productivity Systems
The ClearView productivity initiative combines a comprehensive quality assurance program with project reporting systems to ensure an open and collaborative approach to project compliance and performance across the entire asset lifecycle.

The ClearView Assurance Program implements a staged gate project management approach. Operating standards define the performance requirements mandated during development from project start-up through to delivery and closeout, with compliance reported as milestones are progressively completed.
Clough’s ClearView proprietary software provides real-time reporting on productivity performance on every project, making construction managers accountable for driving project performance.

Reports include a detailed summary of critical path progress against plan, including HSE performance, schedule, productive and non-productive time, cost and potential productivity or safety issues that could impact project performance.

These detailed reports are shared with project owners and enable early detection and intervention, if productivity issues arise.

**Wireless Instrumentation**

Clough Booth Welsh carried out a detailed two year research project on wireless instrumentation within industrial automation in collaboration with a Glasgow University. The Group now offer the ability to provide wireless solutions that complement Clough Booth Welsh’s integrated engineering solution, by offering full installation and design for a project, with consultation and commissioning if required.

**Value Improvement Workshops**

By leveraging a global network of engineering expertise, Clough Booth Welsh will bring together top engineering and asset management minds to conduct Value Improvement Workshops that enhance the value and performance of client assets. These workshops undertake a detailed analysis of project or asset performance with the client’s senior management, and draw on global best practice to define and deliver innovative solutions that will improve cost, operational and production performance.

**Innovative Commercial Models**

Clough Booth Welsh offer innovative commercial models that align client and contractor interest and drive superior project performance.

Developed collaboratively with clients, these models are designed with incentives that drive and reward strong performance, and put contractor revenue at risk should performance not meet agreed standards.

**Specialist Services**

**Process Engineering**

Concept definition and evaluation, process simulation and optimisation, specification of process and utility equipment and piping, piping and instrumentation diagram (P&ID) development.

**Process Hazard Risk Assessment**

Hazard study support in HAZOP and Process Hazard Risk Assessment (PHRA) including chairing PHRA’s.

**Process Simulation**

Process simulation and modelling that assists with option evaluation and subsequent design specification, identification of cost savings, production optimisation and debottlenecking.

**Piping Design and Stress Analysis**

Piping design and complete pipe stress analysis across all aspects of pressure, temperature, weld, corrosion, erosion, displacement and applied loadings for both new build and brownfield facilities.

**Software & System Programming**

Independent systems integration services for large automation projects supported by 25 years of specialist knowledge in functional systems delivery.

**Functional Safety Management**

Safety Instrumented System (SIS) solutions which are fully compliant with IEC 61511 and other relevant functional safety standards.

**SIL Determination**

Safety Integrity Levels (SIL), Layers of Protection Analysis (LOPA) and Fault Tree Analysis (FTA) services.

**Control System Panels**

Bespoke design and assembly of control panel suites and field enclosures. Field panels include remote I/O cubicles, pneumatic/hydraulic, and solenoid valve panels.

**Asset Management**

Asset Management support services focused on improving and maintaining plant data to enhance performance, maintain production and reduce operating costs.
Sustainability is at the core of our health, safety, environment and community programs. Our aim is to deliver projects safely and consistently, while maximising the benefits for all stakeholders.

**Target Zero**

The Clough Booth Welsh Target Zero safety program takes a full project lifecycle view on safety from design through to execution and operations, and employs behavioural based safety programs across every phase of a project.

Leading indicators play a key role in the measurement of safety performance while risk registers have been implemented to lock in safety learning and proactively manage risks on every project.

Clough Booth Welsh employ senior management with extensive operational and managerial experience in global safety and environmental regulatory codes and offer specialist services to assist in compliance with United Kingdom’s Control of Major Accidents Hazards Regulations (COMAH) and Australia’s Occupational Safety and Health Act and Regulations.

**MAP**

To address the safety risk of high consequent events, Clough Booth Welsh has developed a Major Accident Prevention Program (MAP). MAP addresses Major Accident Events (MAE) by providing real time verification of the critical controls and the actions required in the field to prevent the MAEs from occurring.

Hazards are addressed from the earliest project planning stages through to on-site work. Using MAP enables continuous verification that hazard controls are implemented in the field and will be applied through subcontractors, third party installers or operating teams (MAP).

**Environment**

Clough Booth Welsh is committed to continuous improvement in environmental performance throughout our global operations.

The Group seek out ways to continually deliver environmental excellence for clients and the community. Environmental management processes are embedded into the group’s business delivery processes, championed by environmental specialists and delivered by management, engineering and project teams.

**Community**

Clough Booth Welsh can embed dedicated and proactive community relations professionals on projects to implement programs that deliver tangible community benefits while achieving project objectives. Community engagement strategies are developed to facilitate community support and involvement, meet local stakeholder needs, minimise disruption and provide local employment opportunities.

Clough Booth Welsh’s six pillar Corporate Social Responsibility (CSR) program aims to provide sustained benefits to local communities, strengthen stakeholder relationships and encourage employee involvement in community initiatives.
Clough Booth Welsh have developed and implemented workforce programs that produce the people, skills and capabilities to deliver certainty in project delivery performance for every project.

The group work collaboratively with clients to develop a lean workforce model that draws on global engineering resources and utilises strategic operating centres. This minimises the number of permanent personnel mobilised to site which provides significant cost savings for clients.

Clough Booth Welsh take a long-term view to people development. Talent development and succession programs ensure a strong pipeline of future leaders, from apprentices and graduates to executives. The group aim to ensure core positions on projects are filled with talented employees who understand the Clough Booth Welsh project delivery systems and culture.

Recognising that project managers are critical to the success of a project, Clough Booth Welsh have invested in a Project Management Academy in collaboration with Stanford University (USA).

The Academy identifies and selects future project leaders to undertake an intensive project management course. Training consists of e-learning, workshops, on-the-job experiences and culminates with a residential program at Stanford University in the USA.

Key to delivering strong project performance is a reward and recognition program, that drives the right focus on safety, cost and schedule.

**Recruitment Services**

Clough Booth Welsh offer a dedicated technical recruitment service.

Supported by over two decades of experience at the forefront of the engineering sector, Booth Welsh Resources is ideally placed to provide resourcing services across a multitude of sectors including Oil and Gas, Nuclear, Life Sciences, Renewable Energy, Utilities, Food and Beverage, and Medical Devices sectors. Recruitment services are deployed globally for temporary, contract and permanent positions with all candidates fully interviewed, vetted and registered prior to submission.

Booth Welsh Resources is a full corporate member of the Recruitment and Employment Confederation (REC), the professional body for the recruitment industry.