POWER GENERATION

LEADING GLOBAL ENGINEERING CONSULTANCY

ESB INTERNATIONAL

Utility to Utility · **Power Generation** · Transmission & Distribution · Strategic Advisory · Specialist Services

THE MISSION OF ESB INTERNATIONAL IS TO UNLOCK VALUE FOR ENERGY UTILITIES AND DEVELOPERS RIGHT AROUND THE GLOBE.

WELCOME

From conventional thermal power plant to state of the art modern and renewable technologies, we boast the skills, knowledge and experience required to support power generation assets through all stages of their life

ESB International, which is wholly owned by Electricity Supply Board (ESB), is a leading engineering consultancy firm to the global utility sector. Headquartered in Dublin, Ireland, we employ over 725 staff across operations in Europe, the Middle East, Africa and South East Asia.

We work in partnership with asset owners to deliver large-scale, capital intensive projects, using a proprietary project delivery methodology to minimise project risk and maximise investor returns.

In all our markets, we are faced with strategic challenges that affect millions of people – and our solutions help to transform economies, societies, and the lives of individuals and communities.

Our success is built solidly on our experience in delivering electricity to our own country, resulting in a social and economic revolution over many decades.

ESB has brought electricity to Ireland's major towns and cities; a Rural Electrification Scheme brought the transformative power of electricity to even the most remote corners of the country.

We have drawn on this experience in over 120 countries around the world, offering not just technical expertise, but also the leadership and personal commitment to succeed in some of the most demanding economies and geographical regions around the globe.

We would be delighted to share our expertise in Power Generation with you, and we assure you of our unstinting support throughout whatever journey you may now be embarking on.

UTILISING OUR POWER GENERATION CAPABILITIES

120

Since 1975 we have worked with clients in 120 countries

As a result of divesting ageing plant and investing in highly efficient modern plant, Ireland now has plentiful supplies of clean energy, and a healthy capacity margin to accommodate future growth. We are active in decarbonisation strategies across the supply chain, retrofitting existing plants to make them compliant to environmental standards.

THERMAL

Our expertise in conventional power plant spans the complete range from coal and peat technology to open cycle and combined cycle gas turbine (CCGT) technology. This is now developing into renewable and low carbon technologies including energy from waste and biomass.

HYDRO

ESB has a proud tradition in sustainable generation – in fact, our first station in 1927 was the hydro generating station at Ardnacrusha on the river Shannon, Ireland.

WIND

Through innovative wind based solutions we are enabling our parent company, ESB, to deliver their decarbonisation strategy, to be carbon neutral by 2035.

CLEAN PLANT

As a result of divesting ageing plant and investing in highly efficient modern plant, Ireland now has plentiful supplies of clean energy, and a healthy capacity margin to accommodate future growth.

SOLAR

Over the years, solar has become one of the most dynamic sectors in the European renewables electricity market. We are active in the solar industry, and have integrated solar projects across our CCGT plants..

OCEAN

With Ireland's vast ocean energy resources, we are working in collaboration with a number of ocean energy technology developers to support the development and commercialisation of new technologies in this area.

'Our technical competencies span the breadth and depth of the power generation industry, from plant performance and control to piping and materials. Our goal is to ensure that we can provide a complete service offering to our clients across all our international markets'

WE OFFER A FULL SPECTRUM OF SERVICES

We provide a full range of services to meet our clients specific requirements in power generation

Coolkeeragh CCGT Power Station, Northern Ireland

OWNERS ENGINEER

OPERATIONS & MAINTENANCE

SPECIALIST SERVICES

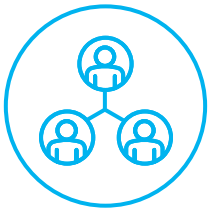
ENGINEERING DESIGN

OVERHAUL MANAGEMENT

In all cases, ESB International aim to provide a complete service to all of our clients. To achieve this, our service capabilities are closely integrated, ensuring the highest standard of services for the power generation industry.

ZONING IN ON OUR POWER GENERATION SERVICES

OWNERS ENGINEER



ESB International has a long and proud history of providing owners engineer services to developers of power generation projects spanning the globe.

The owners engineer role is a function that has existed in large capital investment projects for decades. ESB International has a deep wealth of knowledge and experience in providing owners engineer services to gas, coal, hydro, wind and other renewable projects.

Our capabilities span a wide range of disciplines and technology areas, including:

- Project management
- Specification development
- Contract negotiation
- Site construction & commissioning supervision

OPERATIONS & MAINTENANCE

ESB International operations & maintenance adopts a tailored approach to the delivery of services, geared for optimal performance over the lifetime of the asset.

Our operations & maintenance team is led by the needs of our customers. As a power plant investor in its own right, ESB International has a clear understanding of those needs. Working closely with developers and owners, we identify their specific objectives and then develop the necessary solutions that best suit the challenge.

ESB International's excellent track record has been built on a combination of our utility perspective and our commercially focused, performance driven approach.

SPECIALIST SERVICES

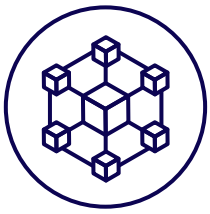
ESB International specialist services consists of a dedicated team of resources across multiple disciplines. We boast a specialised knowledge, acquired and developed through years of hands-on experience.

We also provide the full range of civil, structural and geotechnical services necessary for the planning, design and construction and maintenance of power stations and wind farms.

The key technology competency areas of specialist services are:

- Gas and steam turbine
- Conventional boiler
- Plant generators and electrical systems
- Plant chemistry
- Plant material integrity
- Piping
- Process and performance
- Hazardous areas
- Civil, structural, geotechnical
- Environmental

ENGINEERING DESIGN



ESB International offers a range of engineering design capabilities to the power generation sector. Engineering design consists of teams including mechanical and process, electrical, control and instrumentation (C&I).

Engineering design prides itself on being a method-driven engineering services team, with core capabilities in:

- Front end engineering design (FEED) and concept development
- Detailed process, mechanical, electrical and C&I design
- System and equipment specification and selection
- Site surveying, drafting and 3D modelling
- Design safety
- Tendering and procurement management
- Design construction and commissioning support

OVERHAUL MANAGEMENT

ESB International has an established capability in planning and managing the execution of overhauls on power generation assets.

Overhaul management provides the following services:

- Plant outage, planning and programming
- Commercial and contract management
- Strategic inventory planning
- Contractor supervision and coordination
- Plant inspection
- Safety management
- Post-overhaul plant commissioning support

Overhaul management draws on support from specialist services in the development and execution of inspection plans and the review of ‘as found’ issues.

A CASE STUDY TO JUDGE US ON

CARRINGTON 880 MW COMBINED CYCLE GAS TURBINE POWER PLANT, MANCHESTER, UNITED KINGDOM

Carrington power project is a very important and significant project for ESB, with ESB International responsible for the planning, design, engineering, construction and commissioning of the project

Start Date – End Date
2009 - 2016

Client Name
Carrington Power

Duration of Assignment
7 Years

When completed the Carrington plant will be capable of powering over 1 million homes. Establishing ESB Carrington is central to our company strategy to compete successfully in the regional electricity market with a balanced, low carbon, generation portfolio.

BACKGROUND

Previously a coal fired power station, the plant now comprises two Alstom single shaft Combined Cycle Gas Turbine (CCGT) units, each consisting of 1 Alstom GT26 gas turbine, 1 Alstom steam turbine and an Alstom / Windsor horizontal gas flow Heat Recovery Steam Generator (HRSG). It will be amongst the most efficient generators of electricity in the United Kingdom. The plant is being built under an Engineering, Procurement and Construction (EPC) contract by a consortium comprised of Alstom and Duro Felguera. A 2.4 km long gas pipeline was constructed under a separate contract. Extensive ground investigation, clearance and remediation works were also carried out under separate contracts to prepare the site prior to the EPC contract.

THE SERVICES WE PROVIDED

- Project development activities;
- Detailed engineering review;
- Management of project planning, licences;
- Specifications, tender evaluation and EPC contract award;
- Management of site preparation and gas pipelines contracts;
- Procurement;
- Project construction and commissioning supervision;
- Complete engineering support during all phases of the project;
- Site management, safety management and quality surveillance;
- Project closeout and warranty services

Full contract & project management services from inception through to commercial operation included:

- Feasibility studies
- Financial modelling
- Environmental impact assessment
- Permitting & licensing
- Brownfield site preparation (including mapping of > 3,000 existing buried piles)
- Management of gas pipeline project (multi-contract for design, procure, construct)
- EPC specification preparation
- Contract negotiation
- Contractor management and supervision
- Design review
- Factory inspections
- Witnessing of commissioning and performance testing
- Operation and maintenance

A CASE STUDY TO JUDGE US ON

TILBURY 40 MW RECYCLED WASTE WOOD FIRED POWER PLANT, TILBURY, LONDON, UNITED KINGDOM

ESB International are responsible for carrying out a detailed technical due diligence of the project to support a financial and commercial assessment

Start Date – End Date
2014 - ongoing

Client Name
Tilbury Green Power Limited

Duration of Assignment
5 Years

BACKGROUND

ESB International provided technical support during contract negotiations up to financial close. Subsequently, ESB International was appointed Owners Engineer for the Execution Phase.

Tilbury Green Power is a renewable power plant fuelled by waste wood, located within the Port of Tilbury complex on the banks of the River Thames.

The Plant has a net electrical capacity of 40 megawatts (MW) and will produce up to 319,000 MWh of renewable electricity each year - enough to supply around 97,000 average homes, and will play a valuable role in the UK meeting its target for producing 20% of its energy from renewable sources. The Plant will utilise 275,000 tonnes of Grade C waste wood sourced from the region.

A Single Contractor selected as main EPC and O&M Contractor. The O&M Contract was awarded for 20 years.

THE SERVICES WE PROVIDED

- Detailed Technical Due Diligence to support financial and commercial assessments
- Technical and Commercial negotiations on the EPC Contract prior to financial close
- Technical and Commercial negotiations on the EPC Contract prior to financial close
- Update of EPC technical specifications and supporting Design Information
- Assistance to Client during Lenders Technical Advisor reviews
- Technical assistance to Clients legal representatives
- Technical inputs to financial modelling, value engineering and project RAID logs
- Owners Engineer for EPC Contract
- HV Grid Connection and Construction power
- Environmental Permit and Planning
- Fuel Supply Contract
- O&M Contract

TECHNOLOGY

- Grade ‘C’ recycled waste wood fuel from adjoining waste processing facility
- 4 day fuel storage facility with back up fuel unloading capability, together with two automated overhead cranes for stacking, storing and feeding fuel to the Boiler Plant
- 125 MW, Suspended Boiler design with moving grate technology, with extensive corrosion mitigation design features incorporated. Extensive design and modelling to comply with Industrial Emissions Directive (2010/75/EU)

A CASE STUDY TO JUDGE US ON

ALBA 1,792 MW COMBINED CYCLE GAS TURBINE PLANT & POWER DISTRIBUTION NETWORK, BAHRAIN

ESB International is responsible for the specification, tender negotiation leading to contract award, design review, Project and Construction management, safety and commissioning supervision of the ALBA CCGT power plant project and associated Power Distribution Network.

Start Date – End Date
2015 - ongoing

Client Name
Aluminium Bahrain (ALBA)

Duration of Assignment
4 years to date

BACKGROUND

Following the appointment of ESB International in September 2015, the EPC consortium of GE/GAMA was issued with Notice to Proceed in August 2016. The CCGT plant will consist of 3 x GE 9HA01 gas turbines and is planned to achieve commercial operation in Q3 2019. These "H" technology gas turbines are the first of their type in the Middle East and the first application in an aluminium smelter application.

In a parallel procurement process Siemens was appointed to supply and install new 220 kV and 33 kV sub-stations and associated transformers/ reactors as well as a Scada system for the new power distribution system.

The existing Alba Power Distribution network will also be incorporated into the new Scada system.

THE SERVICES WE PROVIDED

- Project development activities
- Management of project planning
- Specification preparation, tender evaluation and EPC contract Award
- Management of site preparation
- Detailed engineering design review
- Project construction & commissioning supervision
- Complete engineering support during all phases of the project
- Site management, safety management and quality surveillance
- Project closeout and Warranty services

HEALTH, SAFETY AND ENVIRONMENT

HEALTH

The health and safety of all people associated with our business activities is a key focus for ESB International and this is reflected in the company safety policy which is signed off by the Chief Executive of ESB Group and his Executive Director Team. All senior managers have safety related targets in their respective business areas and must complete a number of safety audits annually.

SAFETY

The visible leadership is a key part of ESB International's approach to safety. As a wholly owned subsidiary of ESB, ESB International implements the corporate safety policy in full and strives to deliver every project to the highest level safely. A safety steering group in ESB International reviews all projects in detail and implements appropriate actions where required.

At power plant level, ESB International provides and maintains safe and healthy working conditions, equipment and systems of work for its personnel and other persons visiting or carrying out work on its behalf at site. This is achieved by the use of comprehensive rules, procedures and codes of safe practice relating to particular activities.

ENVIRONMENT

We strive to achieve excellence in all our endeavours and we recognise that our business activities interact with and may have an impact on the environment.

Our objectives are to adhere to the principles set out in the ESB Group Environment Policy in our operational businesses and to deliver best practice solutions to customers while minimising our effects on the environment.

The management and continual improvement of Health, Safety & Environment is a key focus of our Business and an integral part of our approach.

WE SHOULD BE TALKING TO EACH OTHER

To discuss your Power Generation needs, please get in touch with ESB International at the contact points below.

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