



INTERNATIONAL

# Transmission & Distribution

Energy Engineering • It's in our DNA





The mission of ESB International is to unlock value for energy utilities and developers right around the globe.

# Welcome

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The Transmission & Distribution division of ESB International works in close association with private and public sector clients around the world to deliver reliable, secure and efficient electricity transmission & distribution networks.

ESB International, which is wholly owned by Electricity Supply Board (ESB), is a leading engineering consultancy firm to the global utility sector. We are headquartered in Dublin, Ireland, with a central hub in the Kingdom of Bahrain and have operations in Europe, the Middle East, Africa and South East Asia. We have a fully-integrated structure with a team of 7,500+ experts.

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.



# We couldn't say it better ourselves

## What our clients think of us

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### We learn then we lead

The client's challenge: how do we become a sustainable and efficient utility company who aren't dependent on others?

“ When ESB International came to us, we didn't not know anything, we really didn't know ANYTHING – but never did we get the impression that they wanted to force things down to us – it was always this is what we normally do, but how does your system work? They listen to us, listen to what we need, and then we work together. ”

### The expertise we leave behind is our biggest achievement

The client's challenge: how does an existing utility meet international best practice standard?

“ ESB International walk the steps with us while we are working and tell us where we are deficient so that we can improve. We get direct engagement through mentoring, coaching and hands-on on a daily basis. ”

### A shared journey towards a common goal

The client's perception

“ We perceive ESB International as being different from other consultants; they have built the electricity business in our country so we perceive them as partners with us, people who worked with us during the development of electricity in our country. ESB International are like one of us. They are like our own employees ”



“The work we do for our clients is not just about solving today's problems – it's about leaving a genuine legacy for generations to come.”

# Zoning in on Transmission & Distribution

ESB International can provide all the engineering and design services necessary to support the development and operation of transmission & distribution networks.



## Feasibility studies and planning

Our feasibility investigations include cost comparisons while we also assess the condition of existing overhead lines and substations. Environmental Impact Assessment and Cost and Programme development are also part of our service, along with interconnection arrangements, including HVDC options.



## Site investigations and surveys

We deliver selection, survey and detailed mapping services (using the most up-to-date techniques) of routes for overhead lines and underground cables. Our brief can also include substation site evaluation studies, planning permission, analysis and assessment of subsurface conditions – along with topographic and hydrographic surveys.



## Design and specification

We carry out overall design to achieve optimal integration of the various elements of transmission & distribution systems. This can include detailed overhead line design, detailed design of substations, and substation secondary systems. We can take responsibility for HV cable configuration, rating, bonding and earthing, along with telecommunications/SCADA. We also manage technical specifications for the complete range of equipment used in the transmission & distribution systems.



## System studies and planning

Our services include the development of load forecasting models, the development of network master plans, the use of modern software for steady state and transient stability studies, load flow and contingency analysis, and single and three-phase short circuit studies. We can also manage dynamic and transient stability studies, insulation coordination studies, voltage regulation and reactive compensation, plus the development of network planning and security standards.



### Material management

We manage detailed technical specification and procurement procedures, along with material forecasting and costing, tender evaluation and contract negotiations, plus factory and site acceptance procedures. We also take care of all material storage and handling requirements.



### Protection, automation, control and telecommunications

We have extensive experience of Substation Automation Systems and draw on specialised knowledge of smart meter technology, telecommunication infrastructure and back office software. We also oversee the delivery of power system telecommunication systems, new power system control centres and refurbishment/upgrading of existing schemes. Our protection experts provide full protection relay specification, testing, relay configuration and protection relay settings services. We also provide specialised control schemes to enable self-healing networks.



### Construction management, supervision and inspection

Our range of services includes programming and progress monitoring, supervision of construction and installation, approval of all site records, quality control and materials inspections, plus monitoring of safety performance.



### Asset management services

ESB International Asset Management Services (AMS) group provides a comprehensive range of engineering and management services for the maintenance of transmission & distribution networks. These services are based on the adoption of the most up-to-date technologies and systems complementing many years of practical hands-on-experience, and include the development of maintenance policies and procedures, condition-based assessment of overhead lines and substation equipment, commissioning of substation primary plant and associated protection systems and schemes, plus maintenance management of HVDC systems. We also cater for the special needs of ageing plants and carry out technical and safety audits, along with the provision of organisational structure and staffing solutions. Furthermore, we carry out comprehensive training of maintenance staff and provision of maintenance documentation.





— A case study to judge us on



## 220 kV & 66 kV Transmission & Distribution Development: Phase 1 & Phase 4

The Electricity & Water Authority (EWA) in the Kingdom of Bahrain aims to provide electricity and water services at the highest level of quality and reliability to ensure sustainable development in the country and to be a best practice model for providing electricity and water services.

To enable the economic and social growth envisaged by Bahrain's 2030 Economic Vision, EWA is committed to delivering ambitious and challenging transmission and distribution (T&D) development projects.



Client Name	Electricity & Water Authority (EWA)
Start Date – End Date	2014 - ongoing

## Background

One major programme undertaken by EWA has been to strengthen the overall infrastructure and achieve expansion and reinforcement of existing 220 kV and 66 kV transmission & distribution networks in the Kingdom. A high number of substations needed to be delivered quickly, and all related 66 kV & 220 kV cable circuits required urgent approval and installation.

ESB International was appointed by EWA as the consultant to deliver all four phases of this ambitious project, including planning & design, procurement, construction supervision and overall project management of 220 kV and 66kV transmission & distribution substations and cable projects.

## The Transmission & Distribution infrastructure we delivered:

Three new 220/66 kV Bulk Supply Point (BSP) substations and all associated 220kV, 66kV power and communication cabling connections

16 new 66kV substations and all associated 66kV power and communication cabling connections

67 new 220 kV and 66 kV transformers and reactors

250km of 220 kV & 66 kV interconnecting cable feeders

## The services we provided:

The project is in the final stage of completion, with all works being delivered within budget with a continued emphasis on safety and maintaining high-quality standards.

- Power System Studies and project planning, including contract strategy, interfaces, conceptual engineering and statutory approvals.
- Prequalification of contractors, tendering and contract award.
- Overall project & contract management (financial, progress monitoring, interfaces).
- Design review and approval, Factory Acceptance Testing (FAT).
- Supervision of site works and commissioning, including safety and security, meeting internationally recognised quality, safety and environmental standards.
- Collaborating with our client to mitigate commercial and technical exposure and risk throughout the project delivery lifecycle while deploying a best-practice project management approach.

# 132 kV

Submarine cable  
from mainland Tanzania to the island of Zanzibar



— A case study to judge us on



## The Millennium Challenge Account, Tanzania

As part of this highly strategic project, ESB International was required to provide technical assistance to the respective utilities in Tanzania and Zanzibar and to build capacity within both utilities.



Client Name	Millennium Challenge Account, Tanzania
Start Date – End Date	November 2008 – July 2014
Duration	6 Years

## Background

At the time of commencement, the national electricity coverage of Tanzania was approximately 10%, accommodating only 635,000 customers out of a total population of about 40 million. Under the contract, ESB International provided client engineer and construction supervision services in relation to the following key energy project areas:

- Construction of a new 132 kV submarine cable from mainland Tanzania to the island of Zanzibar;
- Zanzibar interconnector 132 kV overhead line supply and installation;
- Substation works – rehabilitation and new-build in six regions of Tanzania, inclusive of the new interconnector substations;
- Extension of rural distribution networks in seven regions in Tanzania;
- Feasibility and technical documentation preparation for bid purposes of a 44.8MV hydro powerplant on the Malagarasi River, Western Tanzania; and,
- A capacity building programme for the two local utilities Tanzanian Electricity Supply Company and Zanzibar Electricity Company.

## The benefits to the local infrastructure and economy

### Road Upgrading

- Reduced transportation costs and travel time
- Increased traffic volume

### Mafia Island Airport Upgrading

- Increased air passenger traffic

### Energy Sector

- Increased quantity of electricity sold
- Increased number of power customers
- Better quality and more reliable power

### Water Sector

- Increased number of households and businesses using improved water sources
- Increased per capita water consumption



— A case study to judge us on



## Planning Studies for EWA Transmission Development Programme

The Electricity and Water Authority (EWA) are the utility sector of the electrical power system in the Kingdom of Bahrain. The power system on the Island of Bahrain consists of a transmission system network of 400 kV, 220 kV and 66 kV substations and feeders. This network has recently undergone a rapid development of new 400 kV, ten 220 kV substations, sixty 66 kV substations, three 200 MVAR STATCOMs. In addition to the development of the grid network, large scale generation facilities and industrial customers have been connected. The Distribution system consists of tightly designed mesh circuits at voltages of 33 kV and 11 kV.



Client Name	Electricity & Water Authority (EWA)
Start Date – End Date	2008 - Ongoing
Duaration of Assignment	15+ years

## Background

Through its Power System Studies (PSS) group, ESB International undertake a wide range of critical electrical power systems studies to support the Electricity and Water Authority (EWA) in Bahrain in developing the Transmission Network.

## The services we provided:

Due to unprecedented load growth, protection studies are critical for Electricity and Water Authority (EWA) in identifying the transmission network expansion projects necessary to reliably support system stability. Power System Protection is a vital part of developing Bahrain's transmission and distribution networks. Optimum settings must be calculated for all new protection relays installed on the system. The settings on existing protection devices also need to be modified to account for the alterations to the network.

## The services we provided:

Load flow and short circuit studies

Dynamic and transient studies

Network master planning

Reactive power compensation studies

Grid impact studies

Insulation coordination studies

Calculation of protection settings for new and upgraded substations and feeders on the transmission and distribution systems from 400 kV down to 11 kV.

Reviewing performance of existing protection devices

Liaising with contractors to ensure coordination of EWA network protection philosophies

Feasibility studies and design of new non-standard protection schemes.

# Health, Safety and Environment

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## Health

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

## Safety

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.

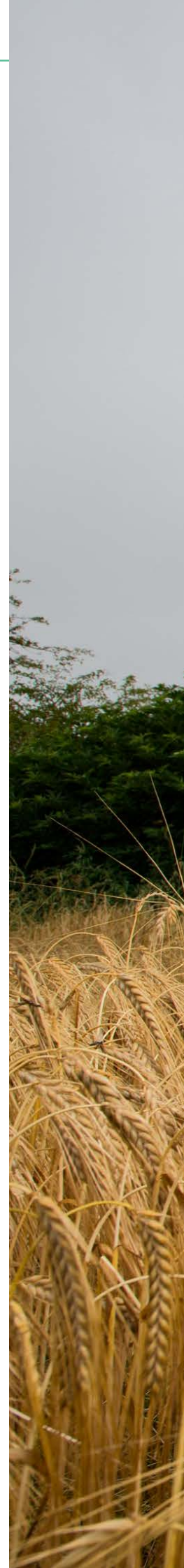
At power plant level, ESB International provides and maintains safe and healthy working conditions, equipment and systems of work for its personnel and other persons visiting or carrying out work on its behalf at site. This is achieved by the use of comprehensive rules, procedures and codes of safe practice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

## Environment

We strive to achieve excellence in all our endeavours and recognise that our business activities interact with and may impact 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.

Managing and continually improving Health, Safety & Environment is a key focus of our business and an integral part of our approach.







We place sustainability at the heart of our business, operating to the highest standards in terms of our impact on and care of the environment.



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# We should be talking to each other

To discuss your Transmission & Distribution needs, please get in touch with ESB International at the contact points below.

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