

Power and Energy Capability Statement Transmission and Distribution



SMEC is a global consulting engineering firm providing high quality, professional services on major infrastructure projects. SMEC has over 5,300 employees and an established network of more than 75 offices around the world. SMEC's Africa Division has offices in North Africa, West Africa, East Africa and Southern Africa, serving the entire continent.

SMEC provides consultancy services for the lifecycle of a project to a broad range of sectors, including: Transport; Water; Environment; Mining, Oil and Gas; Geotechnics and Tunnels; Urban Development; Hydropower and Energy; Social Development; and Government and Advisory Services.

SMEC's consultancy services include: pre-feasibility and feasibility studies; field investigations; laboratory testing; computer modelling; detailed design; tender and contract management; construction supervision; quality assurance; commissioning; operation and maintenance; training and project management.

In 2012 SMEC acquired Vela VKE, a South African professional consulting engineering company. Vela VKE had commenced operations in 1947 and opened its first permanent office in Johannesburg, South Africa in 1951.



Since its creation in 1949, SMEC has delivered thousands of civil, transport, water, environment and power projects in more than 80 countries. SMEC's services generate economic

wealth and provide essential services that contribute to national development in some of the world's fastest growing economies.

SMEC is ranked among the world's top engineering design firms.

SMEC's innovation and expertise ensures delivery of outstanding outcomes to the divisions, sectors and communities in which the Company operates. SMEC has a strong market reputation for its integrity, technical excellence and commitment to client satisfaction.

SMEC's highly experienced team of professionals offers a diverse range of services across all project and asset lifecycles. SMEC's services are tailored to meet client needs for each and every project.

SMEC South Africa now has 12 offices throughout South Africa: Bloemfontein, Cape Town, Durban, East London, George, Johannesburg, Kimberley, Kroonstad, Polokwane, Port Elizabeth, Pretoria and Rustenburg.



SMEC Power and Energy capabilities extend through all stages of project delivery, from inception to completion, including feasibility studies, front-end engineering, modelling and analysis, engineering design, procurement, contract management, construction supervision, quality assurance, operation and maintenance.

Transmission and Distribution

SMEC provides services for all types of transmission and distribution systems, substations and secondary systems, telecommunications and SCADA as well as civil and structural work and other related engineering disciplines. SMEC's team of Professional Engineers and registered Project Managers work with the clients to drive technical excellence and planned project success.



Hydropower

SMEC has extensive technical expertise in the area of hydropower dating back to 1949 and the Snowy Mountains Hydro-Electric Scheme. SMEC has delivered countless hydropower projects ranging from 5kW localised low-capital value projects, to 8,000 MW high-capital cost, multi-disciplinary major projects. SMEC also has expertise in major refurbishment and upgrade projects including re-rating of plants.



Renewables

SMEC was one of the first companies to enter the field of renewable energy, with the Snowy Mountains Hydro-Electric Scheme. SMEC's renewable energy capabilities include: hydro-electric power; geothermal; photovoltaic and solar thermal; wind; biomass; bio-fuels; mini and micro-hydro; tidal and wave technologies; and energy efficient strategies.

SMEC's specialists have provided engineering services to lenders, developers and contractors as part of the South African Department of Energy Renewable Energy REBID (Renewable Energy Bid Programme) Process.



Industrial

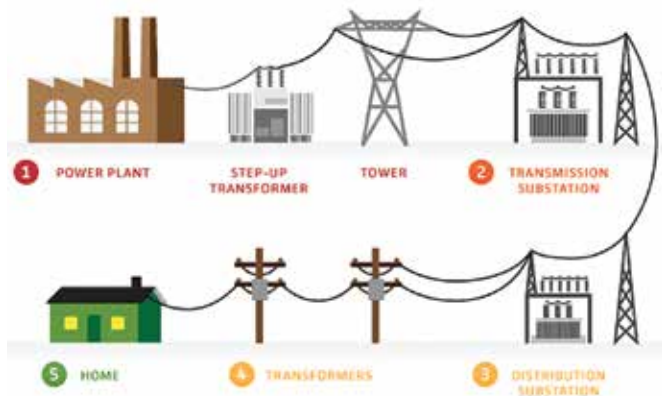
SMEC has expertise in the design, engineering and construction supervision of industrial plants, ranging from pilot scale to full industrial-sized installations. SMEC provides expert consulting services in process industries through a multi-disciplined approach to the investigation, implementation and execution of industrial plant projects.



Transmission and Distribution

SMEC's capability in high, medium and low-voltage power transmission and distribution has been developed and refined through extensive experience and development in association with power utilities and government authorities worldwide. SMEC provides services for all types of transmission and distribution systems, substations and secondary systems, telecommunications and SCADA as well as civil and structural work. SMEC's team of professional engineers and registered project managers work with clients to drive technical excellence and project success.

In the planning and development of power systems, SMEC identifies, evaluates and recommends the most appropriate and holistic option to meet client requirements. SMEC evaluates system optimisation options and system reliability, performs protection studies and stability analyses, designs generator grid connections and completes power security studies.



In project execution, SMEC undertakes preliminary and detailed designs, tailoring project solutions to particular local needs, leveraging off global experience and specialists. SMEC integrates innovative global practices into local client-focused solutions. SMEC understands South African tendering and procurement processes, enabling efficient technical and commercial evaluation of contractor bids. Local construction supervision, backed up by global expertise, ensures a quality infrastructure creation.

SMEC manages projects according to PMBOK (Project Management Body of Knowledge) guidelines from project initiation, through planning, executing, monitoring and control and project closure. SMEC drives project progress to achieve overall project success. SMEC has experience in all facets of power engineering management, project management, construction supervision, network management and institutional capacity building, comprehensively ensuring effective project implementation and continued operational management.

Transmission and distribution projects undertaken by SMEC enhance the quality of life of local communities. The 330kV Aboadze-Volta Transmission Line Project in Ghana will improve the quality of electrical supplies to thousands, transmitting hydro-generated power to customers and significantly reducing the dependence on diesel generators. The Fiji Electrification project planned by SMEC will bring power to many unserved communities and boost small renewable generation capacity (micro-hydropower, biomass, solar photovoltaic and hybrid systems). The Tajikistan Regional 220kV Power Project will improve energy output from Tajikistan's Hydro Power Projects and enable surplus power to be exported to Afghanistan.



SMEC's services include: substations primary and secondary plant; power lines (transmission and distribution); distribution networks; reticulation and electrification; power system studies and transmission master planning; feasibility studies, generation planning and asset management; project management and construction supervision.



Power System Studies and Transmission Master Planning

SMEC provides planning studies, modelling and analysis for the optimisation and development of power system infrastructure. In the planning and development of power systems, SMEC identifies, evaluates and recommends the most appropriate option to meet the client's power and energy requirements holistically.

SMEC evaluates system optimisation options and system reliability, performs protection studies and stability analyses, designs generator grid connections and completes power security studies.

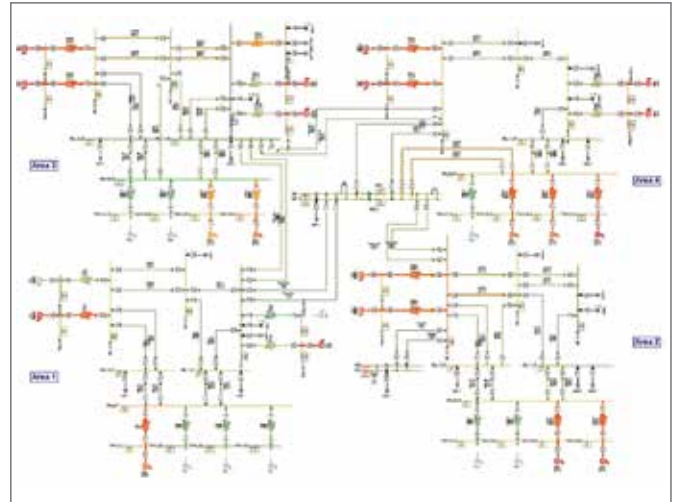
SMEC's services include:

- Transmission master planning
- Network planning and concept design
- Load flows, fault studies, stability, harmonic and protection studies
- Overvoltage and switching studies for reactor sizing
- Status quo investigations
- Viability/feasibility studies including assessment of energy sources
- Operations evaluation
- Energy management planning
- Long term planning
- Network modelling and analysis studies
- Optimisation and reliability analysis
- Regional power interconnections
- Technical, economic and financial feasibility studies and investigations including: Net Present Value (NPV), Internal Rate of Return (IRR), Cost of Unserved Energy (COUE), Long Run Marginal Cost of Energy (LRMC), avoided costs, comparative costs analysis
- The modelling of power systems using the following software packages: PSS/E (Power System Simulation for Engineers), DigSILENT Powerfactory, ETAP (Electrical Transient and Analysis Programme), ATP (Alternative Transients Programme) and PSCAD (Power System Computer Aided Design)

Botswana: North-West and Chobe Districts Transmission Grid Connection

This project will connect new mining, agricultural and industrial load amounting to 350MW to an extended 400kV national transmission grid. SMEC's services include: formulating and optimising alternative lines routes; preliminary line route

selection; power system analysis; environmental studies; and cost analysis and preliminary designs.



Uganda, Kawanda: Masaka 220kV Transmission Line Project

Uganda Electricity Transmission Company identified the need for the extension of the power grid to new substations. This project will provide transmission infrastructure to evacuate power generated by the upcoming 250MW Bujagali power plant to the load centres in the south-western and western regions of Uganda. SMEC undertook power system studies, a Resettlement Action Plan and designs.



With more than 40 years industry experience, SMEC has conducted hundreds of bankable feasibility studies for power and energy projects.

SMEC has broad experience in institutional strengthening, organisational development and restructuring in all aspects of local government. SMEC has successfully implemented institutional strengthening projects (combined with training and technology transfer) for private and public sector organisations, with a focus on human resource development.

SMEC’s services include: demand forecasting; generation planning; tariff studies; technical and non-technical loss studies; financial and economic analysis and financial modelling; bankable feasibility studies; asset management and registers; status quo auditing and reporting (assets).

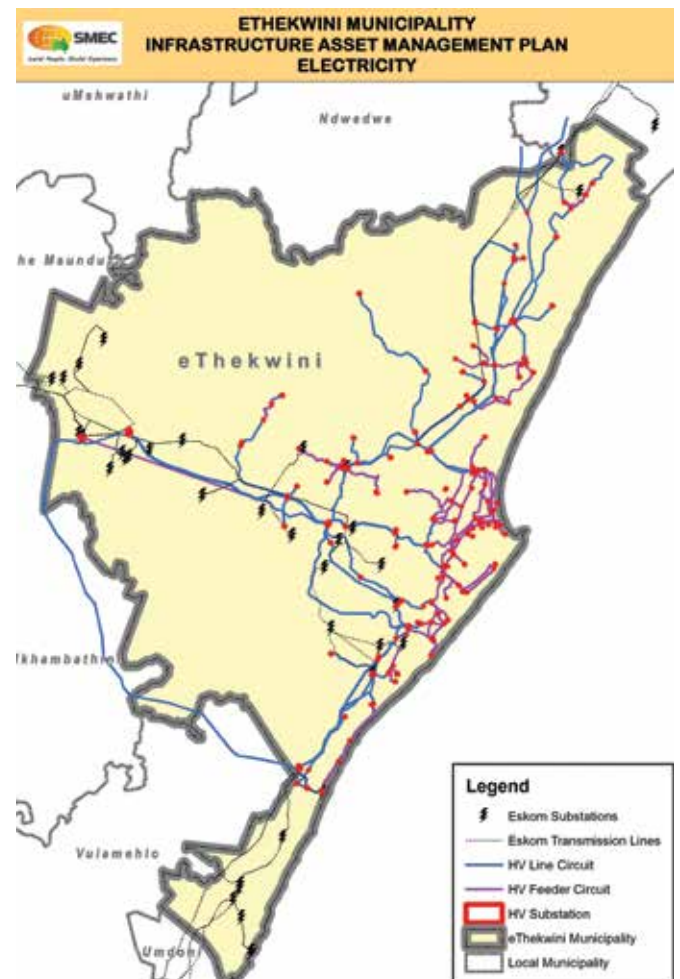
Uganda: Karuma Interconnection Project

The Government of Uganda is implementing the Karuma Hydropower Project, on the White Nile. This project will generate 700MW of power. Transmission lines are required to transmit power generated by the Karuma Hydropower Station to load centres across Uganda. This project involves detailed studies of several alternative transmission lines at 400kV, 132kV and 33kV levels from the Karuma Hydropower Station to load centres. SMEC is providing technical feasibility studies for the lines including: voltage and conductor selection; field surveys; geotechnical surveys; detailed designs; and preparation of Environmental Impact Assessments and financial analyses.



South Africa: eThekweni Asset Management

This project involved the development of a comprehensive fixed asset register that was integrated into the municipality’s GIS and related administrative systems in order to produce a GRAP 17 compliant immovable asset register. All above ground assets including: electrical networks, street lighting, substations and overhead lines were inspected using formal procedures with the data and photographic records captured in the database. Data was then analysed by a set of algorithms using structural parameters to determine asset conditions and remaining useful lives.



Project Management and Construction Supervision

SMEC's team includes: Project Management Professionals (PMP), The South African Council for Project and Construction Management Professionals (SACPCMP), all well-versed in the effective, efficient management of the entire lifecycle of a power project. The team works with clients to drive technical excellence and project success. On larger projects, project success depends equally on technical quality and project management excellence.

SMEC's services include:

- Project initiating
- Project planning
- Project administration
- Cost control
- Schedule management
- Quality management
- Project execution and delivery
- Reporting
- Capacity building
- Project monitoring and control
- Contract management
- Lender / financial management
- Site monitoring
- Technical and project management training
- Commissioning oversight
- Handover
- Defect liability
- Project closure

Ghana: Aboadze-Volta Transmission Line Project

SMEC undertook project management for the construction of a 330kV single circuit transmission line by the Volta River Authority (VRA). Upon completion, the transmission line will stretch from Aboadze in west Ghana, to Volta in the Greater Accra region.

The line includes 330kV and 161kV substation extensions at both ends. The project involves the construction of 215km of 330kV transmission lines and the provision of communication systems at both substations and the system control centre. SMEC's services include: review and upgrade of draft tender documents; evaluation of tenders; factory audits and inspections; quality assurance procedures and review of the contractor's engineering designs; and specifications and drawings.



Mozambique: Matambo Substation

Electricidade de Mozambique (EDM) is enlarging the capacity of the Matambo 220kV Substation in Tete province. Demand has been increasing in Central and Northern Mozambique; this project will enable economic development in the region and improve the quality of power supplied. SMEC has been appointed for the "Supervision and Commissioning for the Design, Supply and Installation for the 220 kV Extension of Matambo Substation". SMEC will carry out engineering services in order to monitor and supervise the project implementation on behalf of the Employer. The detailed design and construction phase will be implemented in compliance with the technical specifications of the contract, on time, within the budget limits and to an acceptable level of technical quality. The scope of Consultancy Services includes the following: contract administration and management; checking and approval of construction drawings; supervision of manufacture and factory tests; site supervision up to commissioning; handing over of the installation and equipment including spare parts and technology transfer to EDM.



Substations Primary and Secondary Plant

SMEC implements world-class substation solutions, providing high-calibre services across all aspects of primary equipment, secondary systems (protection, control, SCADA and auxiliaries), telecommunications, civil engineering and other related engineering disciplines.

SMEC has expertise in the design of primary substation equipment, ranging from medium voltage to 765 kV, and including greenfield substations, extensions, strengthening and rehabilitation. SMEC's services also incorporate the design and specification of grid connection substations at power generation installations for successful integration with the total power system.

SMEC's services include:

- Site identification and selection
- Environmental and social impact assessment
- Concept designs and drawings
- Platform and foundation designs
- Layout, reliability and costing alternatives analysis
- Auxiliary power and batteries
- Substation communications integration
- Detailed engineering design and review
- Protection Functional Design Specification (FDS)
- Performance specifications and bill of quantities
- Construction timeline planning and optimisation
- Insulation co-ordination studies
- Earthing system design
- Fault / Failure studies
- Technical evaluations of bids
- Detailed design approvals
- Factory acceptance testing
- SCADA Integration
- Site supervision inspections and commissioning

Uganda: Bujagali 220kV Switchyard Upgrade Project

This project will provide adequate transmission capacity for the evacuation of power from the 250MW Bujagali Hydropower station in Uganda to distribution companies and large customers in Kampala and the south-western and west of Uganda. SMEC reviewed and updated the infrastructure designs, tender drawings, communications control protocols and SCADA infrastructure, and provided bills of quantity, technical specifications and tender documents.



Kenya: Power Transmission System Improvement Project

The project aims to strengthen Kenya's transmission network through the construction of new 132kV transmission lines and installation of 132/33kV sub-stations. This project is within the framework of the Government's Vision 2030 Statement, promising electricity to all Kenyans by 2030. SMEC's services included: design review, preparation of bid documents; procurement management; quality assurance; implementation of environmental and social impact management; resettlement action plans; and construction supervision and management.



SMEC provides high-quality services for power transmission and distribution lines and associated infrastructure. SMEC's comprehensive range of services includes: grid expansion; rehabilitation of lines to ensure strengthened power transmission capacity and improved access to the electricity grid and telecommunications. All of SMEC's services enhance the efficiency and quality of power supply and ensure organisational and operational improvement for power utilities. SMEC's services include:

- Route and corridor selection
- Environmental consideration and assessment
- Conductor selection
- Tower selection and design
- Optical Fibre Composite Overhead Ground Wire (OPGW) and telecommunications
- Detailed engineering design and review
- Tower failure investigations
- Insulation co-ordination studies
- Tower spotting and optimisation
- Concept and detailed line engineering design e.g. Power Line Systems, Computer Aided Design and Drafting (PLSCADD) and review
- Performance specifications
- Technical evaluations of bids
- Detailed design approvals
- Factory acceptance testing
- Site supervision inspections and commissioning

Uganda: Nkenda, Fort Portal, Hoima 220kV Transmission Line Project

After the discovery of oil in the Albertine Area, a HFO thermal generation plant is being constructed. Uganda Electricity Transmission Company plan to extend the power grid to transmit the 300 MW from the proposed 220/33kV Hoima substation to the proposed 220/132kV Nkenda substation, providing transmission infrastructure to transport power generated by the thermal plant.



SMEC undertook the line design, reviewed the 2008 feasibility study and undertook geotechnical surveys, a Resettlement Action Plan, power system studies, financial analysis and preliminary designs.

Mozambique: Rural Electrification Upgrade

SMEC designed 270 km of 33 kV transmission lines in the Sofala, Manica and Tete Provinces of Mozambique (as part of a design and construct contract). The work involved conventional power line designs as well as bridge crossings, T-structures, stay structures, transformer pole structures and isolating links. SMEC used the PLS-Pole software programme to assist in profiling the line catenaries and to determine minimum clearances. Various line configurations and types of poles were used and inductive reactance was accommodated through alternating line positions at intervals. Aluminium Conductor Steel Reinforced (ACSR) cables were used throughout. Wooden poles were generally used with steel pylons to accommodate the greater loads at river crossings.



SMEC provides clients with innovative best practice solutions, applying the latest technologies and methodologies to ensure project success. With over 40 years distribution network experience, SMEC assists with long term planning, extending existing power distribution networks and constructing new network infrastructure.

SMEC's services include:

- Medium and low voltage substations
- Medium and low voltage networks
- Cable design
- Distribution network master plans
- Engineering audits
- Network rehabilitation
- Environmental considerations and assessment
- Concept and detailed engineering design and review
- Distribution system modelling and analysis studies (Retic Master)
- Network protection analysis, studies and co-ordination
- Network configuration and optimisation
- Distribution management systems (DMS)

Kenya: Energy Access Scale-Up Programme

In accordance with the Kenyan Government's Vision 2030 Statement, Kenya Power and Lighting Company (KPLC) aimed to strengthen its 132kV transmission and distribution network, including 445km of new 132kV lines, four new substations, optimisation of 600km of existing 33kV lines and related system interconnections. SMEC carried out feasibility studies, prepared conceptual design and technical specifications as well as draft bid documents for the proposed sub-projects. SMEC also carried out an optimisation study to identify prioritised investments and prepared a techno-financial report for KPLC.



Tanzania: Distribution System Upgrade

The Tanzania Electric Supply Company's (TANESCO) distribution system in Dar es Salaam was experiencing overloading, frequent outages, losses and low and fluctuating voltages. To address these problems, TANESCO implemented a pilot programme to upgrade the low-voltage distribution system to a high-voltage distribution system which could later be replicated in other areas.

SMEC's services included:

- Appraisal of the existing system
- Development of energy and demand forecasts
- Development of computer models of the new system;
- Conceptual designs
- Technical specifications
- Cost estimates
- Construction supervision.



SMEC has significant capabilities in the field of electrical reticulation, including rural and town electrification and electricity access programmes of varying scale. SMEC identifies the most appropriate technology and implementation strategies to maximise the use of resources and achieve the best long-term sustainable solutions.

SMEC's services include:

- Medium and low voltage, underground and overhead infrastructure
- Low cost electrification
- Access to electricity initiatives and programmes
- Bulk supply/large power user connections
- Network integration modelling and analysis
- Distribution system modelling and analysis studies (Retic Master)
- Mixed use town developments
- Development planning and forecasting analysis
- Economic, financial and social analysis including viability/feasibility studies

Tshwane, South Africa: Electrical Reticulation in Pecanwood Golf Estate

The project comprised the detailed designs and project management for the underground reticulation from the main 11kV Tshwane Council substation within the Pecanwood Golf Estate to various 315kV mini-substations, as well as 400kV low-voltage underground cabling from the 315kV mini-substations to low-voltage distribution kiosks. SMEC undertook electrical reticulation for a number of new extensions within the Pecanwood Golf Estate.



Limpopo Province, South Africa: Mogalakwena District Electrification

The project provides for the electrification of approximately 1,450 households in various villages spread across the municipality, from settlements close to Mokopane to sparsely populated villages at the north-eastern boundary of the municipality. Professional services cover the stages of investigation and preliminary design, detail design, procurement process, construction and project closure. SMEC's responsibility extends to liaising with relevant Eskom stakeholders to obtain applicable approvals, and ensure effective handover of the infrastructure assets to ESKOM upon completion.



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