Increasing access to power in Zimbabwe through infrastructure rehabilitation

WSP participates in a crucial project to improve the reliability of power in Zimbabwe and restore supplies to the 20,000-plus customers who have been without stable access to electricity for some time.

27 May 2019 - Infrastructural challenges in the power and WASH sectors (water, sanitation and hygiene) and the subsequent impact on people's lives in the Republic of Zimbabwe led the government to seek funding to redress the situation. With support from development partners, the government secured a grant of US$35 M from the Zimbabwe Multi-Donor Trust Fund (Zim-Fund) – as administered by the African Development Bank – to be allocated for the implementation of the Emergency Power Infrastructure Rehabilitation Project (EPIRP).

Acting in the role of Implementing Entity on behalf of the government of Zimbabwe, the Power team from WSP in Africa is providing consultancy and project management services throughout the EPIRP lifecycle: from project scoping, development of technical specifications and tender stage management to design management, construction supervision and final handover.

"Though a brownfield project, the EPIRP is crucial to improve the reliability of the power sector in Zimbabwe and restore supplies to the 20,000+ customers who have been without stable access to electricity for some time," explains Dinesh Buldoo, Director Power, WSP in Africa. "This project has been thoroughly planned out and is being implemented in phases to ensure the maximum overall success since there are a number of components that are ultimately interdependent."

Providing adequate and reliable electricity

"The first phase of the EPIRP was designed to improve the provision of adequate and reliable electricity in an environmentally sound manner," says Buldoo.

Phase 1 commenced in 2012 with the rehabilitation of the ash handling plant at the Hwange Power Station to prevent ash build-up in the furnace and precipitator hoppers. "This is critical for the continuous full-load operation of the generating units, as a build-up of ash would lead to a partial or complete shutdown of the power station," indicates Buldoo.

WSP's experts appointed to this project also carried out a substantial assessment of the power transmission and distribution facilities across the country, as well as an environmental and social audit of the plant and its operations. We then produced a comprehensive Environmental and Social Management Plan for the government and investor clients. The final handover took place in 2017, concluding the first phase of the EPIRP.

Work completed under Phase 1 includes:

- Replacement of six power transformers
- Renewing primary equipment such as circuit breakers and instrument transformers at sub-transmission substations
- Replacement of more than 500 distribution transformers
- Installation of 11 kV (kilovolt) and 33 kV underground cables and overhead conductors
- Construction of a new substation that will secure the power supply to the Harare City water treatment plant

Ramping up the voltage

The second phase of the EPIRP commenced in 2014 and was executed in a staged approach. This phase was designed to further the benefit of the Phase 1 interventions by focusing on the rehabilitation of the sub-transmission and distribution network owned by the Zimbabwe Electricity Supply Authority (ZESA).

“The ultimate aim of this phase was to improve reliability of power supply to consumers. However, given the scope of this phase and the number of components involved, execution took place in two execution stages,” says Buldoo. “The first part is completed, and we are now working on the sub-projects of the second stage with the engineering, procurement and construction (EPC) contractor. This is planned for completion by the first quarter of 2020.”

Buldoo indicates that close collaboration among multiple parties was integral to bringing the EPIRP to a successful closure. “We had a team of experts – from engineers, to project managers, accountants and environmentalists - actively involved with varying aspects of this project. Our team members also continue to work closely with sub-consultants, the EPC contractor and numerous other stakeholders, including but not limited to representatives from the Zim-Fund, the Zimbabwe Electricity Transmission and Distribution Company, the Zimbabwe Power Company, and Crown Agents – who all have a shared vested interest in this project.”

“Working on such a high-profile project that can have a direct and lasting impact on people’s lives, and on the economic and social development of a country is a great honour. Everyone involved has shown ingenuity and dedication to working towards the same end goal. We are very proud of our involvement and contribution to this project,” concludes Buldoo.

Below is an overview of the various components and interventions underway as part of a staged approach to Phase 2 of the EPIRP.

Focus: Chertsey Substation

Chertsey 330/132 kV bulk supply substation is located outside the city of Gweru, the capital of the Midlands province. The company's assessment found that there were three 90MVA 330/132kV transformers in service out of the four original units, one having been removed from service after developing a fault. The project entailed replacing the fourth transformer with one of the same rating including:

- 11kV NEC (national electrical code), NER (neutral earthing resistor) and 450 KVA (kilovolt-ampere) auxiliary transformer
- 330kV and 132kV circuit breakers
- Current transformers and surge arrestors complete with concrete plinths and structures for all new bay equipment
- Transformer bay protection panel, including the integration of the new bay equipment into the existing hardwired control scheme
- Integration of the bay into the existing busbar protection scheme
- Secondary multicore cables from the new transformer and primary equipment to the new 330kV and 132kV protection panels located in the existing 330kV and 132kV control rooms, respectively

This sub-project was completed and handed over to the end-user in November 2018.

Focus: Transmission rehabilitation

The Marvel 330/88 kV bulk supply substation is located just outside the city of Bulawayo, Zimbabwe's second largest city. Three transformers were in service of the original four units: 2 x 60 MVA (mega volt amp) 330/88kV units and 1 x 175 MVA 330/88kV unit.

The fourth transformer, T2A, developed a fault and proved to be costly to repair. Instead, this transformer was replaced under the EPIRP project with a larger [330/132(88) kV] 175 MVA unit. This scope included all new:

- 11kV NEC, NER and 450 KVA auxiliary transformer

- 330kV and 132 kV transformer bays complete with concrete plinths and structures for the new bay equipment
- Transformer bay protection and control scheme including integration thereof into the existing substation SCADA (supervisory control and data acquisition) system
- 220VDC battery charger and battery bank
- Busbar protection scheme for the 330kV double busbar arrangement
- Secondary multicore cabling for the new bays

The scope also included the removal of the existing direct buried 88kV oil filled cable and the replacement thereof with 132kV XLPE insulated cable complete with cable termination kits and cable sealing ends. Additionally, the existing scheme comprised two transformers banked onto the 330 kV and 88 kV busbar – where part of the scope for this replacement included de-banking the existing transformer bay.

This sub-project was completed and handed over to the end-user in December 2018.

Focus: Distribution project

Prince Edward Dam (PE Dam) is the second water source for the city of Harare. The substation supplying power to this water pumping station had 11 kV PILC (paper insulated lead cables) feeder cables that were in poor condition and required replacement. The 2 x 4 MVA 33/11 kV transformers at the substation were overloaded and leaking, and based on the 20-year load forecasted, the transformers needed to be upgraded to 2 x 20 MVA. Additionally, the existing 11 kV switchboard had reached the end of its design life and was no longer safe to operate.

The scope of work at the PE Dam included the upgrade of the existing substation to a standard 33/11 kV substation with:

- A single 33 kV outdoor busbar and bus-section isolator
- Two complete new 33 kV and 11 kV transformer feeder bays
- Two complete new 33 kV feeder bays at PE Dam
- A 33 kV feeder bay at the airport substation
- New 11kV PILC feeder cables from the power transformers to 11kV board at PE Dam
- New protection and control schemes
- A new 11kV board and new 110 V and 48 V charger and battery

Sub-projects included in the second execution stage are underway and planned for completion by the first quarter of 2020.

Focus: Sherwood substation

Sherwood 330/88 kV bulk supply substation is located just outside the town of Kwekwe, an industrial hub in the Midlands province. There were four transformers in service of the original five units including: 3 x 90 MVA 330/88kV units and 1 x 175 MVA 330/88kV unit.

The fifth transformer developed a fault and proved to be too costly to fix . This transformer is being replaced with a larger 330/132(88) kV, 175 MVA unit that includes:

- 11kV NEC, NER and 450 kVA auxiliary transformer

- 330kV (rated at 400kV) and 132kV transformer bays complete with concrete plinths and structures for the new bay equipment
- Transformer bay protection and control scheme including integration thereof into the existing substation SCADA system
- 220V DC battery charger and battery bank
- Busbar protection scheme for the 330kV double busbar arrangement
- Secondary multicore cabling for the new bays

The scope also includes the installation of 132kV XLPE insulated cable complete with cable termination kits and cable sealing ends, as well as de-banking the two transformers that form part of the existing scheme.

Focus: Orange Grove substation

Orange Grove 132/33kV sub-transmission substation is located outside the city of Mutare, the capital of the Manicaland province. The transformer suffered extensive damage as a result of a fire and needed to replace a 50/75MVA unit—which included a new 132kV and 33kV transformer bay (i.e. circuit breaker, isolator, surge arresters, voltage transformer and current transformer)—as well as a protection and control scheme with a voltage regulating scheme, designed to match the supplied transformer that is capable of operating independently and in parallel with the existing scheme.