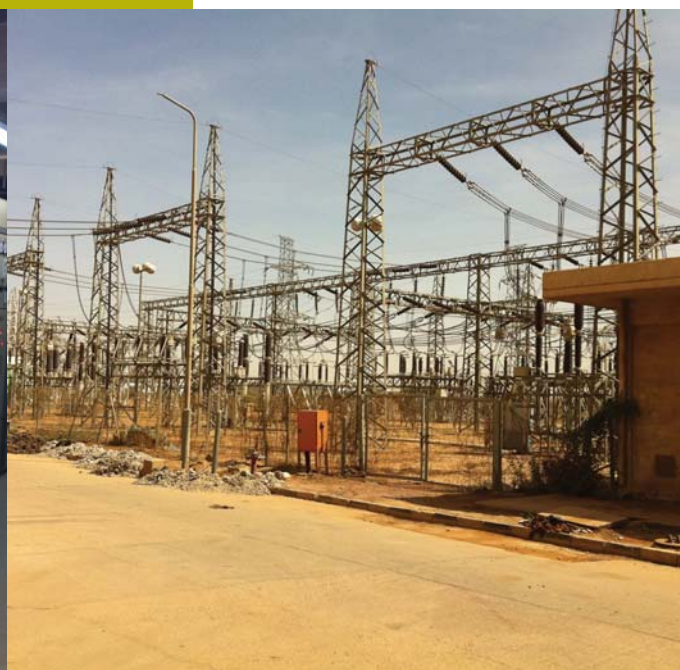




Islamic Development Bank

Together we build a better future

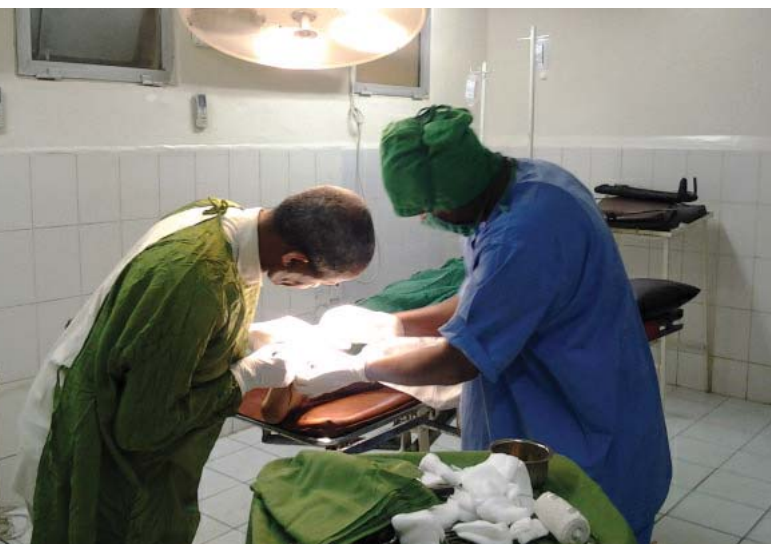
Power plant modernisation gives Sudan's growth a jolt



With an eye to the future, in the 1970s and 1980s, Sudan made substantial investments in power generation that modernised and increased the supply of electricity to businesses, farms and households alike. But by the 1990s it was clear those earlier investments were not keeping pace with economic growth. Lack of reliable, abundant power was seriously hindering socio-economic development in Sudan, a lower-middle-income country where a significant proportion of the population lives below the national poverty line.

With investment from the Islamic Development Bank (IDB), the Government of Sudan undertook two projects between 1999 and 2011 to renovate and modernise those earlier investments in the Khartoum North Power Station.

Countrywide, the additional power procured through these investments amounted to over 30% of total power generation, and electricity became accessible to 35% of the population. At less than a third of the cost of installing new generating capacity, the retrofits of the existing plant boosted socio-economic growth and reduced pollution, while National Electrical Corporation (NEC) staff were trained to maintain these important investments.



A reliable electricity supply benefits the community, for example, enabling better healthcare provision

Power to the people

Of the many pre-conditions for sustainable economic development (including access to financial capital, markets, knowledge, ideas and skilled labour), one of the most important is an abundant, reliable source of electricity. Without it, factory machines do not produce; students cannot readily study at night; and computers and modern irrigation systems cannot function.

Electricity also improves quality of life, from powering household appliances and street lights to ensuring a surgeon has light in the operating room.

By the late 1990s, Sudan had undergone many difficult economic reforms to boost national development. These reforms led to rapid economic growth of more than 5% annually toward the end of the decade.

However, further socio-economic growth was severely hindered by the lack of a reliable, abundant supply of electricity. Significant investments in power plant infrastructure in the 1970s–80s had not been maintained. This was partly due to inflation, which reached 114% in 1996, and currency fluctuations. Together, these put the cost of necessary imported equipment out of reach.

By the 1990s it was clear that the power supply was failing to keep up with economic and population growth. In 1995, electricity accounted for less than 3% of national energy supply. Most energy (79%) was from biomass (fuelwood, charcoal and agricultural residues), the burning of which poses a myriad of environmental concerns, from deforestation to urban smog.

Cover captions: left, Modernisation of the Khartoum North Power Station which enhanced the efficiency and control of the station; right, Feeding into the grid

Identifying the problem

In 1997 a routine inspection of the Khartoum North Power Station, which runs on diesel and other heavy fuel, revealed that defective boilers and turbines in the power plant had reduced its production capacity to 60%.

The strain on the power supply was such that outages were common. These had a devastating impact on business productivity, so the commercial and industrial sectors took matters into their own hands. Rather than depend on power supply from the state-owned NEC, they diverted scarce capital into buying and running their own generators. Farmers and rural communities – the mainstays of this agricultural economy – had little or no access to electricity to improve their wellbeing and livelihoods.

A two-part fix

Having made improved electrical supply a priority, in 1999 the Government of Sudan requested funding from the IsDB to rehabilitate the plant, operated by NEC. Impressed by the obvious socio-economic benefits to be realised by securing more of Sudan's electricity supply, the IsDB agreed to finance the project.

Due to the Government of Sudan's financial constraints, the retrofit was undertaken in two phases. In 1999 (Phase 1), a turbine and two boilers were overhauled using US\$4.76 million from IsDB and US\$2.29 million from the Government. Then, to safeguard that investment, in 2005 (Phase 2), IsDB provided US\$26 million and the Government US\$14.6 million to renovate and modernise the plant's control, automation and firefighting systems and to introduce de-sulphurisation of the plant's fuel, to reduce pollution.

A gold-star project

Thanks in great part to the commitment and skills of all concerned – the Government, NEC, foreign consultants and IsDB staff – Phase 1 was completed within budget and five months ahead of schedule, in almost half the time anticipated.

After start-up in May 2000, the rehabilitated boilers and turbine were producing an extra 25 MW of power; half of their installed capacity that had been unavailable due to the lack of maintenance and upgrading in previous years. Because of the project, power generation in Sudan increased by 529 MW during the period 2000 to 2004.



Improving lives

The Khartoum power plant rehabilitation project helped NEC to partially overcome chronic power shortages, and resulted in some parts of the economy and country accessing electricity for the first time.

Access to energy is an important development indicator. The project had a substantial, positive socio-economic effect on the population, including increases in productivity and incomes, and providing better living conditions. The project resulted in some parts of the economy and country gaining access to electricity for the first time. The retrofitted plant provides about 50% of industry's demand for power and particularly addresses shortages during the peak summer months.

"In the past few years, we've seen more reliability in the power supply. This has been good for the community as our Sudanese culture often have festivities at night, avoiding the hot summer days. Also, while Khartoum is generally safe, street lights have increased the feeling of safety." Ali Osmanne, Bahri Chieftain

"Years ago, during power outages, it was difficult to get a good night's rest, as the sound of generators was very disturbing. Also, the cost of buying or sharing generators, fuel and maintenance was expensive. Now we can use this for more productive purposes." Mohammad Ali, family man, Omdurman, Greater Khartoum

From better to best

All parties involved realised that the investment in Phase 1 would not yield full benefit unless Phase 2 (modernising control, automation and firefighting systems) was undertaken, along with measures to decrease harmful emissions.

In fact, without Phase 2, all previous investment in the plant was in danger, as IsDB staff noted in 2004: "The plant is at risk for major damage to the turbines and boilers due to poor control systems which are obsolete and out of order ... The project aims at increasing the reliability and efficiency of the Khartoum North Power Station and extending its service life."

New instrumentation and control systems were to provide data to improve operations and reduce downtime due to power outages. An improved firefighting system protected staff, citizens and investment in the project. Reducing sulphur emissions with new equipment, which accounted for almost a quarter (US\$7 million) of project costs, reduced the plant's environmental impact.

Huge savings

Phase 2 was completed in three years, by 2011. Combined with Phase 1, it boosted the satisfaction not just of customers but also the staff employed by NEC, considered one of the most successful government entities in Sudan.

With better controls and monitoring, the mix of fuel and air is now optimised for maximum efficiency and less fuel is needed to produce each kilowatt of power, leading to US\$6.5 million in savings annually. These systems have also contributed to the power plant's reliability and made it a more dependable energy partner on which Sudanese industry, agriculture and households can depend.

Building capacity

The project helped build the capacities of NEC which already ran an effective training programme. In Phase 1, a full-time project team of 17 engineers and technicians was assigned to follow-up on project implementation with the contractors, an approach built upon in Phase 2. One IsDB evaluator said: "NEC is providing management, staff and services required to

Success factors

Use of existing resources

The project capitalised on previous investments by renovating existing infrastructure. In addition, the manufacturers who originally supplied the equipment (ABB, Siemens) were hired to work on the rehabilitation project, providing previous knowledge and increasing efficiency.

Planning and management

The success of the project was facilitated by NEC's solid technical capabilities, clear identification of the scope of the work, preparation, planning and timely resource mobilisation. Work was further enhanced by IsDB's quick processing and close monitoring of the project.



Payoffs

The project resulted in Sudan gaining 25 MW of electricity for just US\$7 million, less than a third of the cost of installing new generating equipment of the same capacity. It also added supply and reliability to the power system, while modernising its management and safety. The project significantly reduced the plant's emissions of pollutants, while also reducing noise and air pollution from private generators – many of which no longer need to be used. Fewer power outages mean increased industrial efficiency, worth US\$3.3 million, and benefits of US\$1.2 million to other sectors including agriculture.

operate and maintain the plant in accordance with established operating standards ... Furthermore, a training centre is available within the company and conducts the required courses."

"This project has greatly enhanced the efficiency and control of the station. Now we receive live feedback for units 3 and 4, allowing for faster decision making. This in turn has generated enhanced reliability of electricity services for consumers." Osama Hussein Mohamed Elhassan, Manager, Khartoum North Power Station

"Just a few years ago, the power outages used to last for many days and were quite frequent. Today if there is power outage, it is much shorter. The clinic has benefitted from this enhanced reliability. Medical procedures can be done in more certainty using the regular power system, and the emergency power is used more seldom." Muhammad Toum Musa, Director, University of Khartoum Clinic

Building on progress

With the return of full capacity operation at the Khartoum plant, access to electricity in Sudan rose to one-third of the population. To further widen access, particularly to rural

Sudanese who account for most of the population, the Government and NEC are looking toward hydropower which now provides most of Sudan's electricity.

Future challenges

In addition to providing a greater percentage of the population with access to electricity, there is a need to improve the reliability of the power supply by decreasing the number of power outages annually. This would increase productivity and, in turn, should decrease the reliance on privately-owned generators, which tie up resources that could be put to more productive investment.

As electricity rates are currently below the cost of production, a gradual increase in tariffs would enhance NEC's self-financing capabilities and its overall performance. Decreased reliance on the current state subsidies would promote NEC's self-sufficiency and convey the true cost of electricity to clients.

Acknowledgements

This success story is based on reports provided by IsDB and the Government of Sudan. The evaluation report for Phase 1, prepared by the IsDB Group Operation Evaluations Department (GOED), provided important material for this success story. The story was supplemented by additional material from a field visit by Br Faisal Siddik of IsDB, Jeddah (February 2012). The document preparation was managed by Dr Intizar Hussain and Br Faisal Siddik of the IsDB's Compliance and Development Effectiveness Division of the Operations Policy and Services Department (OPSD). All direct and indirect contributions by colleagues at IsDB and partners for successful implementation and evaluation of the project, and for the preparation of this document, are gratefully acknowledged.

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