



G20 PRINCIPLES FOR QUALITY INFRASTRUCTURE INVESTMENT **PARAGUAY**

STRENGTHENING PARAGUAY'S ENERGY SECTOR

Paraguay's public utility, the National Electricity Administration (ANDE, in Spanish), aimed to strengthen the power supply network through the construction of the Itaipú–Asunción 500 kilovolt transmission line and associated substations. With World Bank support, ANDE included the cost of the energy loss as criteria to evaluate the bids for power transformers to achieve value for money (VfM) in the purchase of the most expensive and strategic component of electrical networks. The project will help satisfy Paraguay's growing demand for electricity, directly benefitting households, companies, and local industries by improving transmission and distribution networks while increasing the volume of available energy.

DEVELOPMENT CHALLENGE

The electricity sector plays a key role in Paraguay's economy, with a large amount of power generated by two highly productive binational hydropower plants, located more than 300 kilometers from the Asunción metropolitan area where 60 percent of the electricity is consumed. Despite outstanding power capacity, outages and voltage fluctuations are frequent due to inadequate investment. Transmission and distribution losses are estimated as high as 24.5 percent, though exact measurements are unavailable due to the lack of a reliable metering system. The poor quality and reliability of the electricity service hindered productivity and prevented Paraguay from optimizing its purchasing agreements with the binational generators. Considerable technical and financial challenges must be addressed to increase efficiency, modernize management practices, and reduce system losses.

WORLD BANK PROJECT

Under the [Paraguay Energy Sector Strengthening Project](#) (\$100 million) the World Bank will bring additional resources and technical support to improve the performance of the transmission network through the construction of a 341-kilometer, 500 kilovolt transmission line connecting Itaipú to Asunción, and the construction/upgrading of the associated substations including additional transforming capacities. The project includes the modernization of Paraguay's power distribution management system that includes a corporate communications system with real-time monitoring and secure power operation system as well as an advanced metering system for large consumers. The project will reduce outages by improving the quality and the quantity of the electricity delivered. In order to reduce losses, this project includes a specific grant (estimated at \$2.6 million) to improve ANDE's capacity for investment planning and project preparation, improving overall performance and transparency.



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QUALITY
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The Paraguay Energy Sector Strengthening Project follows [G20 Principles for Quality Infrastructure Investment \(QII\)](#) specifically related to:



QII PRINCIPLE 2: RAISING ECONOMIC EFFICIENCY IN VIEW OF LIFE- CYCLE ASSESSMENT OF POWER TRANSFORMERS

Thirty three single-phase/three-phase power transformers were necessary for the construction of the 341-kilometer, 500-kilovolt transmission line and associated substations. The procurement process was designed to ensure that transformers were procured for the most economical price through their lifecycle.

The 33 transformers were purchased through two tenders following exactly the same procurement rules. Both of those tenders were structured in three lots comprising transformers of different characteristics and awarded to the lowest bids complying with the technical requirements.

For the economic evaluation of the eligible bids ANDE considered, in addition to the quoted price, the monetary value of the power losses of the transformers. In order to determine which manufacturer's transformer had the lowest evaluated cost including losses, the total bid price comprised:

- **The quoted price (corresponding to the amount of the awarded contract)** after arithmetic corrections, application of discounts (if applicable) and conversion to a single currency.
- **The cost of power losses:** The transformer's power losses comprise copper losses and iron losses. To calculate the dollar value of these losses over the life cycle of the transformers, the guaranteed power of iron losses and guaranteed power of copper losses of each offer was multiplied by the value of the lost kilowatt through a specific copper loss multiplier factor, and a specific iron loss multiplier factor, in U.S. dollars/kilowatt.

“This project will contribute to the expansion of the electricity grid, strengthening the country’s energy sector, expanding the foundations needed to promote the establishment of more industries, and putting Paraguay in a better position to promote and sustain its growth and development paths.”

Former Paraguayan Finance Minister
Dionisio Bordak



The first tender took place in January 2015 where 22 transformers were awarded for \$11.7 million.

The second tender took place in July 2016 where 11 more transformers were purchased for \$7.5 million.

MAKING A DIFFERENCE

The application of the power loss formula as evaluation criteria shifted the purchasing rationale of transformers to be more sustainable and economical throughout the life cycle of this critical component of electric networks. Additionally, addressing the life-cycle costs throughout the procurement process is now incorporated in ANDE's ongoing procurement practice. This will contribute to raising economic efficiency and achieving VfM through the procurement of future equipment.

ABOUT THE QII CASE STUDY SERIES

This case study is one of eight developed by the Quality Infrastructure Investment (QII) Partnership to illustrate how the QII Principles are being applied in practice. The World Bank Group and the government of Japan established the QII Partnership to raise awareness and scale-up quality infrastructure investment aligned to G20 QII Principles in developing countries.

Access the entire series at www.worldbank.org/QII.
