



Managing Energy Transactions Across the Kingdom of Jordan



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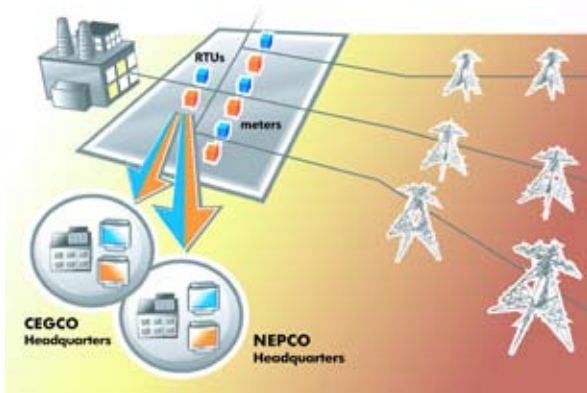
The Hashemite Kingdom of Jordan is a country in the midst of some very big changes. Limited access to natural resources such as water and oil have traditionally placed significant constraints on this region, but for decades, Jordan has faced these challenges with a steady commitment to increasing growth and improving living standards. Part of this commitment has been to provide the country's five million residents with a secure source of reliable and affordable energy. This initiative has grown into a countrywide goal to upgrade, and most recently, deregulate the region's electricity transmission grid.

To accomplish this, the government of Jordan recently split the state-owned National Electric Power Company (NEPCO) into three distinct organizations, and embarked on the next challenge: building a countrywide energy-information infrastructure to monitor energy transactions and billing between the newly independent power generation, transmission and distribution companies. This solution represents a critical step towards Jordan's goal of creating a sustainable energy sector, characterized by efficiency, quality and growth. Jordan's commitment to quality.

The promise to improve Jordan's energy infrastructure dates back to 1967, when the government established the Jordan Electricity Authority (JEA). The JEA was entrusted with developing a system of modern power plants and a reliable high voltage network that would deliver electricity to every village and rural community in the country. Once established, the JEA saw Jordan's installed capacity grow steadily to meet demand and provide sufficient reserve. By the early 1990s, nearly 100% of Jordan's population was supplied with electricity. In 1996, JEA was recast as the National Electric Power Company (NEPCO), a publicly held government entity. Then in 1999, the Cabinet split the state-owned NEPCO into three legally and financially independent operating companies: the Central Electricity Generation Company (CEGCO), the National Electric Power Company (NEPCO), and the Electricity Distribution Company (EDCO).

Privatizing the Energy Sector

As a state-owned utility, NEPCO remains at the center of Jordan's restructured energy sector, responsible for the management, operation and development of the country's high-voltage transmission network. NEPCO maintains ownership of Jordan's transmission assets, but buys power from generation companies such as CEGCO, and sells it to distributors such as EDCO.



Most of Jordan's generation is provided by two main power plants: the 650 MW Aqaba power plant in the south, and the 400 MW Hussein power plant in the north. The country's transmission system runs along the north-south axis of Jordan, with distribution lines served from this 132 kV radial system. In addition to EDCO, other private firms providing distribution services include the Jordan Electric Power Company (JEPCO) in Amman, and the Irbid District Electricity Company (IDECO). To further support the business processes of an expanding energy market, each of the newly independent companies needed a way to efficiently and accurately communicate and verify energy and financial transactions. Everything from the quantity and quality of power produced and delivered, to up-to-the-minute billing and time-of-use data had to be available to all market participants. As the administrator of this developing marketplace, NEPCO began evaluating ways to monitor metering points across the grid - every inter-tie where electricity is transferred from one business to another.

The first priority was to monitor settlement billing between NEPCO's transmission system and the generation assets of CEGCO. To do this, NEPCO installed a PowerLogic® ION Enterprise® energy management system. The Internet-based system uses a network of 150 intelligent PowerLogic ION7500 series energy meters linked to four software servers to track and verify energy transactions between Jordan's generation and transmission companies.

Parallel networks

According to Faten Khuraishi, project manager for NEPCO, a key requirement of this system was to create a parallel communications structure that could provide each company with independent access to metering data from each shared inter-tie point. "Instead of NEPCO providing information to CEGCO, we wanted to give each company its own direct, independent access to metering information from each feed," explains Khuraishi. "But to verify the consistency and accuracy of the metered data, we also needed to build in a network of redundant meters - a parallel network - to act as a check to the main meters."

To do this, NEPCO equipped eight of its substations with a pair of revenue-accurate ION® meters on each feed: one main meter and one check meter. These meters monitor the electricity delivered from CEGCO to NEPCO, and send the data up to a pair of ION® RTU data loggers. Each substation is equipped with two data loggers: a main data logger receives data from all main meters in the station, and a check data logger receives data from all check meters in the station.

To oversee the data loggers, a pair of servers - a main server and a check server - was installed at each company's headquarters and configured to receive information from all metering points. Each main server monitors all main data loggers, and each check server monitors all check data loggers. Both servers are equipped with identical energy management and billing software, and both servers collect revenue and event information from the meters on the main feeds. With this



arrangement, CEGCO and NEPCO maintain two completely identical - yet independent - metering networks, accessible from each company's corporate headquarters.

To supplement the main and check servers located at each headquarters, NEPCO installed additional workstation terminals at each substation so CEGCO and NEPCO engineers could access the system locally for onsite troubleshooting or research. Security safeguards such as a segmented network infrastructure, data validation, and multilevel user authentication ensure all billing and operational data is secure - accessible only to authorized users at each organization.

NEPCO's metering system uses high quality Rittal electrical cabinets, equipped with humidity and temperature controls, to accommodate up to six meters each. The meters and servers communicate over NEPCO's existing fibre optic network - a dedicated Ethernet wide area network (WAN). In remote areas, substations can connect to the Ethernet network via modem over the public telephone network. Every meter is also equipped with a built-in GPS (global positioning satellite) time-sync capability to ensure the accuracy and consistency of all time-sensitive data across the entire network.

High accuracy metering

In selecting an energy management system, NEPCO identified revenue accuracy as a key requirement, according to Dr. Abdallah Abdulrahim, managing director of AMPS, a Middle East-based energy consulting business that assisted with the implementation of the new system. "With a synchronized network of intelligent revenue meters, both CEGCO and NEPCO can verify the amount of energy produced and delivered," says Abdulrahim, "and the high accuracy of these meters ensure that energy can be measured against the highest revenue-metering standards, such as IEC 60687, Class 0.2S. Also, each meter can help evaluate factors such as active and reactive energy, voltage and current levels, and power-quality concerns like sags and swells, and harmonics."

"With both companies sharing the same meters at the same time, there's no variation in the data," explains Abdulrahim, "and with every meter in the network synchronized to the millisecond using a standard GPS signal, time-of-use data is absolutely accurate. Overall, this arrangement provides the shared monitoring, reporting and billing capabilities needed to help accommodate the needs of this growing market."

As part of Jordan's efforts to attract private investment to the country's developing energy sector, a reliable metering and communications infrastructure is helping to support the business processes between market participants. Through the adoption of a synchronized, countrywide enterprise energy management system, NEPCO has set the stage for a competitive, financially viable environment for the production and sale of electricity.

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