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PAKISTAN ENGINEERING EXECUTIVES REVIEW BEST PRACTICES IN DISTRIBUTION SYSTEM ENGINEERING & PLANNING

EXECUTIVE EXCHANGE WITH TENAGA NASIONAL BERHAD, MALAYSIA

MAY 2013 – KUALA LUMPUR & MELAKA, MALAYSIA – Supported by the U.S. Agency for International Development (USAID), ten senior engineers from seven of Pakistan’s electricity distribution utilities participated in an executive exchange with their counterparts at Tenaga Nasional Berhad (TNB) to review best practices in distribution system engineering and planning. The exchange, conducted by the U.S. Energy Association as part of USAID’s Power Distribution Program (PDP) in Pakistan, was aimed at improving engineering and planning operations within Pakistan’s electricity distribution sector.

USAID’s **Power Distribution Program (PDP)** is a five-year project conducted jointly with government-owned electric power distribution companies in Pakistan to improve their performance in the areas of loss-reduction, revenue collection and customer services. Throughout the executive exchange, TNB presented strategies to enhance distribution system engineering and planning to the delegation of executive engineers from Pakistan.



TNB, Malaysia’s national electric utility, is vertically integrated and owns 9,110 MW of the 21,748 MW of total installed capacity on Peninsular Malaysia. With 8.3 million customers, TNB sold 96,257.2 GWh in FY2012. The utility provides electricity for 99% of Peninsular Malaysia, while its current maximum demand stands at over 16,000 MW.

PRIMARY TOPICS OF THE EXCHANGE

The delegation of ten senior engineers from Pakistan spent five days visiting TNB in Malaysia, reviewing various methods to advance distribution system engineering and planning. Key topics of the program included:

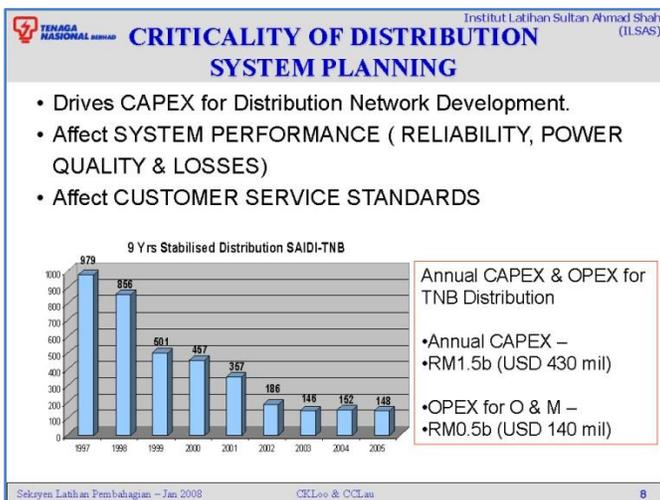
- **Commercial and technical planning**
- **Asset management**
- **Revenue management**
- **Human resources development and training.**

COMMERCIAL & TECHNICAL PLANNING

PDP delegates were presented with best practices in commercial planning from TNB, stressing its customer-focused motto, "Gemilang 2015" ("be great by 2015"). TNB shared its 20 year strategic plan, which revolved around incremental five year goals for performance improvement. These goals included service excellence by 2010, geographic expansion of services by 2015, overseas investment by 2020 and global leadership in the energy industry by 2025. Currently, TNB has 15 key performance indicators (KPIs) that project to 2020. These KPIs identify clear metrics against which TNB can measure its performance and progress.



PDP delegates listen to a lecture at ILSAS (Integrated Learning Solution), the official training institute for TNB. ILSAS is home to TNB's R&D Center, numerous training facilities and Universiti Tenaga Nasional, a government-run university focused on the education and promotion of engineers.



TNB provided a thorough overview of their technical planning processes and methodologies for their distribution business. TNB's national headquarters sets all policies for forecasting, planning and asset management activities at the regional level. To accommodate and prepare for roughly 10% annual load growth, TNB generates annual forecasts of one and five year increments. This process facilitates growth within the system while reinforcing reliability and optimizing capital investments. TNB highlighted some of its main considerations in system planning, including load density, load growth, technical standards, minimization of costs and environmental impacts. Also, due to an average of 20 lightning strikes per square meter across peninsular Malaysia, TNB locates all 33kV and 22kV distribution lines underground.

ASSET MANAGEMENT

To gain a better understanding of how planning and engineering influence system operations, PDP delegates spent a day visiting TNB's operations, maintenance and materials management departments. PDP delegates toured TNB's largest equipment warehouse located in Bukit Sentosa, part of TNB's Central Distribution Zone. Along with the other three warehouses, TNB holds approximately \$160million of material in stock.

TNB carries roughly 5-10% of total assets in stock at any given time, while they average a 28 day issuance time from the date that material is requested to the date that it is delivered. To improve reliability and enhance customer satisfaction, TNB aims to reduce the amount of time that it takes to issue and deliver material to 14 days by 2020. To reach this goal, TNB has begun to share warehoused equipment among the different regional warehouses instead of procuring material from the outside. TNB has, on average, a turnover time of total stock about five times per year.



Left: PDP delegates stand outside of the 100ft x 220ft TNB warehouse. Delegates noted the organized and clean state of TNB’s warehouse and felt that such orderliness would benefit warehousing operations in Pakistan. **Right:** Delegates examine transformers outside of the Bukit Sentosa warehouse. In an effort to reduce faults, TNB tries to minimize the number of vendors it uses, thus creating more consistency in the network.

PDP delegates also visited TNB’s Metro Control Center to review best practices in asset management and control center operations. TNB showcased its transformer maintenance tests, which included visual inspections, thermography, oil quality analyses and offline diagnostic tests, among others. TNB assumes that its transformers will last for the length of their warranty, but also noted that transformers can also last much longer if they are under loaded and properly maintained. TNB demonstrated the capabilities of its SCADA system, which is integrated in the distribution system. TNB also highlighted its Control Center security policies. Notably, TNB does not allow anyone, including TNB executives, into the control room without first obtaining authorization and an escort.

REVENUE MANAGEMENT, LOSS REDUCTION & CUSTOMER SERVICE

TNB provided PDP delegates with an overview and tour of its revenue assurance department and metering lab. TNB utilizes digitized meter-reading and billing systems to ensure accurate and timely billing. Its revenue assurance group creates programs that provide customers with a variety of payment methods, including a prepaid option which they call “Smart Payment.” With 6.6% of total system losses, TNB noted that it has taken numerous steps to discourage non-payment and electricity theft. These include disconnecting delinquent customers, charging a high reconnection fee and giving incentives to customers who inform TNB of electricity thieves.

All of TNB’s metering labs have international accreditation, lending legitimacy to lab results and testing programs. To ensure meter quality and accuracy, TNB performs sampling tests of its new meters, by which they select 40 meters out of a lot of 1000. If a single meter fails, the whole lot is sent back to the manufacturer. PDP delegates commented on TNB’s meter design specifications, which require meter batteries to be located outside the meter and mitigate the need for meter replacement when the battery dies.



PDP delegates observe a test of industrial customer meters at TNB’s internationally-accredited metering lab.

Located within the revenue assurance department is TNB’s customer service operations center. PDP delegates reviewed customer relations best practices at TNB’s Care Line Call Center, observing the Call Management Center (CMC) and the One-Stop Engagement Center.



At TNB's Care Line Call Center, PDP delegates observed how TNB customer service staff handle customer calls and manage communications with restoration crews working in the field.

The Care Line Call Center holds more than 500 employees and receives about 300m calls annually. In an effort to increase customer engagement and satisfaction, TNB has expanded the number of ways customers may reach the utility, including via telephone, SMS, fax, web chat, email and Facebook. At the distribution service level, 90% of calls are answered within 30 seconds, with a 100% call back rate for customers requesting a return call.

TNB highlighted several key factors behind improvements in customer service, including the importance starting with pilot projects, studying the services and technologies that customers appreciate and taking a step-by-step approach to new programs. Last year, TNB recorded a public satisfaction level of over 80%. Response times to outages have significantly decreased as a result of customer

communication with TNB. Additionally, the utility uses a Mobile Field Force Automation (MFFA) system, which improves TNB's communication processes between the CMC and restoration crews. MFFA utilizes several technologies, including SMS, GPS and GIS, and has replaced TNB's inefficient manual communication processes.

HUMAN RESOURCES DEVELOPMENT, TRAINING & KEY PERFORMANCE INDICATORS (KPIs)

TNB recognizes the critical role played by its engineers in designing, planning, maintaining and operating its distribution network. As such, TNB invests in its employees through mandatory training programs and certification processes. Training programs target critical technical skills required of their engineers to maintain a state-of-the-art top-performing distribution network. They also target key functions in an engineer's job description, which are also tied to their individual key performance indicators (KPIs). In order to receive a promotion, employees at TNB must exceed 75% of their individual KPIs annually, which helps employees to value their training.

TNB engineers begin in operations and maintenance, followed by customer service and finally as planners. Within four months of working at TNB, all engineers must obtain a competency certification, in which they are trained in resuscitation, first aid and basic safety practices. Employees at TNB receive at least seven days of training annually, including at least one day for safety training. TNB's efforts to mitigate accidents include safety manuals, bulletins, posters, pamphlets and videos. TNB also broadcasts accident reports to relevant employees, which provides an accident synopsis and accident prevention instructions. PDP delegates commended TNB's emphasis on safety training for all workers.

BACKGROUND ON PAKISTAN'S POWER & ELECTRICITY DISTRIBUTION SECTOR

Pakistan's power sector is confronted by significant challenges. These include the limited availability of reliable and affordable electric power, ageing or inadequate transmission and distribution networks, and utility policies and practices that lag behind those of advanced utilities elsewhere in the world. Additionally, the distribution utilities lack a robust technological infrastructure that can enable efficient back-office operations, such as handling customer service requests.



TNB shows a map of all their training facilities across their service territory, allowing for employees even in remote areas to access training facilities and opportunities.

For major electric distribution utilities in Pakistan, these deficiencies translate into levels of financial performance that are not self-sustaining. Financial self-sufficiency is becoming critical, as Pakistan's power industry is undergoing sweeping changes. These changes include transitioning from wholly government-owned utilities to fully autonomous companies that will engage in power generation, transmission, and distribution under the government's aggressive reform agenda. A similar industry structure exists and functions smoothly in many other countries today. In Pakistan, however, outdated policies, procedures, and work practices, as well as low investment in infrastructure, pose barriers to a successful transition.

BEST PRACTICES INTRODUCED

Over the course of the program, the PDP delegation was exposed to numerous best practices in distribution system engineering and planning. The senior engineers recognized many similarities in the challenges faced by TNB's distribution operations and observed firsthand TNB's strategies to deal with these issues. Beyond the key topics of commercial and technical planning, revenue management, asset management and human resources development and training, the exchange also highlighted issues in customer relations, the integration of renewables into the distribution system and measures for maintaining excellent service levels while preserving historic cities (Melaka). Through the course of the program, the delegation was exposed to numerous best practices:



PDP delegates Eng. Abdul Latif (PESCO) and Eng. Kawish Shariatullah (IESCO) present an overview of Pakistan's electricity sector to TNB representatives.

Commercial & Technical Planning:

- Short and long-term KPIs for commercial planning purposes. With 15 KPIs projecting into the next decade, TNB employees, from top management to technical staff, understand the technical metrics against which they are measured and can benchmark their performance against their goals.
- A customer-focused approach to all aspects of utility operations. TNB stressed that customer engagement is imperative to the utility's reputation and future activities. With their motto, "Gemilang 2015" TNB employees can rally around the idea of becoming great by 2015. For TNB, this greatness can only come through outstanding planning, technical excellence and customer engagement.
- Future load forecasting — TNB generates annual forecasts of one and five year increments.

Asset Management:

- Sharing warehoused equipment from multiple regional warehouses instead of procuring from the outside vendors; this practice reduces equipment issuance time and cost.
- Requiring warranties on equipment to begin at the date of installation, not the date of purchase. TNB maintains strong relations with its vendors to help them negotiate favorable terms for their equipment warranties.
- Minimizing the number of vendors used in procurement as a way of minimizing the number of brands and equipment designs used in a system. TNB aims for consistency in its system as a means of reducing the likelihood of faults.
- Instituting control room safety measures and security protocols, including only three shifts per 24 hours and restricted control room access for unauthorized TNB employees, no matter who is requesting entrance.

Revenue Assurance:

- Digitizing data inputs to avoid errors and create accurate and timely billing.
- Offering customers multiple payment options as a way to reduce non-payment. TNB has coined its prepaid option as "Smart Payment" in an effort to market the option to delinquent customers as a convenient payment method.

- Offering incentives to informants of electricity thefts.
- Reframing the issue of electricity theft in terms of customer safety; communicating the health and safety risks involved with electricity theft.
- Newly-Purchased Meter Testing — TNB tests 40 meters out of every lot of 1000. If a single meter fails its test, then TNB sends the entire lot back to the manufacturer for replacement.
- Increasing the number of ways that customers can contact the utility, including via telephone, fax, web chat, email and social media.
- Answering 90% of distribution service level calls within 30 seconds and offering a 100% call back rate for customers requesting a return call.

Human Resources Development & Training:

- Requiring employees to meet at least 75% of their individual KPIs in order to be considered for promotion.
- Requiring engineers to obtain a competency certificate, focused on safety, within the first 4 months of employment.
- Requiring employees to undertake at least seven days of training annually with at least one day devoted to safety training.
- Requiring engineers to complete three year rotations in different technical fields in order to acquire a variety of technical skills and experience.

RESULTS

- **Enterprise Resource Planning (ERP):** PDP delegates remarked at the sophistication of TNB's planning processes, as well as the integration of their ERP system. PDP delegates are interested in improving their own utilities' ERP integration into their planning processes.
- **Clean and Organized Warehouses:** PDP delegates were very impressed with the cleanliness and organized nature of TNB's warehouse and thought that they would benefit from improved organization within their warehouses.
- **Computer-Based Inventory System:** PDP delegates recognized the value of a computer-based inventory system for warehousing and materials management. They also recommended better training in computer literacy across their employee base to facilitate the integration of such computer-based databases.
- **Condition-Based Maintenance:** PDP delegates committed to investigating methods for instituting CBM schemes on their distribution assets. TNB has mandatory CBM regimes for all distribution assets, which they believe helps them to extend the life of their equipment beyond their warranties.
- **Integrating SCADA:** PDP delegates noted the value of integrating SCADA at the distribution level in Pakistan in order to enhance reliability and facilitate system automation.
- **Call Center Technology:** PDP delegates were impressed with the integration of technology at TNB's call centers, notably their Mobile Field Force Automation (MFFA) communications system to expedite the restoration process for customers experiencing a service interruption. They committed to investigating similar communications equipment for their emergency restoration crews and customer service teams.
- **Women in the Workforce:** PDP delegates were impressed with the high percentage of female engineers (roughly 40%) at TNB. They recommended that their utilities work to encourage more women to study engineering and to enter the utility workforce in Pakistan.
- **Promotions Based on Merit:** PDP delegates recommended incorporating a merit-based promotion system within their utilities. They also felt that TNB's succession planning activities would be useful to ensure continuity within senior management and technical positions.
- **Cultural Diversity:** PDP delegates were impressed with the cultural diversity of TNB's workforce and remarked on the social cohesion of employees.
- **Clear Job Descriptions:** PDP noted the value in having clearly defined job descriptions and responsibilities. They felt that this helps to encourage efficiency within TNB's working processes.

UTILITY EXCHANGE PROGRAM PARTICIPANTS

1. Mr. Muhammad Amjad Khan, Manager P&E, Peshawar Electric Supply Company (PESCO)
2. Mr. Fida Ahmad Khan, Chief Engineer O&M, Peshawar Electric Supply Company (PESCO)
3. Mr. Abdul Latif, Chief Operations Officer, Peshawar Electric Supply Company (PESCO)
4. Mr. Khalid Rauf Khan Durrani, Chief Engineer P&E, Hyderabad Electric Supply Company (HESCO)
5. Mr. Kawish Shariatullah, Chief Engineer/Technical Director, Islamabad Electric Supply Company (IESCO)
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