



## JORDANIAN DISTRIBUTION UTILITIES EXAMINE ENERGY EFFICIENCY PROGRAMS AND UTILITY TRAINING METHODOLOGIES

by Tricia C. Williams, Senior Program Coordinator, United States Energy Association

The **United States Energy Association (USEA)** conducted the fifth executive exchange for distribution utility executives from Jordan under the partnership funded by the **United States Agency for International Development (USAID)** from May 23 to 27, 2011. Five executives from **Electricity Distribution Company (EDCO)**, **Irbid District Electricity Company (IDECO)**, **Jordan Electric Power Company (JEPCO)** and **Kingdom Electricity Company (KEC)** met with **Sacramento Municipal Utility District (SMUD)** to continue discussions on energy efficiency programs, safety and training programs, and distribution system maintenance.



*Jordanian delegation from left to right: Bashar Altamimi, EDCO; Jafar Obeidat, JEPCO; Sahem Almajali, IDECO; Bilal Jaradat, EDCO; and Jamal Al Arja, KEC.*

### BACKGROUND

The distribution partnership for Jordan was formed to discuss:

- Improving energy efficiency, energy conservation and demand side management (DSM) programs
- Improving energy efficiency in the distribution system
- Training for professional and technical development and safety
- Improving system performance through enhanced maintenance planning, operation procedures and system protection schemes

The Jordanian distribution utilities are partnered with the Sacramento Municipal Utility District (SMUD). SMUD is the fifth largest municipal utility in the United States. SMUD provides electricity for Sacramento County and a small portion of Placer County, with a peak energy load of 3,280 MW (set in 2006). SMUD generates the bulk of its power with natural gas (62%) and Hydro (17%). SMUD is an environmentally conscious company and has

pushed its renewable generation to 24% of its total generation. SMUD also has a state mandate to reduce its load by 1% a year through energy efficiency.

The executive exchange was divided into three tracks: energy efficiency, distribution system operations and maintenance, and safety and training. Meetings centered on the organization of energy efficiency departments and staff roles, energy efficiency programs and the process of creating them, safety and training programs, transformer maintenance, hot line maintenance, and distribution system operations.

## ENERGY EFFICIENCY TRACK

Energy efficiency is a key element of Jordan's Energy Sector Master Plan. The Renewable Energy and Energy Efficiency Law that was passed in January 2010 established the Renewable Energy and Energy Efficiency Fund, which will be devoted to supporting energy-saving and renewable energy initiatives. Now that potential funding is in place, it is critical for the distribution utilities to create energy efficiency programs. Participants met with SMUD to learn how a leading U.S. utility created energy efficiency programs. Mr. Jamal Al Arja of KEC and Mr. Bashar Altamimi of EDCO met with SMUD executives to discuss how to create an energy efficiency program. Of particular interest to the delegation was the organization of the energy efficiency department and the duties of staff, why projects succeed or fail, and the process of setting up an energy efficiency program.

### SMUD Energy Efficiency Program Development – Reducing Consumption

SMUD is continually looking at improving energy efficiency as a means to manage its load while reducing consumer demand. SMUD has an annual goal of 1% reduction in demand from energy efficiency measures. Jamal Al Arja of KEC mentioned the Jordanian utilities hope to achieve the goal of a 1% reduction in energy consumption a year to avoid building a new power plant in 10 years.

SMUD begins its energy efficiency programs by first evaluating the area where energy efficiency could possibly benefit the consumers. Next, SMUD begins a period of market research to determine how the efficiency program could be implemented. At this point, SMUD begins planning the project for actual implementation and ultimately moves to the implementation phase of the program. This four step process is conducted on an annual basis.



*Jordanian delegates discuss the design of SMUD's customer center with SMUD. From left to right: Jamal Al Arja, KEC; Mr. Stephen Oliver, SMUD; Jafar Obeidat, JEPCO; Bashar Altamimi, EDCO; and Sahem Almajali, EDCO.*

For a program to be considered financially viable it must be able to have its overall cost covered by funds available in SMUD's annual budget. The project must be cost effective and have an adequate return on investment (ROI). SMUD also looks at whether the work on the project can be performed with internal labor or if it will have to be contracted to a third party. The investment in technology must not exceed the value of the energy efficiency program.

Market considerations for energy efficiency programs start with a needs/opportunity assessment. During the assessment, customer response to the program is gauged, the short-term and long-term benefits of the program are evaluated, the feasibility of the project is weighed against the acceptance of the project by customers, and any market barriers are identified and means to mitigate these barriers are determined.

### **Financial Incentives Needed**

Implementation begins with the development of an incentive structure which is set in a manner to give the majority of targeted consumers enough impetus to actually start the program. Programs are coordinated regionally and SMUD seeks partnership opportunities to leverage greater efficiency gains by including other interested parties in the project. SMUD also invests a significant amount of funds to market and advertise its energy efficiency programs.

### **Evaluation**

SMUD evaluates its energy efficiency programs on a three year cycle. SMUD uses the California Evaluation Framework – which was provided to the Jordanians - to measure and verify energy savings from energy efficiency programs. The majority of SMUD's energy efficiency programs are evaluated by independent third-party contractors, but SMUD supervises impact evaluations through its Resource Planning Group, and SMUD's Market Research Group conducts both process evaluation and customer satisfaction research. Mr. Al Arja was especially interested in verification of savings due to energy efficiency measures as the Jordanian utilities will receive a percentage of the savings to share with their investors.

#### **BEST PRACTICES RESULTING FROM ENERGY EFFICIENCY TRACK**

As a result of the exchange, the Jordanian utilities are considering implementing the following best practices:

- IDECO and EDCO will look at energy efficient water pumps/motors as their first energy efficiency program as 40% of one of the utility's load is from water pumps.
- Jordanian utilities will start to define energy efficiency goals.
- IDECO will further organize the energy efficiency department and will determine what functions and staff they require.
- KEC will consider making energy efficiency the first resource for

### **Lighting Technology**



*Bashar Altamimi (EDCO) examines a CFL while Jamal Al Arja (KEC) discusses the technology with SMUD.*

Dave Bisbee, Project Manager of the SMUD Customer Advanced Technologies Program, discussed the latest lighting technology that SMUD is using or currently testing for future use. SMUD often tests technology in customers' locations to help identify those with promise and shares the cost with the customer – SMUD pays for the technology and the customer pays to have it installed. New technology is critical for SMUD as once an advanced technology is in common use, SMUD can no longer claim it toward its energy efficiency goals.

SMUD tests various lights and submits feedback to the manufacturers to improve the projects. In a recent instance, SMUD tested a LED retrofit kit for decorative street lighting but determined it did not give enough light compared to a 75 watt metal halide. SMUD is

also looking into LEP (plasma light) but finds the price prohibitive at this time. The main problem SMUD has discovered with LEDs is that the electronics wear out before the LED does. SMUD uses U.S. Department of Energy certified labs and the Design Light Consortium for test verification.

## Energy Efficiency Site Visits

The Jordanian delegation went on several site visits to SMUD customers to view the energy efficiency measures utilized. The delegation Fry's Electronic Super Store and Cenveo's large multi-use energy efficient lighting projects, the California Independent System Operator's LEED certified building, and the UC Davis Medical Center cogeneration plant.

SMUD also gave the delegation a tour of its Customer Service Center, a LEED Platinum building. Key features of the building include:

- natural daylighting;
- windows with special coating to allow light to enter but reflect away the sun's heat;
- light shelves and light sails to bounce sunlight inward and upward toward the ceiling to light the room without the sun hitting occupants;
- electric lighting controls to reduce the need for electric lighting;
- a cool roof covered in a highly reflective material to redirect solar heat away from the building;
- an under-floor air distribution system that supplies air through diffusers upward, reducing energy requirements; and
- an economizer in the air conditioning system that allows them to turn off the AC equipment and un the fan to draw in outside air when it is cooler than the inside air.



*Bashar Altamimi and Jamal Al Arja discuss SMUD's energy efficiency department organization with Steven Oliver of SMUD.*

## SAFETY AND TRAINING TRACK – IMPROVING RELIABILITY AND REDUCING BLACKOUTS

The Jordanian distribution utilities currently do not have an adequate system in place to train all levels of staff on safety issues or general work knowledge. Training and safety are critical to the continued success of the utilities and their employees and can form the basis for advancement within the companies. There is a need to modernize the training available to all levels of employees. Mr. Bilal Jaradat of IDECO participated in the safety and training track to gain insight into how U.S. utilities create safety and training programs. Mr. Jaradat expressed a particular interest in the process SMUD went through to create its procedures and training systems.



*Bilal Jaradat of IDECO examines a pole pruner.*

## SMUD Training

SMUD has a comprehensive system of training for all technical and non-technical employees. In addition, SMUD has a Learning Strategy Committee that meets weekly to discuss training needs for the company, how to evaluate training programs, and to insure uniformity in training throughout the District.

SMUD's Learning Strategy includes workforce planning, developing the skills of existing employees, transferring knowledge from older employees to younger employees, and managing the change that is continually taking place at SMUD. Mr. Bilal Jaradat of IDECO visited SMUD's Training Facility and the Upper American River Project to view technical and non-technical training.

## SMUD's Safety Incident Reporting

SMUD has two types of safety reports: the first report documents when an accident or near miss occurs. The second new approach is a behavior report to identify potential practices that could lead to an accident.

Catherine Simonsen of SMUD outlined the safety incident report and created one online to illustrate the process. The system tracks accidents with and without injury and near misses as well and automatically sends an email about the incident to workers compensation and management.

The second type of report is called SCORCH (Safely Conducted Observations Reduce Common Hazards). SCORCH was designed to assist SMUD in reducing incidents by observing SMUD employees in both the field and office and looking for practices that could contribute to accidents. The employee fills out a report without naming the staff they observed, reviews both the safe and risky behaviors with the staff, and submits the report to management. If several reports contain the same risky behavior or a barrier to performing a job safely, SMUD management will work to address the issue. The system operates on the "no name, no blame" philosophy – employees observed performing in an unsafe manner will not be penalized or reported to their supervisor for disciplinary action. Mr. Jaradat stated the "no name, no blame" was an excellent idea he planned to implement immediately to solve the problem they currently have in Jordan of failing to report near misses.



*From left to right: Bilal Jaradat, IDECO; Jaspal Deol, SMUD; Donatus Okhomina, SMUD; Jafar Obeidat, JEPSCO; and Sahem Almajali, EDCO.*

### BEST PRACTICES RESULTING FROM SAFETY AND TRAINING TRACK

As a result of the exchange, the Jordanian utilities are considering implementing the following best practices:

- Prior to beginning work, the foreman will write down the address where they are located.
- Employees will be able to report near misses anonymously. "No name, no blame."
- IDECO will order pole pruners to be able to trim trees near live wires.
- IDECO will begin implementing the life line as well as the safety line for workers on poles and in trees for added safety.
- IDECO will look at the possibility of using a mobile chipper to deal with waste.
- All trucks will have an insulated cooler full of ice and bottled water.
- Field employees will be reminded to take one cup of water every 15 minutes by the crew foreman.
- Workers will be offered boots without steel toes to reduce foot lacerations from dropping items on the steel toe.
- IDECO will purchase pole pruners to allow for safe pruning near live wires.
- IDECO will create a system that automatically emails necessary personnel when a safety incident is reported.
- IDECO will look at the possibility of having on site medical staff that can handle workers compensation issues, physicals etc.
- The medical staff will also start yearly checks for lead and asbestos health issues.
- IDECO will place evacuation maps throughout their facilities.
- IDECO will begin quarterly safety meetings for all employees.
- IDECO will assign and train a medical response team who can give basic first aid and CPR until medics arrive.

## Best Practices to Avoid Heat Illness – Increased Worker Safety

Another presentation of great interest to the Jordanian delegation was SMUD's training and procedures to avoid heat illness. Sheryl Yee of SMUD discussed the various types of heat illness – cramps, fainting, exhaustion and stroke – and measures SMUD takes to ensure it does not occur. SMUD's policy is that all field crews must locate shade prior to beginning work. If there is no shade from a building nearby, all SMUD trucks are equipped with pop up shade and umbrellas. The vehicles can also be used for shade if they have air conditioning. The presentation also highlighted that all staff should drink a cup of water every 15 minutes and gave instructions on what to do if someone is suffering from a heat illness. Mr. Jaradat said he plans to implement these procedures at IDECO.

## OPERATIONS AND MAINTENANCE TRACK

All three Jordanian distribution utilities invested in the expansion of their networks and substations 10-15 years ago and the system now requires a great deal of maintenance to avoid equipment failure and interruptions of service. Current maintenance plans are not deemed sufficient and need to be improved. This issue has become more urgent since the Electricity Regulatory Commission of Jordan prepared a Distribution Code that will soon be approved mandating long term, medium term and short term maintenance plans. SMUD provided the Jordanian utilities with a copy of its maintenance plan and the utilities realized the need for additional training to create a similar plan in Jordan.



*Jafar Obeidat of JEPCO, Sahem Almajali of EDCO and Bilal Jaradat of IDECO examine SMUD's equipment for hot line work.*

The Jordanian utilities need to train staff on how to create these maintenance plans and ensure that the maintenance procedures are carried out correctly. Mr. Jafar Obeidat of JEPCO and Mr. Sahem Almajali of EDCO participated in the operations and maintenance track to discuss these issues.

## Transformer Best Practices and Saving Money

One of the topics critical to the Jordanian delegation was the issue of transformer design and maintenance as well maintained and operated transformers are critical to avoid outages and safely operate the distribution system. SMUD outlined the various transformer configurations they use and said 95% of new construction uses single phase, one wire transformers that they can bundle to make three phase. Mike Rudek of SMUD explained using single phase fused transformers saves money and reduces the amount of stock needed to keep in the warehouse. Their transformers are typically delta on the primary and wye on the secondary and all transformers are fused. Jafar Obeidat of JEPCO questioned how SMUD gets inside the transformers. SMUD said they terminate the cable with an operable elbow and do not de-energize the line. The Jordanians also wanted to know how SMUD calculates transformer losses - Mike Rudek said SMUD uses the numbers from the manufacturer and uses the customers' meters and substation loads to arrive at the number.

Transformer oils were also of great interest to the Jordanians. SMUD uses natural ester (vegetable oil) in its transformers like FR3 because the oil will not burn and the transformers can operate at higher temperatures. The delegation went into the supply room and looked at the various brands and types of oils.

### Operations and Maintenance Site Visits and Live Line Maintenance

The Jordanian delegation went on several site visits to watch SMUD employees in the field. Bilal Jaradat joined Jafar Obeidat and Sahem Almajali on the site visit to watch SMUD perform live line maintenance. Live line maintenance improves the efficiency of the system and decreases outages. The Jordanian distribution utilities have less experience with this important technique and were keen to learn SMUD's procedures. The first

question asked by all three participants was how SMUD authorizes the work and the clearance process. SMUD showed the delegation the switching order form and gave them a copy of their switching and authorization procedures. Before any employee starts work on de-energized equipment, apparatus, or lines for which clearances are required, the employee obtains a clearance – authorization to work on an electrical line or some piece of equipment which is inherently too hazardous to work on while in service, and which has therefore been deactivated or de-energized. The employee who receives the clearance must repeat it back word for word to ensure everyone understands the scope and limits of the clearance and must assure themselves that the line or equipment has been properly de-activated. Employees should request a clearance several days before work is to be completed whenever possible to ensure SMUD can properly schedule the outage. SMUD also highlighted the need for constant and reliable communication between the control center and the employees working on the de-energized system.

The other major question the Jordanian delegation had was the procedure for live line work and how SMUD performs such tasks. To address these questions, SMUD arranged for the delegation to watch SMUD move energized lines to a different

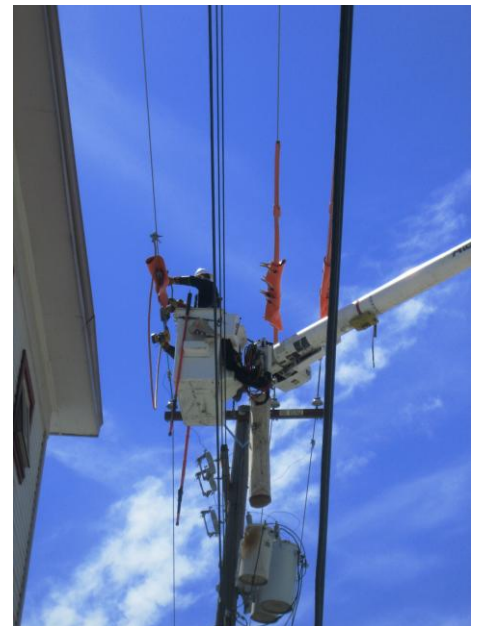


utility pole, place rubber insulating blankets on live lines, and install jumpers. While on site, they also inspected the materials SMUD keeps in all of their trucks and looked at live line safety equipment like rubber gloves, hot sticks, and rubber insulating blankets.

*Parallel Groove connector used by SMUD.*

#### BEST PRACTICES RESULTING FROM OPERATIONS AND MAINTENANCE TRACK

- JEPCO will look at purchasing the S&S Interrupter (a unique alternative to conventional automatic circuit reclosers)
- JEPCO received confirmation that they were following best practices in regard to oils and oil analysis in transformers
- Participants expressed greater comfort with live line maintenance
- Participants learned what materials and equipment are needed to work on live lines
- Participants will begin to create standards for construction and maintenance so all jobs are done the same way
- All utilities will look at using the Parallel Groove (PG)
- The utilities will adapt the work force planning tool kit they received from SMUD – this will help insure they have multiple people who can do a job and help them plan for succession



*A SMUD lineman places a rubber insulating blanket on a distribution line.*

Also, the Jordanian delegation asked the foreman about various equipment and how SMUD tests them for safety. SMUD uses water instead of air in the daily test for leaks in rubber gloves as water leaking is visible and easier to spot. The foreman also discussed SMUD's field equipment testing facility that tests gloves, hot sticks, rubber sleeves and all other equipment used when working on energized power lines.

One particular piece of equipment SMUD uses caught the eye of the delegation: the parallel groove, used to connect cables of different sizes and metals.

## PARTICIPANTS

### Irbid District Electricity Distribution Co/ Ltd. (IDECO)

Bilal Tawfiq Tahhan Jaradat  
Technical Auditing and EHSQ Manager

Mr. Bashar Tamimi  
Energy Efficiency

### Electricity Distribution Company (EDCO)

Sahem Ahmad Talab Almajali  
Technical Manager

### Jordan Electric Power Company (JEPCO)

Ja'far Radi Moh'd Obeidat  
Maintenance Section Head

### Kingdom Electric Company (KEC)

Jamal El Arja  
Technical and Regulatory Director

For more information, please contact Tricia

Williams at [twilliams@usea.org](mailto:twilliams@usea.org)

or visit:

[http://www.usea.org/Programs/EUPP/Jordan\\_Distribution/jordan\\_distribution\\_may\\_2011/jordan\\_distribution\\_may\\_2011.htm](http://www.usea.org/Programs/EUPP/Jordan_Distribution/jordan_distribution_may_2011/jordan_distribution_may_2011.htm)



SMUD General Manager  
John DiStasio

## Utility Best Practices Documents Transferred from SMUD to the Jordanian Distribution Utilities

### Training and Safety Documents

- SCORCH Observation manual
- Western Arborist Magazine
- Hydro Clearance Procedure
- Fall Protection Guide
- Sherrill Tree catalog of equipment to prune trees
- 1236-10 Spring Class Schedule
- After Action Review
- Brand Presentation
- California Evaluation Framework June 2004
- Communities of Practice
- Mandatory District Training Grid
- Desk Manual Template
- Engagement Roadmap
- Introduction to Workforce Planning at SMUD
- Leadership Portfolio
- Load Estimation for Demand Response (Calmac)
- Template Task Overview Grid
- Tips for Creating a Desk Manual
- Team Share
- Hurt Man Rescue
- Distribution Services Course Catalog 2011
- Fire Safety and Emergency Procedures 2011
- Heat Illness Prevention 2010
- Heat Illness Refresher 2011
- Sample New Employee Orientation Schedule
- Network Expanded NEO

### Energy Efficiency Documents

- Title 24 Residential Lighting Design Guide
- SMUD Customer Service Center LEED Platinum design brochure
- SMUD's Energy & Technology Center January-June Programs
- Brochure on SMUD's E-house
- Strata Boundary Determination
- Marketing & Evaluation Plan Outline
- List of recent and planned evaluation projects for energy efficiency and load management
- SMUD's Energy Efficiency Organization and Program Development Process
- Demand Response at SMUD

### Operations and Maintenance Documents

- Request for Outage & Clearance Form
- System Loss Reduction Through Transformer Replacement
- Transformer Losses and Impact on First Cost
- Diagrams of transformer configurations with a list of needed materials
- Authorization Approval List Template
- Authorization Training
- Authorizations Test Key
- GNN\_011
- Switching Order Form 2972
- Switching Request Form
- Construction and Design Manual
- Presentation on Reclosers
- S&C Interruption
- 2011-2015 System Maintenance Plan
- Faults
- Overhead Line\_CM
- TMIP 2010
- Distribution Services Line Construction Workflow
- Job Workflow
- Pre-Job Audit Form
- Traffic Control Training 1
- SMUD Clearance Request and Release
- System Operations Authorization and Switching Procedures