Water/Wastewater Case Study:

Patterson Irrigation District

Background

- Type of Agency: Water
- Location: Stanislaus County
- Population Served: 625 agricultural water users
- Water Connections: 450
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Summary

Given California's energy challenges and electricity supply shortage in 2001, Patterson Irrigation District (PID) reinforced and sharpened its focus on reducing energy consumption in 2001. Where Gov. Davis asked all California sectors to reduce electricity use immediately by at least 10 percent and 20 percent during the summer months, PID reiterated its commitment to reduce energy consumption by at least 8 percent and by 20 percent during Stage Two alerts. The district took actions such as installing control devices and variable frequency drives (VFDs) and participating in a public outreach effort. PID succeeded in increasing energy efficiency by 40 percent and reducing energy consumption by 10 to 20 percent during the critical summer months while still meeting its irrigation water obligations to the family farms it serves.

The Patterson Irrigation District has completed several energy conservation projects since 1997, including state-of-the-art pumping plant control systems and a Power Monitoring SCADA system at its five pumping plants on the Main Canal. PID also participated in the California Energy Commission's (CEC) pump testing and pump retrofit/repair program.

Referenced in Water/Wastewater Guides:

- #1, "Reduce Energy Use in Water and Wastewater Facilities Through Conservation and Efficiency Measures"
- #2," Promote Energy Conservation and Efficiency Through Public Outreach, Incentives and Assistance"

Plan

Patterson Irrigation hired an electrical engineering firm to conduct an audit on the district's electrical delivery systems. The audit documented reliability, safety and remaining life and usefulness of the district's hardware, including motor control centers, transformers and power factor correction capacitors.

The PID General Manager (GM) handles the planning and program ideas for all public outreach and efficiency projects. As part of this duty, the GM prepares a presentation of any projects to the PID Board of Directors, which subsequently approves or denies the projects. Project implementation involves the GM, a water conservation specialist, a consulting engineer, Irrigation Training & Research Center (ITRC) at Cal Poly State University in San Luis Obispo, Calif., and PID field personnel.

Almost entirely reliant on its Main Canal electrical and pumping system to deliver water, PID identified replacing its motor control centers and transformers as top priority – the district was still using GE 1960's vintage Motor Control Center. With the help of ITRC and the U.S. Bureau of Reclamation (USBR), Patterson designed a modernization program that would upgrade key facilities and automate its pumping plants. Specifically, PID was interested in projects that promoted improved energy conservation and water-use efficiency and were not cost prohibitive at the local level.

Programs: Conservation

✓ **System controls**: Installed a plant control system in 1997 that utilized a VFD and pump staging by order of efficiency at its Pumping Plant No. 1. An integral part of this system was a SCADA system, including a monitoring PC at the main office. The SCADA system allows the district to remotely monitor and control its Main Canal, groundwater and Delta Mendota Canal Water supplies. PID hired an integrator (person or entity familiar with all aspects of system), with the help of the ITRC, to provide a cost estimate of the project and develop a project scope. After the first year, Pumping Plant No. 1 saw a 23 percent increase in pumping efficiency. The pumping plant control and SCADA system contributed to an increase in the District's energy efficiency on the Main Canal pumping system by 37 percent since 1997.

In 2000 and 2001, the District upgraded two more pumping stations (five total) to the SCADA system. In 2001, the upgrades included installation of five solar panel RTU sites along the Main Canal and one RTU on the Delta-Mendota Canal. The RTU's monitor flows in main laterals, providing data to calculate delivery efficiencies in the laterals and reduce staff time needed to monitor the systems. The RTU on the Delta-Mendota Canal provides PID with instantaneous flow readings and totalized volume diverted for the turnout site located five miles from the district's main office facility.

✓ **Motor controls**: Upgraded motor controls to Allen-Bradley's IntelliCENTER's Motor Control Centers, which incorporate soft-starters, capacitors, PLCs, local and remote networking and communications capabilities and IntelliCENTER diagnostic and monitoring software. Several bidders applied.

The new system includes the communications and software to integrate the current SCADA system: the PLC gathers data at each plant and send it to the SCADA system, a center computer that can be read at the main building or using Ethernet, ControlNet or DeviceNet. The data is real-time and allows for a more precise and frequent analysis of data for water and energy management. The new system includes advanced unsteady flow canal modeling, variable frequency drives, soft-starters and new capacitors to all motors (capacitor is a passive electronic component that stores energy in the form of an electrostatic field.)[2]

✓ **Water pumping**: Current water supply and energy-efficiency management dictate that the District use the bulk of its Delta Mendota Canal gravity supplies during the months of July and August, thereby reducing the District's electrical pumping demand during those critical summer months

Programs: Efficiency

✓ **Variable frequency drives**: Purchased two additional variable frequency drives (VFDs) in 2001, which were expected to eliminate most over-pumping when utilized in the plant control algorithm implementation. The district on average re-circulated (over-pumped) five acre-feet per day per pumping plant in prior to 1997, before implementation of the plant control system on its Main Canal pumping system.

2. John Sweigard, Dick Hearth, and Mark Crosset, "Case Study: Patterson Irrigation District's Use of SCADA for Total Water & Energy Management," Found online at http://www.itrc.org/papers/uscid/Pid.pdf.

Programs: Public Outreach

✓ **Pump Testing Mobile Lab Program**: The San Luis and Delta Mendota Water Authority operate the Delta Mendota on behalf of the U.S. Bureau of Reclamation (USBR). PID is a member of the San Luis & Delta Mendota Water Authority. The San Luis & Delta Mendota Water Authority received a grant from the USBR to provide cost assistance to water districts for pump and irrigation system testing. The grant covered 50 percent of the pump testing cost and PID paid the remaining 50 percent on behalf of the participants in the program. Each test cost $300. Eight farmers participated in the program in 2001. PID mailed a newsletter twice in 2001 that included information on the available pump testing program.

Budget and Finance

Patterson Irrigation applied for U.S. Bureau of Reclamation grants through the Mid-Pacific Region Field Services Program for its modernization and automation projects. The district received a total of $65,000 between 1997 and 2002.

Results

PID tracked energy usage and total load in conjunction with volume pumped from the San Joaquin River on a monthly and annual basis to calculate cost savings and energy-efficiency improvements. PID developed historical data on electrical usage and volumes pumped. The spreadsheets were updated monthly as data was developed and recorded.

- Estimated/anticipated energy and financial savings of SCADA system: A conservative estimate, 17 percent increase in efficiency reducing annual demand by 1,444 kW and annual energy consumption by 650,000 kWh, saving the district approximately $23,000 annually based on 1998 – 2000 pumping and electrical data.
- Based on projected results from the first couple months of 2002, the new VFDs decreased energy usage by approximately 45,000 kWh per month and electrical demand by 12.5 kW per day. The VFDs were initially purchased for use in pumping plant automation, but they also resulted in significant energy savings by almost eliminating recirculation and the load reduction characteristics of VFDs on motors.

Lessons Learned

To prevent or fix costly mistakes, PID found it helpful to consult qualified experts and communicate with other districts and agencies that had completed similar projects.