TEXAS PROJECT FOR AG WATER EFFICIENCY
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IN-DISTRICT
AWESOME FACTS
on agricultural water conservation and efficiency

Telemetry & SCADA: Information Technology Takes Auto-Gates to Next Level of Efficiency

FEATURES & BENEFITS

Surface water irrigation districts can reduce delivery losses and improve their efficiencies by adopting some low-cost techniques for automating system operations.

Automated gates are the first step; the next is networking those and other data points into a comprehensive information system that allows for real-time monitoring of canal conditions and rapid response to changing conditions.

The keys to this system are telemetry (automatic measurement and transmission of data from remote sources by wire or radio or other similar means) and SCADA (supervisory control and data acquisition).

As part of the Texas Project for Ag Water Efficiency, the Harlingen Irrigation District has networked its pumps, auto-gates, water sensors, and other components of its conveyance system by means of telemetry stations remotely controlled via SCADA. HID built its network using low-cost, off-the-shelf components. Its 37 auto-gates cost about $3,500 each; enhancing operations with the full complement of SCADA features brought the total cost to about $10,000 per gate.

HID's networked system also can compute the volume of water delivered to each individual farm, readily enabling an anticipated move to volumetric pricing. Other enhancements in the future could include notifying farmers when their irrigation cycles are complete or when tail water reaches a certain level, and even changing flow to new sets of rows in the middle of the night. Eventually, weather and soil moisture monitoring stations also will be brought into the system.

TECHNICAL DETAILS

Because irrigation districts typically employ telemetry units in remote areas, units not only have to perform their intended function of gathering and transmitting data, but also must be constructed to use alternative power sources and survive inclement weather conditions.

The major components of a telemetry unit are:

- **The housing/enclosure** for the electronic components and the power supply. HID fashioned its enclosures of robust materials that stand up to sunlight, rain, and variations in temperature, including UV-resistant schedule 40 PVC electrical conduit pipe and fittings.
- **A power supply system** that can work in remote areas far from electrical transmission lines. At HID, an external 10-watt solar panel recharges a 12-volt DC lead/acid battery located inside the enclosure. Between the solar panel and the battery pack is an off-the-shelf voltage regulator circuit board.
- **Electronic circuits** to read signals and transmit data. HID "piggy backed" a radio transmitter on to the reverse side of a "single-board computer" (i.e., a minicomputer complete with microprocessor, memory, and input/output features on a single circuit board). This space-saving device gathers readings from water-level sensors and then transmits them to the central data collection system.

Detailed instructions and schematics for building a low-cost remote telemetry unit are available online at TexasAWE.org. Click on "Resources," then on "Technical Reports & Specs."

AUTOMATION AT WORK: The Harlingen Irrigation District moves on average about 52,000 acre-feet per year through a fully automated system integrating 40 miles of canal, 200 miles of pipeline, 37 automated gates, and 36 re-lift pump houses — all networked by telemetry stations and remotely controlled via SCADA.

By allowing real-time monitoring of operations and remote operations, the system has created real efficiencies. Thanks to sensors that monitor water levels, district staff can set the auto-gates to automatically open or close in response to changing levels, keeping the entire irrigation system charged and at an optimal performance level. The automated system also alerts staff to problems that could trigger overflows, especially in remote areas. HID estimates that by enabling rapid response and preventing overflows, the automated system saves 40 to 70 acre-feet of water per irrigation.

This secure network is accessible by canal riders and other personnel through any electronic communications device — smart phone, computer, or iPad — enabling rapid response to a variety of situations that might need attention. District personnel can check on the status of just about everything in the delivery system from just about anywhere and at any time — and they can make changes to settings whenever necessary.

Primary components of an irrigation SCADA system include:

- **Data measurement equipment** used to measure water flow rate, soil moisture, rainfall, humidity, temperature, wind speed, water quality, and other parameters and/or **remote control equipment** for operating pumps, motors, gates, or other water delivery devices.
- **Remote terminal unit** or programmable logic controller, consisting of a data acquisition and control computer and the associated power and battery system.
- **Data communication system** (radio, telephone, cellular phone, satellite, etc.) for messaging between the remote unit and the base computer.
- **Telemetry data server**, which communicates with the field terminal and stores data from the terminal. The server also runs control, data logging, and display software.
- **Software** for distributing and displaying the collected data.
- **Data distribution system** through such means as a website and use of e-mail, pagers, iPads, and cell phones.

ADDITIONAL INFO

Successful automation requires that districts have on staff qualified personnel trained in electronics and the operation of computerized network. The Rio Grande Center for Ag Water Efficiency, part of Texas AWE, offers hands-on training in reading sensors and using telemetry and SCADA to set and control auto-gates at its on-site simulated canal. Call 956.423.7015.

Short videos showcasing "In-District Water Management Efficiencies" and the "Rio Grande Center for Ag Water Efficiency" are available at TexasAWE.org.

About Texas AWE

The Texas Project for Ag Water Efficiency (Texas AWE) focuses on affordable and achievable methods for conserving irrigation water through on-farm applications and in-district delivery systems.

Texas AWE was developed and is managed by the Harlingen Irrigation District (HID) with grant funding by the Texas Water Development Board as one of two 10-year Agricultural Water Conservation Demonstration Initiatives in Texas.

Starting in 2004, HID and its project partners have gathered data on ways to manage agricultural water more efficiently. On-farm demonstration sites have proven how new irrigation technologies can conserve water and produce good crop yields, while in-district automation and networked telemetry showcase how water management can support irrigation efficiencies at the farm level.

Project findings are shared on the project website (TexasAWE.org) and at the Rio Grande Center for Ag Water Efficiency through hands-on training and workshops for producers and district personnel. The Center is also the only site in Texas to offer flow meter calibration for producers and other districts.

Report #ID-02-13

For information on auto-gates, see *AWEsome Facts* #ID-01-13, available at TexasAWE.org.

CREDITS

Al Blair, P.E., PhD, A.W. Blair Engineering, *Low-Cost RTU for Water Level Measurement*, prepared for Harlingen Irrigation District under a Texas Water Development Board Innovative Technologies for Agricultural Water Management and Flow Measurement grant, 2010. Available at TexasAWE.org; click on "Resources," then on "Technical Reports & Specs."

Left: transmitter sends data from a canal water-level sensor to telecommunications devices networked via SCADA.
Bottom: a canal rider uses an iPad to make gate adjustments based on data received.