U.S. DEPARTMENT OF ENERGY | Electricity Delivery & Energy Reliability

Agricultural Demand Response Program in California Helps Farmers Reduce Peak Electricity Usage, Operate More Efficiently Year-Round

The development of a two-way, web-to-wireless controller for irrigation pumps is the foundation for an agricultural demand response program in California. Designed by M2M Communications of Boise, Idaho, the controller is part of an irrigation load control system that also includes sensors, smart meters, and other monitoring equipment.

A "Smarter" Load Control Program

Partially funded with $2.2 million in Recovery Act stimulus funds awarded by the U.S. Department of Energy (DOE), M2M Communications has designed the irrigation pump controller and accompanying system for its Peak Energy Agriculture Rewards (PEAR) program, a demand response program marketed to agricultural customers within Pacific Gas and Electric (PG&E) and Southern California Edison (SCE) service territories.

The DOE funding for this Smart Grid Investment Grant (SGIG) project accelerated research and development, enabling M2M to commercialize its controller about two years ahead of schedule. "The two-way communicating capability is what makes our approach 'smarter' than what has been done historically," says John Laughlin, M2M's chief executive officer. "In the past, load control had no visibility. We are now monitoring all assets."

M2M provides convenient access to real-time information on water use and soil conditions, enabling farmers to make informed decisions as to whether they can participate in peak demand events and earn cash incentives. The information provided by the system can also help farmers save electricity and water year-round, increasing the overall efficiency of day-to-day operations in a cost-competitive agriculture industry.

An irrigation pump connected to a web-to-wireless controller designed by M2M Communications.

Agricultural Demand Response

While load control programs for residential, commercial, and industrial buildings have helped

reduce peak demand for many years, the PEAR program is tapping irrigation pumps and the agricultural demand response market, a largely untapped resource. Irrigation is well-suited for load management because loads are typically coincident with the electric system's summer peak demand. Also, irrigation pumps can be shut off for entire peak periods, which can last for several hours. This complete shutdown option is not typically available for other types of loads, such as air conditioning, because of concerns about the comfort and safety of building tenants.

M2M Communications' customers can see the status of their equipment at a glance via a personalized web portal.

As part of the PEAR program, farmers have access to real-time information on irrigation pump operations, soil moisture, water consumption, temperature, and other data points via a customized web portal. M2M typically provides farmers with notice of an anticipated peak demand event 24 hours in advance via text, voice, or email. If shutting off the pumps is not feasible, the farmer can choose to opt out. If the farmer does not opt out, M2M's network operations center sends a shutdown signal to the irrigation pumps through its wireless network.

"Inherent to M2M's technology is the ability to give individual farmers tools that they can put into operation to enable them to understand their preparedness and ready their fields for shutdown," adds Laughlin. "A customer portal makes all of this information available to the farmer in real time. This has not been the case previously."

Additional Benefits to Farmers

Farmers receive equipment free of charge and have opportunities to earn cash incentives by reducing peak electricity usage. Participation in peak demand events can earn farmers an average of $5,000 per irrigation pump per year. In addition, the avoided costs of peak demand charges can top $10,000 per pump per year.

Farmers can conveniently turn pumps on or off via the web portal or by calling a toll-free phone number. Similar to programming a household thermostat, farmers can also create flexible on/off schedules for the pumps via the web portal. This feature can save time and travel and increase the overall efficiency of farm operations.

"Success in agriculture these days is a matter of containing and reducing costs," says Brad Gleason, president of West Hills Farm Services based in Fresno, California, who enrolled two of his 250-horsepower irrigation pumps in the PEAR program in 2010 and has participated in several peak demand events since. "Productivity gains are incremental, and rising expenses are always a threat. So we're

constantly looking for ways to get more efficient. Technology advances [like these] can make a big difference."

Gleason is especially pleased with "the added value from soil moisture monitoring and going online to see how the wells are running." M2M estimates that 80–90 percent of the farmers enrolled in the PEAR program have accessed the water flow data.

2011 PEAR Program Results

M2M has installed its irrigation load control system on 300 pumps in the PG&E service territory, representing about 60 megawatts of interruptible load. PG&E called four peak demand events in 2011, and M2M estimates that PEAR program participation reduced summer peak demand by an average of 18 megawatts per event.

Many more PG&E customers have signed up for the PEAR program and are awaiting installation of interval meters, a requirement for participation in the program. M2M is also starting to deploy equipment in SCE's service territory. By the end of 2012, M2M anticipates installing systems on approximately 700 additional pumps in California, for a total of 1,000 pumps representing about 180 megawatts of potentially interruptible load.

Future Plans

The potential for agricultural demand response may be large and extends beyond California. Some 160,000 irrigation pumps are located in the PG&E and SCE service territories. M2M estimates the agricultural demand response resource in California to be about 1,000 megawatts, and could be more than 10,000 megawatts nationwide.

M2M believes the PEAR program could serve as a model for future irrigation load management programs across the country. In the spring of 2011, for example, M2M conducted a pilot project with Midwest Energy in Kansas; and the third-party demand response provider is currently looking for other utility partners with significant summer irrigation loads and interest in reducing peak demand. M2M is working with farmers to assess effectiveness and determine how the information from the irrigation load control system can provide additional savings to agricultural customers nationwide.

Learn More

The American Recovery and Reinvestment Act of 2009 provided DOE with $4.5 billion to fund projects that modernize the Nation's electricity infrastructure. For more information visit www.smartgrid.gov or www.oe.energy.gov. There are five recent reports available for download:

- *Smart Grid Investment Grant Progress Report*, July 2012
- *Demand Reductions from the Application of Advanced Metering Infrastructure, Time-Based Rates, and Customer Systems – Initial Results*, December 2012

- *Operations and Maintenance Savings from the Application of Advanced Metering Infrastructure – Initial Results*, December 2012
- *Reliability Improvements from the Application of Distribution Automation Technologies and Systems – Initial Results*, December 2012
- *Application of Automated Controls for Voltage and Reactive Power Management – Initial Results*, December 2012