

M2M Communications

Agricultural Load Control Program in California Central Valley

Scope of Work

Beginning in March 2010, M2M Communications (M2M) developed and installed two-way, web-to-wireless load-control devices as part of the Peak Energy Agriculture Rewards (PEAR) program, an agricultural demand response program in California's Central Valley. The program was marketed to agricultural customers within Pacific Gas and Electric (PG&E) and Southern California Edison (SCE) service territories and ran through April 2011.

The controllers collected real-time information on water use and soil conditions, enabling farmers to make informed decisions as to whether they could participate in peak demand response vents and earn cash incentives. The load-control devices turned irrigation pumps off and on in response to announcements of critical peak events.

Objectives

The project aimed to reduce peak electricity demand and overall energy usage during the growing season by providing large agricultural customers with better, more technologically advanced energy management tools.

Smart Grid Tools and Technologies

- **Communications infrastructure:** The project deployed two-way wireless modems for remote measurement and control of irrigation and food processing loads. Utility peak demand events were communicated to the network operations center and transmitted to direct load-control devices through Internet and modem networks. The two-way communications and automated demand response applications provided customers with the ability to manage, measure, aggregate, and verify targeted demand reduction via a web portal.
- **Customer System Devices:** The project provided direct load-control devices for agricultural customers who agreed to allow M2M to control their irrigation pumps and food processing cooling loads during periods of peak demand. M2M aggregated the demand reductions from these devices and bid the savings into the utility capacity and energy markets for settlement on behalf of its customers. Customers received cash incentives for contributing towards load reduction events. The direct load-control devices verified demand reductions via two-way communication through wireless modem networks. All customers participating in M2M's agricultural demand response program received web portal access, which allowed them to remotely view their electricity usage, water pressure, water flow rate, and soil moisture information (enabled by the installation of wireless moisture sensors). Customers also had the ability to set their own operating criteria for the direct load-control devices to minimize the impacts of demand response dispatches on crop health and yields.

At-A-Glance

Recipient: M2M Communications

State: California

NERC Region: Western Electricity Coordinating Council

Total Project Cost: \$4,343,420

Total Federal Share: \$2,171,710

Project Type: Customer Systems

Equipment

- Two-way Communications Network
 - 546 Direct Load-Control Devices
 - Customer Web Portal
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Targeted Benefits

- Increase Customer Participation in Aggregated Demand Response Program
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M2M Communications *(continued)***Benefits Realized**

- **Increase Customer Participation in Aggregated Demand Response Program:** The demand response program provided cash incentives to offset overhead costs for business customers. M2M estimates that PEAR program participation reduced summer peak demand by an average of 25 megawatts (MW) per event. The information provided by the devices also helped farmers save electricity and water year-round, increasing the overall efficiency of day-to-day operations in California's cost-competitive agriculture industry. M2M installed irrigation load-control systems on 546 irrigation pumps in the PG&E and SCE service territories, and has installed capacity of up to 69 MW of interruptible load. Program participants were able to reinvest energy savings and cash incentives to improve business operations.

Lessons Learned

- **Rolling 10-Day Baseline Averages:** For agricultural customers, rolling 10-day baselines proved to be problematic, often causing customers to be penalized for electric use above their baselines. This often resulted from instances where a customer's participating irrigation pump was shut off during part of or the entire baseline period, either for maintenance or crop-related reasons, and then the customer resumed normal usage resulting in increased electrical use. This project highlighted the need for a modified baseline calculation to prevent customers from receiving reduced incentive payments or program penalties stemming from the needs of their crops or equipment.
- **Seasonality and Crop Rotations:** Energy curtailment by agricultural resources is limited and dependent upon the time of year and vegetation planted. Late spring through early fall is the widest window for many of the crops grown by the participating agricultural customers, though harvesting techniques for individual crops alters growers' water use, which affects the electrical load available for demand response. Most growers shut down irrigation pumps at different times during the growing season and may leave them off for extended periods, making energy use forecasting problematic. Also, growers tend to rotate crops and leave fields fallow at times, complicating demand response forecasting. One reason a grower could have higher electrical use from one season to the next is because a crop necessitates more water than it did the previous season. The next season, the same grower could rotate crops or leave the field fallow, resulting in a significant drop or increase in energy use—or even zero energy use.
- **Water Allocations and Weather Patterns:** The effectiveness of irrigation resources as a demand response component is proportionate to the availability of ground water for pumping. Growers plan their crops according to yearly water allocations. Irrigation pumps run so as to maximize the effectiveness of the groundwater available for crops; once maximum water allocations are reached, irrigation resources cease to contribute to demand response. M2M also conducted research into how seasonal weather patterns such as drought can be used to aid in long-term energy use forecasting and demand response planning.

Future Plans

Agricultural demand response may present a large potential source of energy savings in California and nationwide. M2M was acquired by EnerNOC in January 2011 and through leveraging M2M's experience with the PEAR program, EnerNOC has conducted successful programs with different utilities across the country, such as AEP Texas, Midwest Energy, PacifiCorp, and others. Using the lessons learned from the PEAR program, EnerNOC has created an irrigation load-management program that can be customized and employed wherever utilities with significant summer irrigation loads have a desire to reduce peak demand. EnerNOC is continuing to explore ways in which the information collected from its load-control system can provide additional insight to energy usage trends as well as operational savings to agricultural customers.

M2M Communications *(continued)*

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