Fact Sheet
Well pump monitoring and irrigation optimization to reduce energy and water usage

The Issue
Agricultural water-related electricity use is 10 TWh per year, approximately 4% of California total electricity usage. This usage increases significantly in drought years due to the need to pump water from increasingly deeper wells. In 2014, California growers were expected to extract an additional 5 million acre-feet of groundwater from aquifers to compensate for the lack of surface water and rain, resulting in an additional $454 million of energy costs for water pumping. This usage of groundwater is not sustainable, and resulted in the Governor recently signing a law (SB1166) to require growers to monitor groundwater extraction at their farms.

There is however a gap between water extraction and water application. Growers need solutions that optimize irrigation without putting extra burden in their operation. Some methods for reducing water use in times of drought have existed for years, but have very low adoption rates due to management complexity or up-front capital cost. Two particular methods of reducing water and energy use over existing irrigation practices are regulated deficit irrigation (RDI) and soil moisture monitoring (SMM).

Project Description
This project addresses the root cause of the issue by providing a simple and scalable way to measure groundwater extraction that is not disconnected from irrigation practices. We leverage existing smart meters deployed by California’s Investor Owned Utilities (IOU) to provide automated water records to growers by using our patent-pending software algorithms.

The water measurements are then combined with other sources of data to reduce irrigation while maintaining or optimizing yield. Irrigation schedules based on RDI or SMM can save 20-40% over existing evaporation-transpiration (ET) schedules. The technology will be applied on an industrial scale (1657 acres) by several growers and will save at least 20% of energy and water. The project is commercializing and combining several relevant technologies to provide growers with insight into the full cycle from energy usage and water to the crop conditions affecting yield. The system both monitors irrigation and also sends text alerts if it detects serious problems.
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The process begins with PowWow Energy's patent-pending technology to measure water usage based on smart meter data. This data is augmented by weather data and optional soil moisture data from local sensors. To ensure privacy, there is the option to store those water records locally at the computer on the farm, and never save them in the cloud-based server. The reduced irrigation methods and models developed at UC Davis are used to compute recommendations for how much water is needed that day, based on plan plus recent weather. The final critical piece is the use of aerial imagery for crop monitoring and sending text messages if problems are found.

The project will include irrigation models for four popular crops (almond, pistachio, tomato and alfalfa) representing more than 2 million acres in California. The Software-as-a-Service (SaaS) solution will be deployed at four commercial sites totaling more than 1657 acres. This include tree crops (832 acres almonds and 491 acres pistachios) and row crops (256 acres of tomatoes). This variety of crops and locations will show the applicability across most of the state. Both PGE & SCE territories are involved to demonstrate applicability across utilities using the standard Green Button Connect program. The accuracy of the water measurement will be verified against calibrated water at 30 pumps at site #6.

The project also includes a demonstration field at Russell Ranch (site #5) operated by UC Davis to provide calibrated data to tune our algorithms, and to answer questions from growers and farm advisors. Collaborating with the existing network of farm advisors is key to accelerate technology adoption among conservative growers.

Anticipated Benefits for California
Agricultural energy demand is a significant fraction of power usage, and currently peaks in August, when total grid energy needs are highest. The methods demonstrated in this project will enable growers to avoid waste with automated water records and energy alerts that relate to their farming operation (Pump Monitor), and more easily use regulated deficit irrigation (RDI) or soil moisture monitoring (SMM) to reduce water and energy usage in irrigation. The integration of local sensors and the use of aerial imagery will provide a safety net for growers.

These energy and water saving techniques currently have low adoption rate (less than 5%) by California growers due to difficulties of using these irrigation techniques. The results of this project could, over time, enable increasing the adoption of RDI in years of drought from under 5% to 30% of acreage. If this happened, the potential reduction in agricultural energy use for pumping water could be over 100 GWhr a year.

Project Specifics
Contractor: PowWow Energy Inc.
Partners: UC Davis, UC Santa Barbara
Amount: $2,292,829
Matching funds: $535,568
Term: July 2015 to April 2018