PNM Prosperity Energy Storage Project

"Solar is the fastest growing form of renewable energy. We need to understand how to effectively integrate it and many other systems into the grid, like smart buildings, so they work together." ***– Andrea Mammoli, University of New Mexico***

"The project is a logical next step from ideas on paper to a demonstration on a real utility grid. We can apply the lessons we learn here to other smart grid applications." ***- Abraham Ellis, Sandia National Laboratories***

"We must learn to process massive amounts of data and make sophisticated decisions in real time. It's an emerging field referred to as "big data." We are learning here and teaching our students at the same time." ***– Olga Lavrova, University of New Mexico***

"*The data being produced is phenomenal and will help shape the future of energy storage. People are following this.****"***
- Haresh Kamath, Electric Power Research Institute

The PNM Prosperity Energy Storage Project is the nation's first solar storage facility fully integrated into a utility power grid and uses smart grid technology to advance renewable energy.

Grid-connected solar photovoltaic panels and an energy storage system comprised of two kinds of batteries are linked to a sophisticated computer bank that collects up to 220 data points a second.

The data is being used to address learn how to safely integrate a variable power source (solar energy) with a grid designed to handle steady, one-way power flows and make solar power available when the customer most wants it. Learning how to deploy batteries optimally to reduce the high cost and using smart grid technology have application for utilities beyond solar integration.

Details

Location: *Near Mesa del Sol, south of Albuquerque, NM*
Site size: *Approximately 4.9 acres*
Solar panels: *2,158*
Solar power produced: *Up to 500 kilowatts*
Battery containers: *8*
Batteries in each container: *160*
Storage capacity: *250 kilowatts per hour delivered over four hours or 1 megawatt-hour*
Cost: *Overall cost of the storage system and research is $5.8 million. The DOE grant: $2.3 million.*
Batteries: *Advanced lead acid batteries with an energy rating of 1 megawatt for shifting and UltraBattery™ advanced battery units with a power rating of 500 kilowatts for smoothing.*

Partners with **PNM** include the **U.S. Department of Energy**, **Sandia Laboratories**, the **University of New Mexico**, **Northern New Mexico**

College and **Ecoult/East Penn Manufacturing**, the battery maker. The project is supported in part by a grant through the American Recovery and Reinvestment Act. The panels were manufactured in America. New Mexico companies SCHOTT Solar, Cameron Swinerton and Positive Energy also contributed to the project.

Smoothing Solar Output

To protect power quality and prevent damage to customers' appliances and equipment, electricity flowing onto power lines must always equal customer demand for electricity. Grid operators have a short window of time to adjust for changes in demand or reductions in output from power plants. While we can control the power output from conventional power plants, the output from a solar PV facility changes instantly, sometimes dramatically throughout the day as clouds pass by and as the sun makes its passage from east to west. To compensate, an algorithm is being used to tell the batteries when to discharge stored solar energy and when to charge or pull back. Variations of this algorithm are being demonstrated and the data analyzed to find the optimal strategy.

Shifting Solar Output

Power planners work days, months and years ahead to lock in needed power for their customers. Workers at power plants have detailed operating and maintenance schedules to ensure they can deliver the promised amount of power at any time. In the industry, that power is considered firm, meaning you can count on it, and dispatchable, meaning we can generate and use it when we want it.

Solar energy is neither firm nor dispatchable. Moreover, peak output from the solar panels occurs around at 2 p.m. in the summer and is on the wane by late afternoon, yet the most needed (and expensive) power utilities generate in the summer is between 4 p.m. and 8 p.m. Aligning output with peak means customers will get more value for the investment in renewable energy.

Visit PNM.com/solarstorage to view the project at work in real time.

Ahead

The project has been demonstrating the ability to use the battery to store the right amount of energy in the morning and subsequently deliver it the same day during the late afternoon peak. Gaps have been identified such as the need for manufacturers to work more closely together and the need for better weather and cloud cover information. Over the next two years, the use of more complex data-sets, modeling and analysis will allow us to use knowledge learned at this site on other parts of the PNM system and on systems across the nation. Thanks to Northern New Mexico College and UNM, the project is helping students improve math, analytical, and engineering skills and prepare for the future.