

Wind Firming EnergyFarm

Using energy storage to integrate wind energy in California's Modesto Irrigation District

Primus Power

Primus Power is deploying a 25 MW/75 MWh EnergyFarm in the Modesto Irrigation District, located in California's Central Valley. An EnergyFarm comprises an array of 20 kW EnergyCell flow batteries combined with off-the-shelf components and power electronics housed inside a standard shipping container. The modular design and operation will be field tested at Pacific Gas & Electric with support from Sandia National Laboratories and the Electric Power Research Institute (EPRI). The EnergyFarm will displace a planned \$73 million natural-gas-fired power plant intended to smooth (or firm) the output of intermittent wind and solar energy. The 25 MW EnergyFarm will deliver the same load balancing benefit as a 50 MW thermal plant and cost \$56 million less than the thermal plant over 20 years.

About Primus Power's Technology

There are several flow battery technologies either available in the market or currently under development, including technologies based on iron-chrome and zinc-bromine. Primus Power leverages research from EPRI that demonstrates the effectiveness of zinc-based battery technology for utility applications and offers enhancements over other technologies by achieving low cost, high power density, and a small footprint. Primus EnergyCells are low cost and have a high electrochemical voltage couple, high current density, fewer parts than comparable systems, commodity materials, and inexpensive electrolyte. This technology was developed with the assistance of the Advanced Research Projects Agency—Energy.

Project Benefits

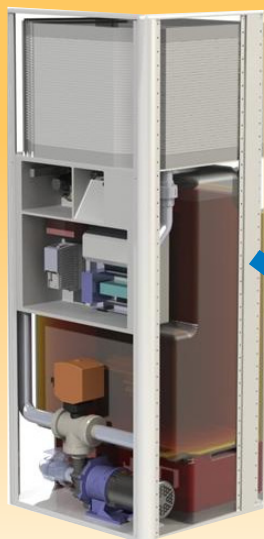
- Enables integration of renewable energy technologies, such as solar and wind
- Substitutes for more expensive natural gas power plant
- Enhances grid stability
- Improves grid asset utilization
- Reduces greenhouse gas emissions
- Creates domestic manufacturing, construction, and installation jobs in the advanced battery industry

Budget

Total Project Value:
\$46,700,000

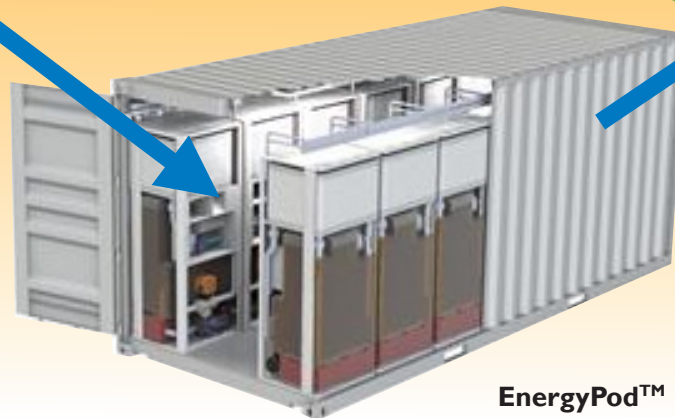
DOE/Non-DOE Share:
\$14,000,000/\$32,700,000

Primus Power's EnergyFarm System

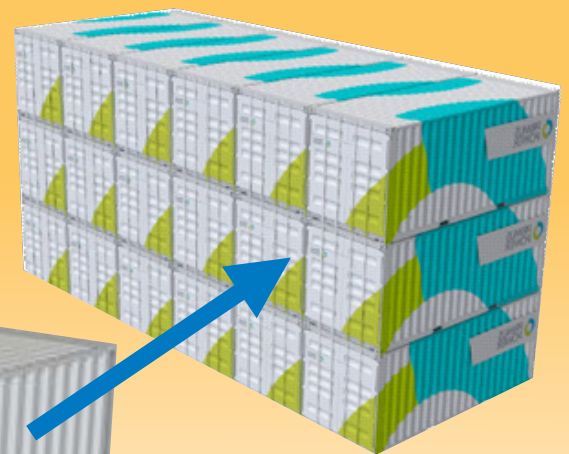


EnergyCells + Power Electronics

Using off-the-shelf components and power electronics, Primus Power's EnergyCells flow batteries can be housed inside standard shipping containers, which can then be combined for the power and energy needs of the application.



EnergyPod™



EnergyFarm

Timeline

- March 2011:**
EnergyCell design completed
- November 2011:**
EnergyPod™ design completed
- December 2013:**
EnergyPod™ third party validation
- February 2014:**
Modesto Irrigation District - deployment plan finalized
- June 2014:**
First EnergyPod™ installed
- August 2014:**
First EnergyPod™ commissioned
EnergyFarm data collection begins
- May 2015:**
Last EnergyPod™ commissioned
- August 2016:**
EnergyFarm data collection ends final wind firming
EnergyFarm project review

Goals

- Develop a distributed, mobile energy storage module based on a zinc-flow battery technology that can be mass produced
- Reduce system capital costs and footprint
- Enhance application flexibility
- Validate module performance and functionality (greater than 75% efficiency)

Project Partners

- Primus Power
www.primuspower.com
- Modesto Irrigation District
www.mid.org
- California Energy Commission
www.energy.ca.gov
- Pacific Gas & Electric
www.pge.com
- Sandia National Laboratories
www.sandia.gov
- Electric Power Research Institute
www.epri.com

Technology Advancement

The wind firming EnergyFarm will be used to integrate wind energy into the electric delivery system, displacing a planned and expensive natural gas power plant. The EnergyFarm will store energy generated by renewable sources during inexpensive, off-peak load cycles and deploy the energy during times of high peak load, which makes the renewable energy economical for utility use.

Using the EnergyFarm rather than a natural gas power plant offers the following improvements:

- No emissions
- No water use
- Less noise
- Faster response time



For More Information

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Related Reading

Sandia National Laboratories, "Energy Storage Systems Program (ESS)," <http://www.sandia.gov/ess/>.

Department of Energy, "Low-cost, High-Performance 50-Year Electrode", <http://arpa-e.energy.gov/ProgramsProjects/GRIDS/LowCostHighPerformance50YearElectrodes.aspx>.

Importance of Energy Storage

Large-scale, low-cost energy storage is needed to improve the reliability, resiliency, and efficiency of next-generation power grids. Energy storage can reduce power fluctuations, enhance system flexibility, and enable the storage and dispatch of electricity generated by variable renewable energy sources such as wind, solar, and water power. The Office of Electricity Delivery and Energy Reliability Energy Storage Program funds applied research, device development, bench and field testing, and analysis to help improve the performance and reduce the cost of energy storage technologies.