

# Energy Storage Techno-Economic Optimization for Resilience, Reliability and Value Stacked Benefits

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## Program Overview

The Energy Storage for Rural Resilience (ES4RR) program provides technical assistance (TA) to ten capacity-limited rural utilities. PNNL is supporting utilities as they develop their ideas for resilience improvements utilizing energy storage from concept to fully scoped projects. PNNL has tailored the assistance for each utility based on their identified energy challenges and goals.

The program has engaged public power utilities and electric cooperatives and is executed in partnership with American Public Power Association (APPA) and the National Rural Electric Cooperative Association (NRECA). The TA projects span a variety of techno-economic analysis, modeling, regulatory and policy assistance to support local decision-making and energy storage project development that can deliver measurable impact to the reliability and resilience of the rural electric grids.

## City of Lompoc, California

### PROJECT OBJECTIVES

- The City of Lompoc, situated in Santa Barbara County, California and adjacent to Vandenberg Space Force Base (VSFB), plans to install a large battery energy storage system (BESS)
- The City of Lompoc is designated as a High Fire Threat District, and this project aims to enhance resilience against PSPS events triggered by wildfire risks
- The project could potentially also provide resilience benefits to a nearby Federal Correctional Facility (FCC) and the VSFB
- **Utility Objective:** Use battery and hydrogen energy storage (up to 100 MW) for resilience against public safety power shut-offs (PSPS) triggered by wildfires for the entire City of Lompoc, as well as potentially a nearby federal correctional facility and the Vandenberg Space Force Base
- **Research Interest:** Evaluation of storage sizing requirements and techno-economics for different types of energy storage, weather scenarios and resilience needs
- **Potential Insights:** Use of a battery system as a resilience asset in PSPS conditions, large scale deployment of a mix of battery resources

### METHODOLOGY AND USE CASES

- **Scenarios:** Three techno-economic scenarios created to assess sizing needs for resilience needs, each including battery and hydrogen storage sub-scenarios: (1) City of Lompoc, (2) City + FCC, (3) City + FCC + VSFB

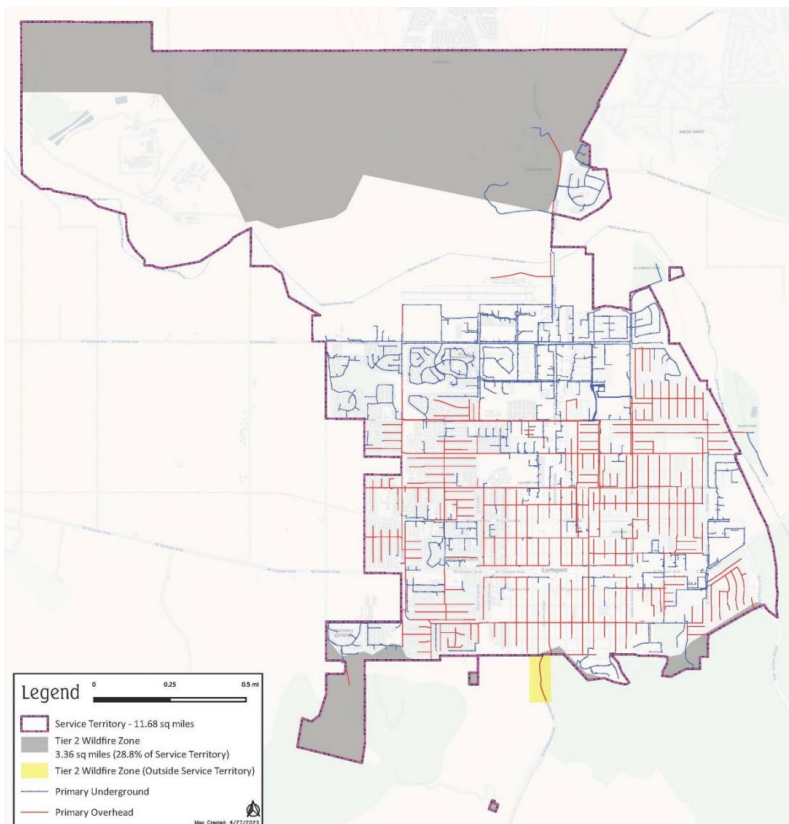


Figure 1. Fire Threats in City of Lompoc Service Territory

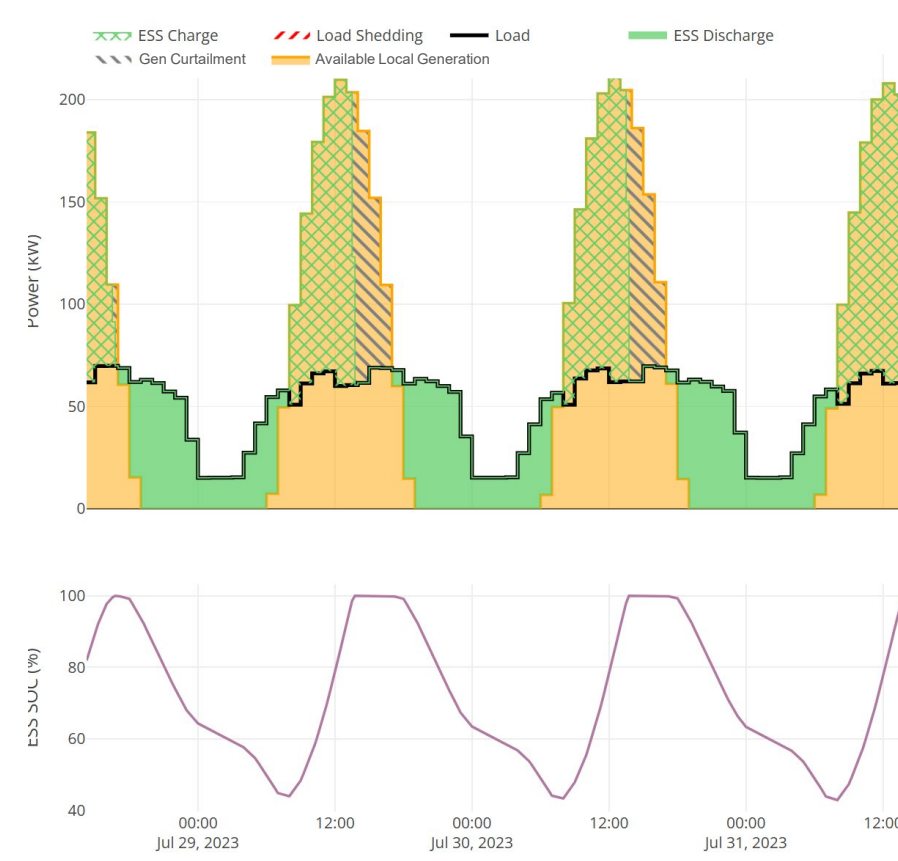


Figure 2. ES4R2 Tool Sample Output for Outage Dispatch using BESS

- **Tools:** MASCORE and ES4R2 modules of PNNL's ESET tool (funded by OE)
- **Analysis:** Sizing the system around high peak, summer months where wildfires are a resilience threat
- Under outage conditions, the system would be islanded from the grid supply (PG&E) but would have variable generation and energy storage available for resilience support

### PRELIMINARY RESULTS AND IMPACTS

- Preliminary analysis results show that it is possible to meet the resilience needs of the system in different scenarios, within the technical system sizing constraints
- Costs indicate system feasibility, additional revenue streams are being evaluated
- This technoeconomic analysis can help decision making for City of Lompoc on the size and scope of their system
- Regulatory support will also aid in understanding challenges associated with shared resilience benefits with a DOD facility

## Delaware Municipal Electric Corporation (DEMEC)

### PROJECT OBJECTIVES

- The Delaware Municipal Electric Corporation (DEMEC) is a Joint Action Agency (JAA) based in Smyrna, Delaware with nine member utilities and is responsible for bulk power purchasing, project development, and program management for its members.
- DEMEC aims to address the critical issue of intermittent back feed into the transmission grid during periods where local generation exceeds local consumption in Milford, DE.
- **Utility Objective:** Use battery energy storage for improved grid reliability (during low load and high local generation months) and market participation
- **Research Interest:** Evaluating energy storage operation and dispatch strategies for balancing variable output of local generation and for maximum value stacking
- **Potential Insights:** Use of a battery system as a grid reliability asset, prioritization of stacked value stream objectives

### METHODOLOGY AND USE CASES

- **Scenarios:** Techno-economic scenarios created to assess optimal dispatch ensuring reliability and value streams
- **Use cases** in the decreasing priority order are (1) balancing local generation, (2) peak shaving and (3) participation in frequency regulation markets

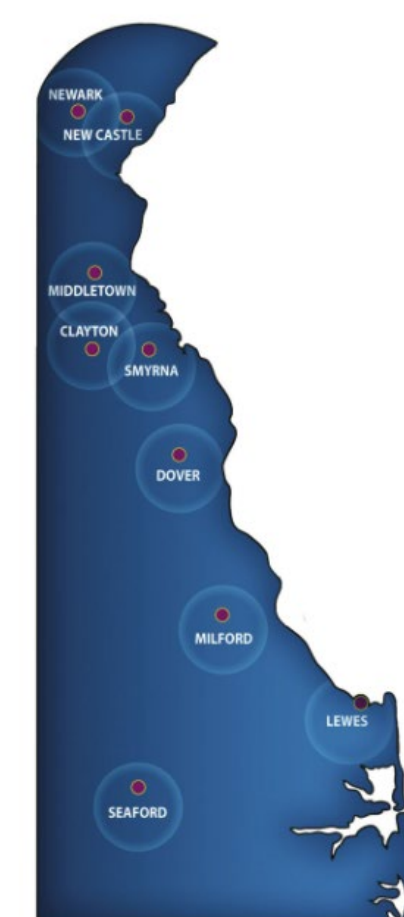


Figure 3. DEMEC Member Utilities

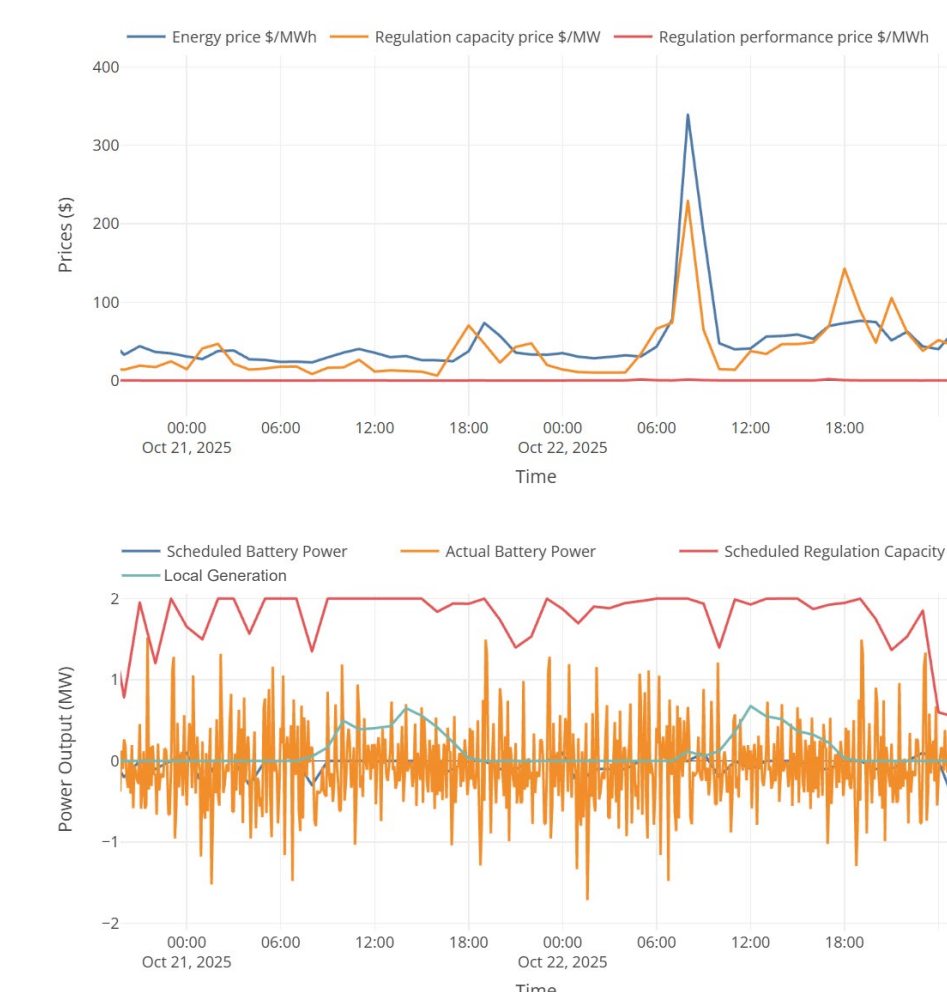


Figure 4. BSET Tool Sample Output for Frequency Regulation Operation using BESS

- **Tools:** BSET and MASCORE modules of PNNL's ESET tool (funded by OE)
- Technical support on energy storage service agreement (ESSA) best practices also provided to DEMEC

### PRELIMINARY RESULTS AND IMPACTS

- Preliminary results show that variable local generation could be potentially balanced by the BESS system
- Additional benefits in using BESS system as a grid capacity asset are also realized
- This is the first utility-level energy storage system deployment in Delaware, and the analysis provides one step toward concept validation
- Once the back-feed issue on the grid from the local generation is alleviated, the project could allow more customers in the City of Milford to interconnect to the grid