

Exceptional service in the national interest



Los Alamos Energy Storage Analysis

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Motivation

Los Alamos Department of Public Utilities provides the following services:

- Water
- Electricity
- Natural gas
- Waste services

And owns the following microgrid assets:

- 2 MW solar generation
- 8.3 MWh (1 MW, 6 MWh Sodium Sulphur battery + lead acid)

Question: can energy storage provide savings with respect to the PNM power purchase Tariff?



Courtesy: Los Alamos National Laboratory



Courtesy: Kyocera, Inc

Methodology

- Analyzed one year of data, March 9, 2014 through March 8, 2015
- Developed a production cost model of the Los Alamos system
- Used actual irradiance data
- Generated simulated 5-minute load data from hourly measurements
- Analyzed three scenarios:
 - ESS only providing to the reserve
 - ESS providing cost effective support to the load bandwidth constraint, and
 - ESS providing full support to the load bandwidth constraint.
- Three penalty scenarios:
 - minimum value 0.1 times the market value
 - medium value of 100 times the market value, and
 - maximum of 1000 times the market value



Lead Acid



Sodium-Sulfur

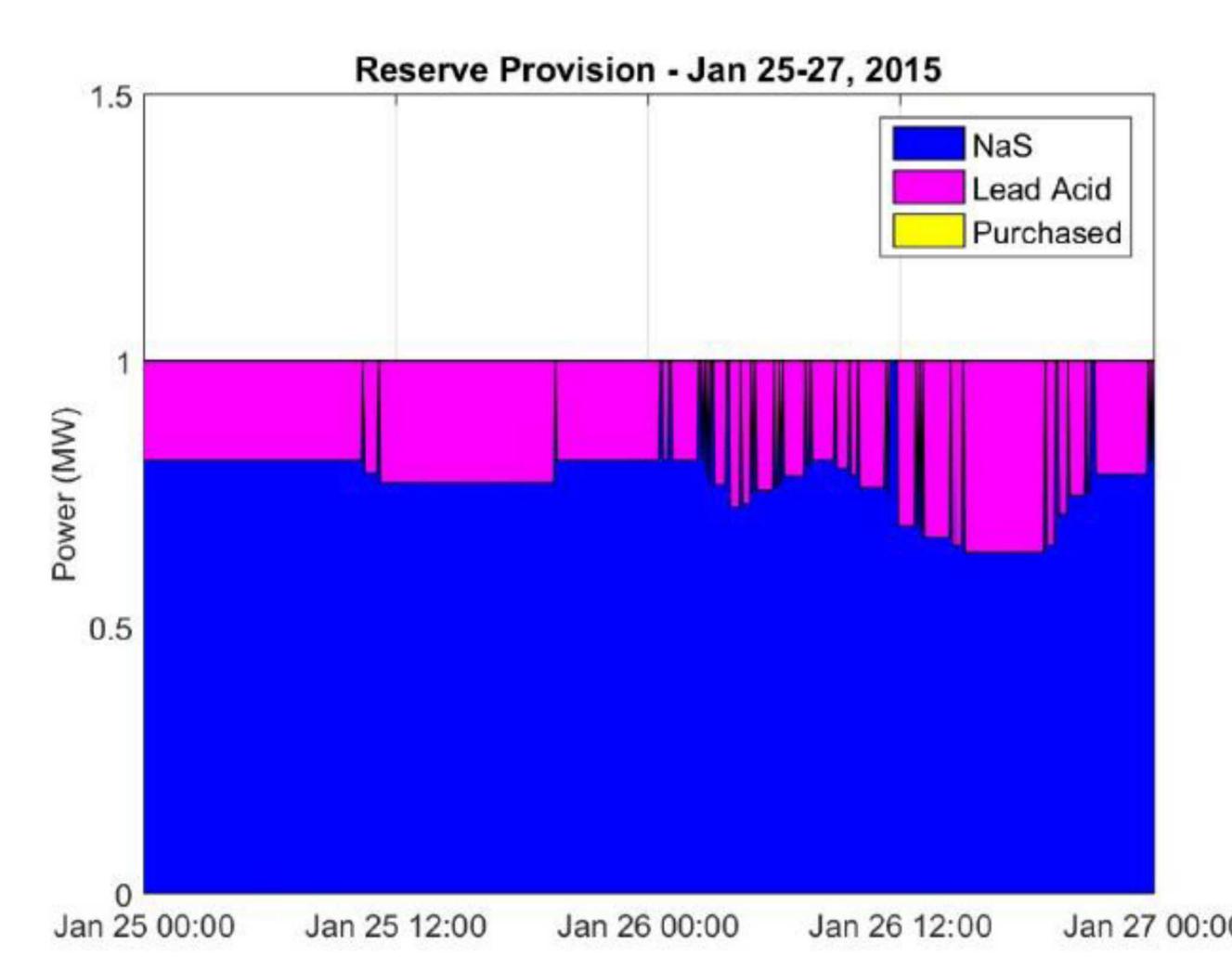


Figure 2 ESS reserve support for two days with partial support of bandwidth constraint

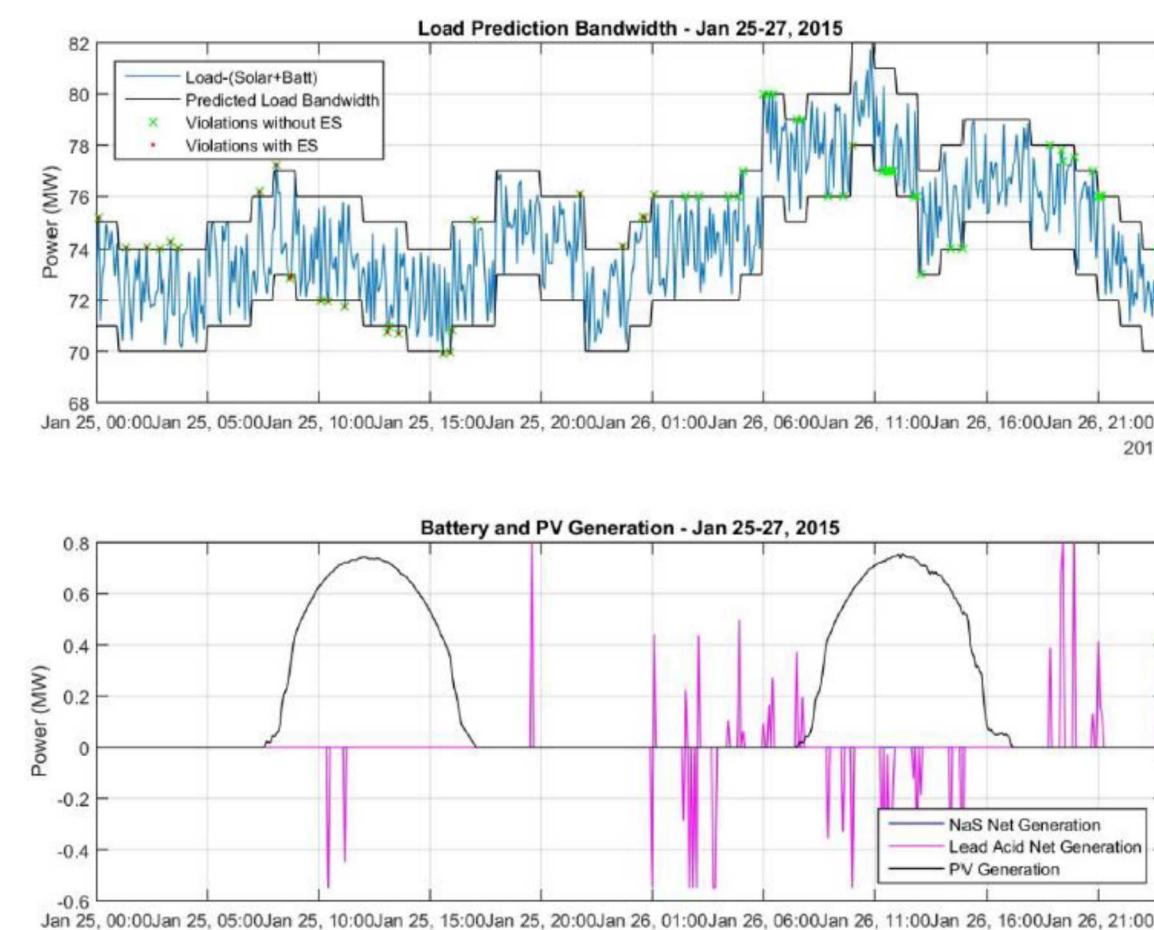


Figure 1 Bandwidth constraint behavior (top) and ESS generation (bottom) for two days with the minimum penalty and partial support from the ESS

Table 1: LADPU Bulk Power Costs Under Three Load Bandwidth Penalty Scenarios (Base Case: No Use of ESS to Control Load Bandwidth)

All numbers in (000) USD	10% Bandwidth Excursion Penalty	1,000% Bandwidth Excursion Penalty	10,000% Bandwidth Excursion Penalty
LAC Generation	16,009	16,017	16,020
Grid Generation	2,027	2,031	2,033
> 2 MW Penalty	0.570	570	5702
< -2 MW Penalty	1.67	415	0
TOTAL	18,038	19,034	23,756

Table 2: LADPU Bulk Power Costs Under Both Soft and Hard Load Bandwidth Excursion Constraints (ESS Control Case: Using the ESS to Control Load Bandwidth)

All numbers in (000) USD	10% Soft Excursion Penalty	1,000% Soft Excursion Penalty	10,000% Soft Excursion Penalty	Hard Excursion Constraint
LAC Generation	16,010	16,013	16,013	16,013
Grid Generation	2,006	2,010	2,010	2,010
Reserve Payments	6.7	7.2	7.2	7.4
> 2 MW Penalty	0.76	0.09	0.01	0
< -2 MW Penalty	1.91	0	0	0
TOTAL	18,026	18,030	18,030	18,030

The actual dispatch cost for deviations from scheduled dispatch is as follows:

Actual Dispatch Cost/MWh = Actual Dispatch Cost of Last 10 MW/10MWh

The difference between actual and scheduled load is:

MWh Difference = MWh Actual Load (in a given hour) - MWh Scheduled Load (in same hour)

If the hourly imbalance is under 2MW, then LADPU owes:

Actual Dispatch Cost * MWh Difference

If the hourly imbalance is between +2MW and +10MW, then LADPU owes:

110% * Actual Dispatch Cost * MWh Difference

If the hourly imbalance is between -2MW and -10MW, then LAC is owed:

90% * Actual Dispatch Cost * MWh Difference

If the hourly imbalance is greater than +10MW, then LADPU owes:

125% * Actual Dispatch Cost * MWh Difference

If the hourly imbalance is less than -10MW, then LADPU is owed:

75% * Actual Dispatch Cost * MWh Difference

In other words, a 10% penalty is assessed when the hourly imbalance is between 2MW and 10MW, and a 25% penalty when the hourly imbalance is greater than 10MW.

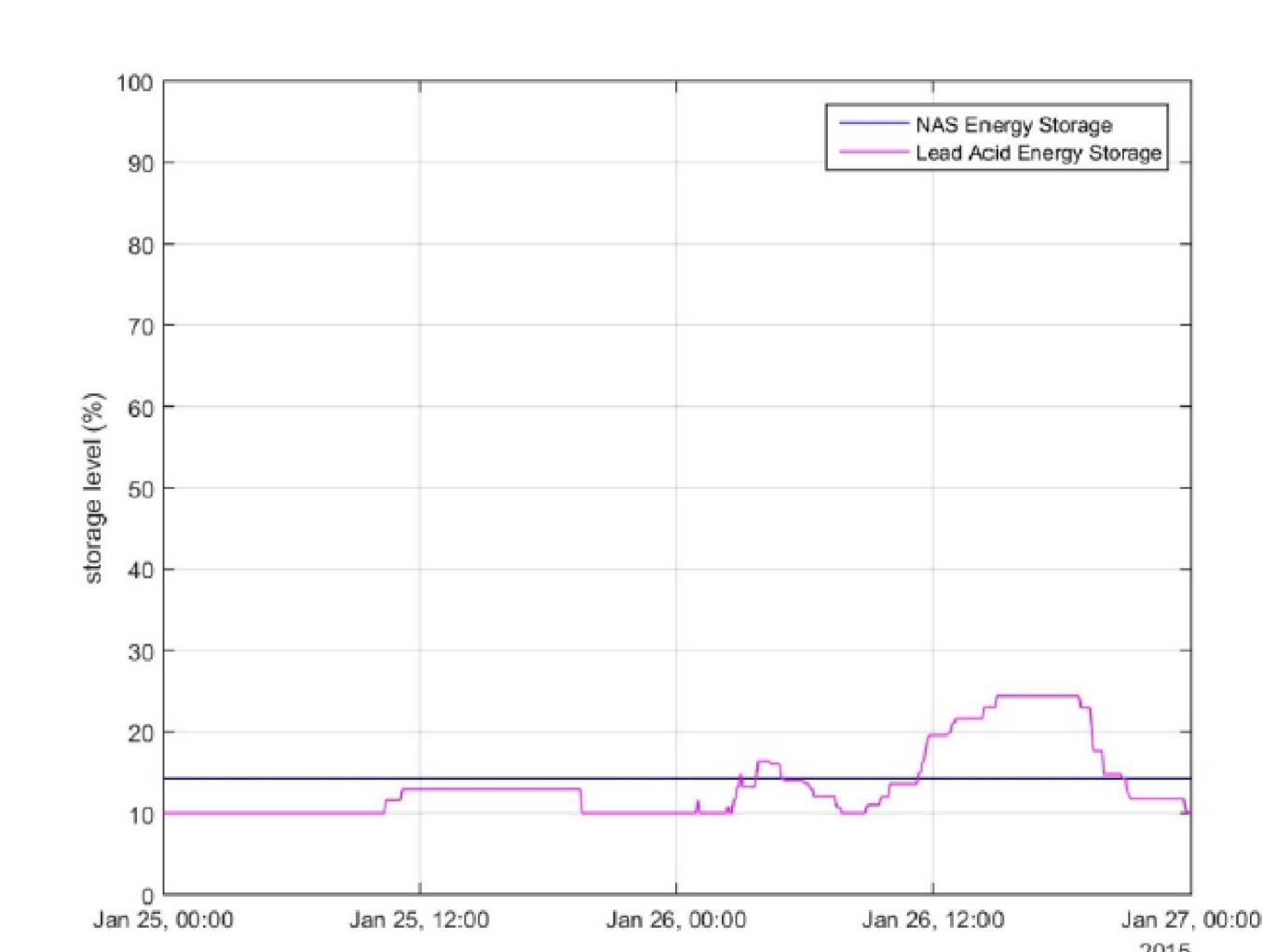


Figure 3 ESS state of charge for two days with partial support of bandwidth constraint