



# Hawaiian Electric Energy Storage Cost Analysis

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## Motivation

- Hawaii is mandating 100% renewable portfolio standard by 2045.
- Oahu is experiencing rapid integration of variable generation (primarily PV).
- Oahu is facing the following challenges:
  - The high amount of variable generation has reduced the amount of firm generation in operation
  - The high amount of variable generation has resulted in the need for higher amounts of regulating reserve
  - The high amount of PV on distribution circuits has reduced the effectiveness of the island's load shedding scheme.

## Value Proposition

This study evaluated the benefits of deploying energy storage for providing arbitrage and regulating reserves. It should be noted that an additional potential benefit to the system is providing contingency reserve.

## Simulation

- A base scenario for the current operational state of dispatch for the generation system was developed.
- Model included grid layout and load information from Hawaiian Electric Company.
- PLEXOS cost-analysis program determines the optimal dispatch of generation over an entire year.
  - Max/min generation conditions
  - Fuel consumption rates
  - Ramp rates
  - Fuel costs
  - Reserve requirements
  - Other constraints
- Scenarios were developed for the different types of fuel available, differently sized ESS, share of energy storage allocated to the reserve, and other cases of interest.

## Results

- The studies concentrated on the economic savings that an additional half hour of ESS would provide as a function of the wattage added. Round trip efficiency was assumed to be 90%.
  - 0 MW
  - 60 MW
  - 80 MW
  - 100 MW
  - 150 MW
  - 200 MW
- Run for case where battery is only used for regulating reserve provision.
- Run for case where battery is only used for arbitrage.
- Finding indicate (see below) that the price of electricity goes down as the battery size increases, but it is not a linear relationship.
- The benefits from arbitrage and energy shifting are minimal and would not justify capital investment. Any decrease in the peak/off-peak differential or efficiency would totally eliminate the arbitrage benefit.
- Regulating reserve provided a significantly larger benefit than arbitrage.
  - Increasing energy storage reduces the run time of more expensive units, resulting in lower production costs.
  - There is a diminishing return on increasing energy storage.

