Energy Storage to Increase Hosting Capacity

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Energy Storage is a flexible asset that provides unprecedented flexibility in grid optimization.

ES provides instantaneous local capacity, & continuous ancillary services with no fuel consumption or emissions.

Modifying Hosting Capacity

- Addressing reverse power flow by providing load
- Grid stability
  - Voltage control
  - Reactive Power
- Ramp rate control
Power Flow Control (From Demand Energy)

Project Overview

- 489 kW Solar PV
- 400 kW Fuel Cell
- 300 kW/1200 kWh Storage
Power Flow Control (From Demand Energy)

September Loads w/FC+PV

[Graph showing September 2014 weekday intervals with export 200 kW]
Power Flow Control (From Demand Energy)

June Peak Load Day

June 9th - With Storage

- Building Load
- Fuel Cell
- Resulting Load
- Storage

Solar

Graph showing the power flow control with storage, indicating contributions from various energy sources and the resulting load.
Hosting and Capacity Constraints

- Important that hosting capacity consider what is being “hosted”
- The same energy storage system that is providing power to address capacity constraints at times of peak load can provide load at times of over-generation.
A New England utility investigated storage to defer/negate the need for a new substation to support a remote and weak feeder with high penetration of distributed PV.

**Primary issues:**
1. Limitation to load serving ability
2. Voltage flicker caused by PV variability
3. Voltage sags due to large motor starts

**Scenario modeled:**
1. Sudden cloud cover causes 70% instantaneous drop in PV generation
2. Simultaneous industrial motor start event (150 hp)
3. Events occur during peak demand period
Using industry-standard distribution network analysis tools and leveraging its storage expertise, RES modeled feeder with & without ESS

- 12.47kV, 7 MVA Peak Feeder
- 2.5 MW of Distributed PV (35% penetration)
- 17 MVA Fault Level near end of feeder
Voltage Support (From RES)

Case Study Findings

3.2 MVA of battery + inverter demonstrated to mitigate voltage impacts of a simultaneous drop in PV generation and 150 HP motor start

*No Storage*
Dynamic response condition of circuit

*With Storage*
Dynamic response condition of circuit

Voltage Profile - Dynamic response - No ES
116% global growth - motor start - drop in PV

Voltage Profile - Dynamic Response with ES
116% global growth - motor start - drop in PV

Voltage regulators
## Project Use Case

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRIMARY</strong></td>
<td></td>
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<tr>
<td>Substation Upgrade Deferral</td>
<td>Use ESS to control feeder voltage in order to 1) defer need for new $10 million substation, 2) allows reconnection of 2MW from other utility, 3) add new industrial customers with large inductive loads.</td>
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<tr>
<td><strong>SECONDARY</strong></td>
<td></td>
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<tr>
<td>Supply Capacity</td>
<td>Reserve ESS capacity for top 40 ISO-NE load hours per year to reduce utility load during ISO coincident peaks. Reduces need to acquire additional capacity from ISO capacity markets.</td>
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<tr>
<td>Transmission Charges</td>
<td>Reserve ESS capacity for designed # hours per month to reduce utility load during regional system peaks. Reduces transmission charges from provider.</td>
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<tr>
<td><strong>TERTIARY</strong></td>
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<td>Frequency Regulation</td>
<td>ESS bids into ISO regulation markets and is paid based on market clearing prices.</td>
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<td>Energy Arbitrage</td>
<td>ESS charges during low-price hours and discharges during high-priced hours if price spreads can overcome losses, degradation, and O&amp;M costs.</td>
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Concluding Points

**Hosting Capacity should be thought of as Hosting Management**

- Numerous methods to modify hosting capacity
- Behind-the-meter and on-grid assets can contribute
- Distribution grid assets will be important in achieving Clean Energy Standard requirement.

**Opportunity with NWA projects**

- Solutions for capacity constraints can increase hosting capacity
- Should develop means to consider these multiple benefits