NYISO DER Roadmap MIWG

December 5th, 2016

Agenda

Deployment Experience

Market Design Principles

SolarCity is a national leader in solar, storage, and grid services, with increasing NY presence

- 2,100+ MW of installed solar with 300,000+ customers
- 40+ MW of commercial and utility storage over 140+ active projects
  - Dozens of systems installed
- Ramping up storage deployments nationally, and in New York
- Partnering with utilities on innovative projects to deliver customer, distribution, and transmission benefits from storage and other DERs.

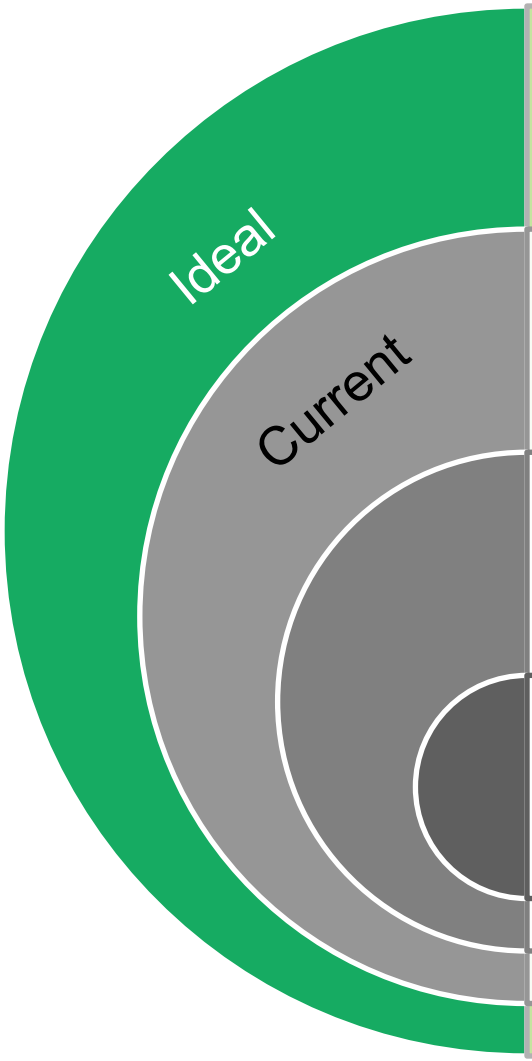
- Six NY Regional Warehouses
  - Albany (2)
  - Long Island (2)
  - Orange County
  - Westchester
- >800 NY employees
- Residential, Commercial, Community, Municipal, Educational Markets
- SolarCity Buffalo Manufacturing Plant under construction; 1GW annual production target

Agenda

Deployment Experience

Market Design Principles

Current vs Ideal Market Structures

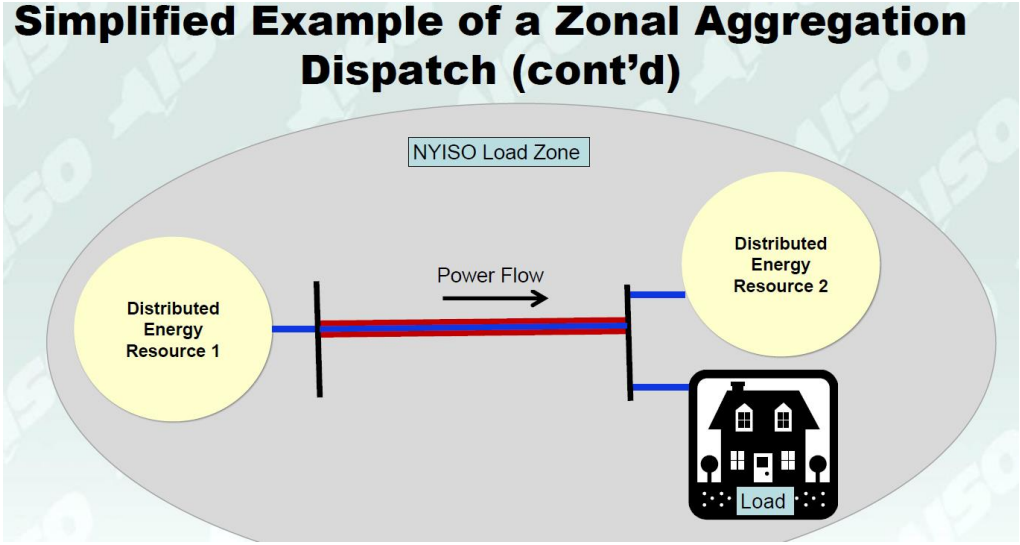


(iv) Distributed Energy Resource with energy, AS and Capacity payments+ distribution service	• DER compensated for **distinct** and **incremental** energy dispatch, capacity and ancillary services • Receives compensation for net export • e.g. NYISO DER roadmap
(iii) Demand Response with energy, AS and Capacity Payment	• DER compensated for **distinct** and **incremental** energy dispatch, capacity and ancillary services • No compensation for net export • e.g. PJM DR programs
(ii) Demand Response with energy payment only	• DER compensated for **incremental** dispatch • No compensation for net export • e.g. CAISO PDR
(i) Load modifying resource	• DER offsets load and indirectly provides wholesale benefits • e.g. ISO NE RNS application

Market Design Principles
(i) DER Aggregation

- **NYISO Aggregation Discussion and Feedback:**
  - NYISO, "zonally aggregated dispatchable DER do not provide NYISO operators with the same flexibility and effectiveness (reliability and market efficiency) to solve constraints as transmission substation-level aggregations"
  - NYISO believes all resources in the aggregation must be interconnected to the same transmission substation and use substation LBMPs

- **Challenge:**
  - NYISO believes zonal aggregations across multiple nodes would be difficult to manage constraints and resources within the zone



Market Design Principles
(i) DER Aggregation

- DER aggregations should be flexible

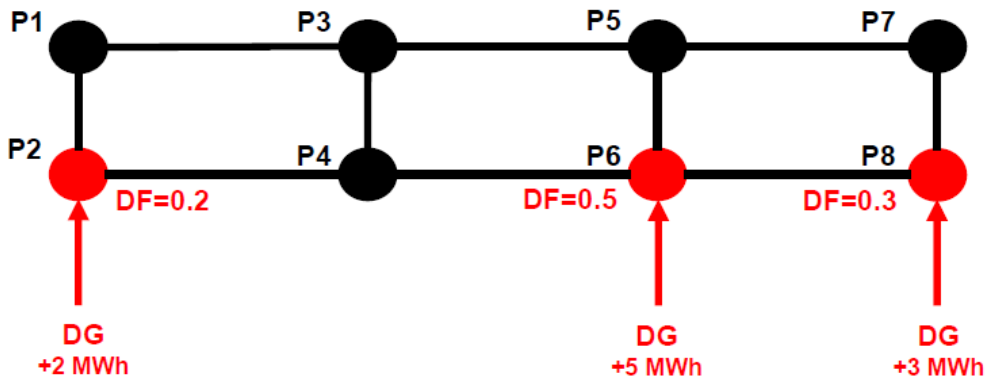
  i. Multi-pricing node aggregations may consist of different sub-resource types (i.e., heterogeneous).
  ii. Sub-resources in multi-pricing node aggregations may move in different directions from an ISO dispatch instruction.
  iii. Energy storage aggregations can operate in different modes (i.e., charging or discharging).

- **The aggregation must provide a net response at each of its pricing nodes that is consistent with the ISO dispatch instruction, and**
- **The distribution of the aggregation's response across its pricing nodes must be consistent with applicable allocation factors that the aggregation submits with its bid.**

Market Design Principles

(i) DER Aggregation

- Example 1



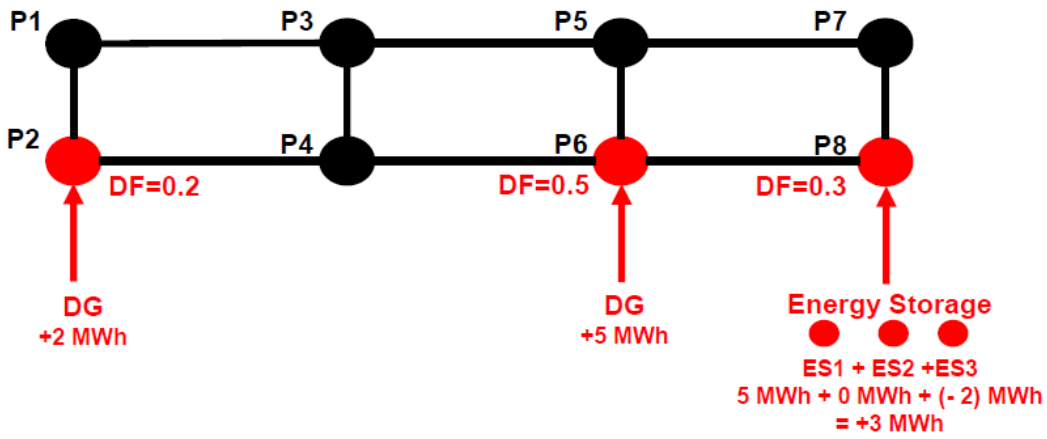
If this aggregation gets a dispatch instruction to increase output by 10 MWh, then

- the net response at P2 must be +2 MWh
- the net response at P6 must be +5 MWh
- the net response at P8 must be +3 MWh

Source: CAISO DERP Draft Final Proposal

Market Design Principles
(i) DER Aggregation

- Example 2:



If this aggregation gets a dispatch instruction to increase output by 10 MWh, then

- the net response at P2 must be +2 MWh
- the net response at P6 must be +5 MWh
- the net response at P8 must be +3 MWh

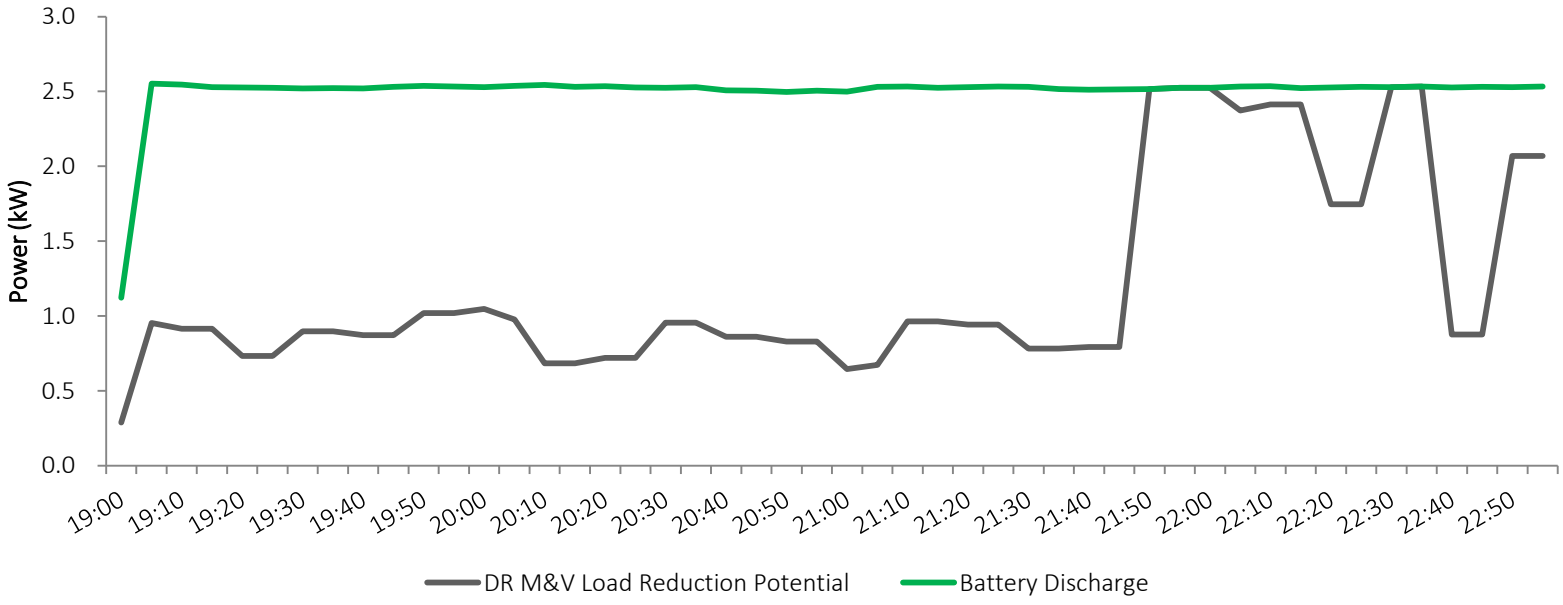
Net response of the energy storage at P8 must be positive

Source: CAISO DERP Draft Final Proposal

Market Design Principles
(ii) DER beyond DR – Net export compensation

- DERs should receive full compensation for generated energy including energy that is exported to the grid
  - Current market structures limited compensation to physical load which is overly restrictive

Bad example



Market Access Principles
(iii) DER Metering and Verification

- Behind-the-meter DER performance should be based on direct metering and not synthetic baselines
  - Baselines are inaccurate and introduce compensation and accuracy risks

Good Example

CAISO Metering Generation Output for Proxy Demand Resource

Market Access Principles
(iv) Enable Multi-Use Applications

- DERs should be allowed to provide multi-use applications in wholesale and retail markets that are ***distinct*** and ***incremental***

  - Resources are not being "compensated" twice for the same performance when seeking attributes that are similar, but not identical

  - To the extent a resource earns revenue based on multiple services, and prices for those services are established independently of each other, there is no "double payment"

SolarCity

Thank you