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Firming & Aggregating Customer-Sited Renewables for T&D Benefits

Dan Vickery

Director, Market Development



- One of largest providers of commercial, distributed energy storage
 - 50 MWh deployed/under construction
- Founded in 2009 out of Con Ed & DOE demo – 1st peak shaving system in NY
- Interconnection in 6 utilities
- Offices in NYC, Santa Clara, San Diego
- Pioneered performance based financing
- Proven experience drove industry-first non-recourse financing
- Recent acquisition by ENGIE (GDF Suez)



ENVIRONMENTAL
LEADER PRODUCT
OF THE YEAR
2015



ENERGY STORAGE
NORTH AMERICA
GOLD AWARD
2014 & 2015



GREENTECH MEDIA'S
GRID EDGE 20
2015



STEVIE'S AMERICAN
BUSINESS AWARDS
FINALIST
2015



PLATTS GLOBAL
ENERGY AWARDS
FINALIST
2015



FIERCE INNOVATION
AWARD WINNER
2015



SMART GRID NEWS
TOP 15 COMPANIES
FINALIST
2015



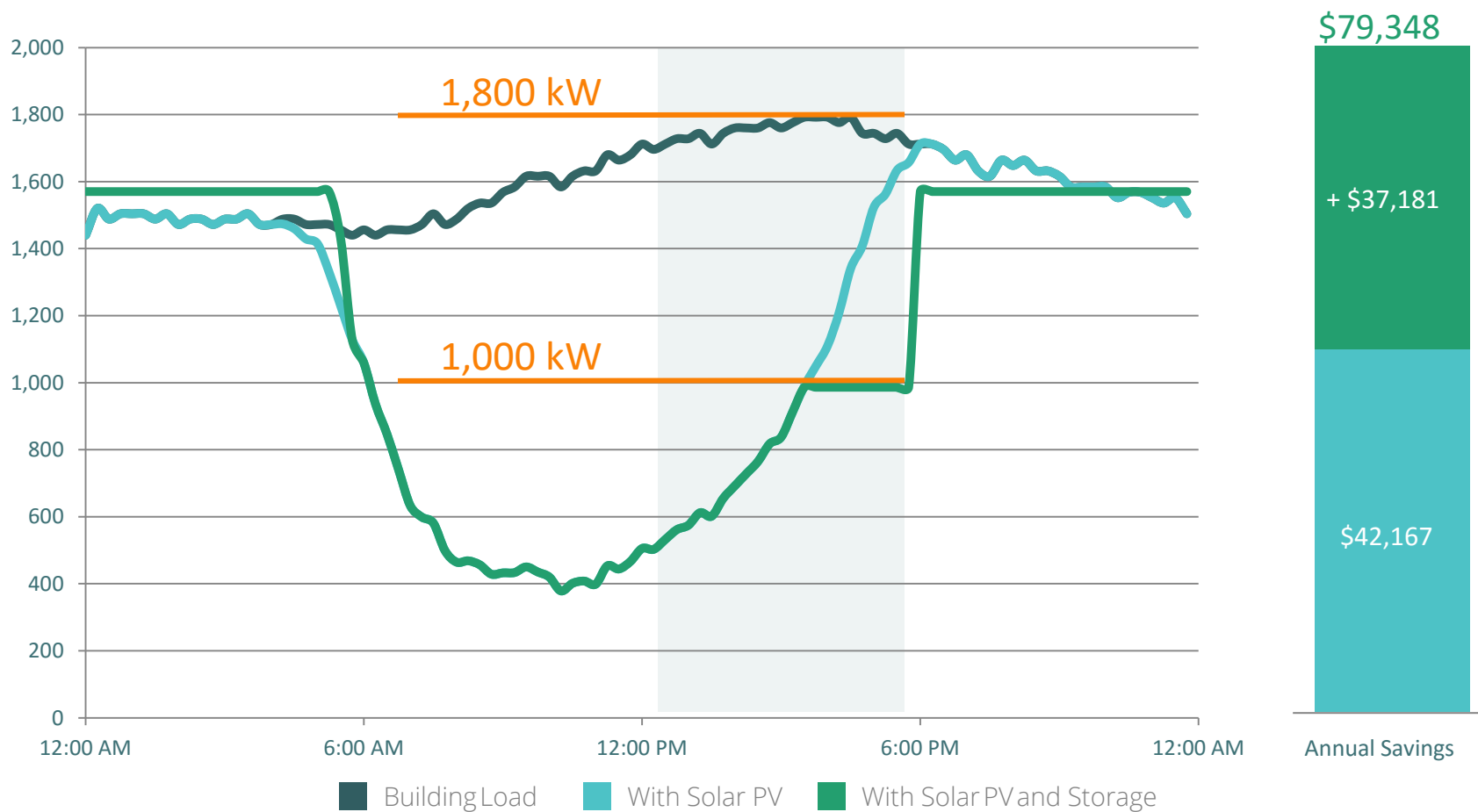


Energy storage is a critical grid support asset to reduce T&D capital costs and to accommodate even greater penetrations of renewables

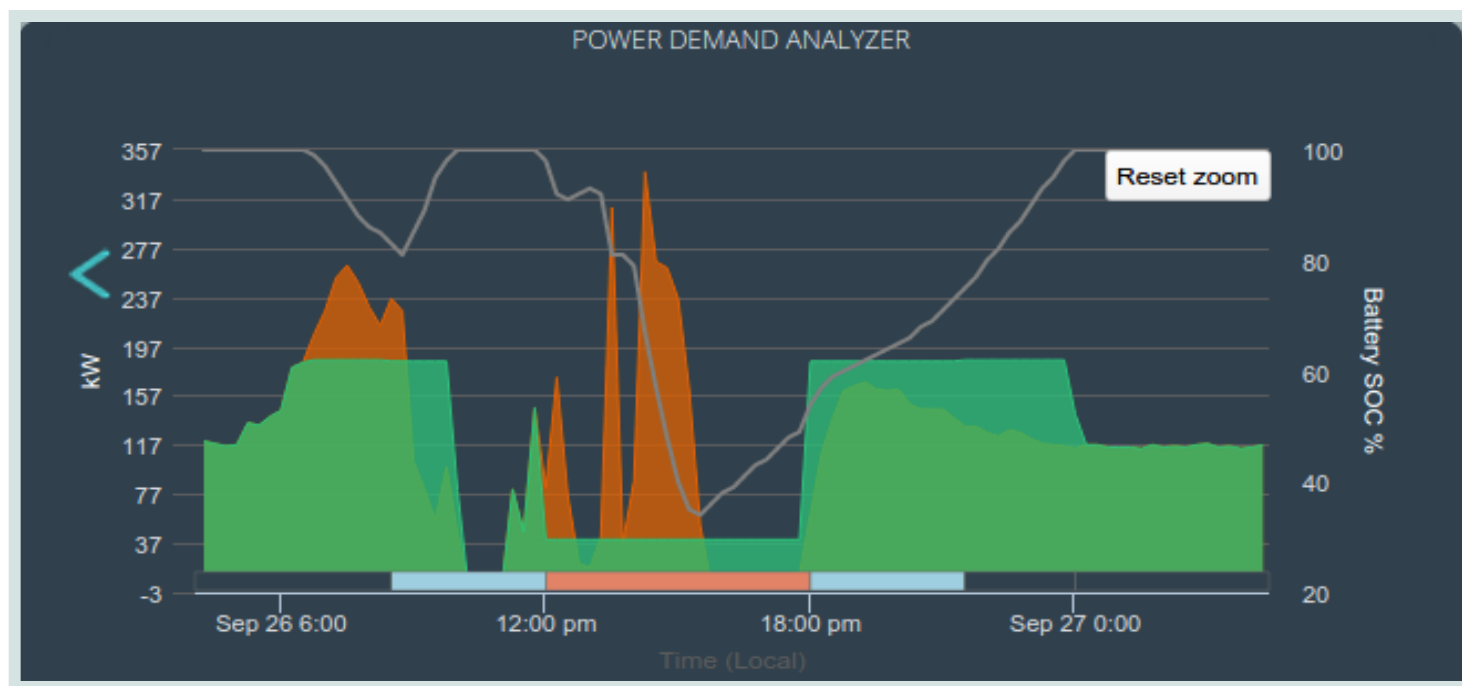
- Distributed network capable of surgically affecting primary feeders and secondary network is key tool to inject energy under highly-intermittent generation
 - Backfeeding and network trips are a real concern in NY
 - Each network has its own needs - peaking behavior varies network to network, thus solutions must be flexible (Wall Street v. Williamsburg)
- Systems and aggregations provide value to the network whether co-located with renewables or otherwise
- This solution is technologically proven, but developers still face barriers due to lack of state certainty; lack of investor return assurance; and lack of market products for self-sustainment

Value Stacking and Distribution Services

Solar firming drives retail demand charge savings...

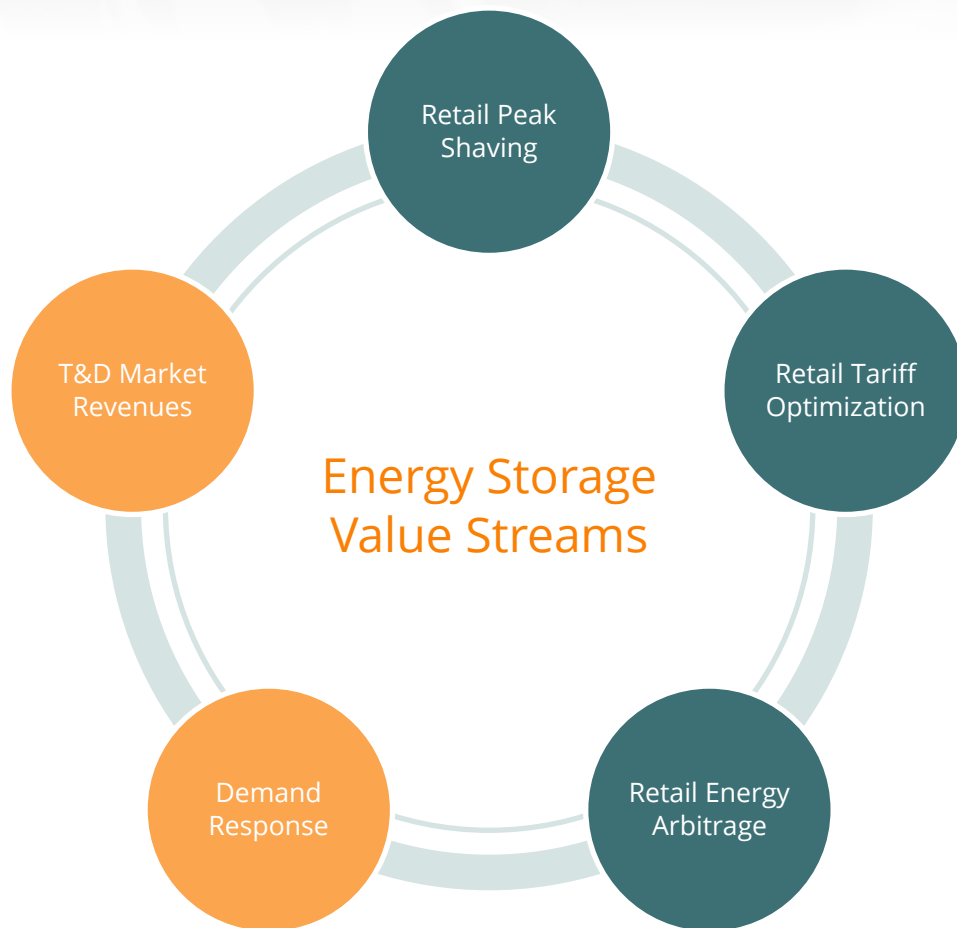


...and can provide substantial distribution benefits



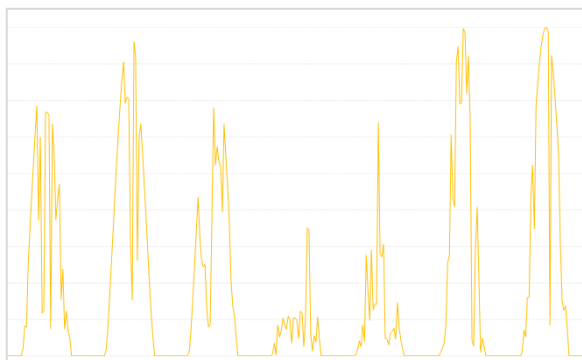
System Control Software

Governs each storage system to maximize value, performing multiple functions to provide sustainable economics.



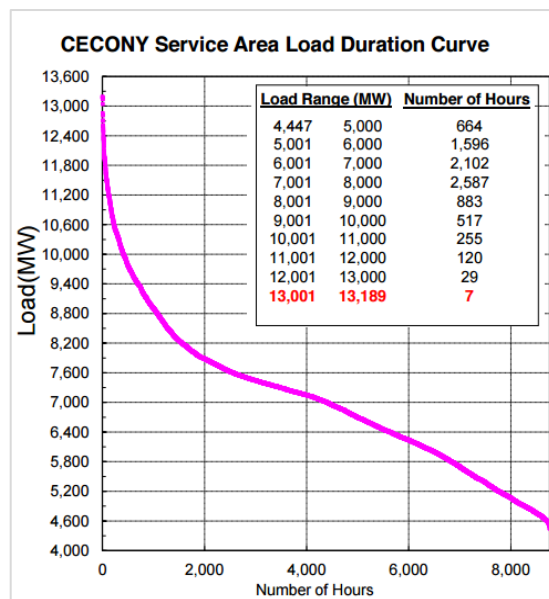
Energy storage targets three costly issues to New York ratepayers and to clean energy development in New York State

SOLAR/RENEWABLE INTERMITTENCY



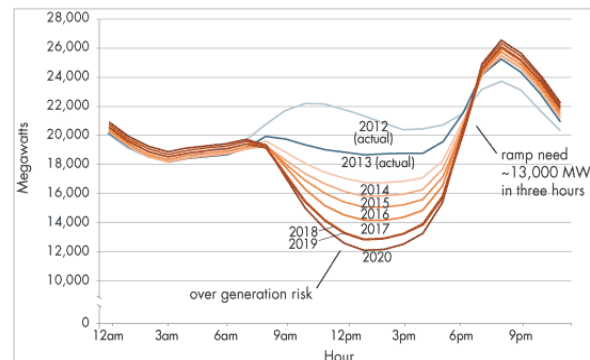
Source: Green Charge Networks using NREL's National Solar Radiation Data Base (NSRDB)

PEAK LOAD DURATION



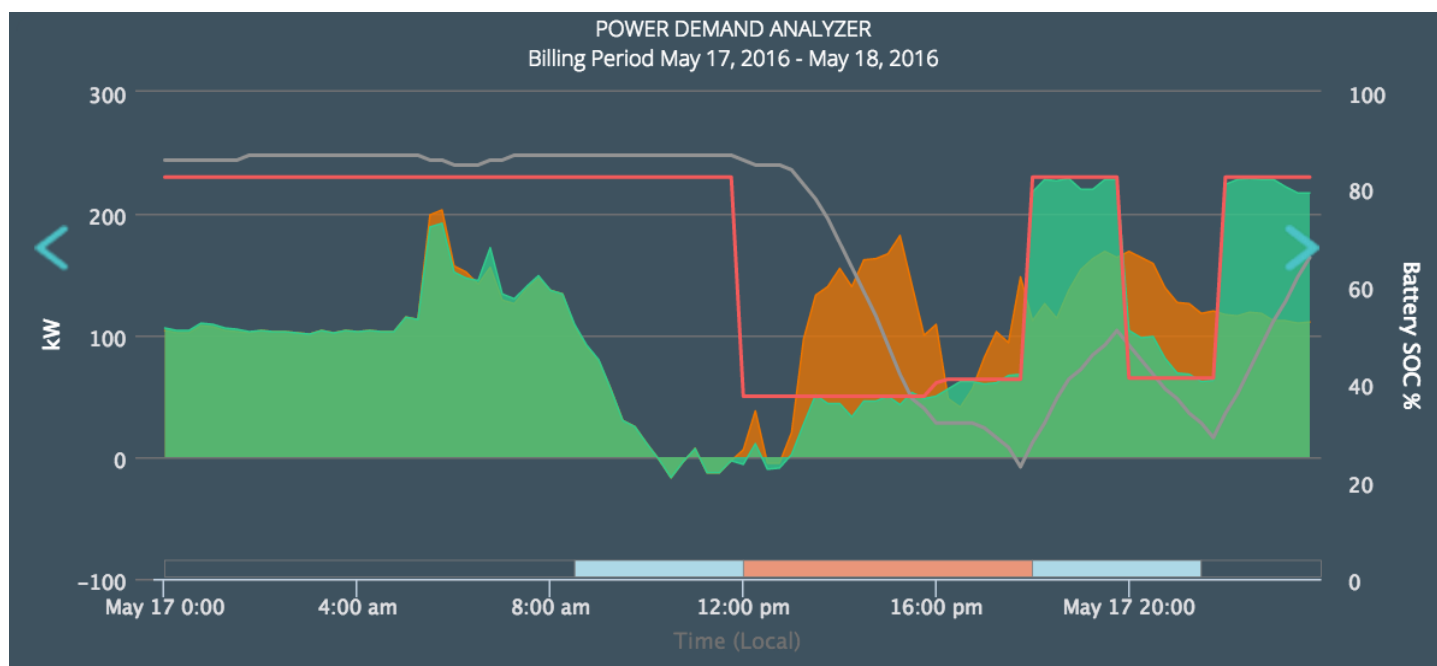
Source: Con Edison

SOLAR BACKFEED

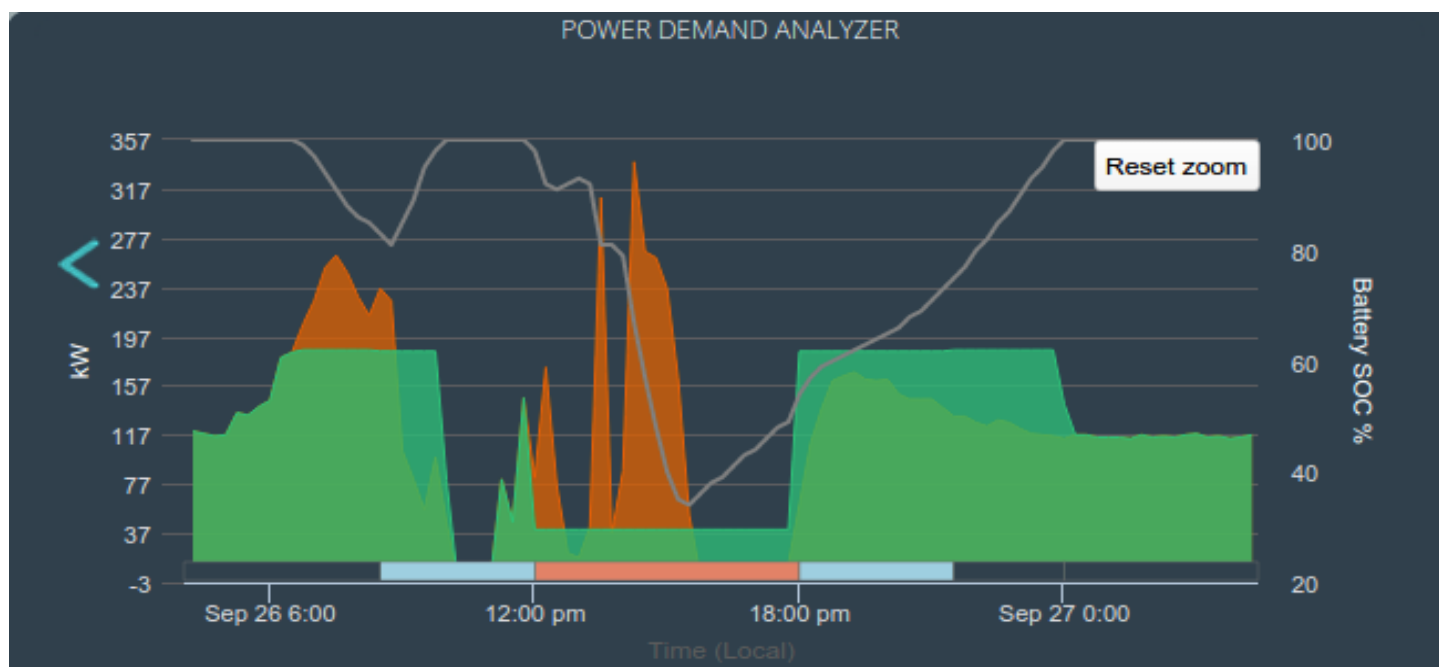


Source: CAISO

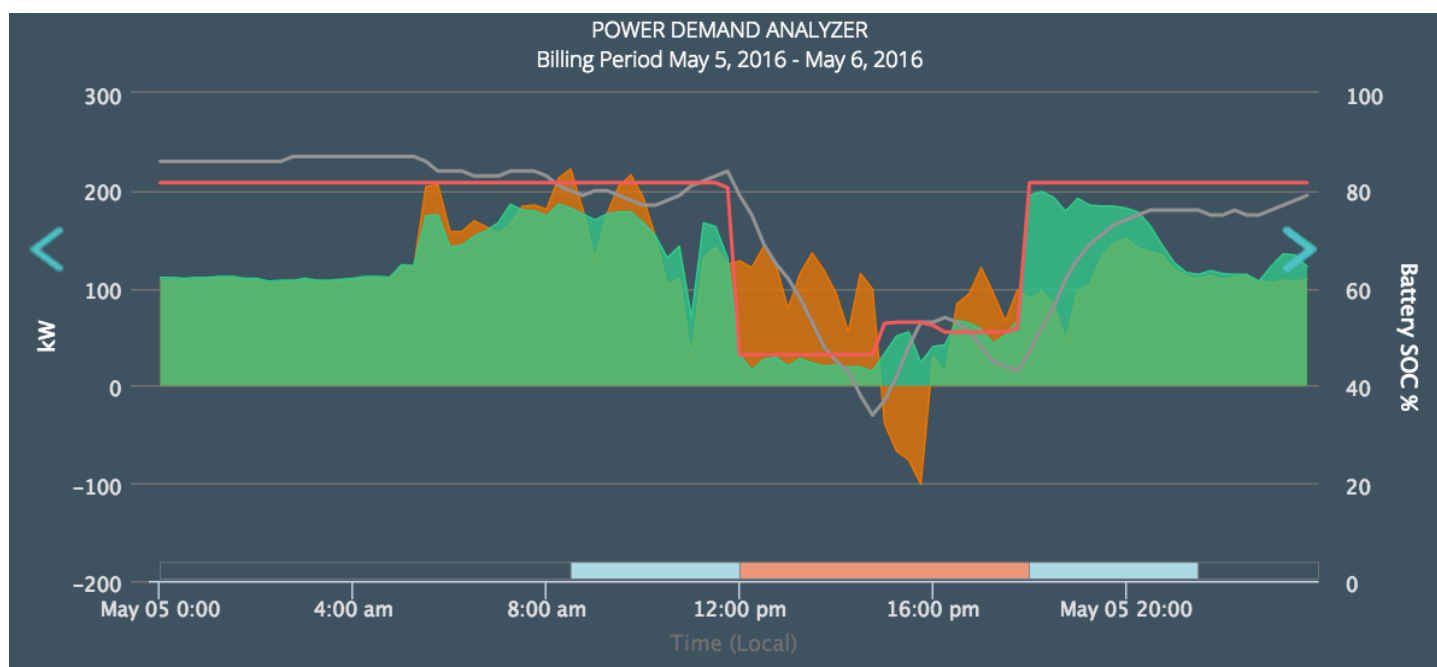
Shifting renewable production to high-value hours allows for responding directly to distribution circuit needs



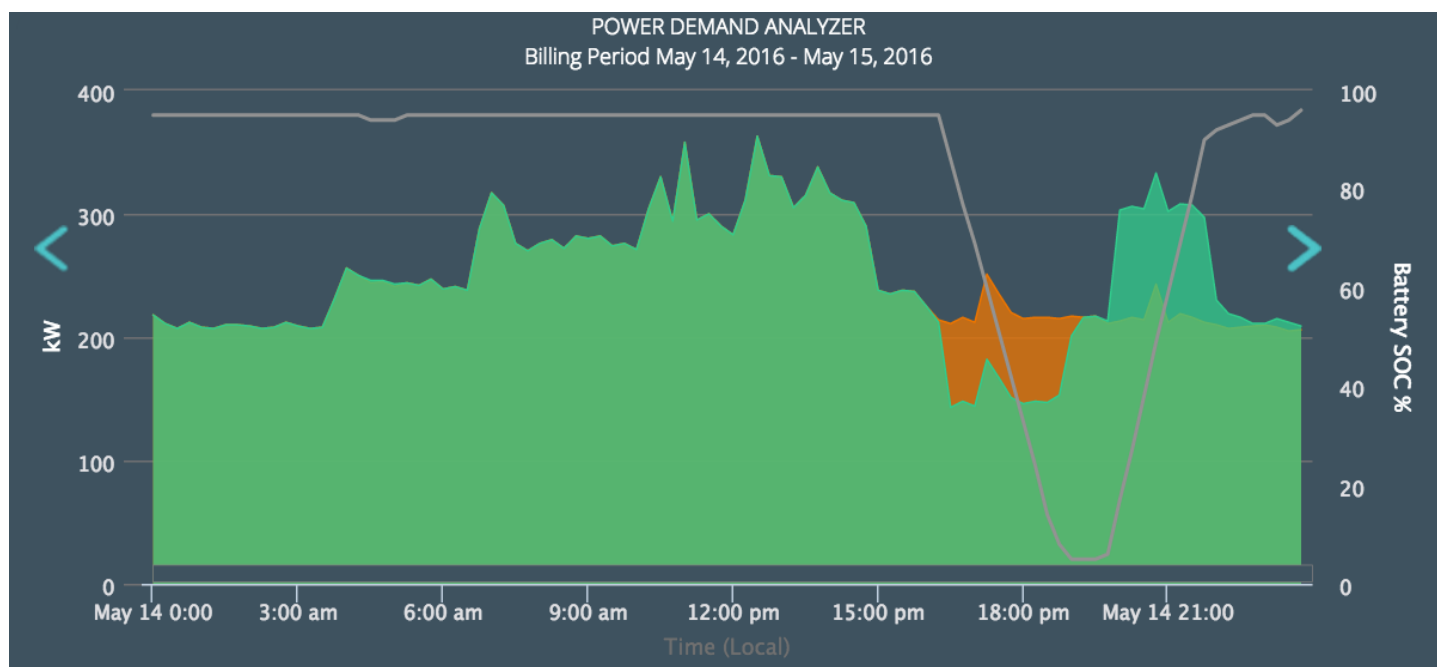
Firming solar intermittency mitigates need for transmission and distribution capacity and spinning generators as backstop



Mitigating solar backfeed allows for higher penetration of renewables without impacts to T&D infrastructure

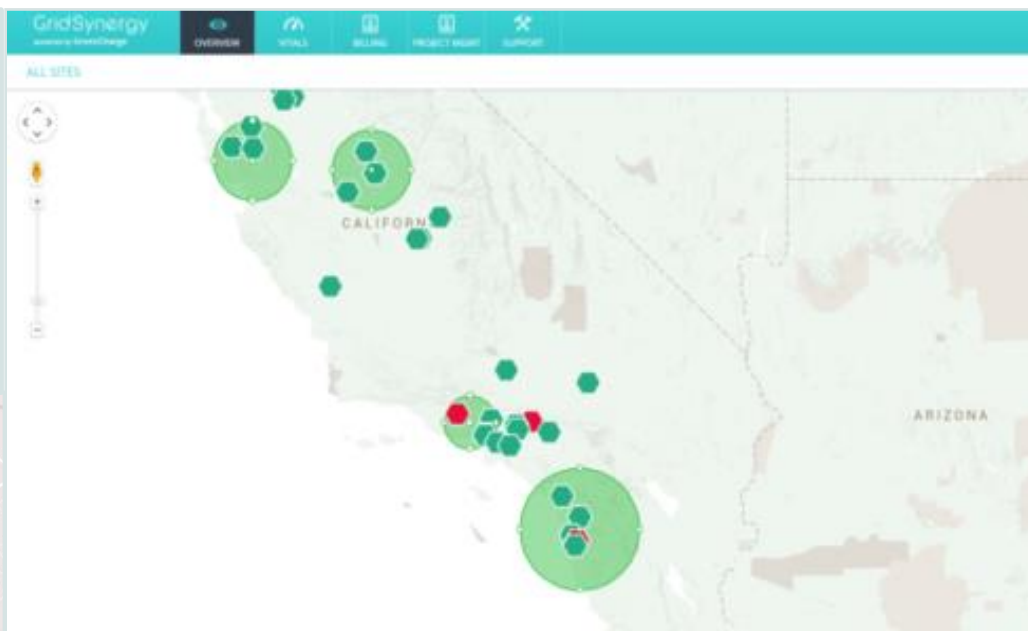
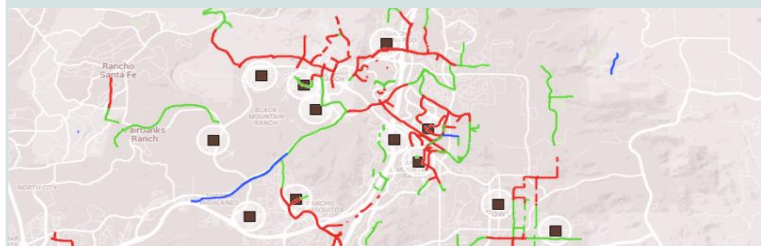


Mitigating solar backfeed allows for higher penetration of renewables without impacts to T&D infrastructure – regardless of co-location



Technical capabilities for aggregation & bidding exist and are proven

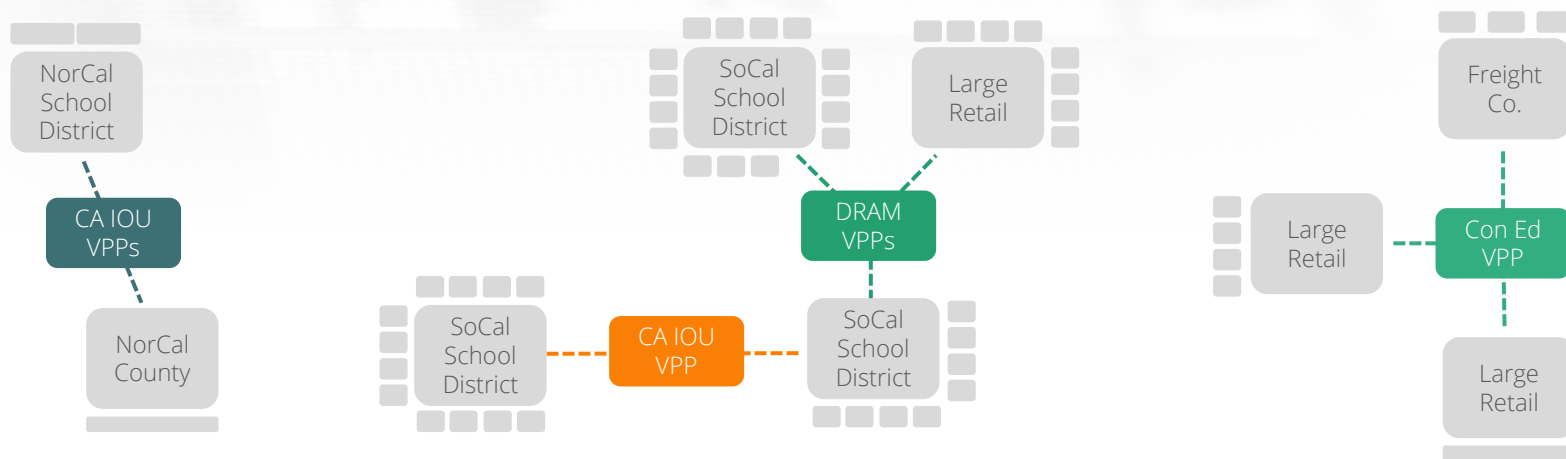
- Aggregation programs being demonstrated throughout the country, including in New York City
 - Encourage more utility pilots & implementations for peak relief
 - Regulatory barriers remain
-
- Network peak relief (T&D deferral)
 - Solar curtailment avoidance
 - Resource adequacy
 - Wholesale economic bidding






Aggregations provide immediate capacity to T&D operators

Green Charge has over 16 MWh and 40 sites enrolled and awarded in various Demand Response Programs




- **New York:** Demand Management Program (DMP), Con Edison Pilot Demonstration
- **California:** Demand Response Auction Mechanism (DRAM), Supply-side Pilot (SSP), Excess Supply Pilot (XSP), DR Programs, Other IOU Peak Relief Programs



Barriers to Scalable Adoption of Energy Storage in New York




| |  |  |  |
|----------------------------------|--|---|---|
| Performance & Experience | ✓ | ✓ | ✓ |
| Capital Cost Reductions | ✓ | ✓ | ⊙ |
| Development Cost Certainty | ✓ | ✓ | ⊙ |
| Revenue Availability & Certainty | ✓ | ⊙ | |
| Regulatory Risk | ⊙ | | |

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Competition & Incentives

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Competition & Incentives

Experience & Regulatory




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Competition & Incentives

Experience & Regulatory

Incentives, Programs, and Long-term Contracts

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Competition & Incentives

Experience & Regulatory

Incentives, Programs, and Long-term Contracts

Commitment to Storage

Energy storage solutions are technologically proven, but developers still face significant barriers to deployment at scale

- Barrier: Lack of certainty in direction of state (locational v. statewide, co-location v. stand-alone)
 - Solution: Commitment to energy storage (e.g., 4 GW mandate) with additional statewide signals for stand-alone energy storage will drive company investments to state
- Barrier: Lack of investor assurance for adequate returns prevents project deployments
 - Solution: A REC-like payment that offers predictability/stability in costs and revenues for stand-alone energy storage will get systems into the field
- Barrier: Lack of market mechanisms to monetize services provided by energy storage systems prevents economic sustainability
 - Solution: Development of utility- or statewide pilot programs (in addition to REV) will push toward market self-sustainment



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Thank you.